Atlantic wolffish; Figures

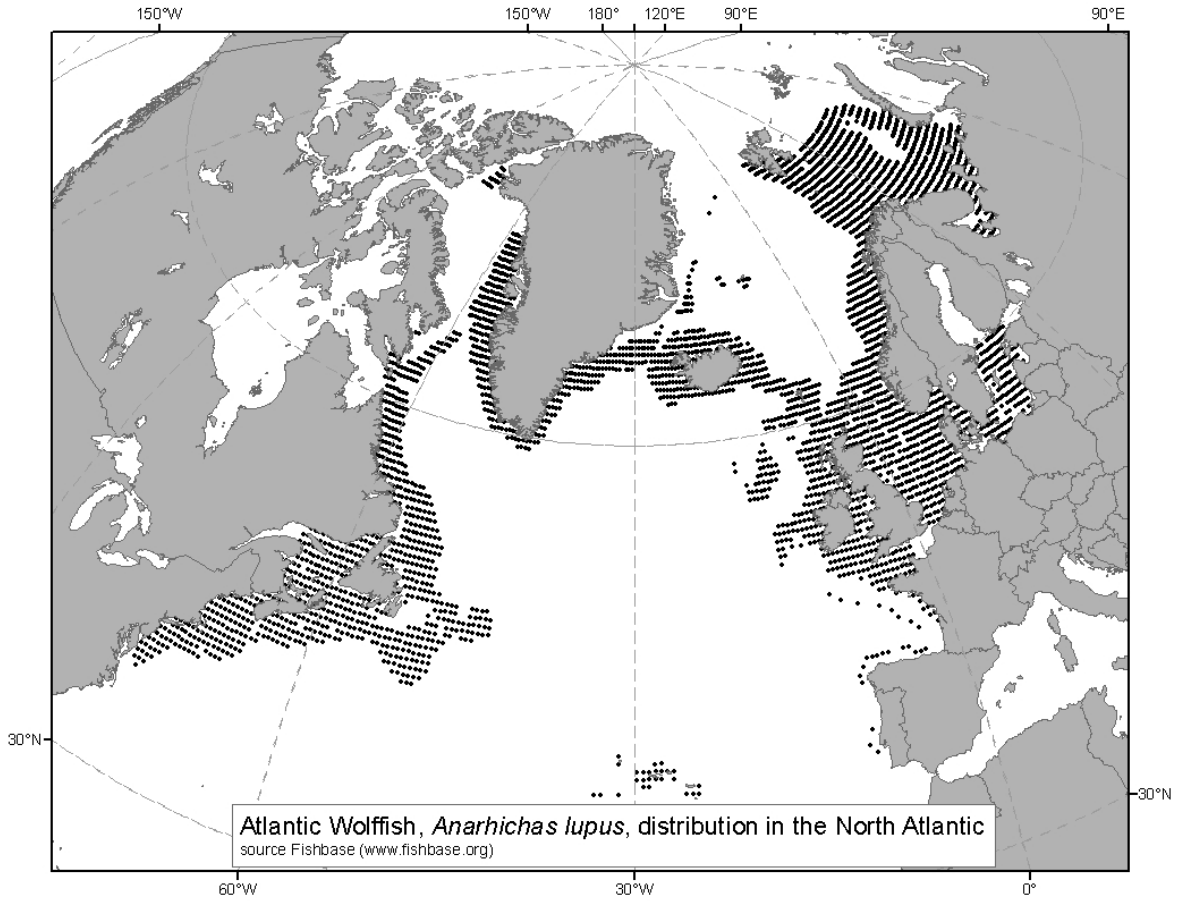


Figure 1. Atlantic wolffish distribution in the North Atlantic Ocean. The US is the southern extent of the geographic range in the western Atlantic.

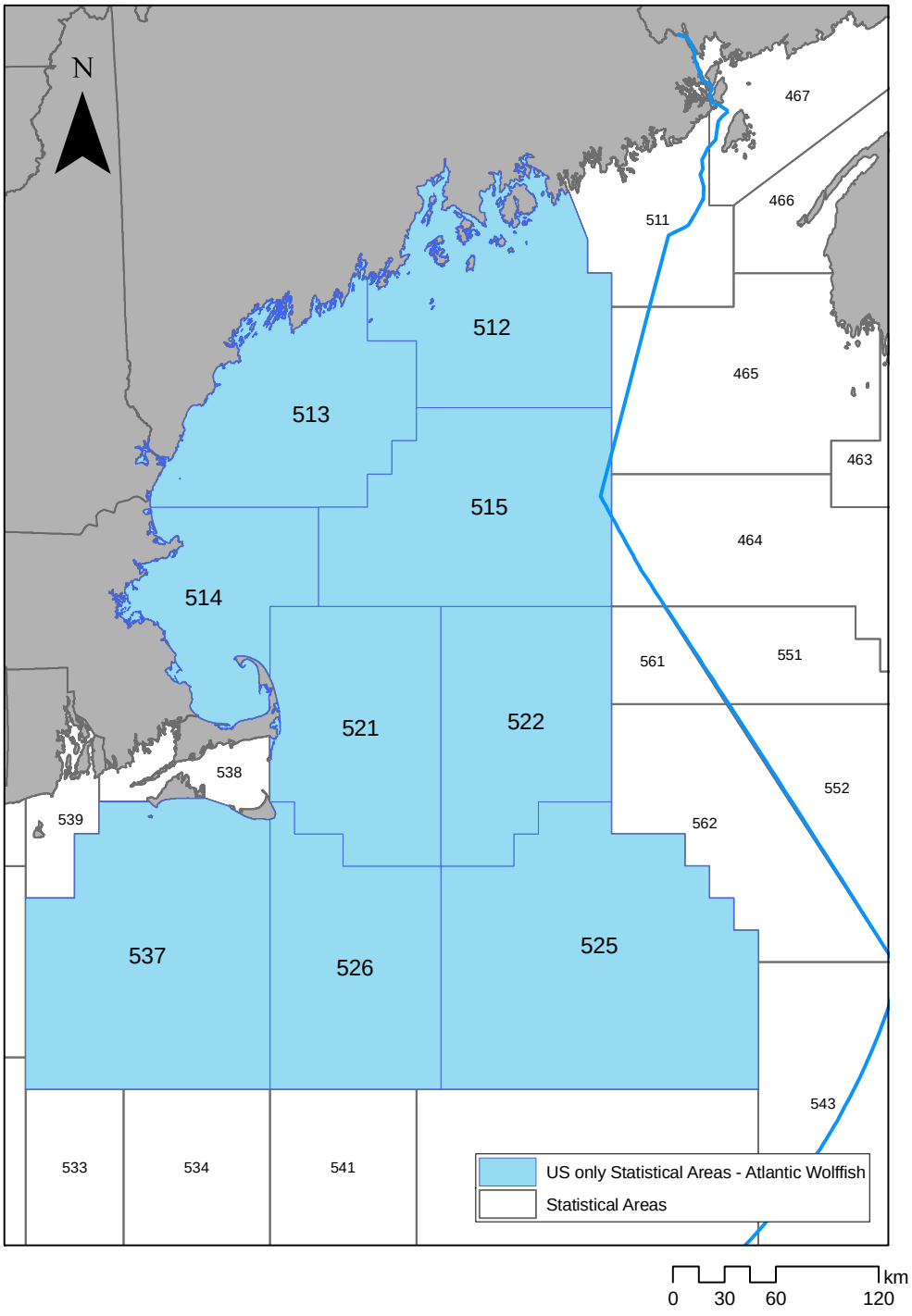


Figure 2. Fishery statistical areas used for Atlantic wolffish landings, catch and discard estimates.

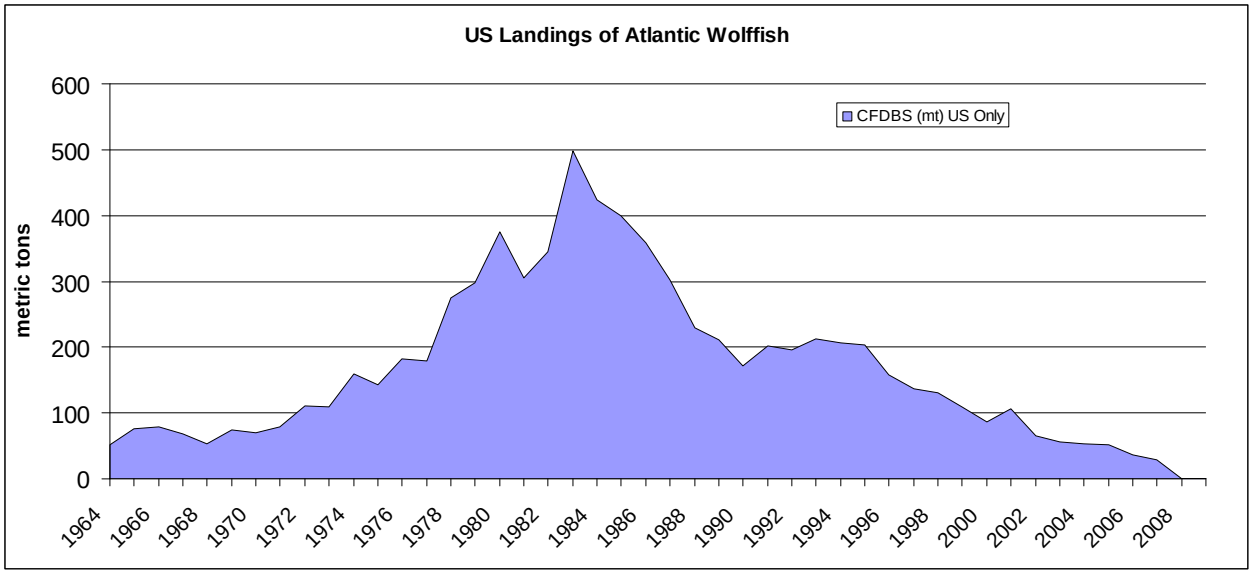


Figure 3. Reported landings of Atlantic wolffish in fishery statistical areas 512-515, 521-522, 525-526 and 537.

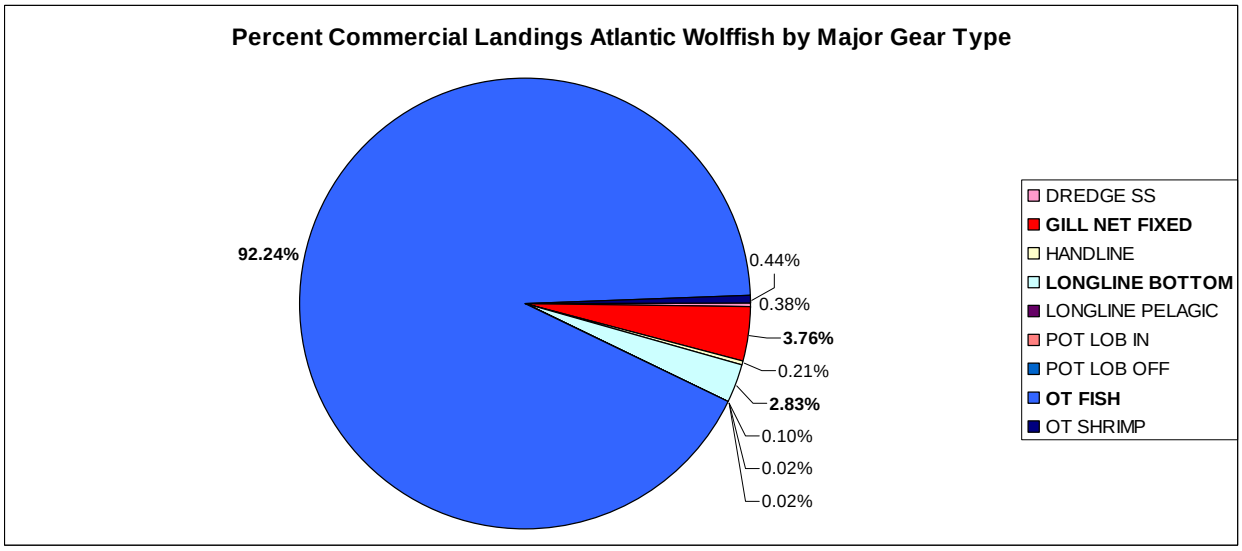


Figure 4. Atlantic wolffish landings by gear type for all years, 1964-2007.

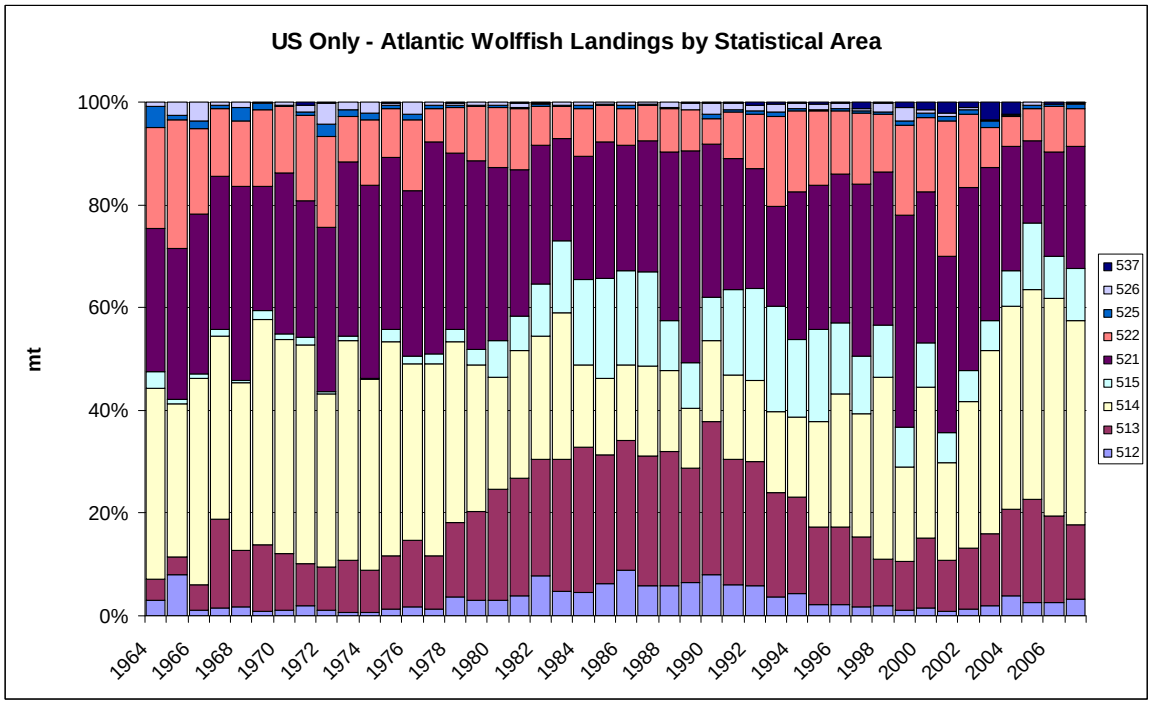


Figure 5. Reported wolffish landings by fishery statistical area in US waters.

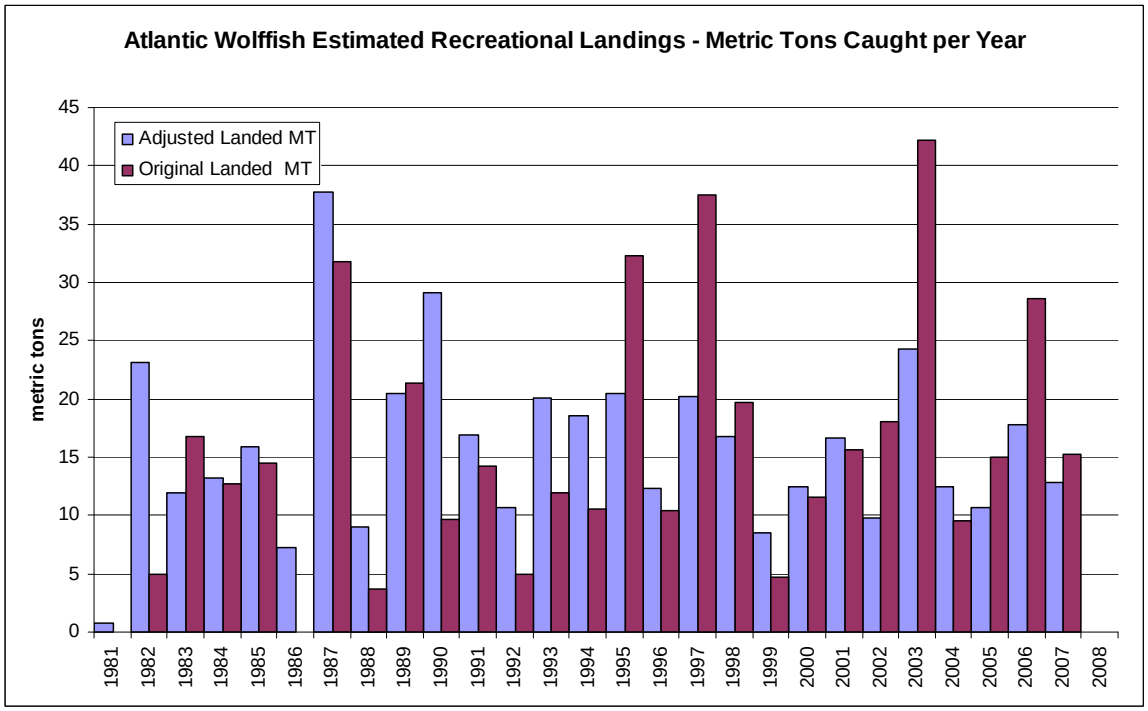


Figure 6. Reported and adjusted recreational landings by year from MRFSS database, 1981-2007.

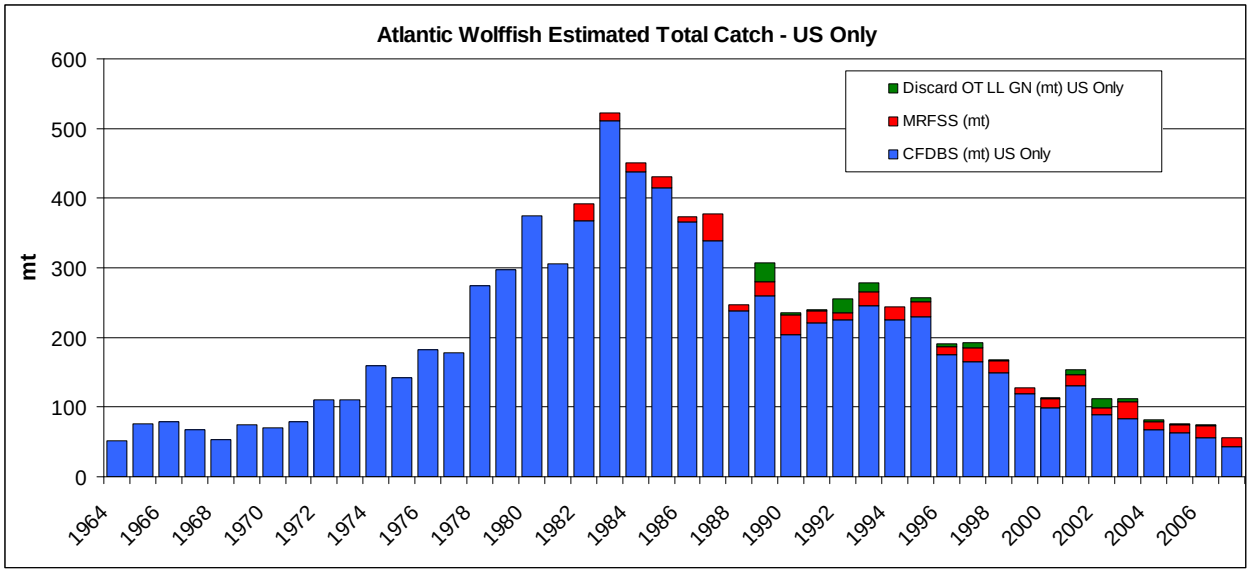


Figure 7. Total catch from reported commercial landings, estimated discards and recreational landings for US only 1964-2007.

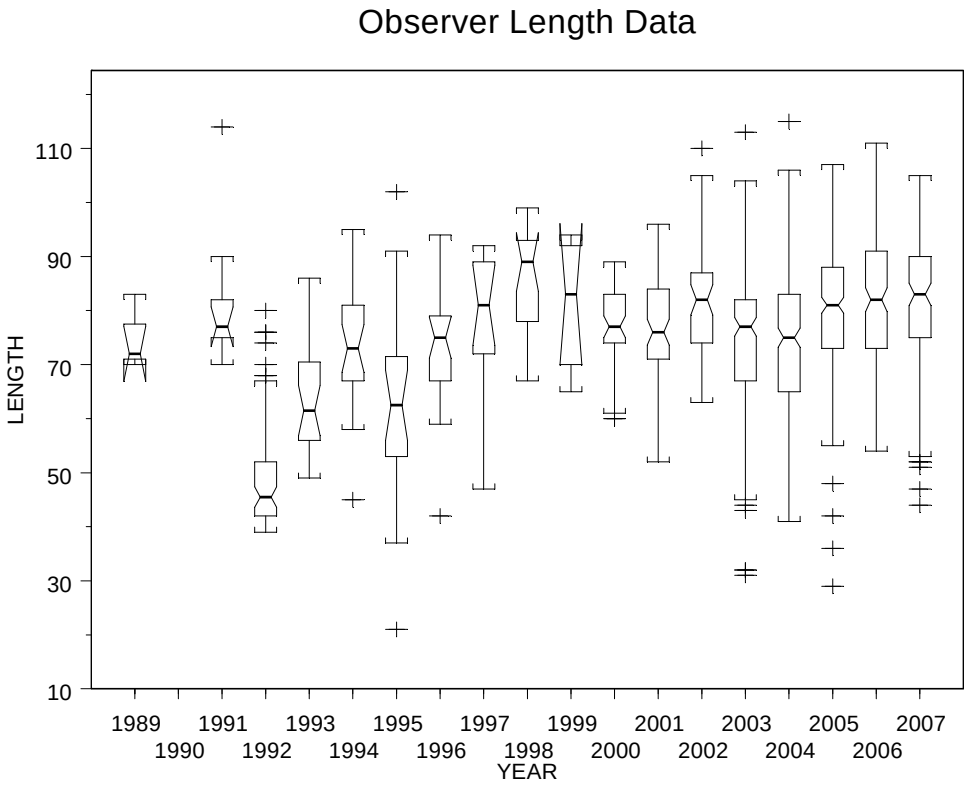


Figure 8. Fishery observer length distribution by year, 1989-2007.

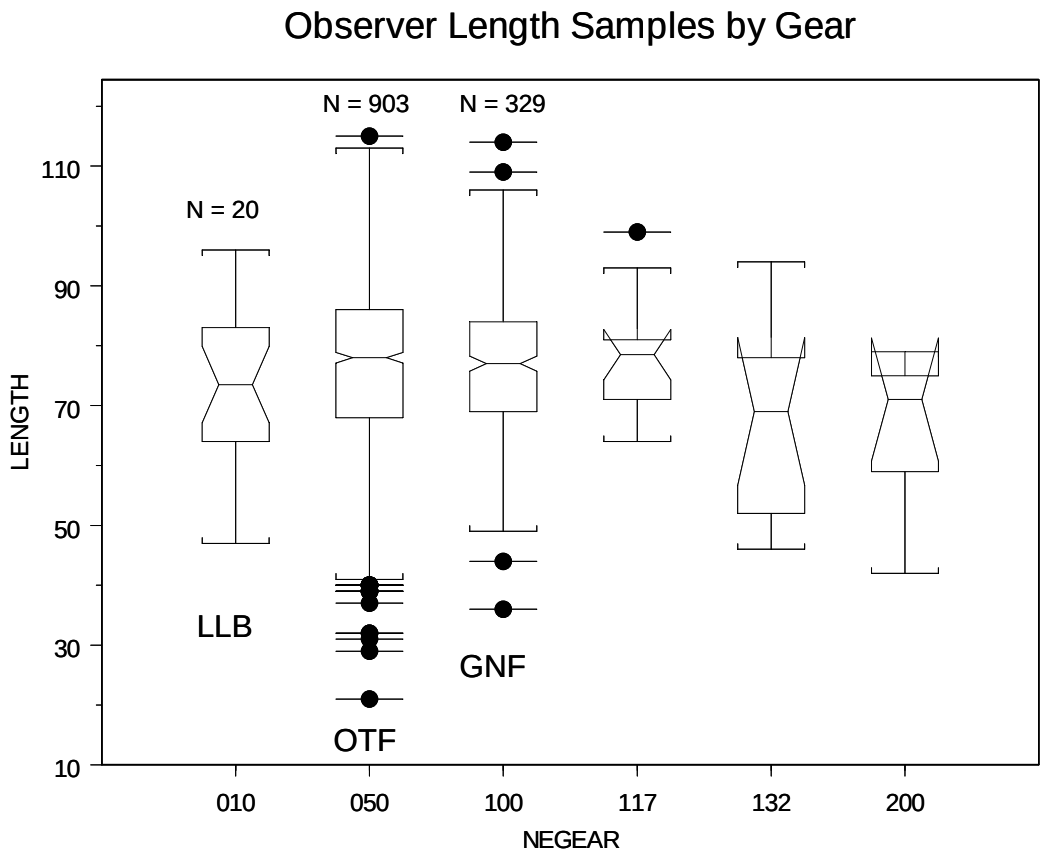


Figure 9. Fishery observer length distribution by major gear type.

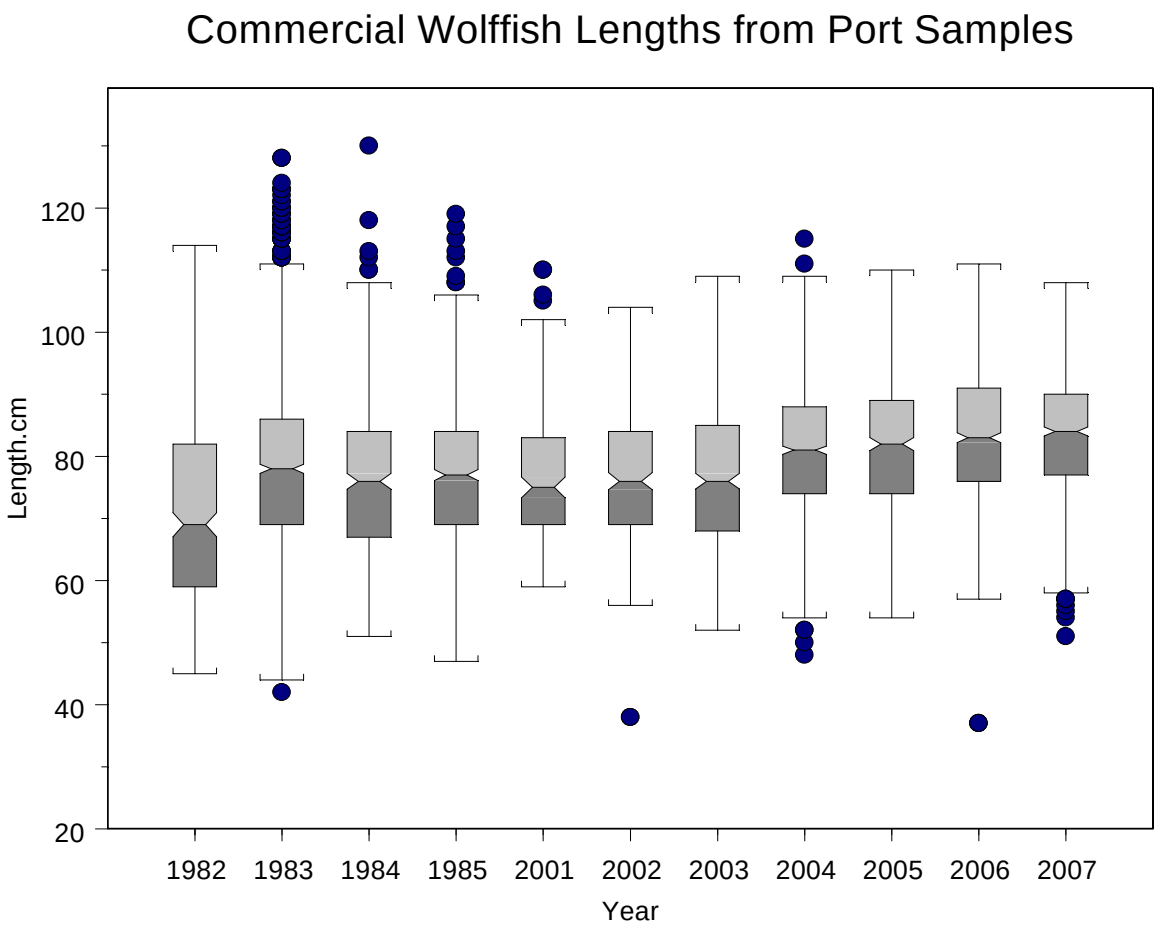


Figure 10. Atlantic wolffish commercial length distributions by year from port samples, 1982-1985 and 2001-2007.

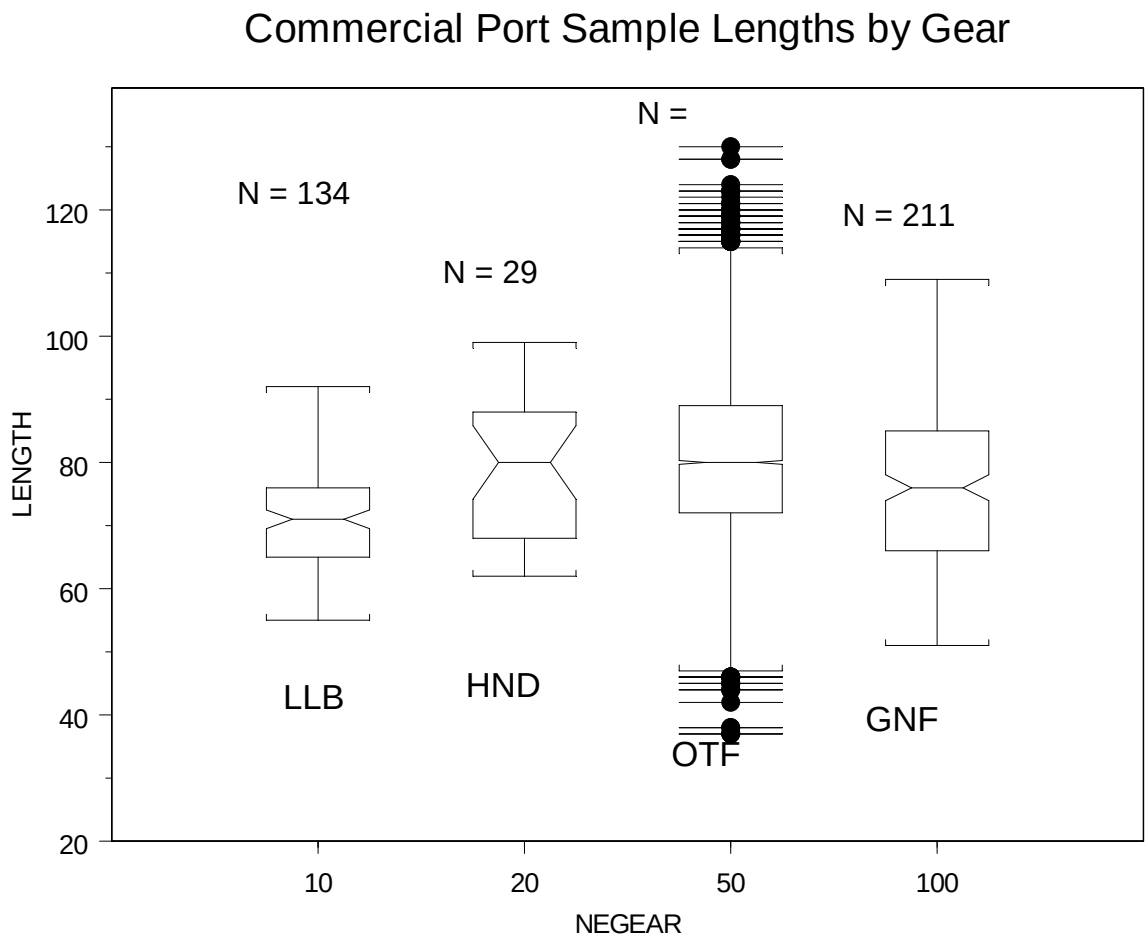


Figure 11. Commercial port sample length distributions by major gear type, all years combined (1982-1985 & 2001-2007).

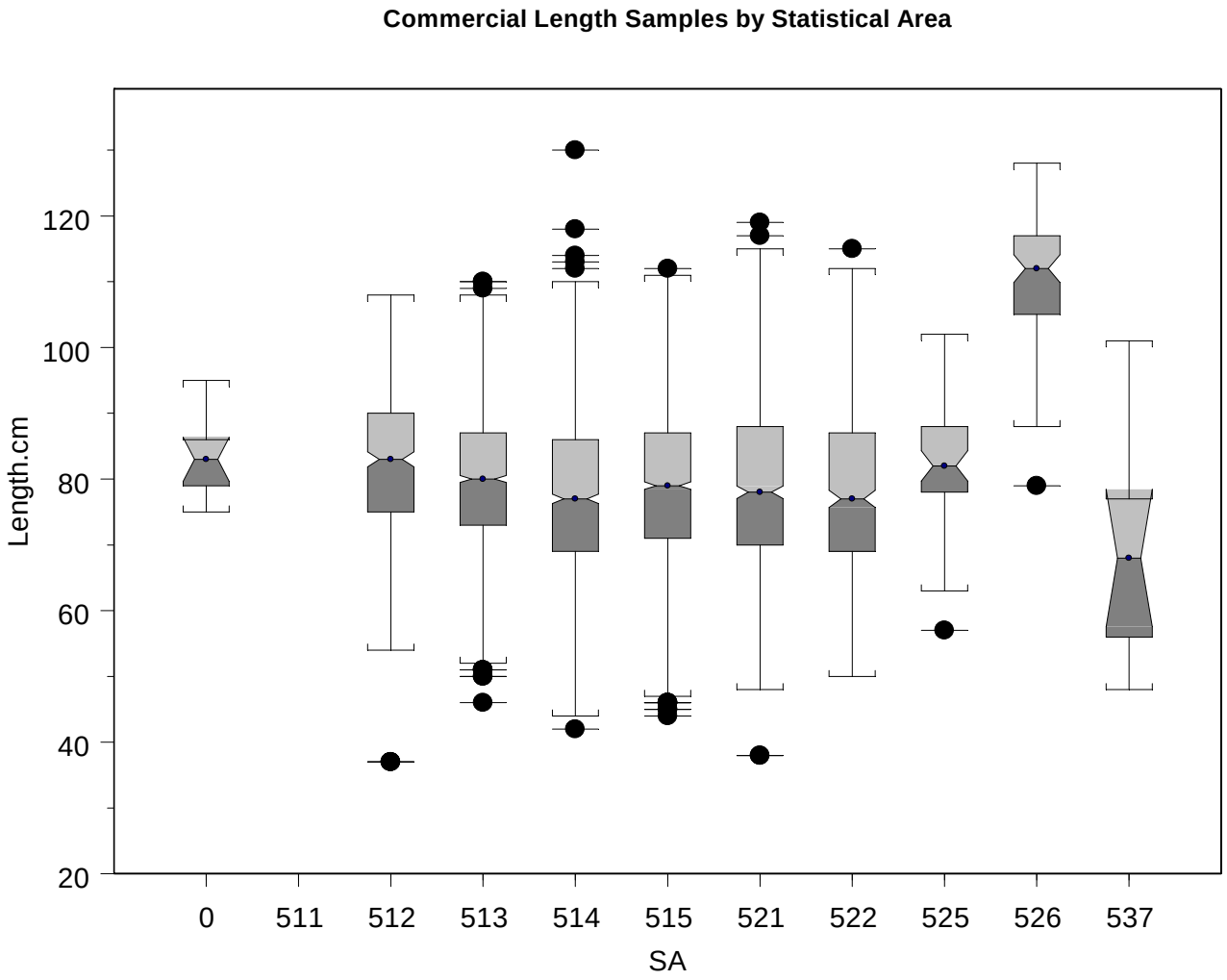


Figure 12. Commercial port sample length distributions by fishery statistical area in US waters, all years combined (1982-1985 & 2001-2007).

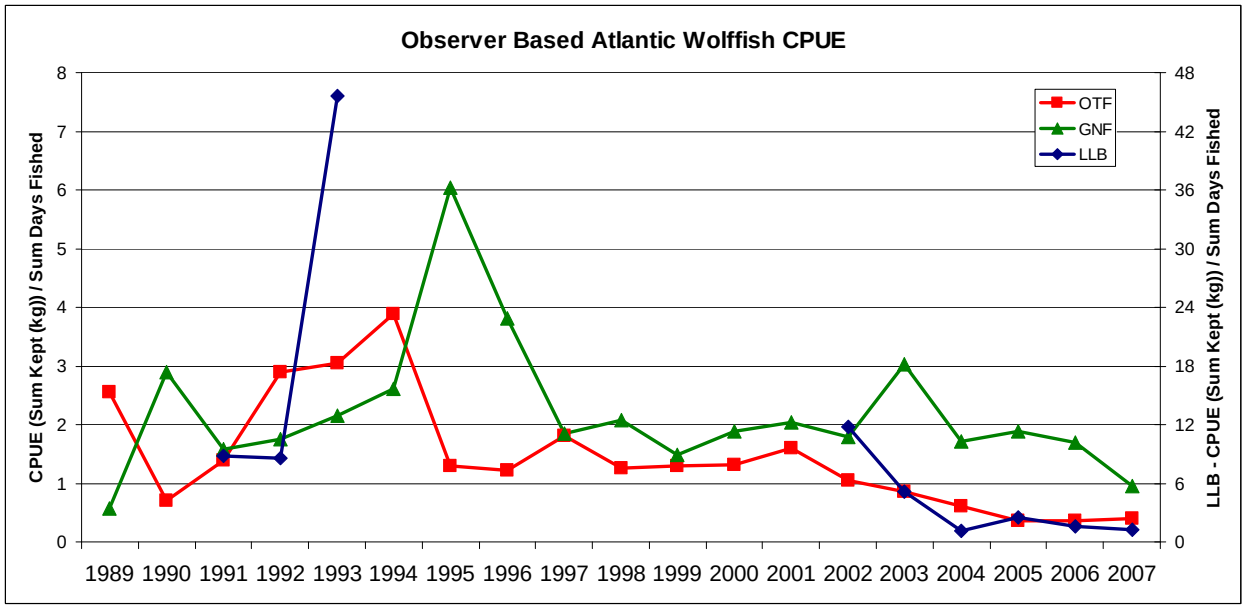


Figure 13. Catch per unit effort of Atlantic wolffish based on observer data in the otter trawl, gillnet and longline fisheries.

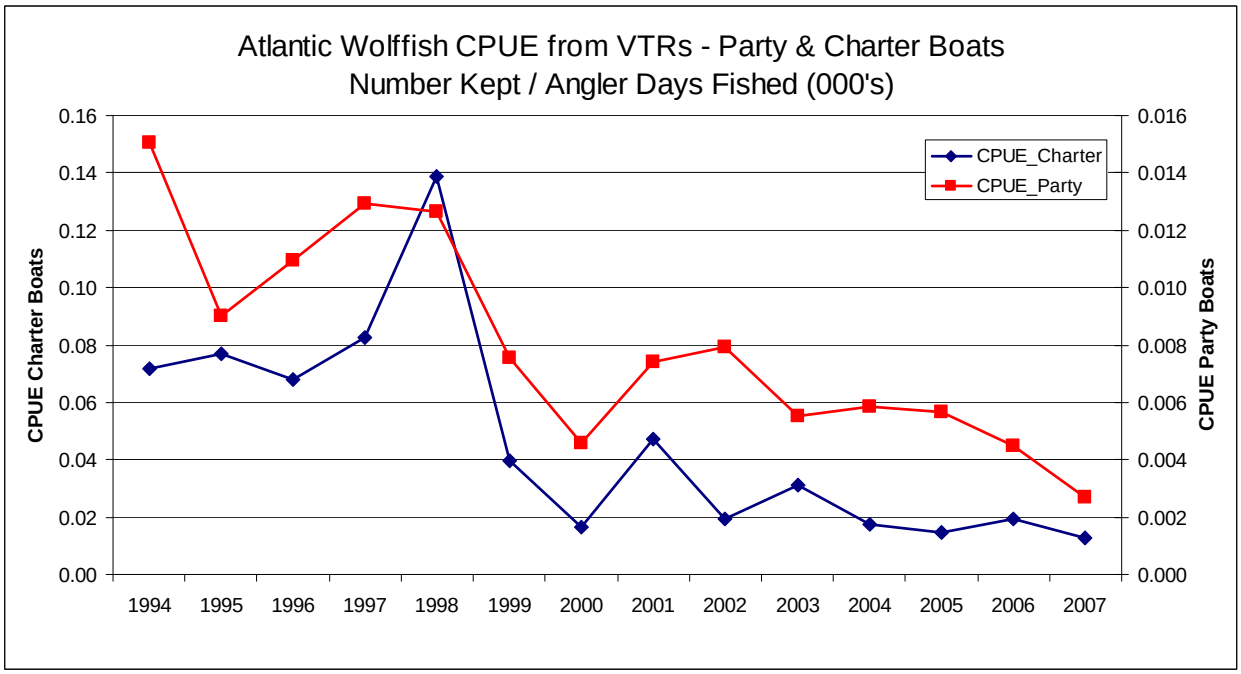


Figure 14. Catch per unit effort of Atlantic wolffish based on VTR data in the party and charter boat sectors.

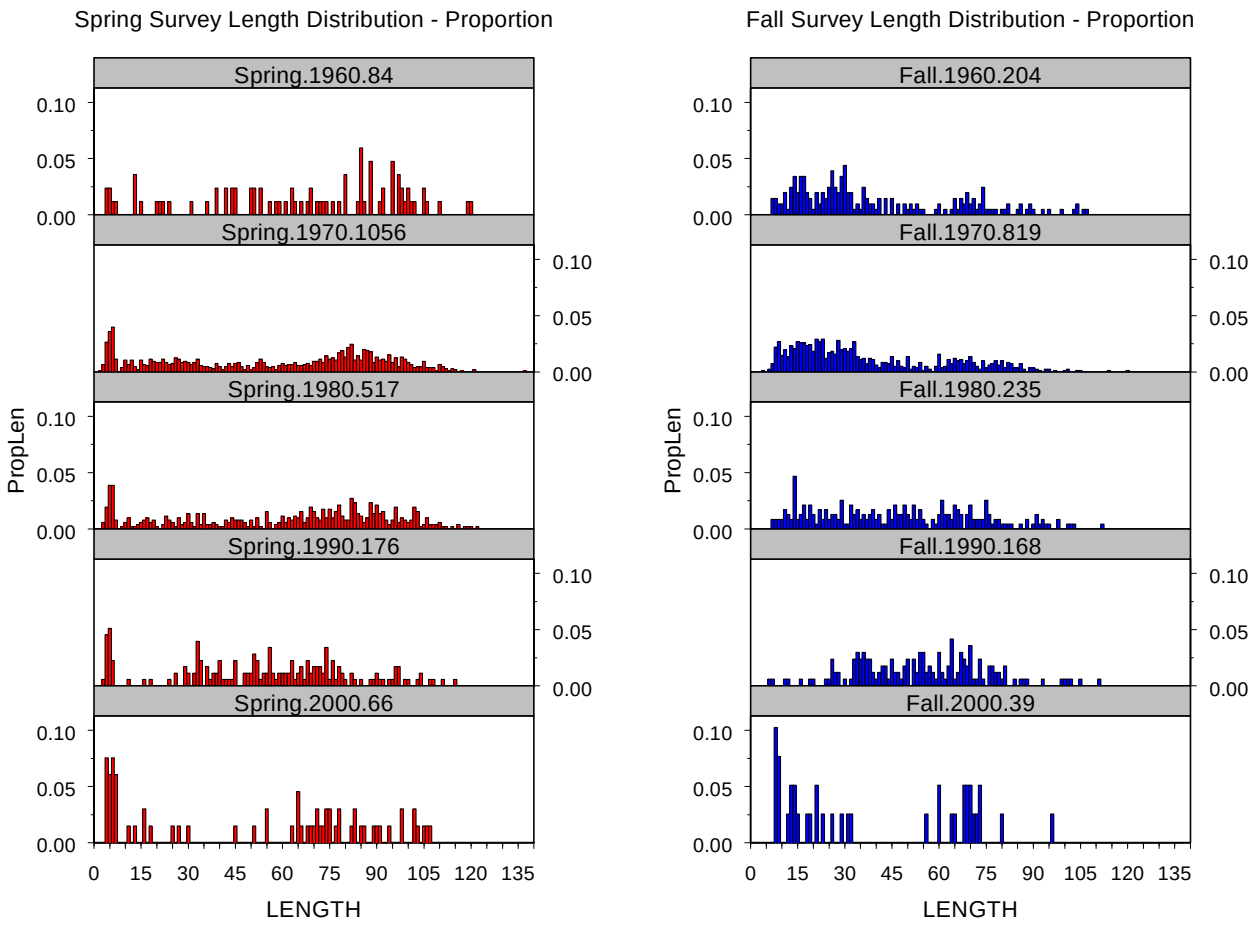


Figure 15. Spring and fall proportional length distributions grouped by decade from NEFSC bottom trawl surveys. Spring and fall time series 1968-2007 and 1963-2007 respectively.

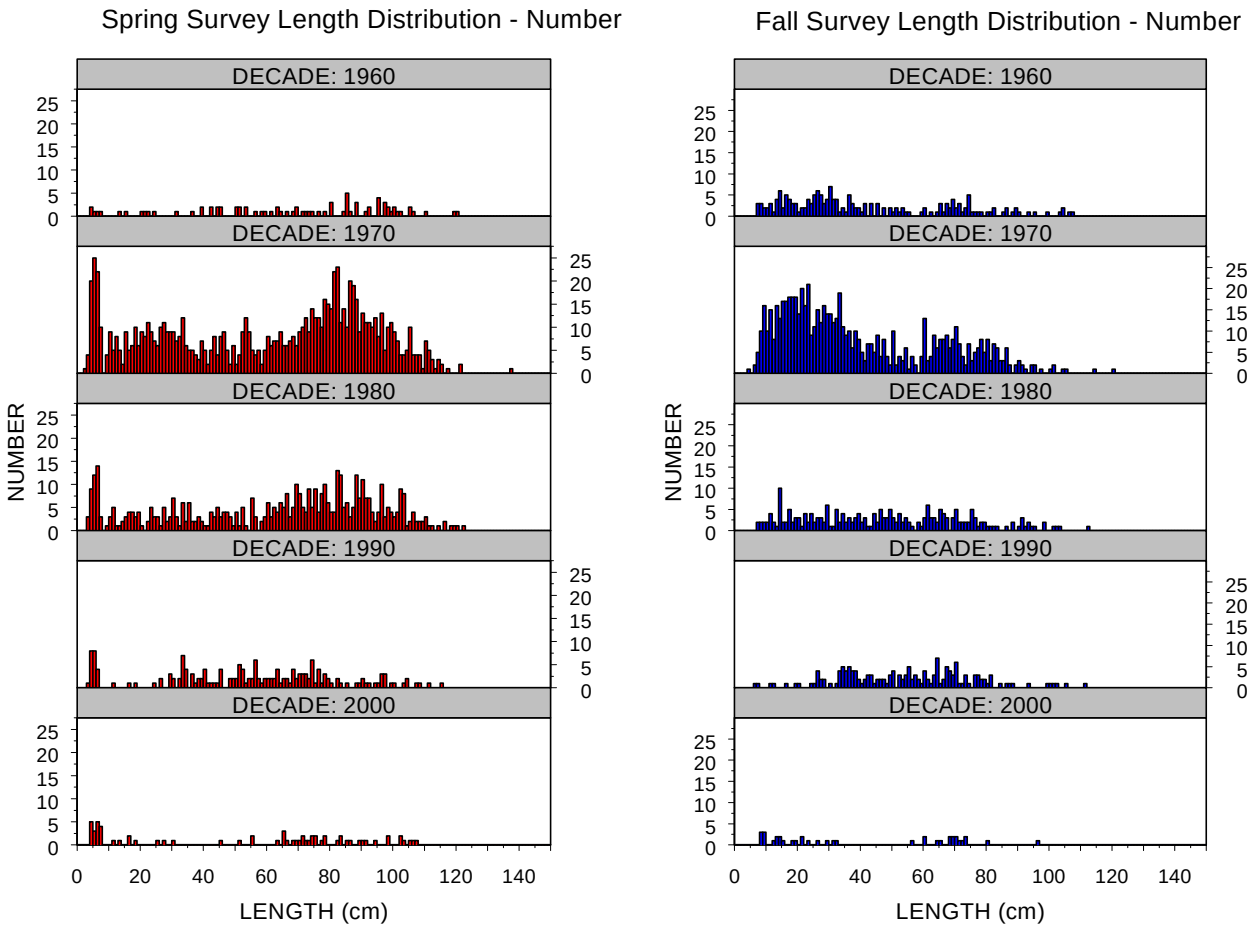


Figure 16. Spring and fall number at length histograms grouped by decade from NEFSC bottom trawl surveys. Spring and fall time series 1968-2007 and 1963-2007 respectively.

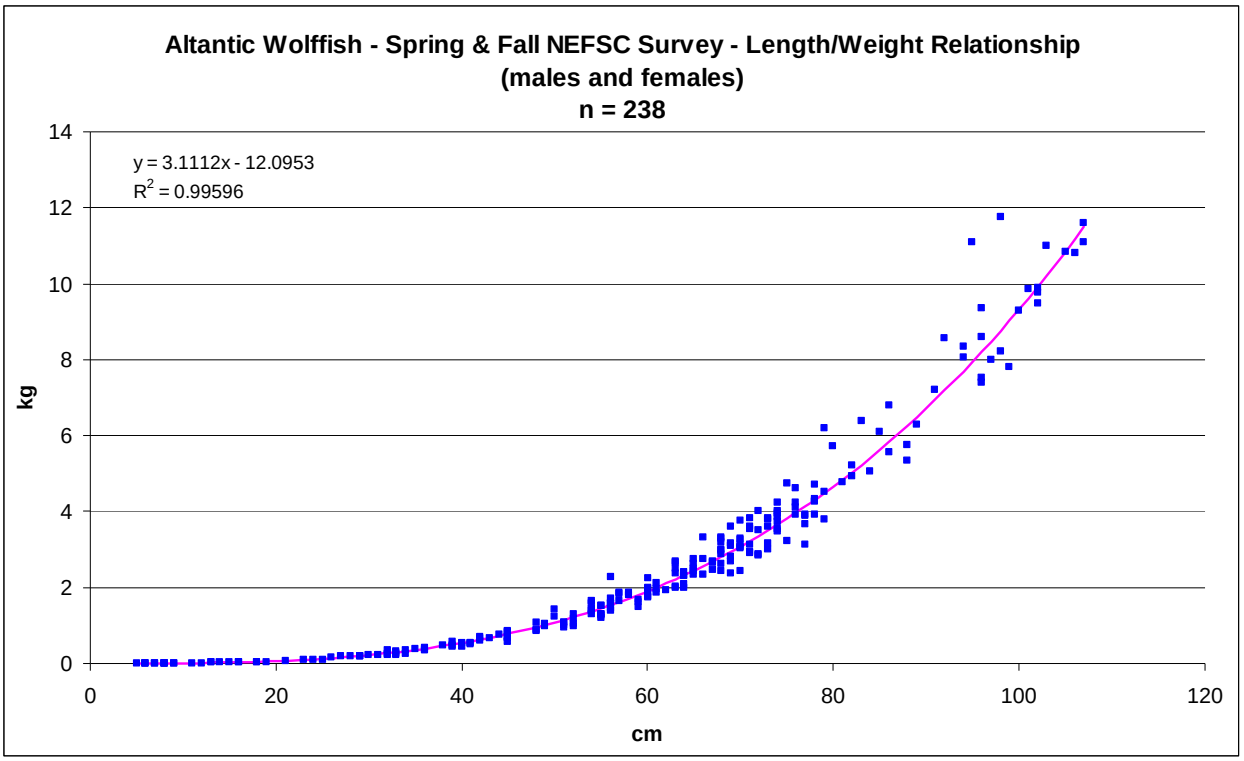


Figure 17. A combined male and female length weight relationship for Atlantic wolffish from NEFSC spring and fall bottom trawl surveys, all years.

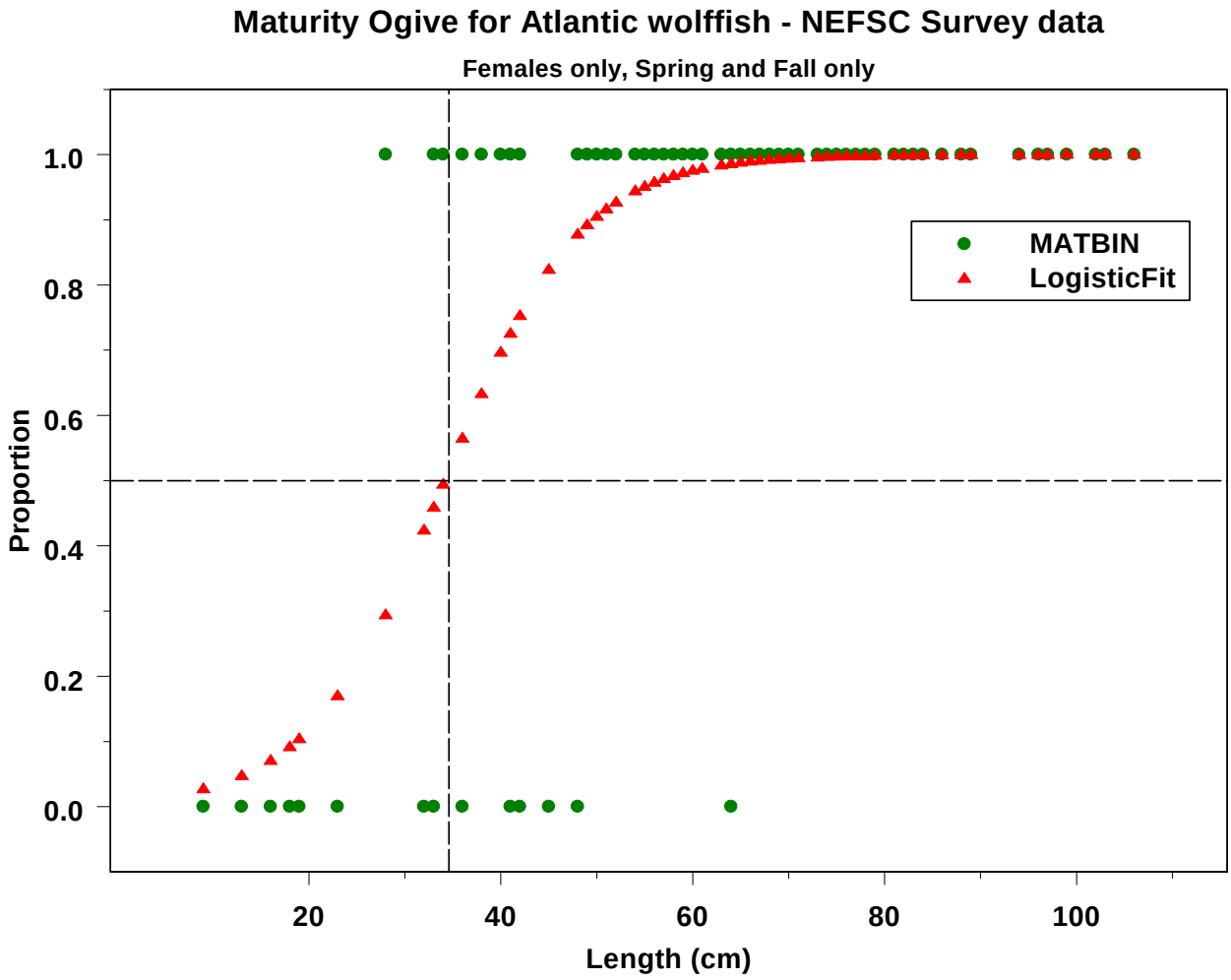


Figure 18. Maturity ogive for female Atlantic wolffish from NEFSC spring and fall data, all years.

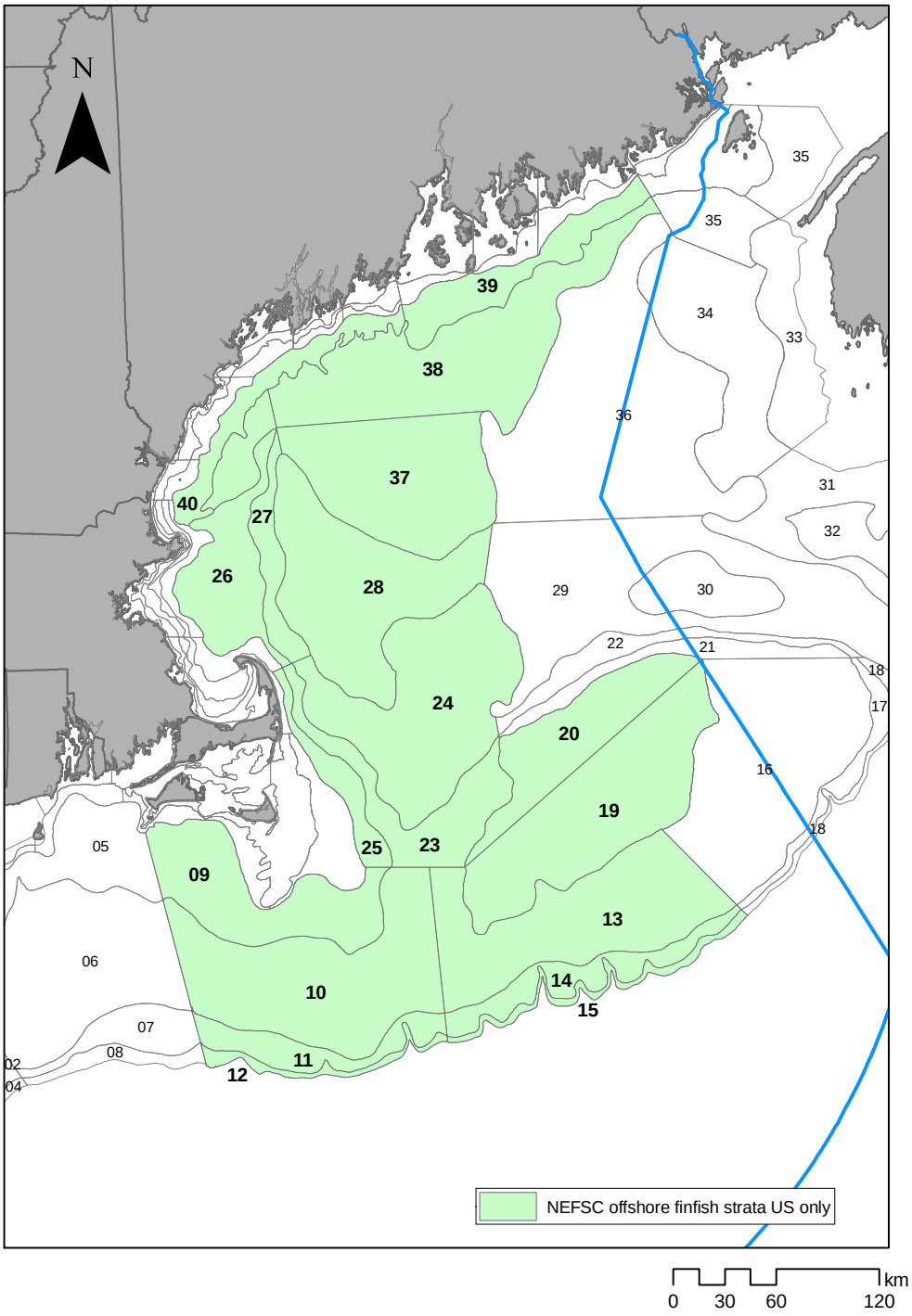


Figure 19. NEFSC survey strata used for Atlantic wolffish abundance and biomass indices.

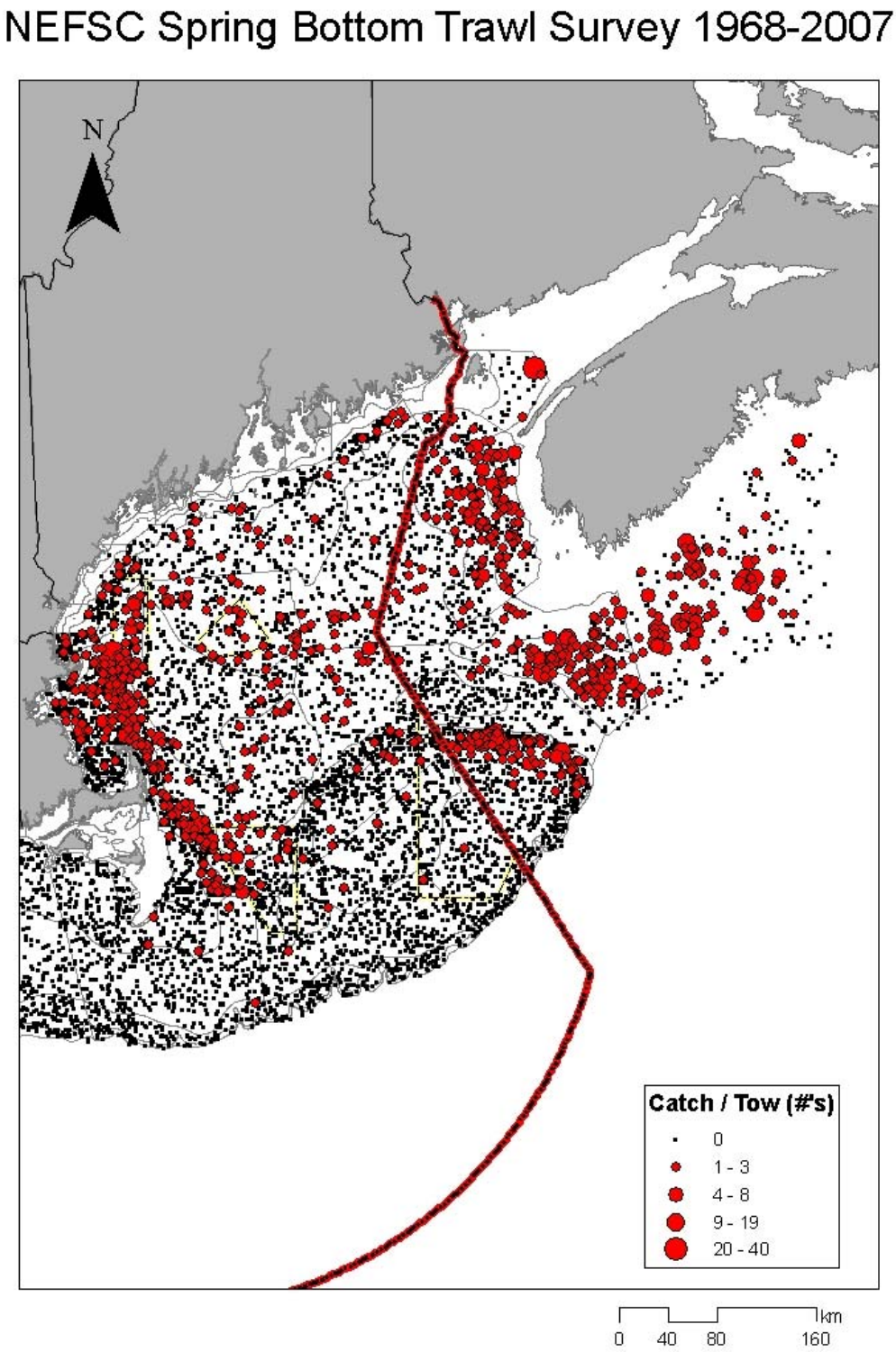


Figure 20. NEFSC spring bottom trawl survey wolffish catches, 1968-2007. Regions east of the Hague line were not included in abundance and biomass estimates.

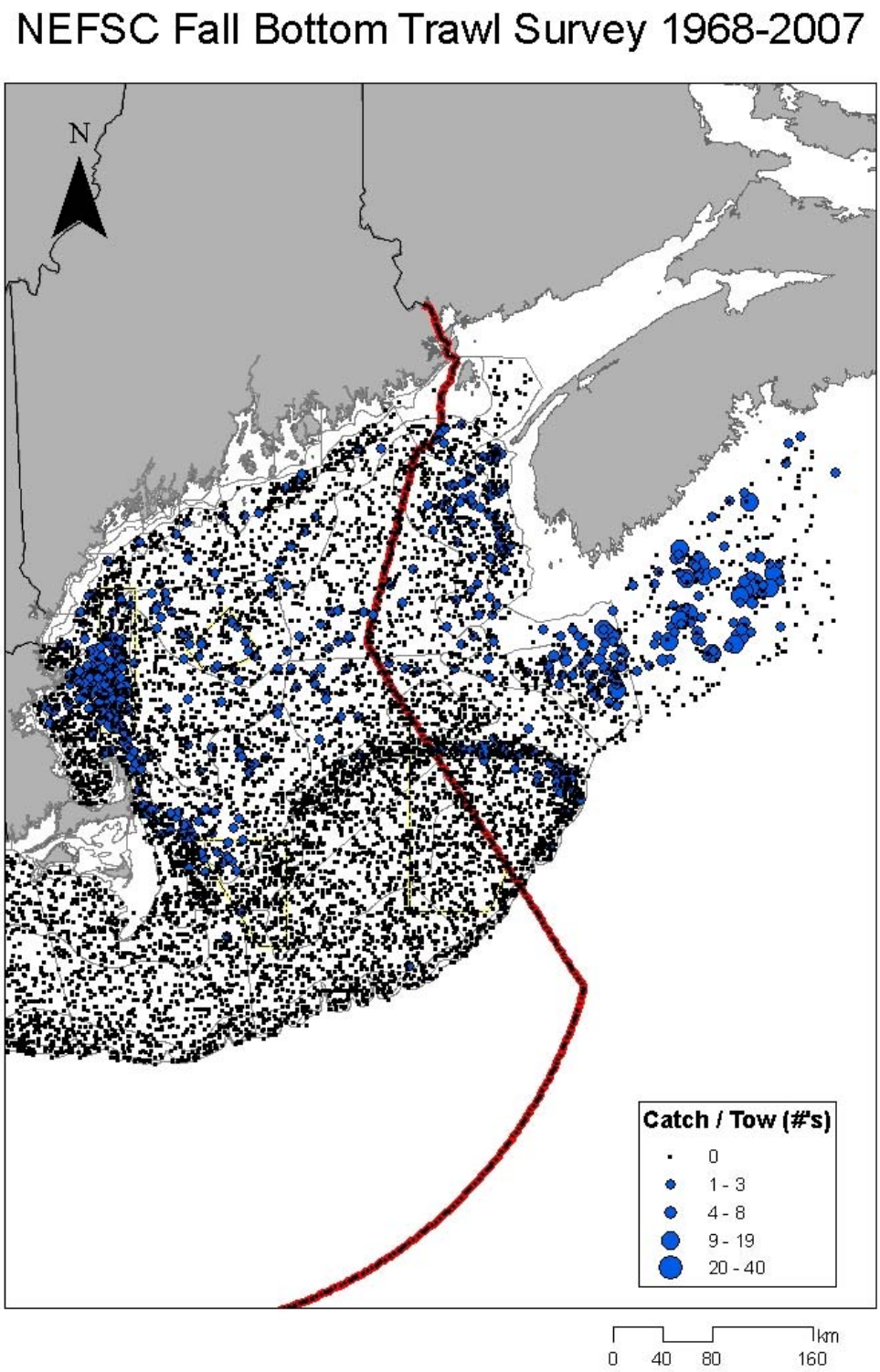


Figure 21. NEFSC fall bottom trawl survey wolffish catches, 1963-2007. Regions east of the Hague line were not included in abundance and biomass estimates.

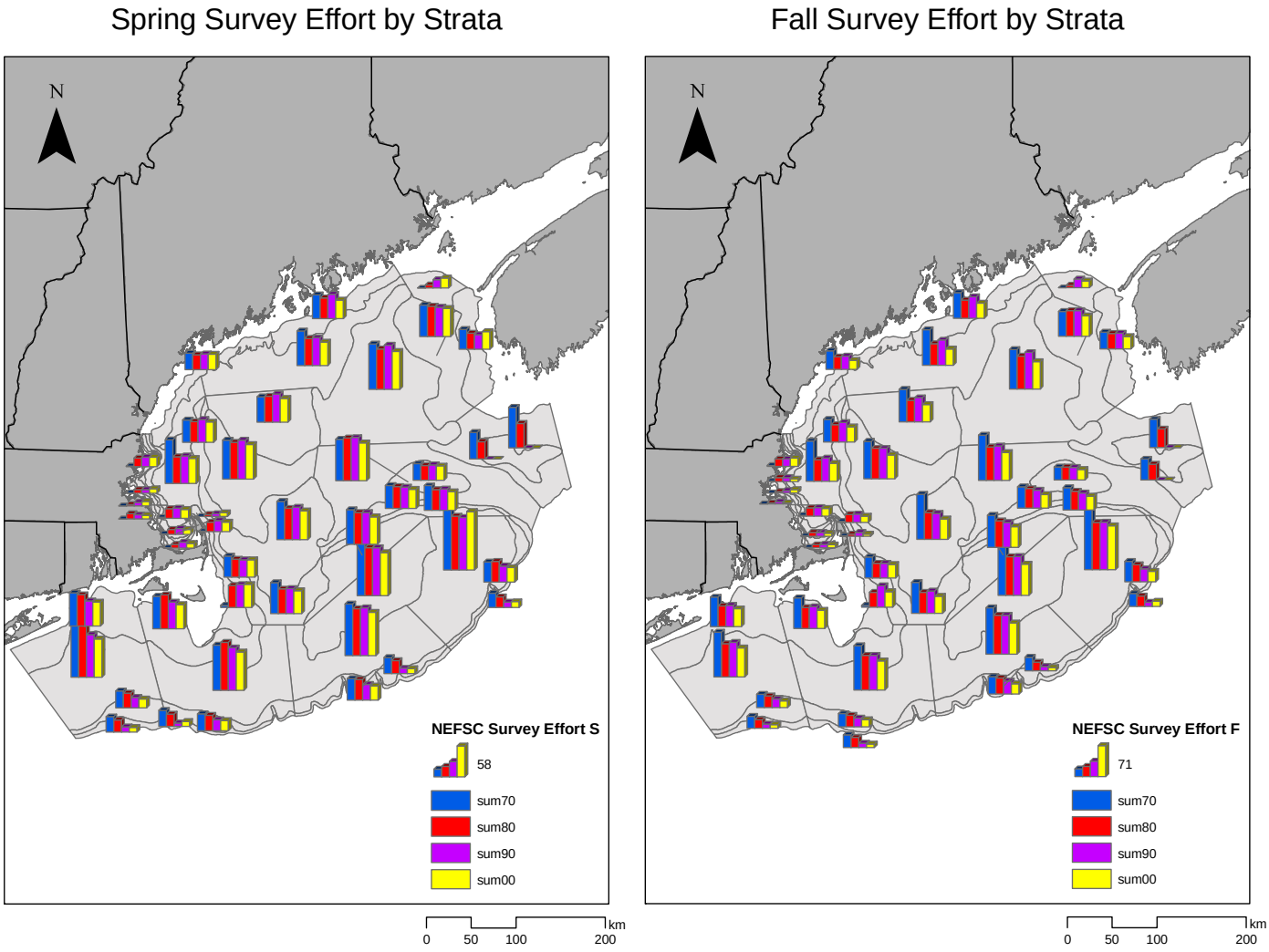


Figure 22. NEFSC spring and fall bottom trawl survey effort by decade per strata. Bars indicate number of stations per strata.

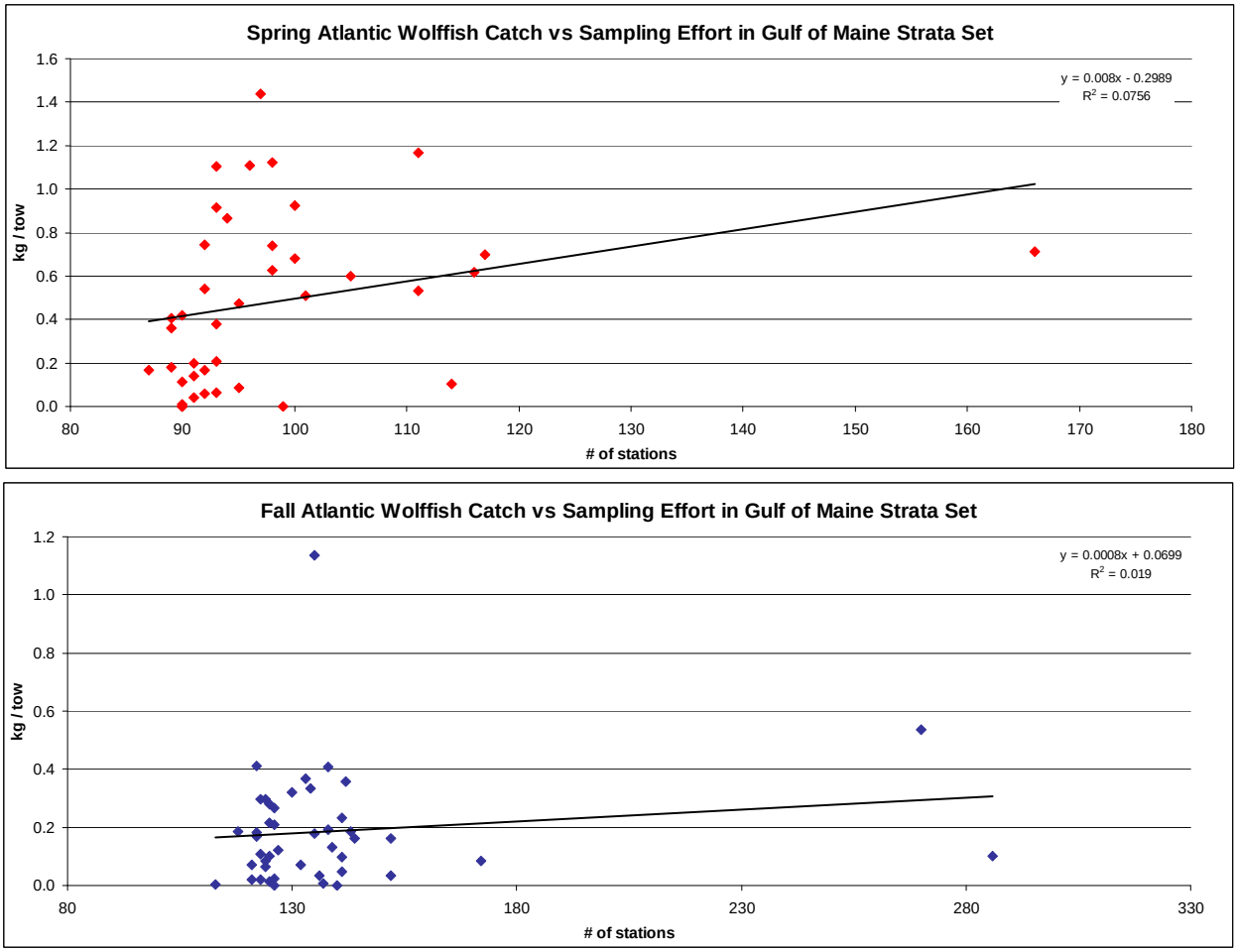


Figure 23. NEFSC sampling effort and biomass of Atlantic wolffish captured.

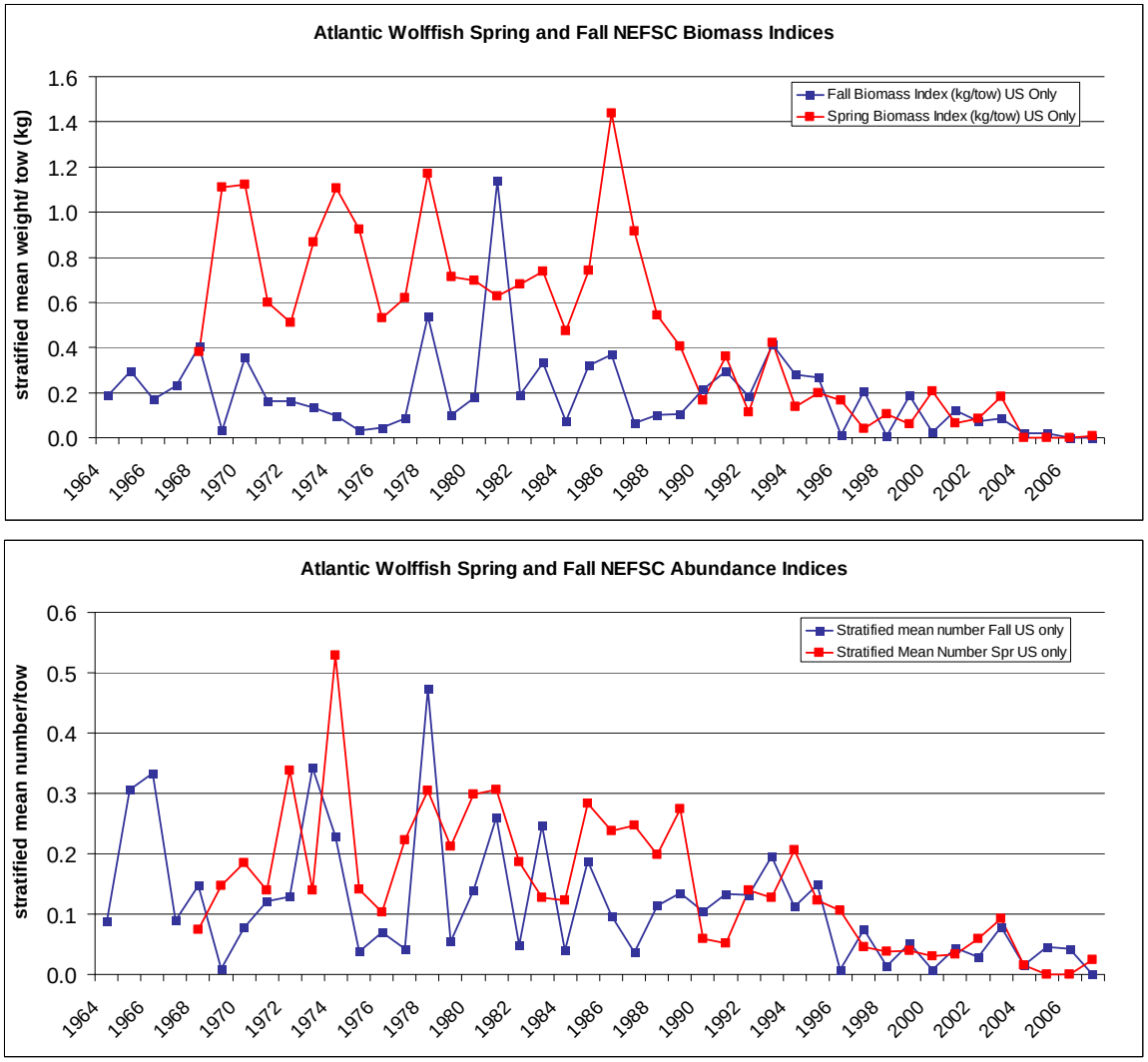


Figure 24. Spring and fall biomass and abundance indices for US only survey strata, 1964-2007.

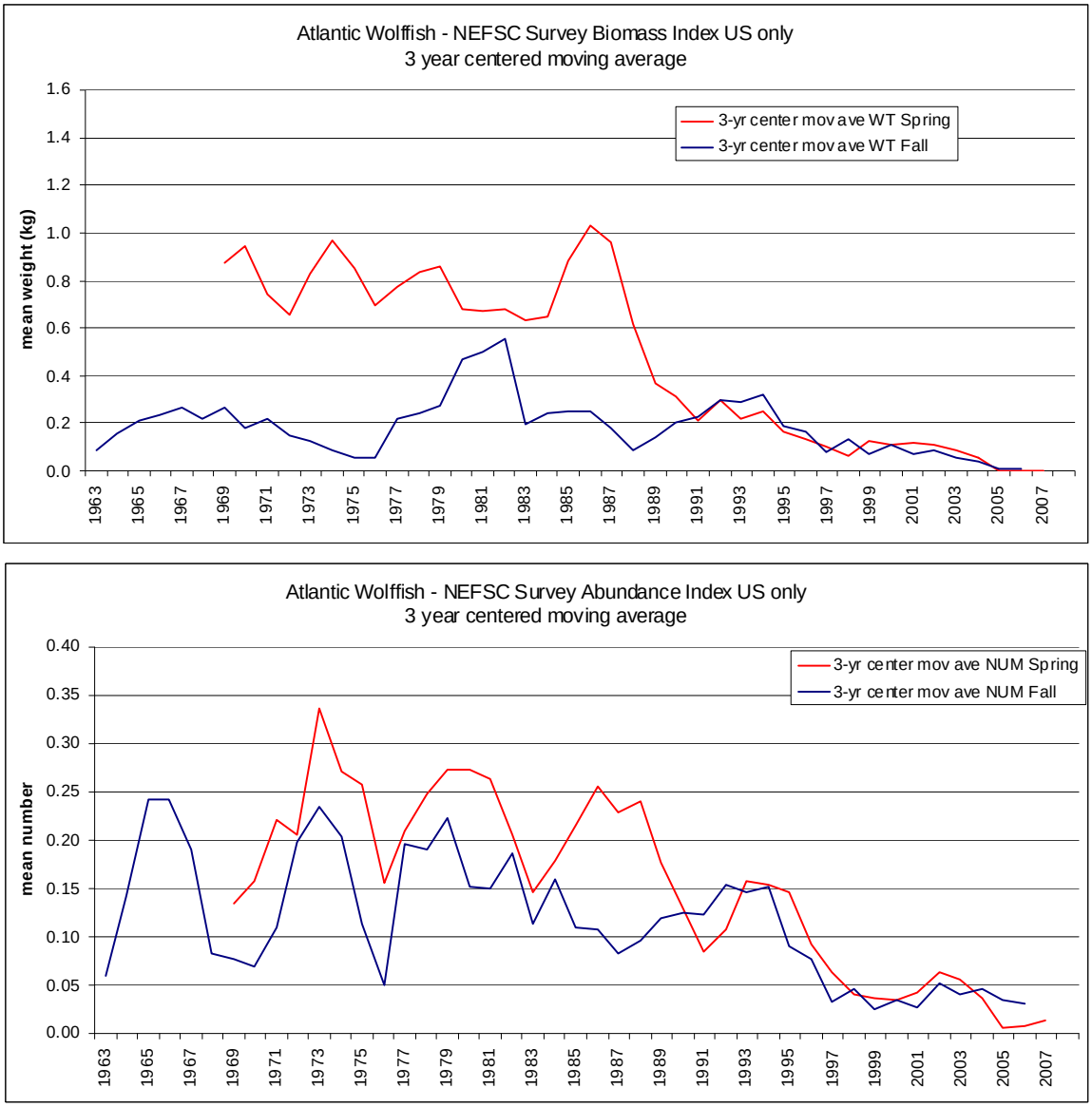


Figure 25. 3 year moving average for NEFSC spring and fall biomass and abundance indices.

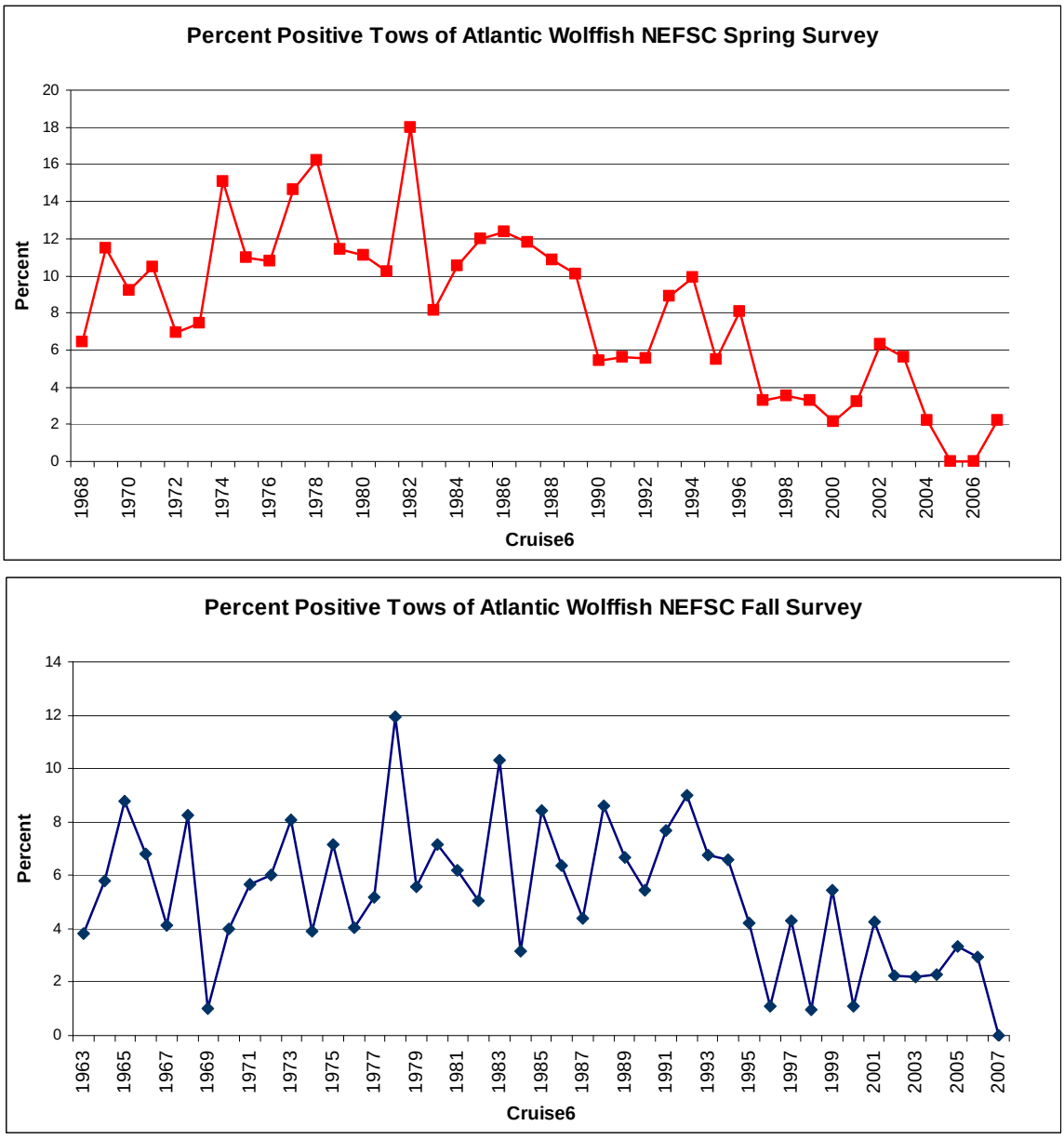


Figure 26. Percent positive Atlantic wolffish catches by year from NEFSC spring and fall bottom trawl surveys.

Spring NEFSC Survey Catches by Decades - US Strata Only

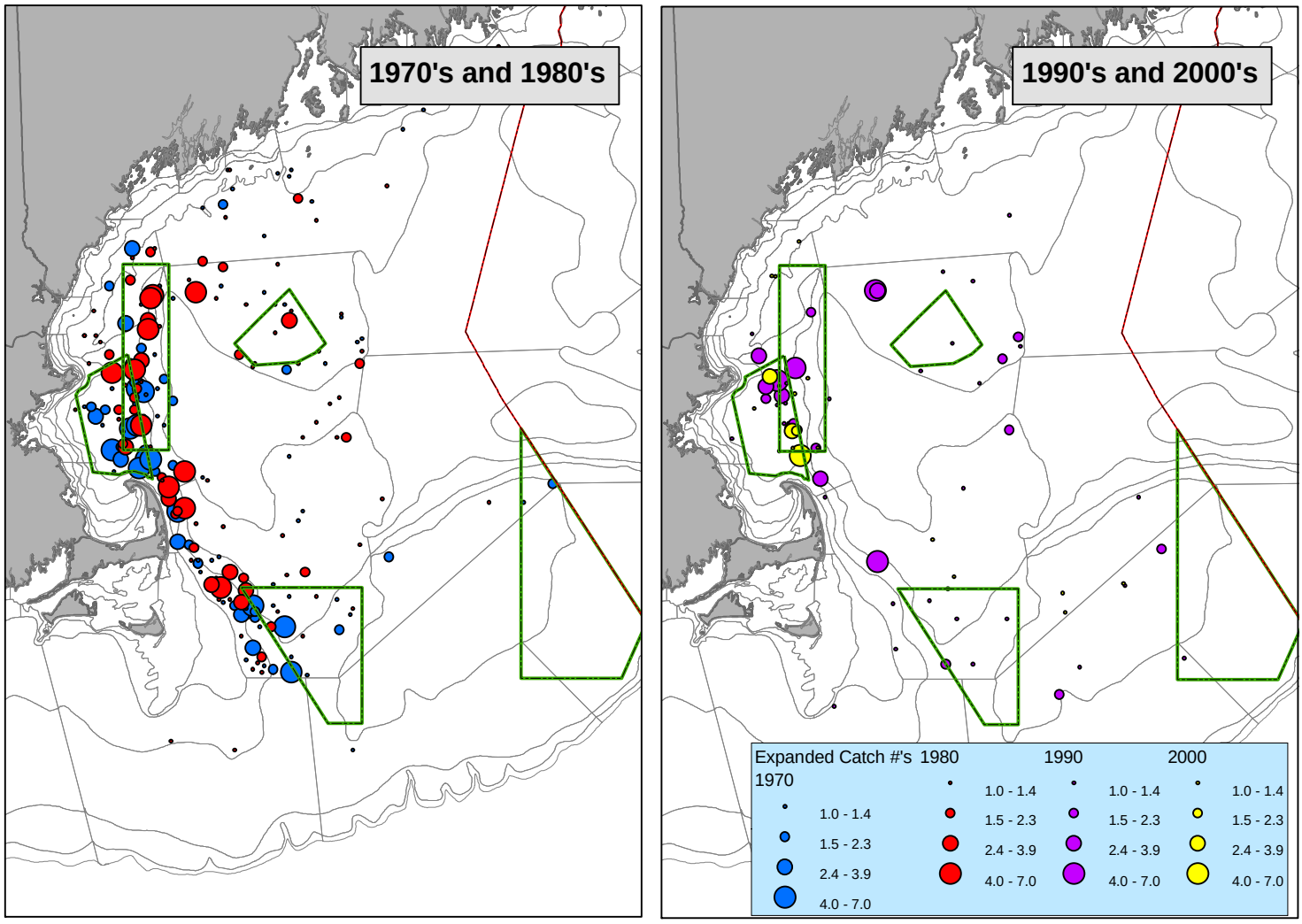


Figure 27. NEFSC spring survey catches by decade.

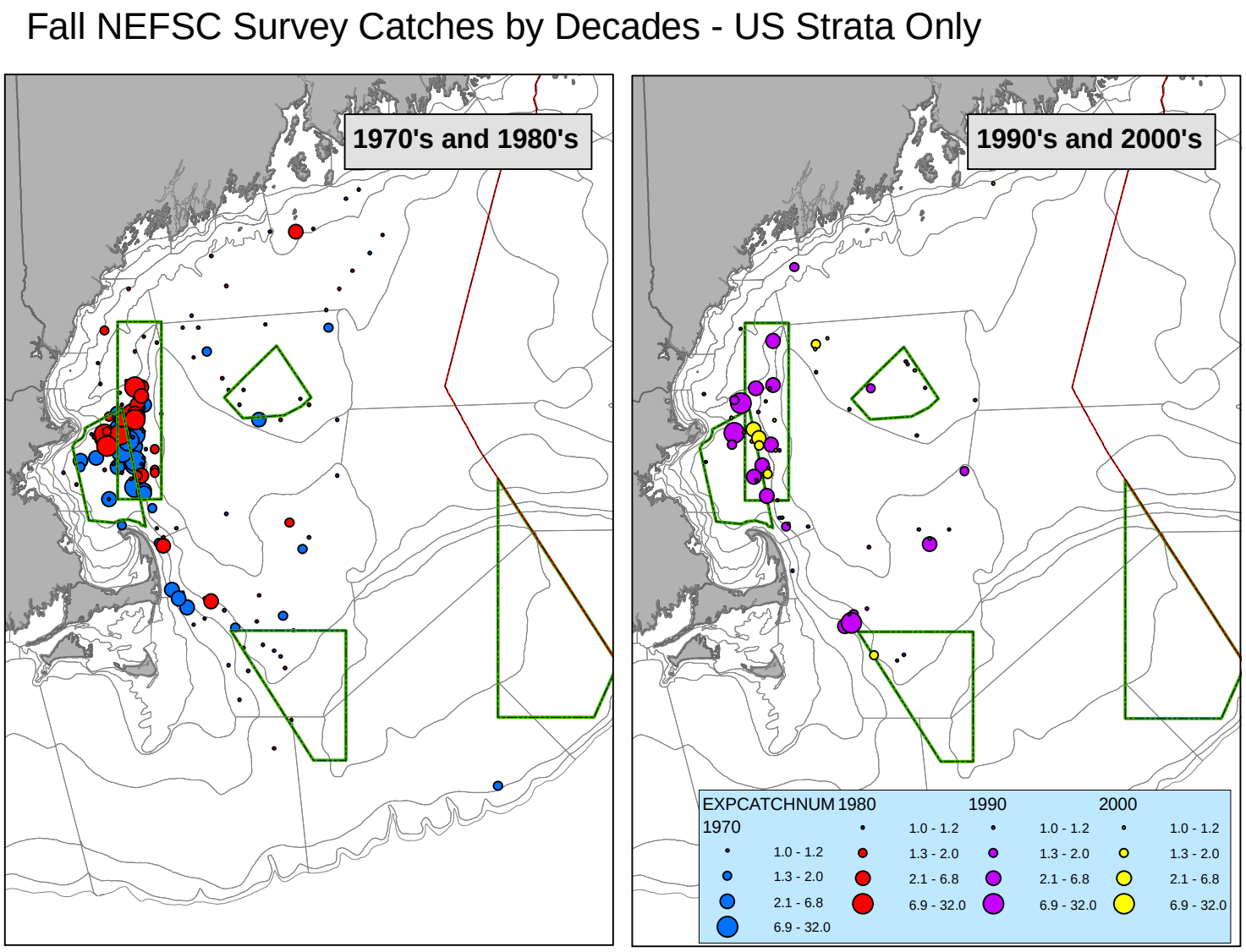


Figure 28. NEFSC fall survey catches by decade.

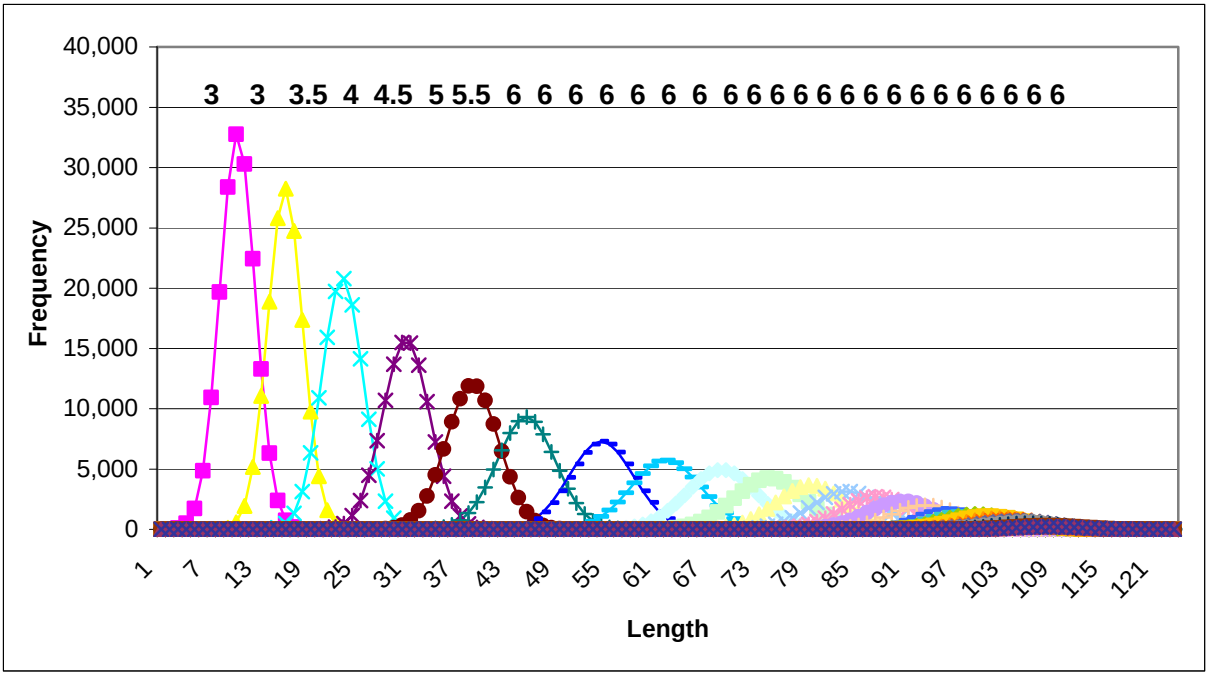


Figure 29. Mean lengths at age distributions assumed for wolffish growth. The input standard deviation is given in the top row of numbers. Ages greater than 7 had a standard deviation of 6.

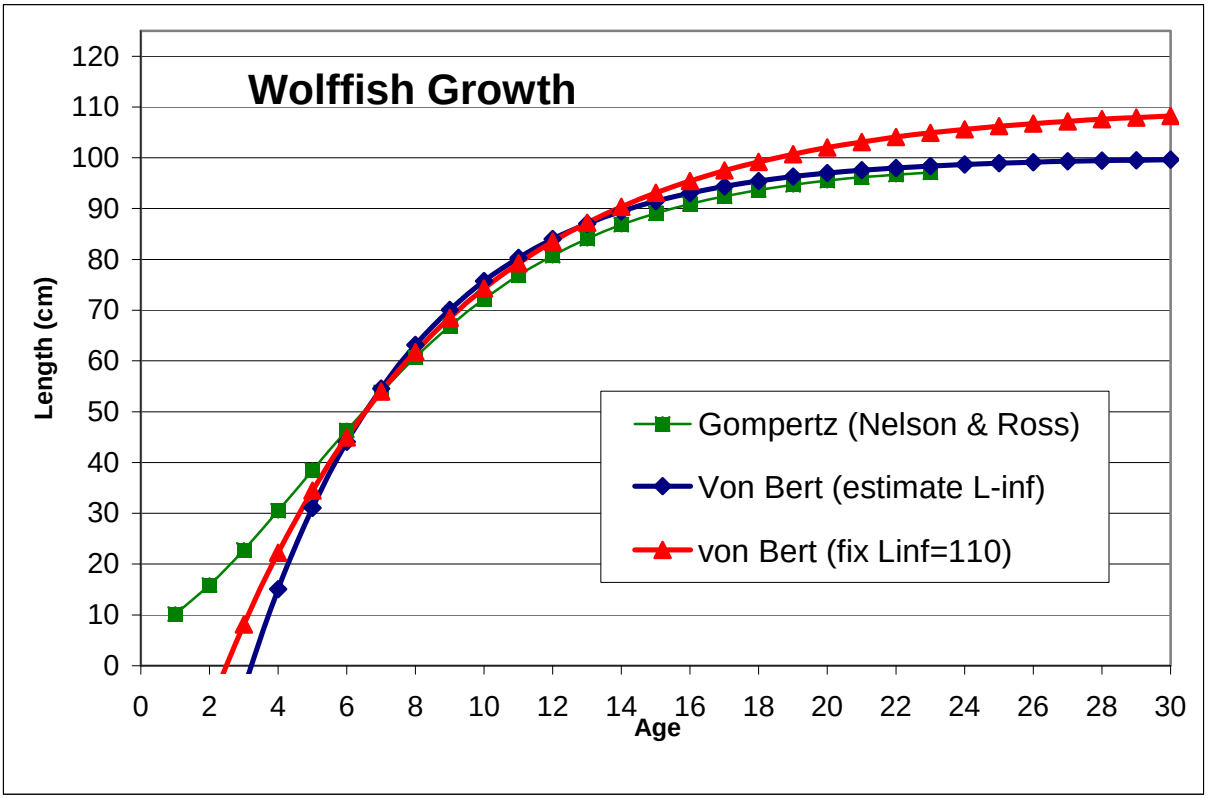


Figure 30. Wolffish estimated growth from Nelson and Ross (1992), von Bertalanffy model limited to 5+ fish, and von Bertalanffy model limited to 5+ fish with fixed L-infinity at 110 cm.

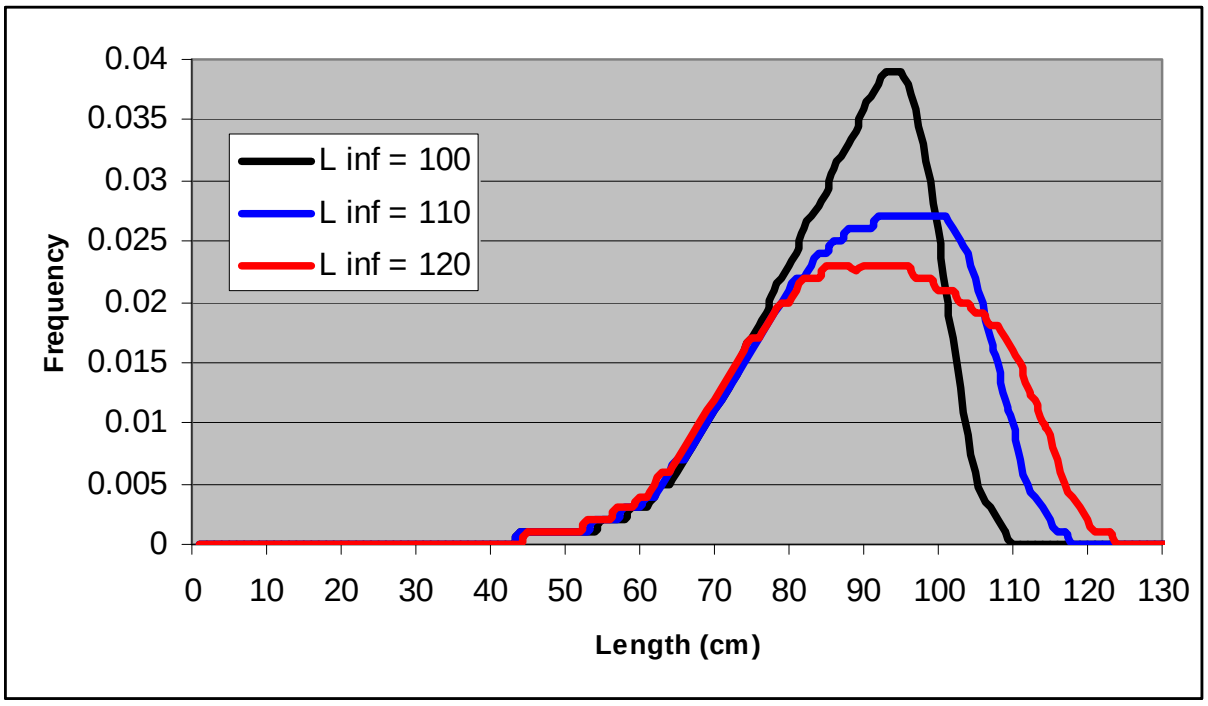


Figure 31. Predicted catch length frequency distributions at low fishing mortality (F = 0.001) with different assumed L-infinity values for growth.

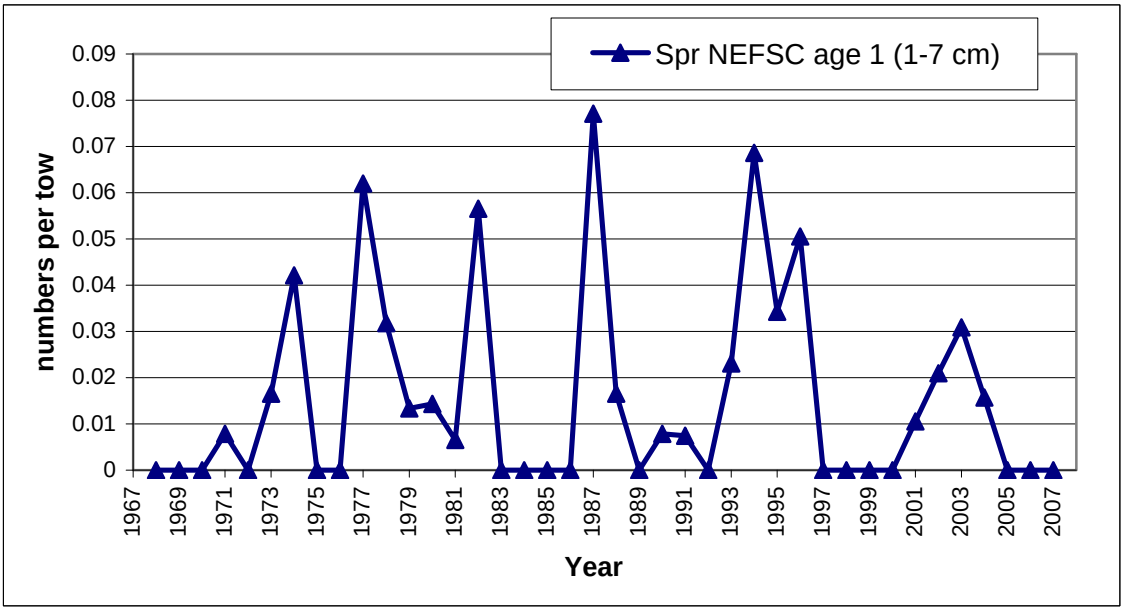


Figure 32. NEFSC spring age-1 stratified mean numbers per tow index. Lengths 1-7 cm was used as a proxy for age-1.

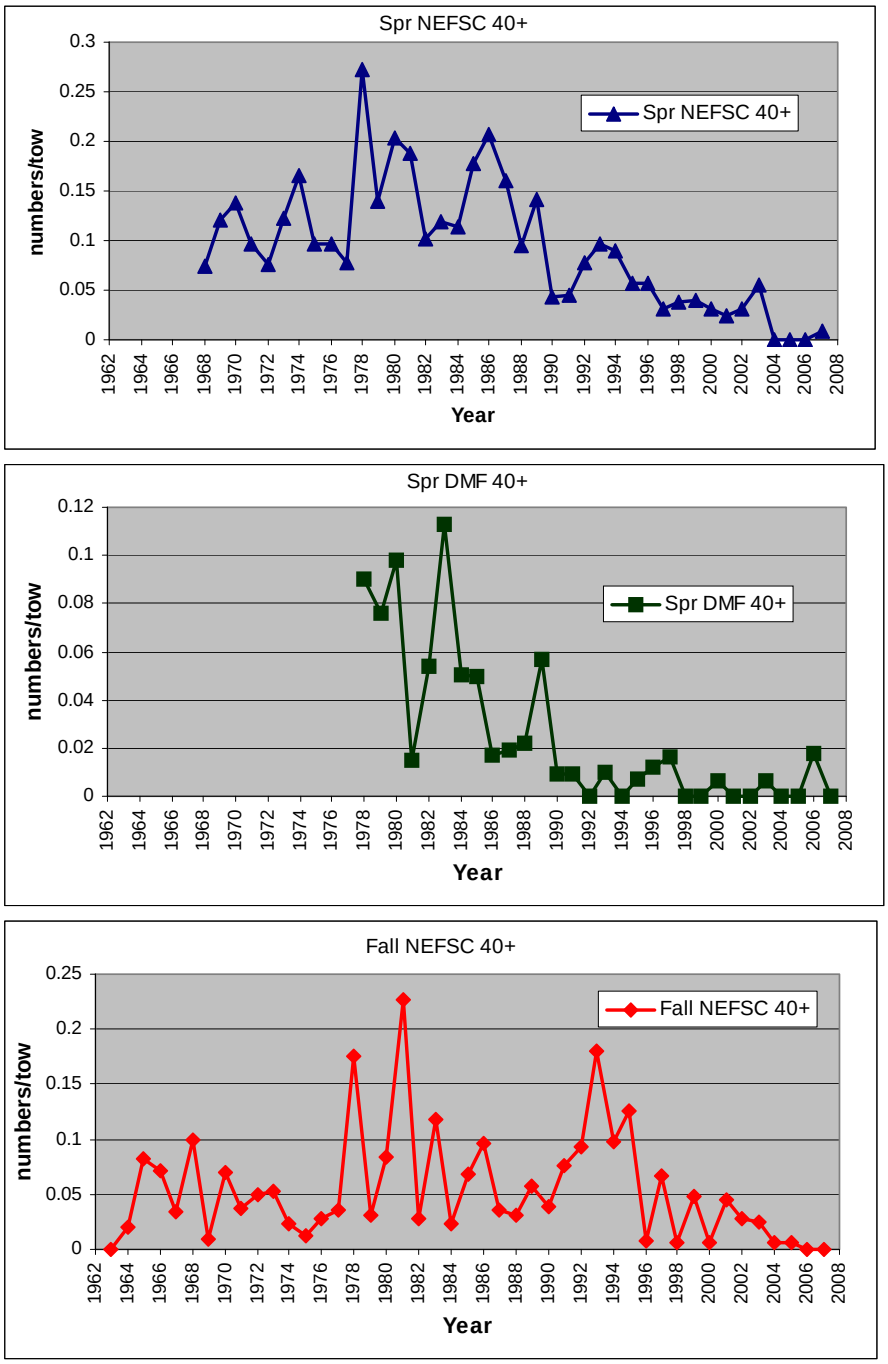


Figure 33. NEFSC spring 40+ cm, MDMF spring 40+ cm, and NEFSC fall 40+ cm stratified numbers per tow survey indices for wolffish.

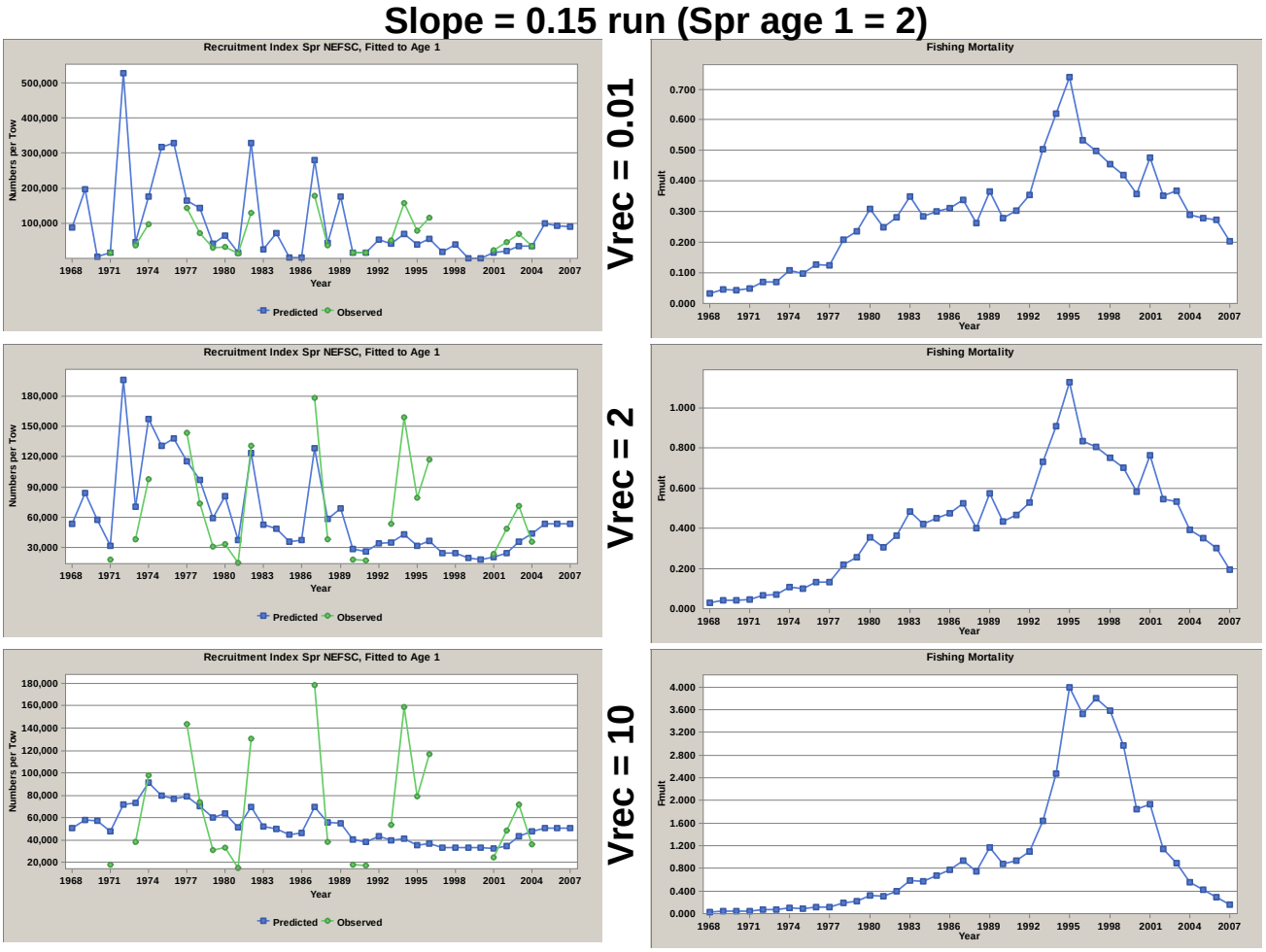


Figure 34. SCALE model sensitivity of fitting the recruitment index and the estimated fishing mortality with different penalty weights on recruitment variation (0.01, 2, 10). The weight on the age-1 recruitment index was fixed at 2.

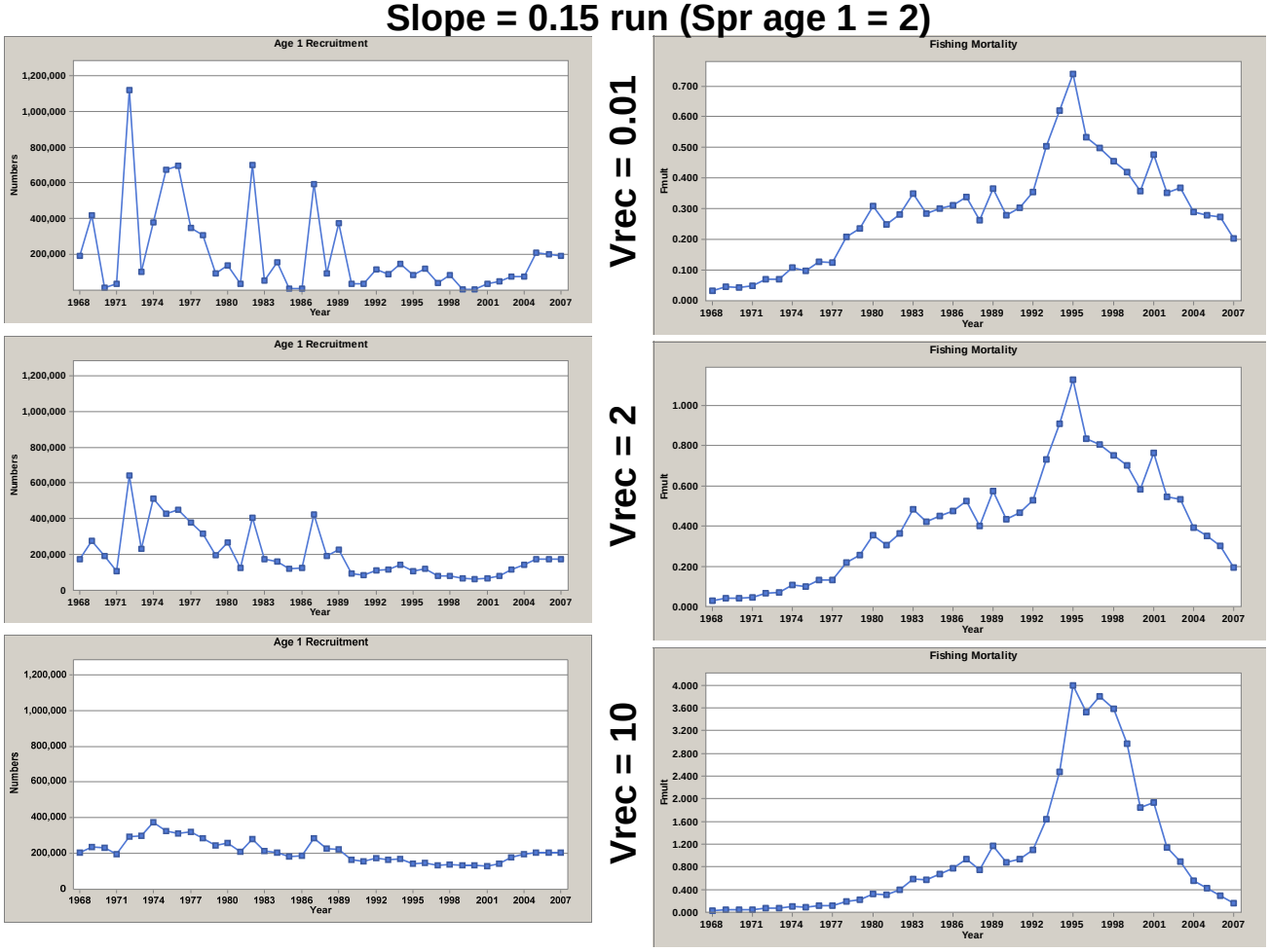


Figure 35. SCALE model sensitivity of estimated recruitment and fishing mortality with different penalty weights on recruitment variation (0.01, 2, 10). The weight on the age-1 recruitment index was fixed at 2.

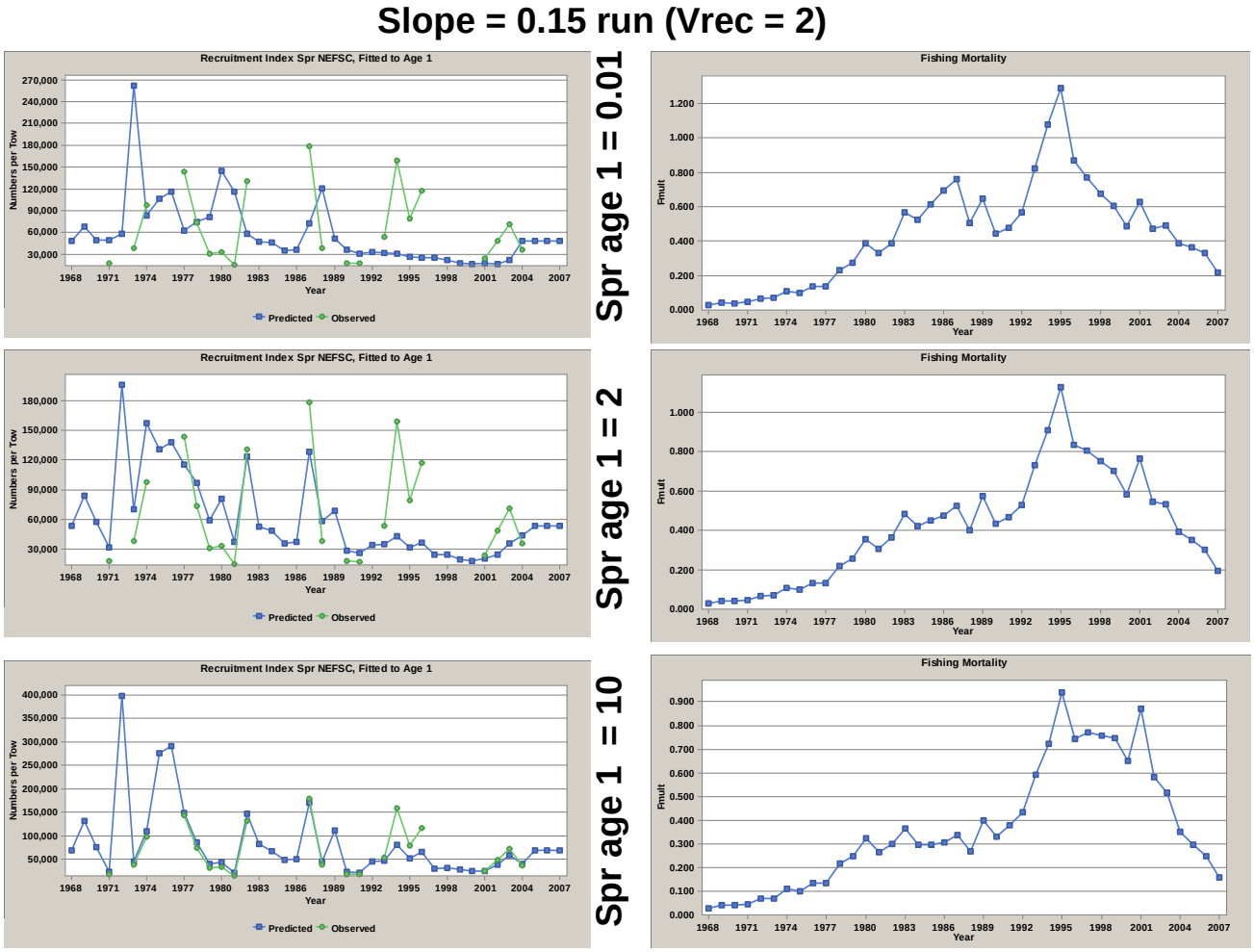


Figure 36. SCALE model sensitivity of fitting the recruitment index and the estimated fishing mortality with different weights on the recruitment index (0.01, 2, 10). The weight on recruitment variation penalty was fixed at 2.

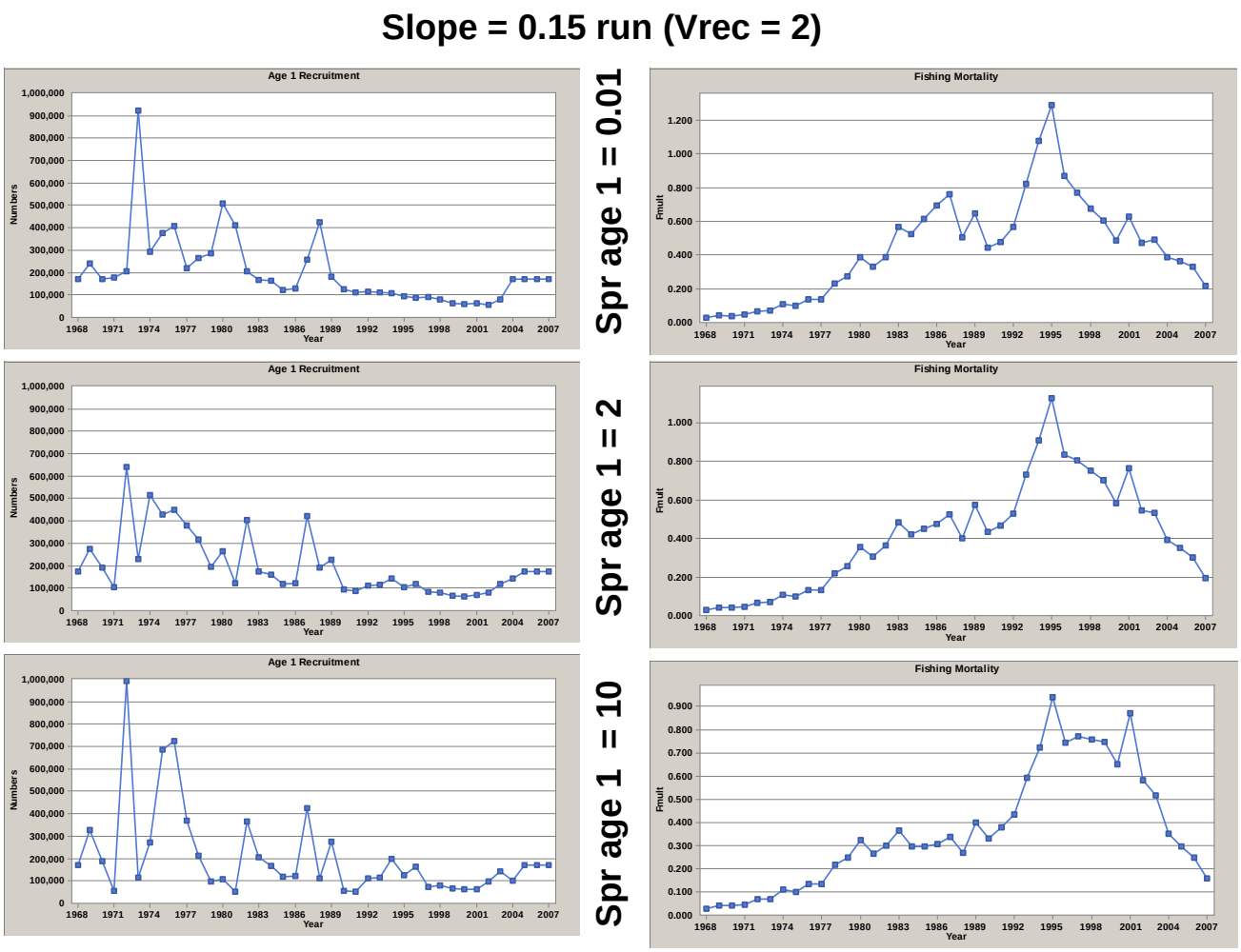


Figure 37. SCALE model sensitivity of estimated recruitment and fishing mortality with different weights on the recruitment index (0.01, 2, 10). The weight on recruitment variation penalty was fixed at 2.

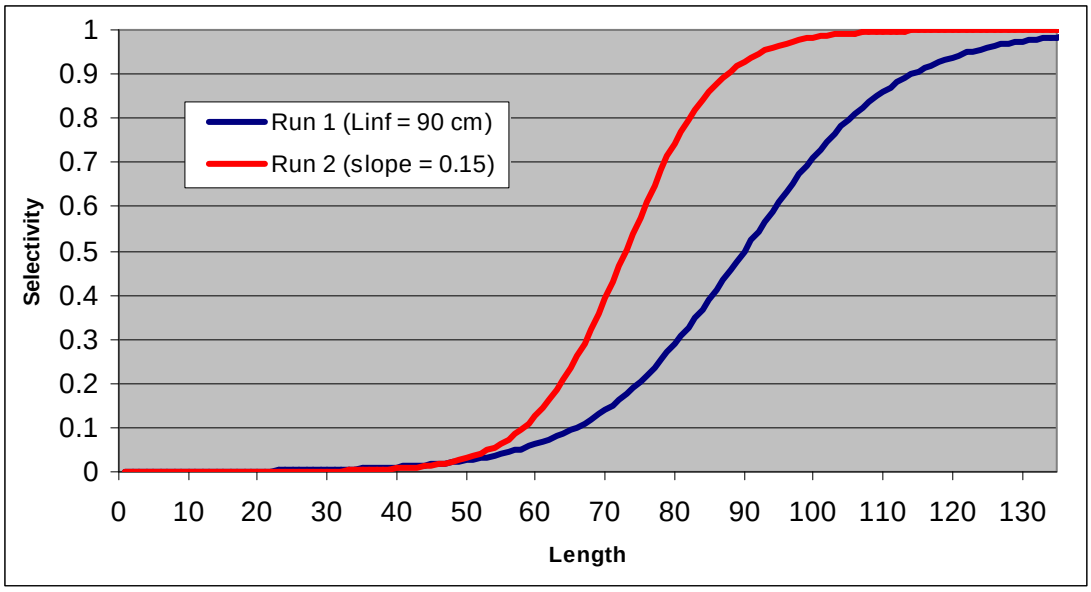


Figure 38. SCALE run 1 selectivity was allowed to hit the L-infinity bound of 90 cm which estimates a relatively flat selectivity curve. SCALE run 2 hits the slope bound of 0.15 which estimated a lower L-infinity.

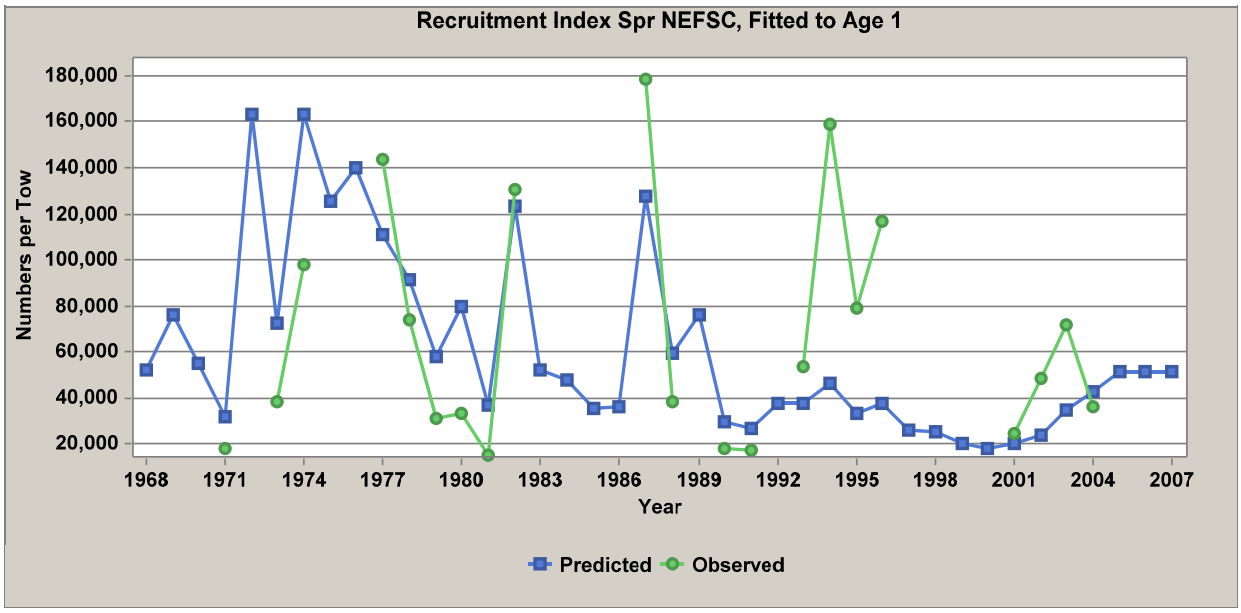


Figure 39. SCALE run 1 (L-infinity = 90 cm) fit to the NEFSC spring age-1 recruitment index.

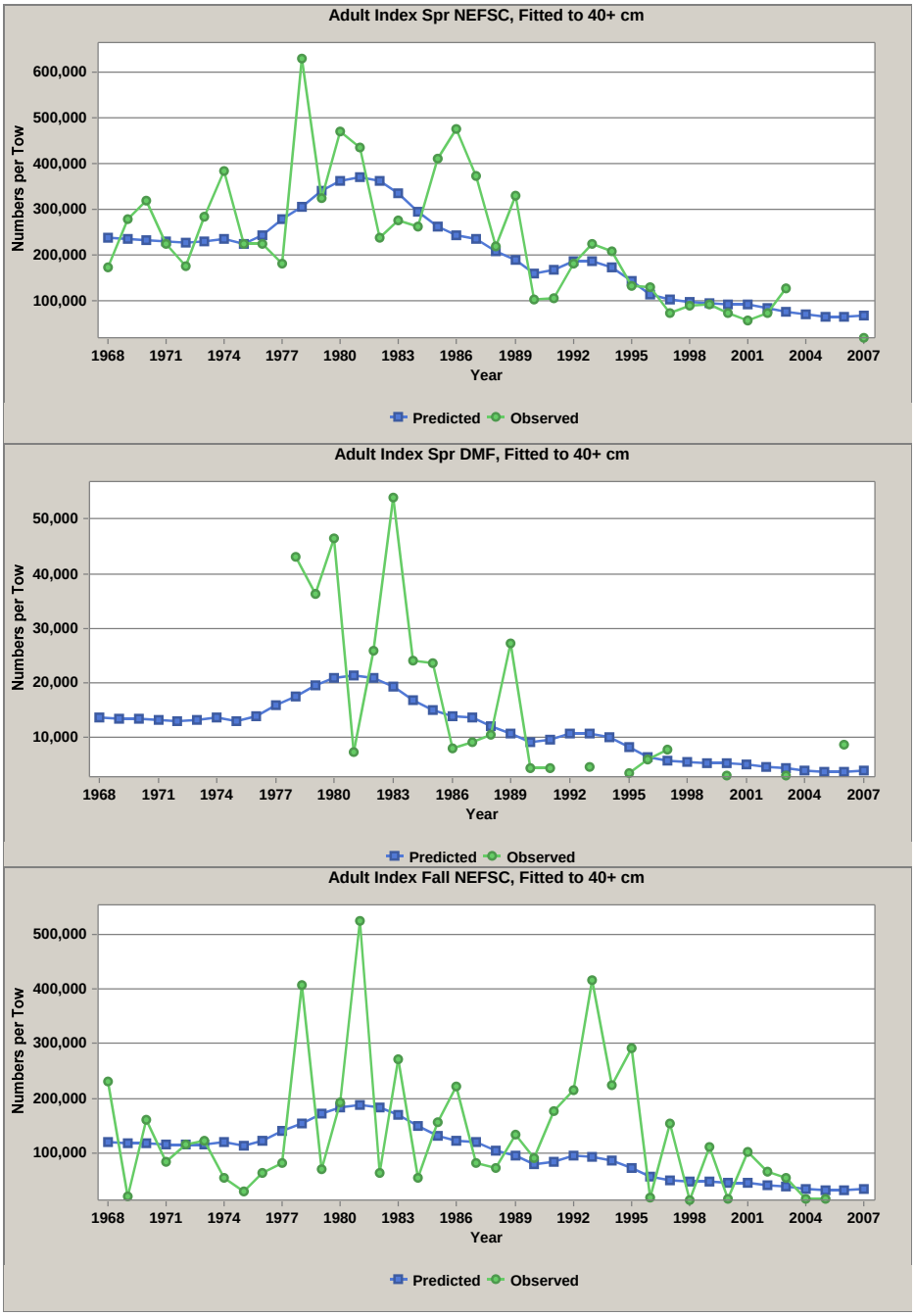


Figure 40. SCALE run 1 (L-infinity = 90 cm) fit to the NEFSC spring 40+ cm, MDMF 40+ cm, and NEFSC fall 40+ cm indices.

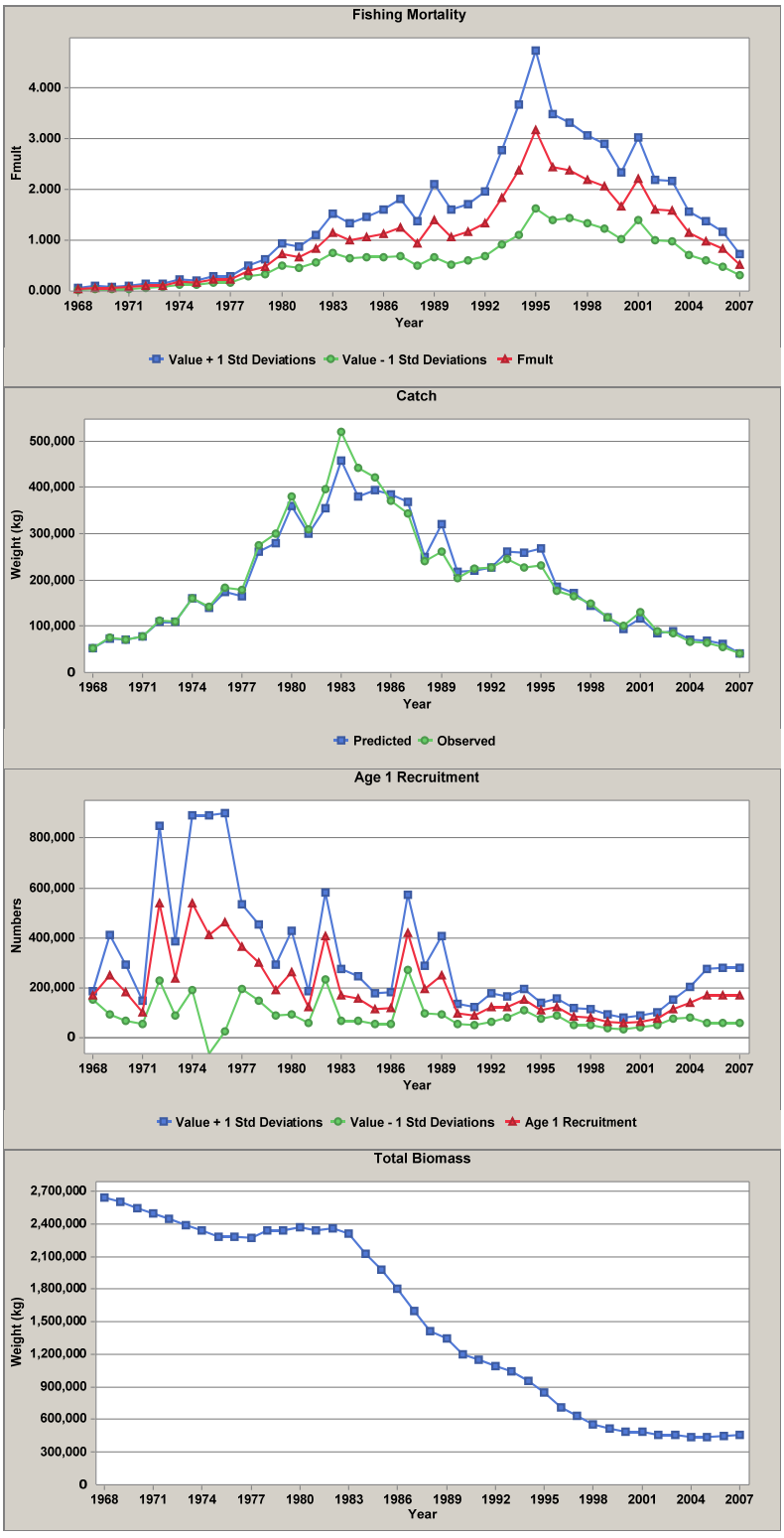


Figure 41. Run 1 (L-infinity = 90 cm) F, fit to the catch, recruitment and total biomass. Plus 1 and minus 1 standard deviations are shown on F and recruitment.

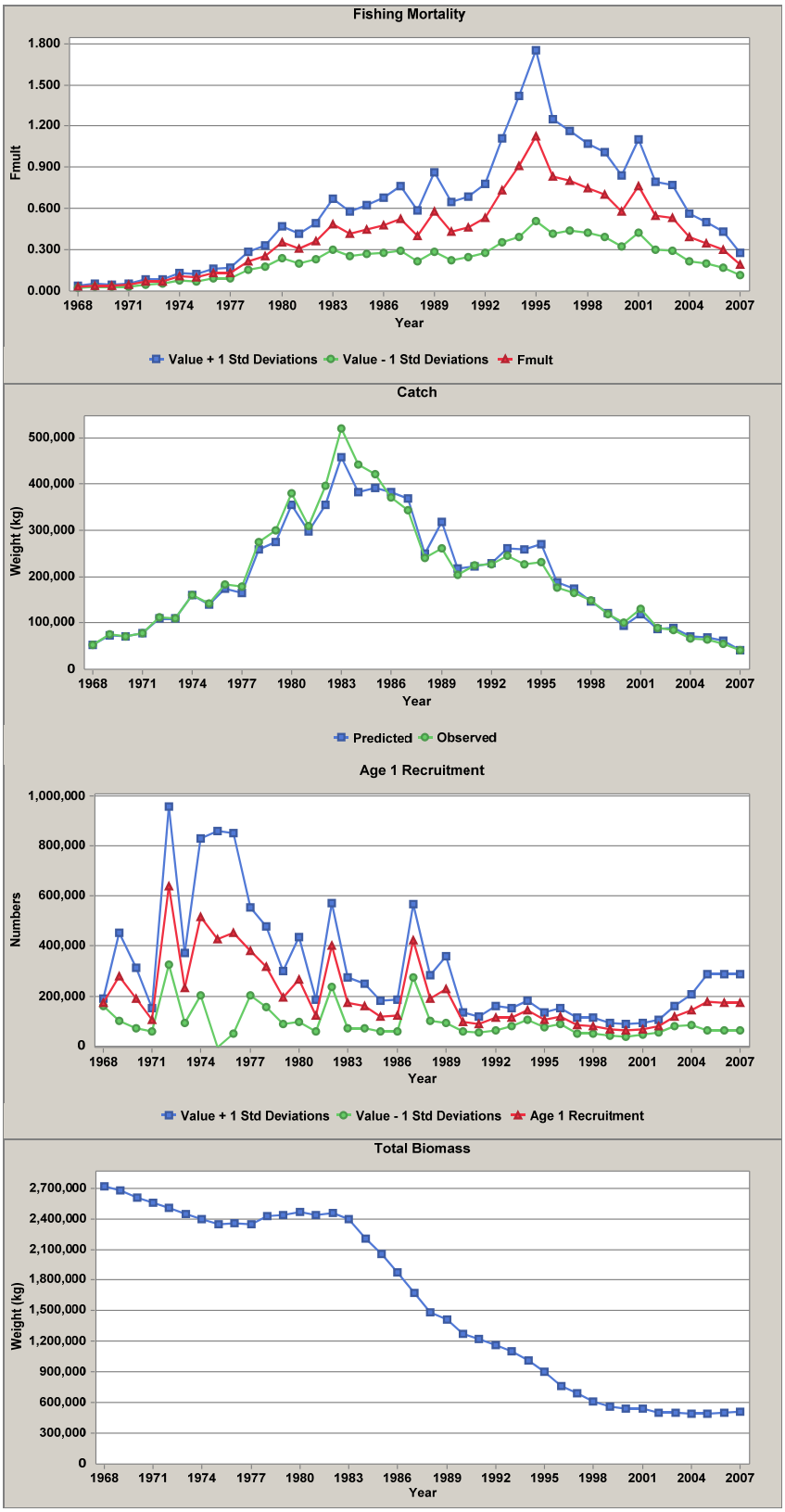


Figure 42. Run 2 (Slope = 0.15) F, fit to the catch, recruitment and total biomass. Plus 1 and minus 1 standard deviations are shown on F and recruitment.

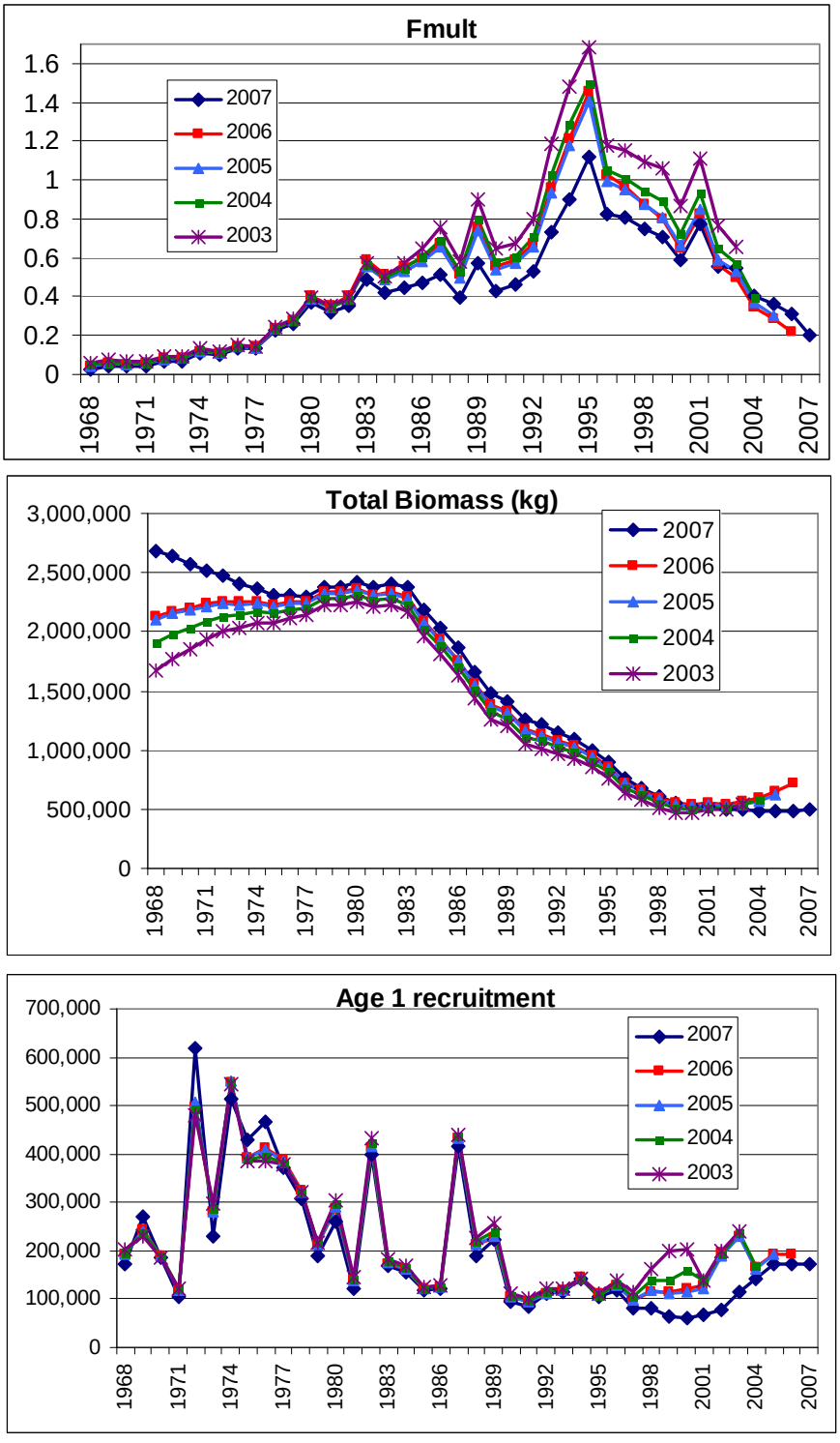


Figure 43. Run 2 (slope = 0.15) retrospective on F, total biomass and age-1 recruitment.

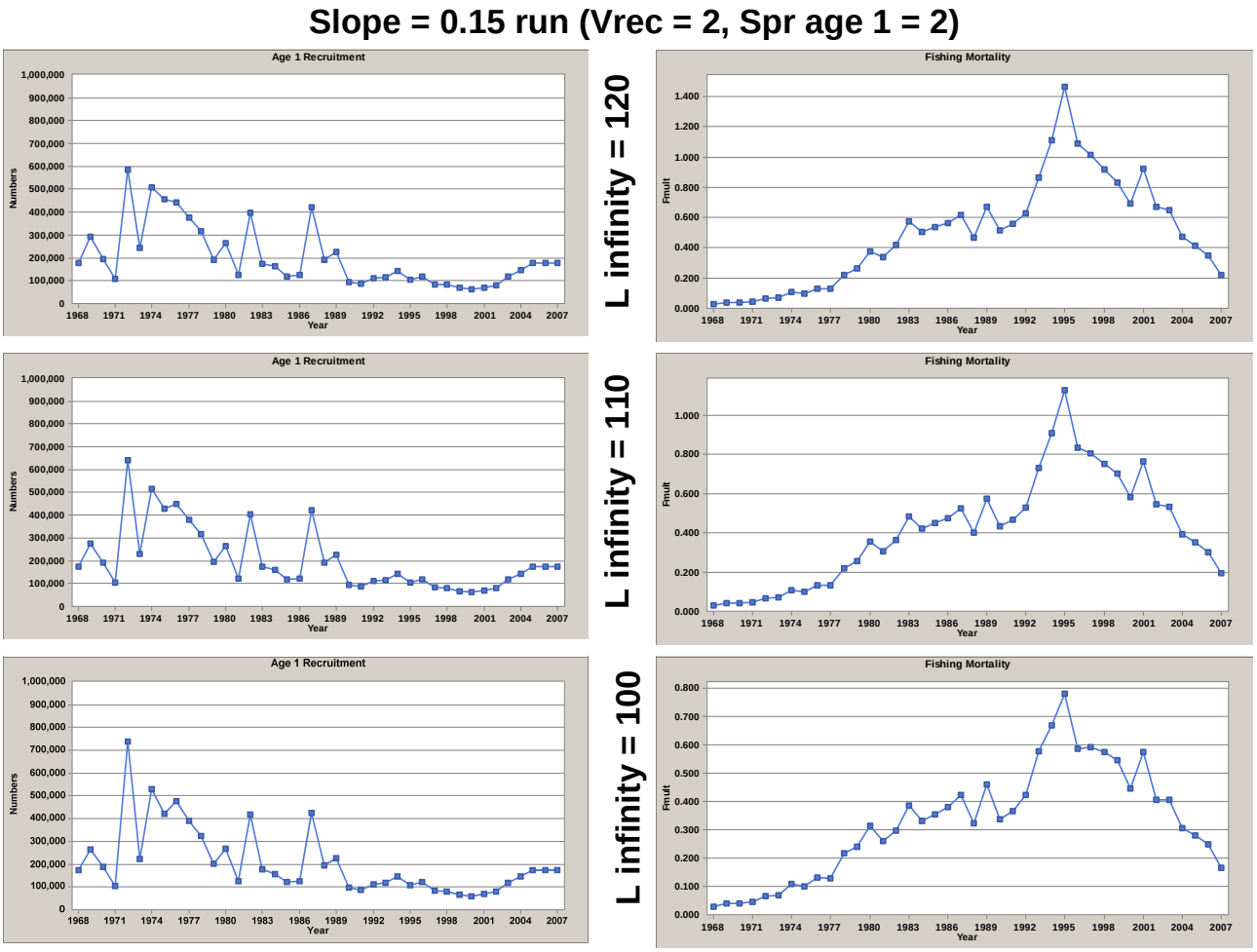


Figure 44. Run 1 (slope = 0.15) sensitivity of recruitment and fishing mortality using three different assumed L-infinity values (100, 110, 120) on growth.

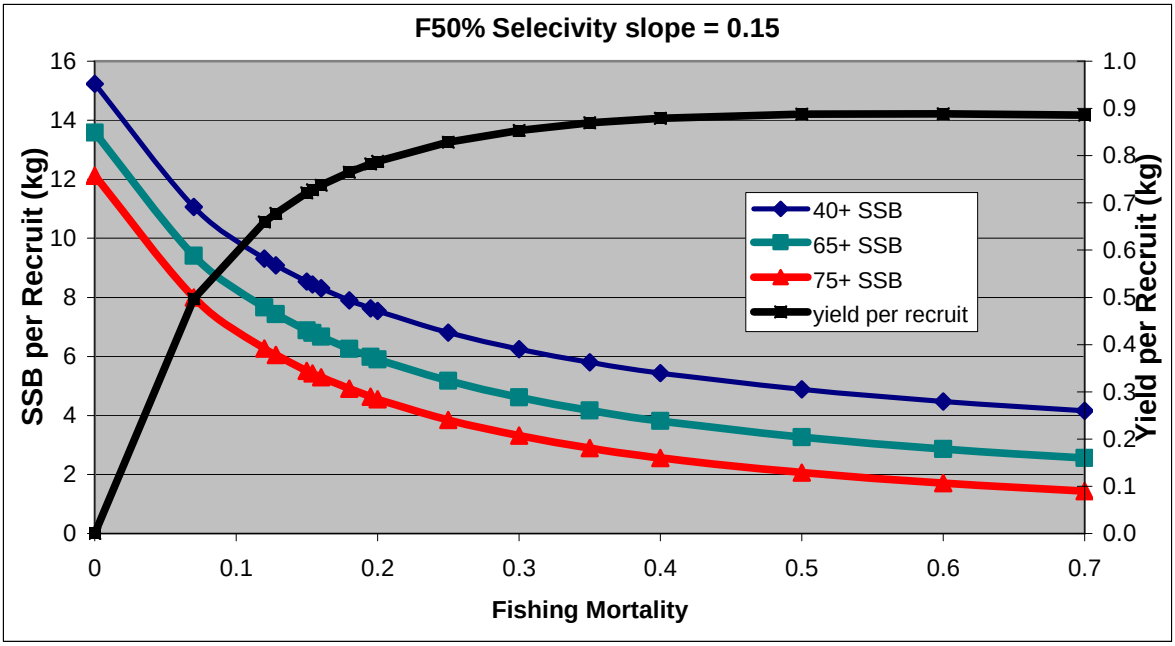


Figure 45. Updated Run 3 SCALE model F50% yield per recruit and spawn stock biomass per recruit curves.

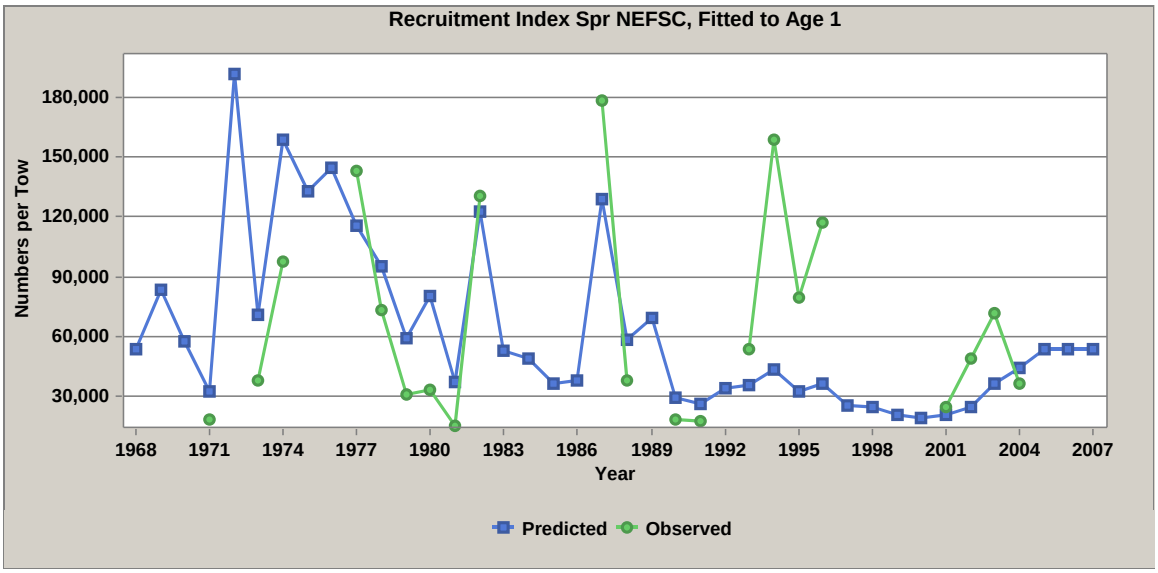


Figure 46. Updated Run 3 (slope = 0.15) SCALE model fit to the NEFSC spring age-1 recruitment index

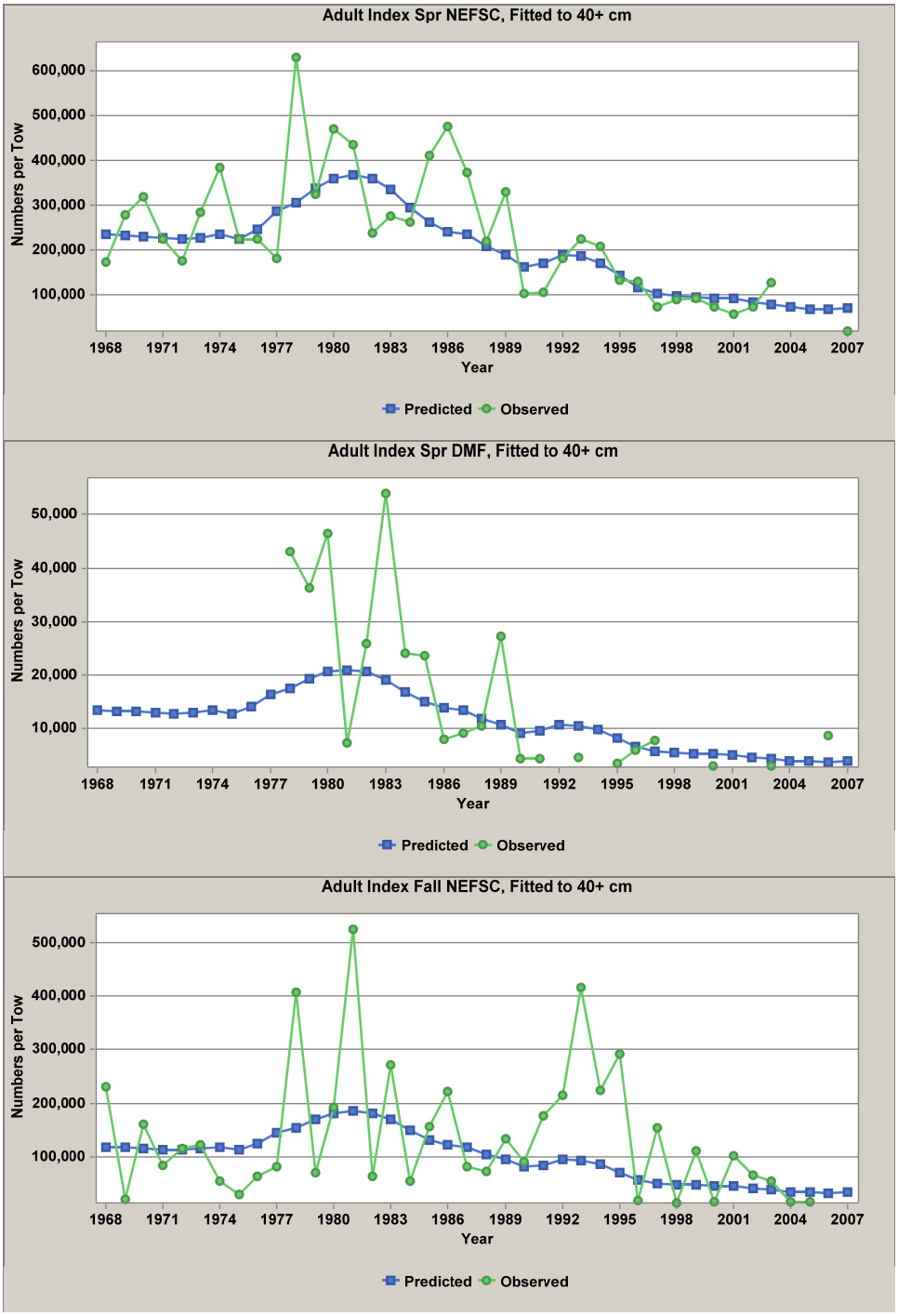


Figure 47. Updated Run 3 (slope = 0.15) SCALE model fit to the NEFSC spring 40+ cm, MDMF 40+ cm, and NEFSC fall 40+ cm indices.

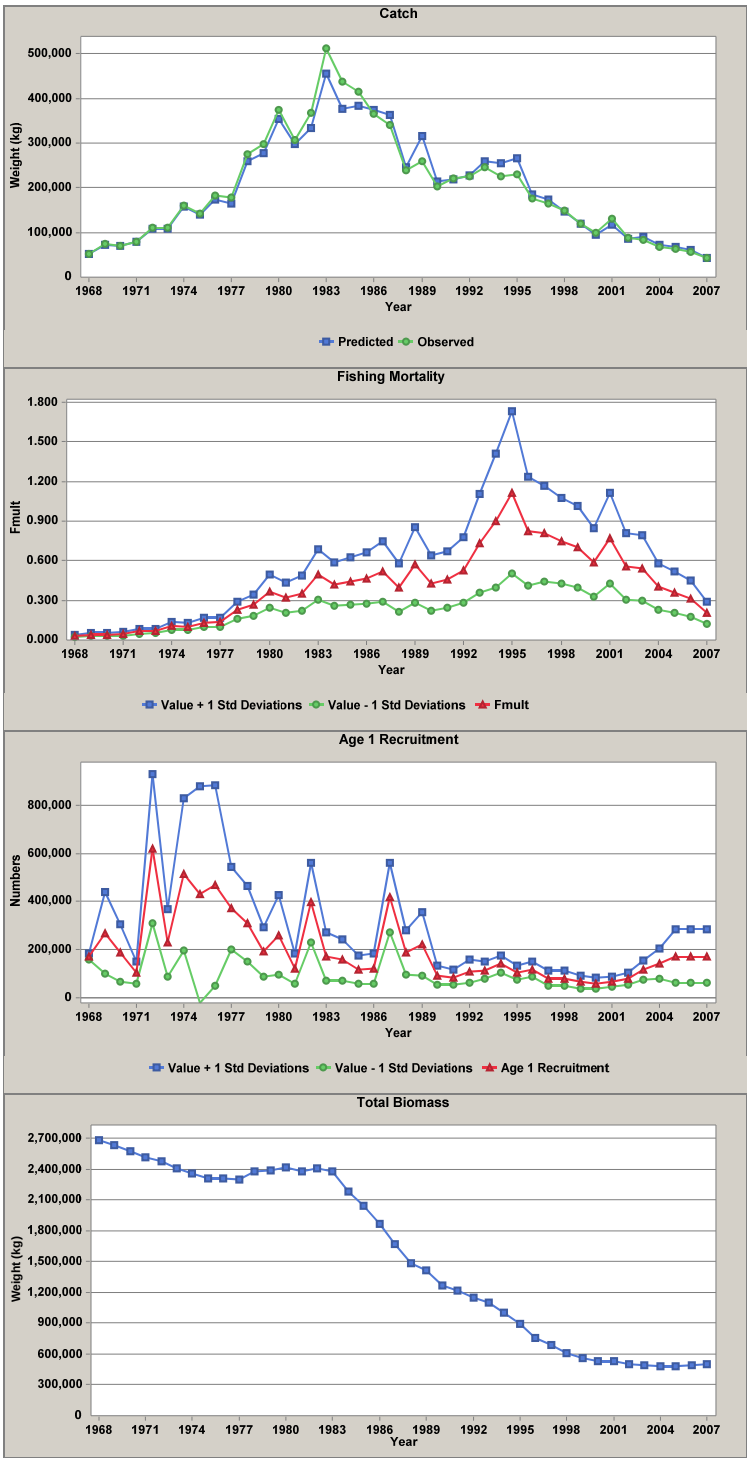


Figure 48. Run 3 (Slope = 0.15) F, fit to the catch, recruitment and total biomass. Plus 1 and minus 1 standard deviation are shown on F and recruitment.

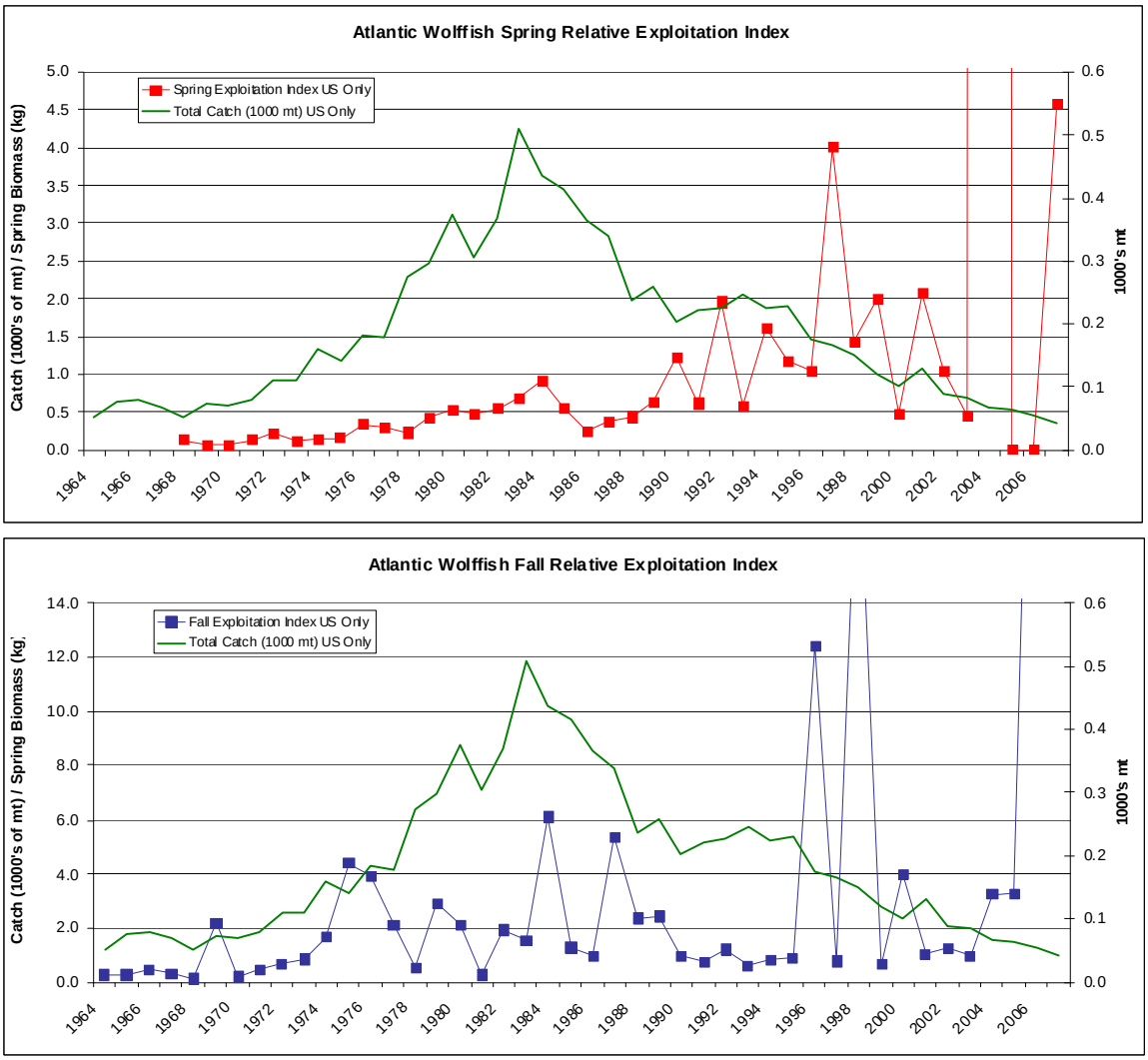


Figure 49. Spring and fall exploitation indices with total catch of Atlantic wolffish.

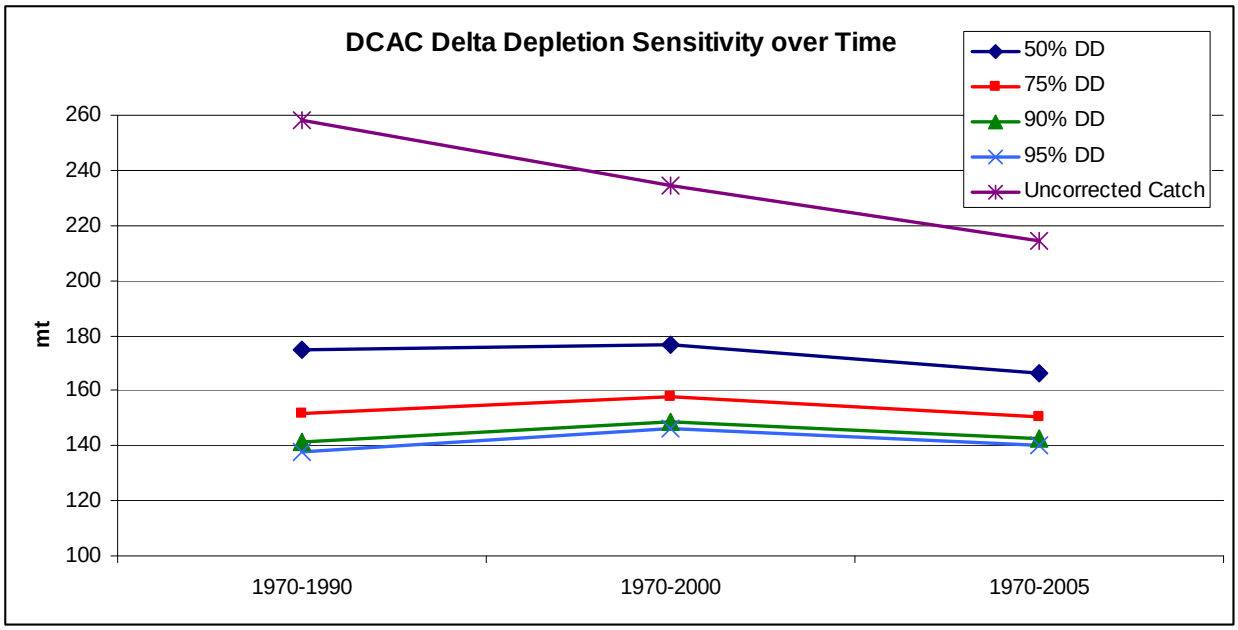


Figure 50. Results of a sensitivity analysis of the depletion ratio from the Depletion-Corrected Average Catch model (DCAC) over time.

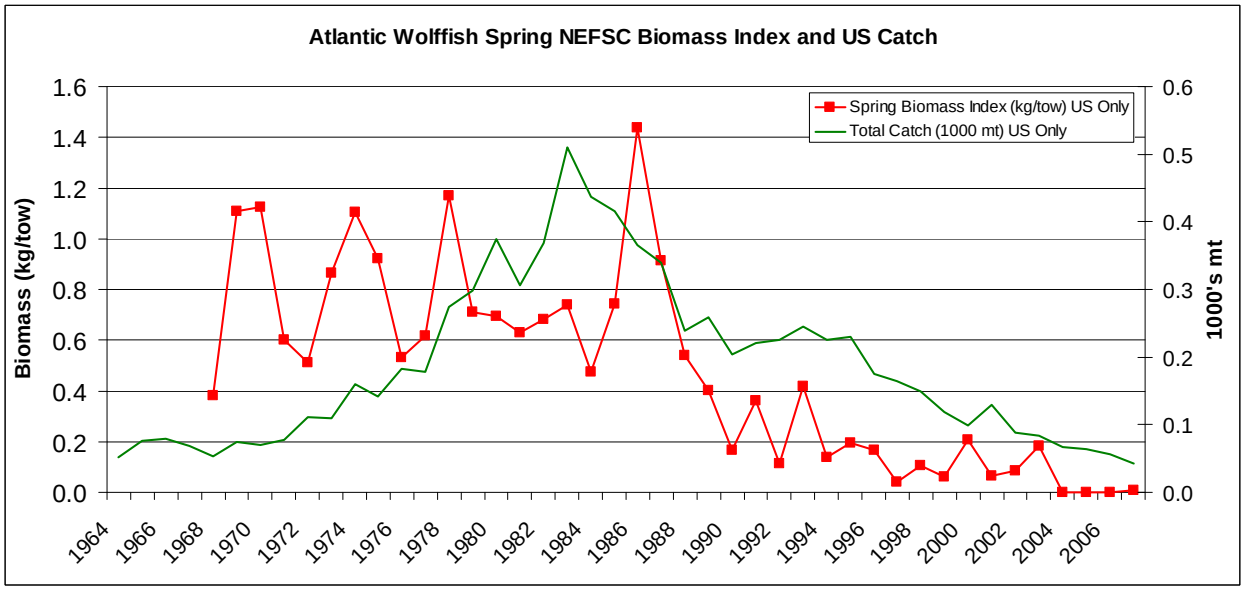
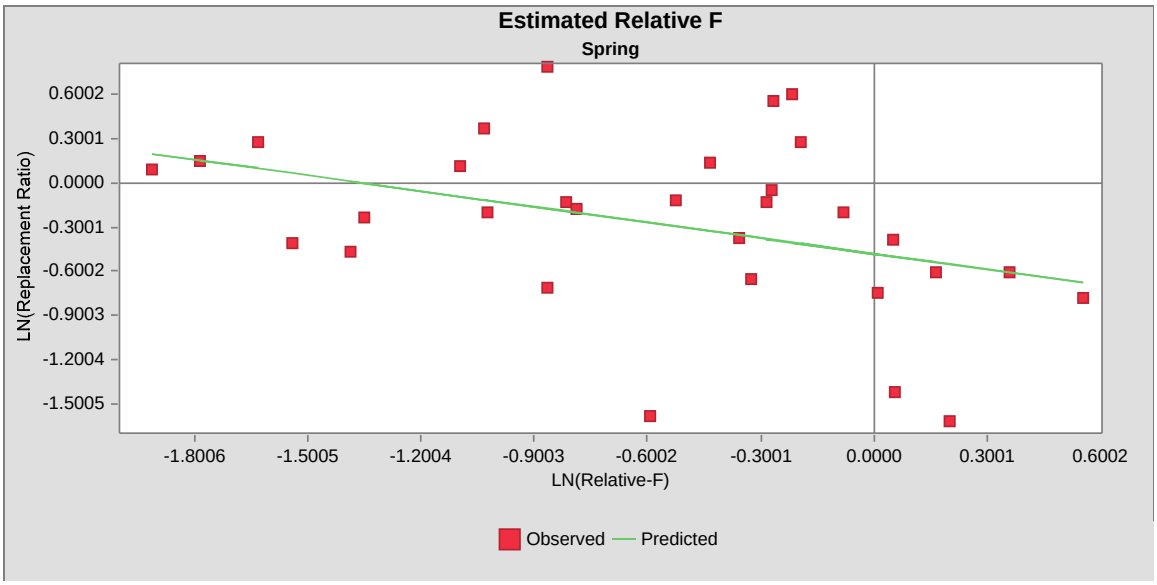


Figure 51. NEFSC spring biomass index and total US catch of Atlantic wolffish used in the AIM (An Index Method) model.



Randomization Test	
	Spring
Critical Value	-0.384824
Significance Level	0.134000

Figure 52. Linear regression of log replacement ratio and log relative F and statistical test results from the AIM model.