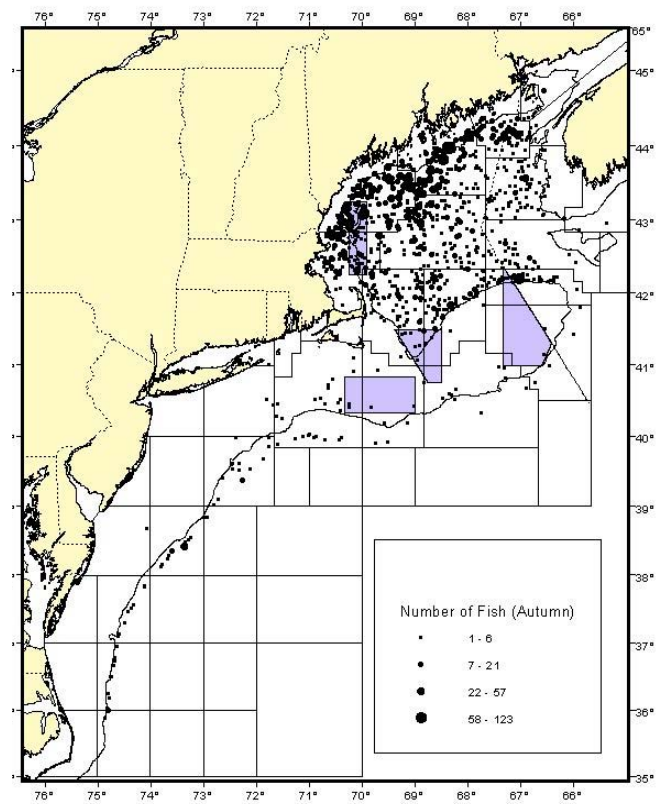
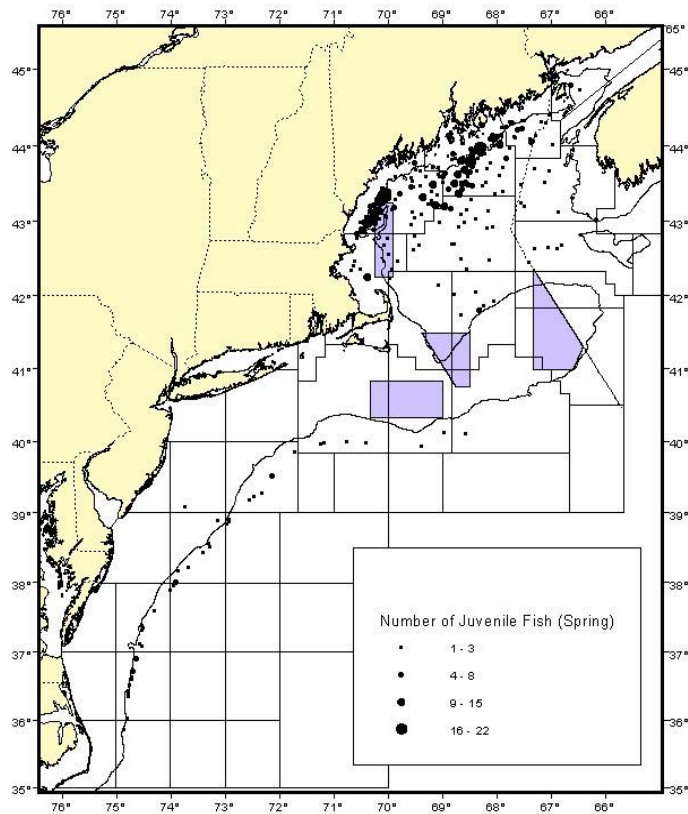


Witch Flounder - Spring 1983 - 2002

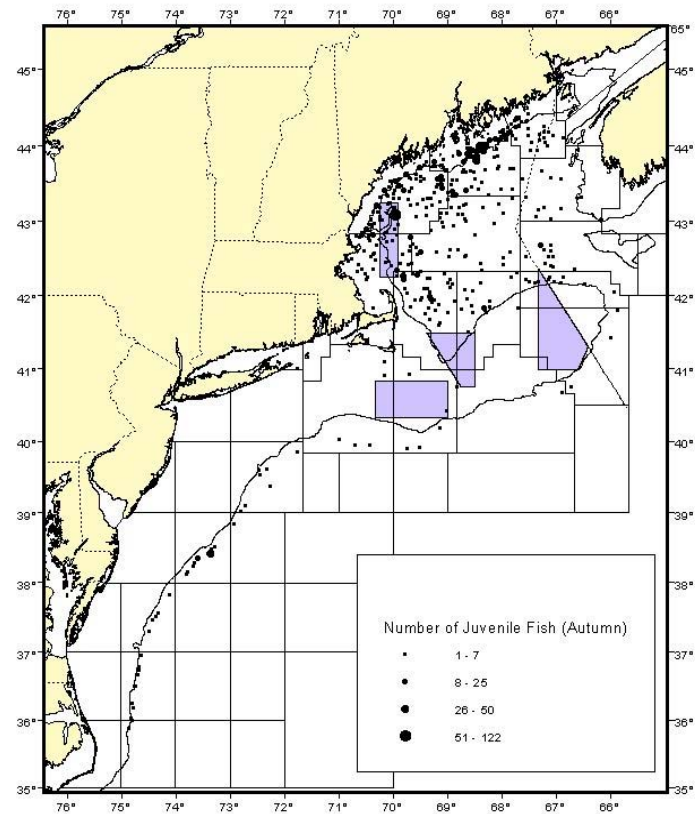


Witch Flounder - Autumn 1983 - 2002

Figure A.1 Number of witch flounder per tow in the NEFSC spring and autumn bottom trawl surveys, 1983-2002; year-around area closures are indicated by shaded polygons.



Witch Flounder - Spring 1983 - 2002 Juveniles < 25 cm



Witch Flounder - Autumn 1983 - 2002 Juveniles < 25 cm

Figure A.2. Number of juvenile (< 25 cm) witch flounder per tow in the NEFSC spring and autumn surveys, 1983-2002; year-around area closures are indicated by shaded polygons.

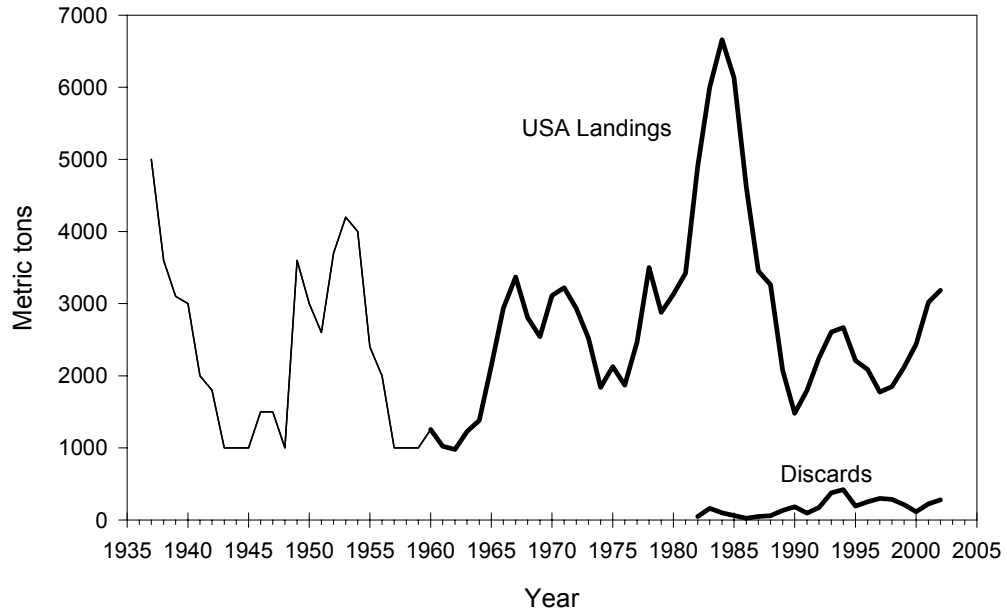


Figure A.3. Historical USA witch flounder landings (mt), excluding USA landings from the Grand Banks in the mid-1980's. Thin line represents provisional landings data taken from Lange and Lux (1978); discards are from the shrimp and large-mesh otter trawl fishery.

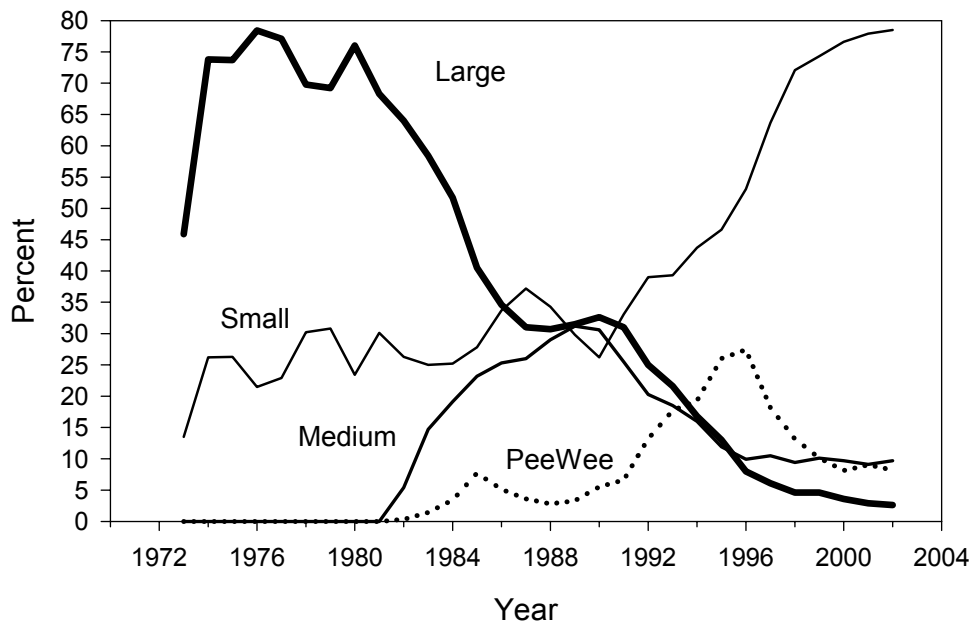


Figure A.4. Commercial landings of witch flounder by market category, 1973 – 2002.

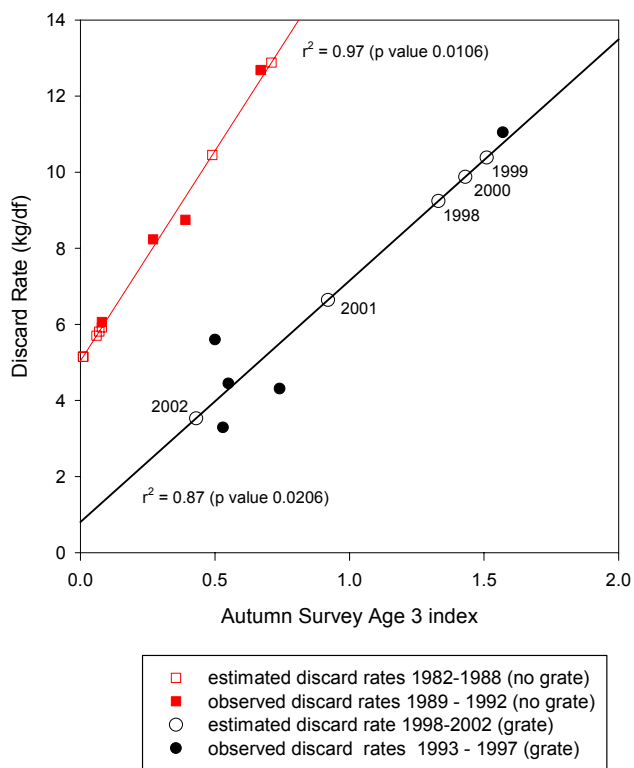


Figure A.5. Observed with flounder discard rates (kg per day fished, closed symbols) from the Fisheries Observer Program, and estimated discard rates (kg/df, open symbols) in northern shrimp fishery estimated from linear regressions (solid line) of observed discard rates and NEFSC autumn survey age 3 index.

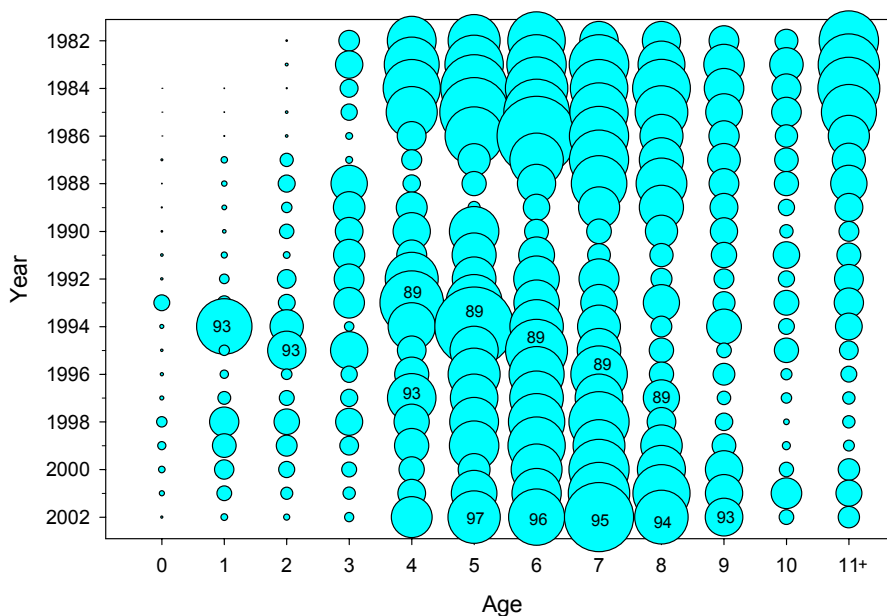


Figure A.6. Witch flounder catch at age (in numbers), 1982 – 2002; selected cohorts are labeled.

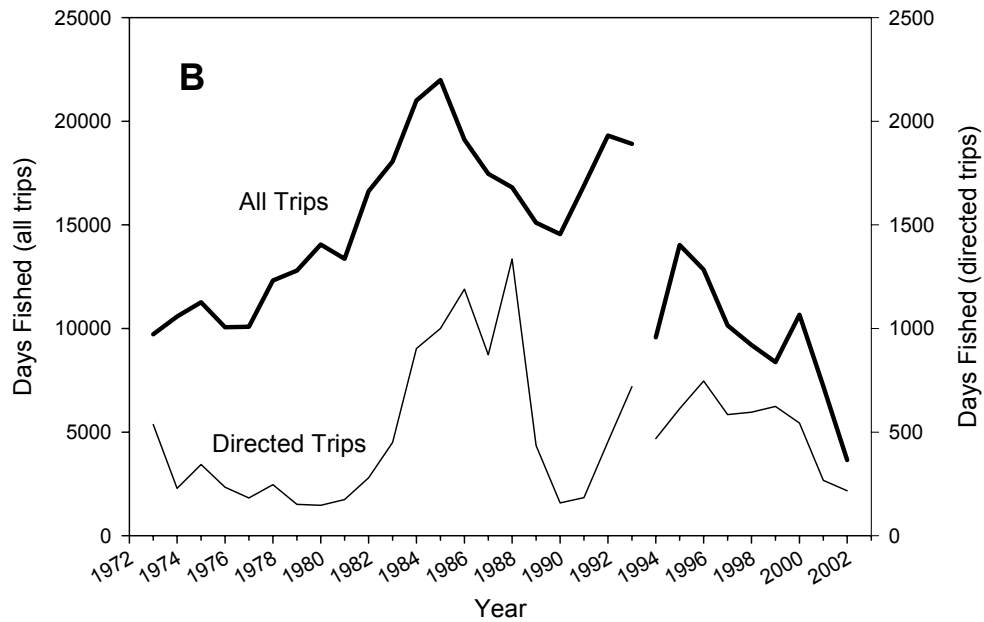
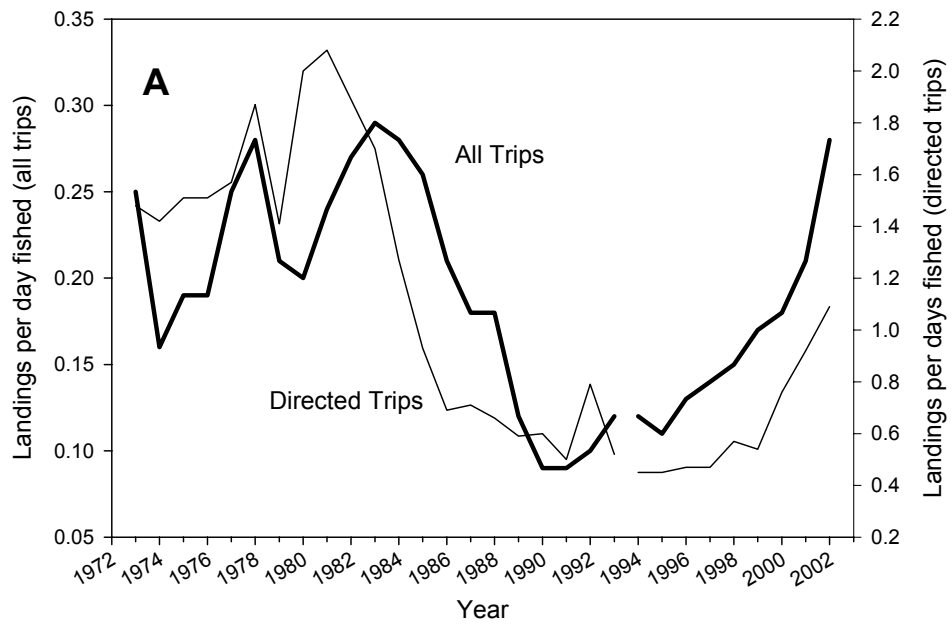
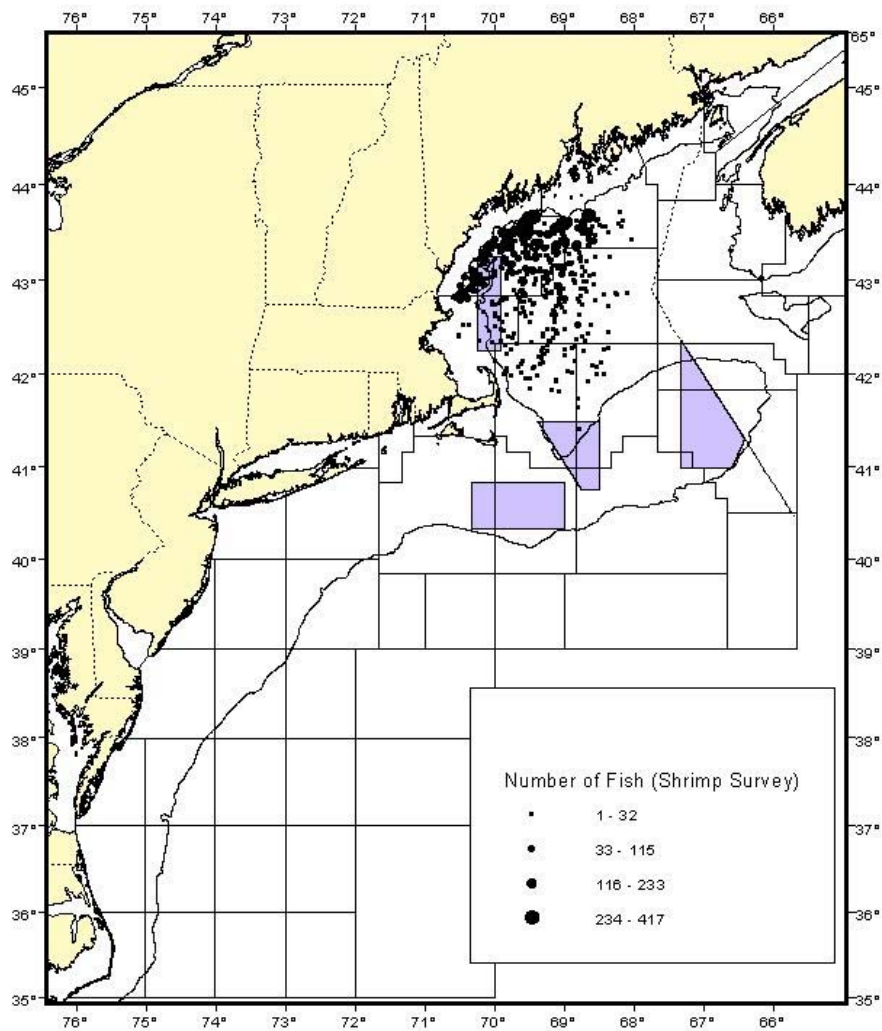


Figure A.7. Trends in USA landings per day fished (A) and effort (B) of witch flounder, 1973 -2002.



Witch Flounder - ASMFC Summer Shrimp Survey 1985 - 2002

Figure A.8. Number of witch flounder per tow in the ASMFC northern shrimp survey, 1985-2002; year-around area closures are indicated by shaded polygons.

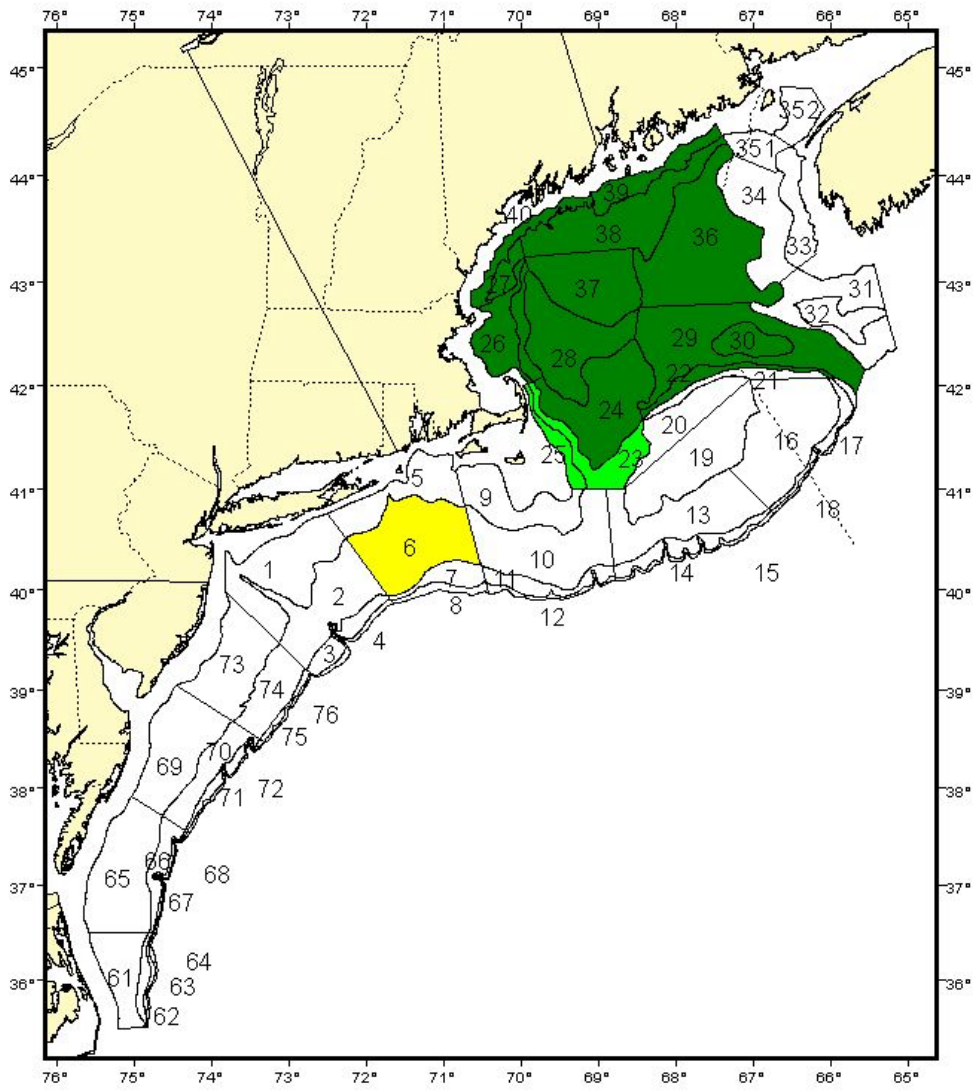


Figure A.9. NEFSC bottom trawl survey sampling strata.

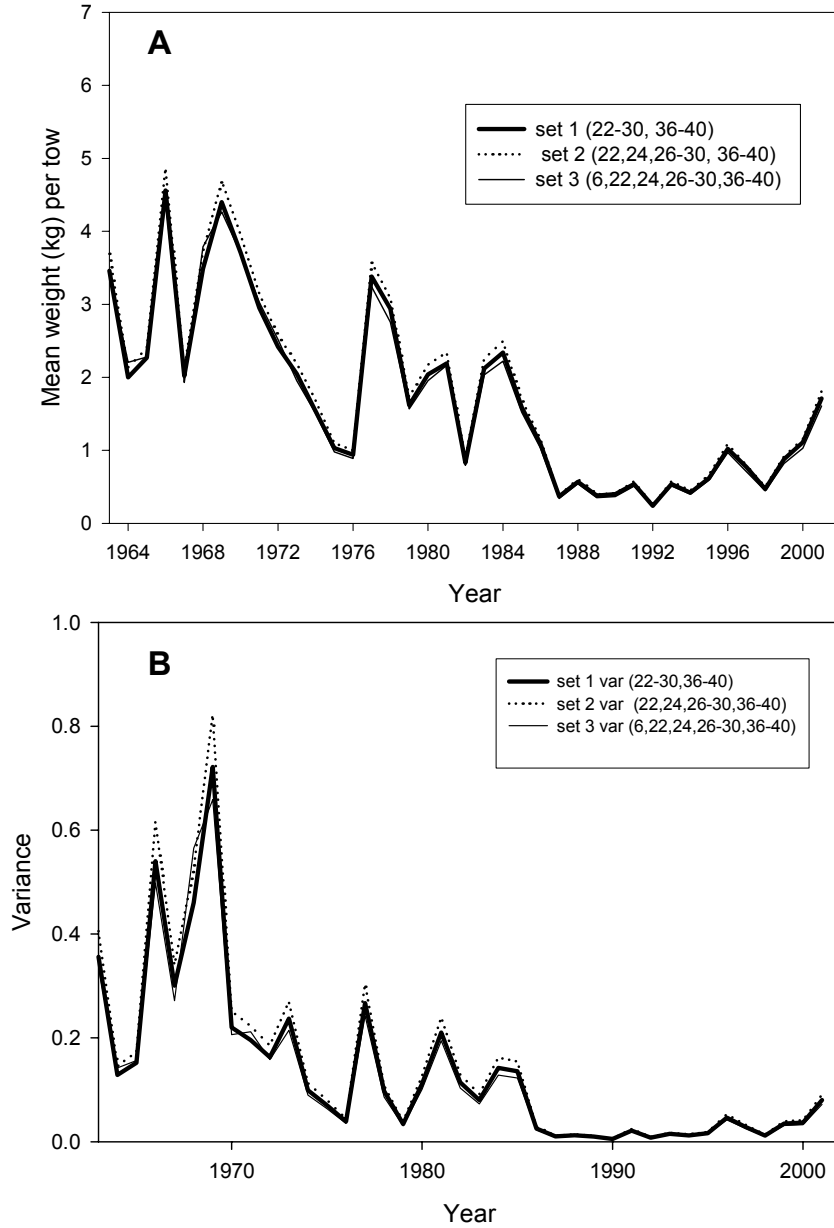


Figure A.10. Stratified mean catch (kg) per tow (A) and variance (B) of witch flounder in the NEFSC autumn bottom trawl surveys for three strata sets in the Georges Bank-Gulf of Maine region, 1963 – 2001.



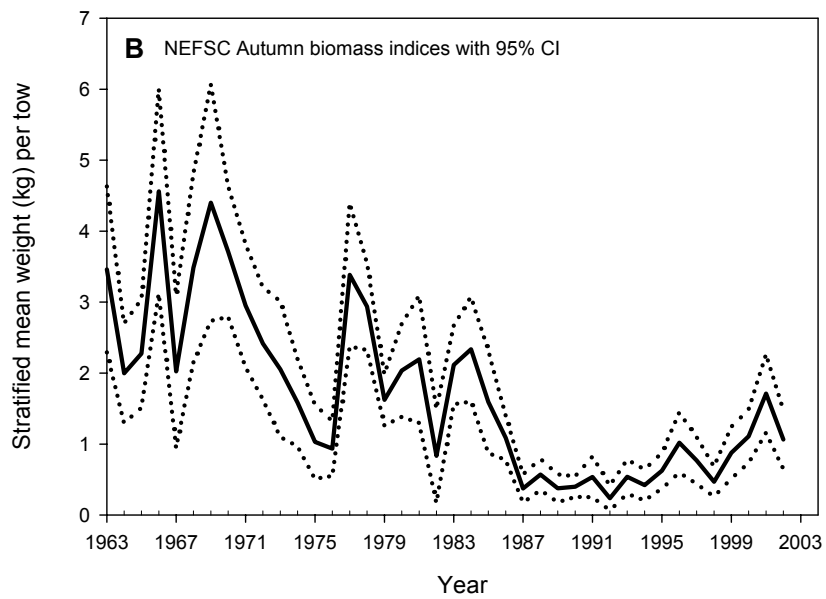
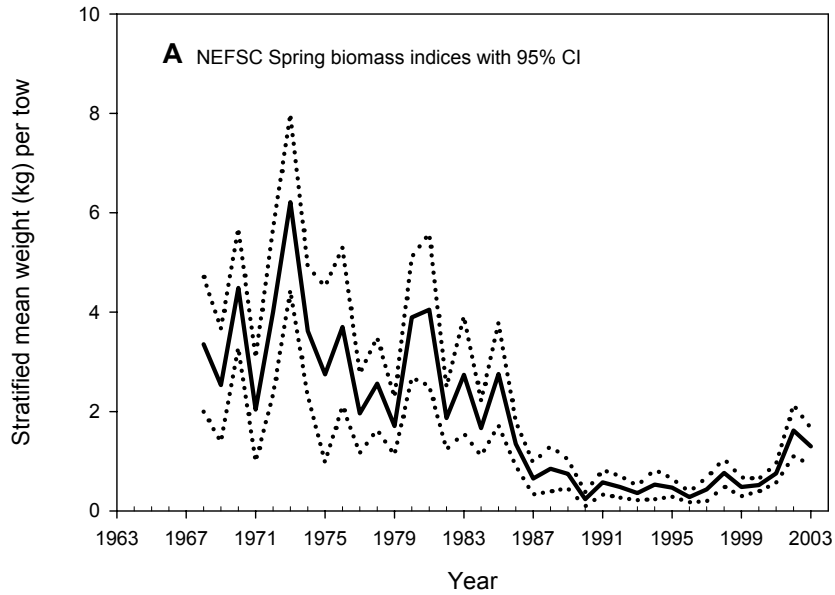


Figure A.11. Stratified mean weight (kg) per tow, with 95% confidence limits, of witch flounder in the NEFSC spring (A) and autumn (B) bottom trawl surveys, 1963 – 2003.

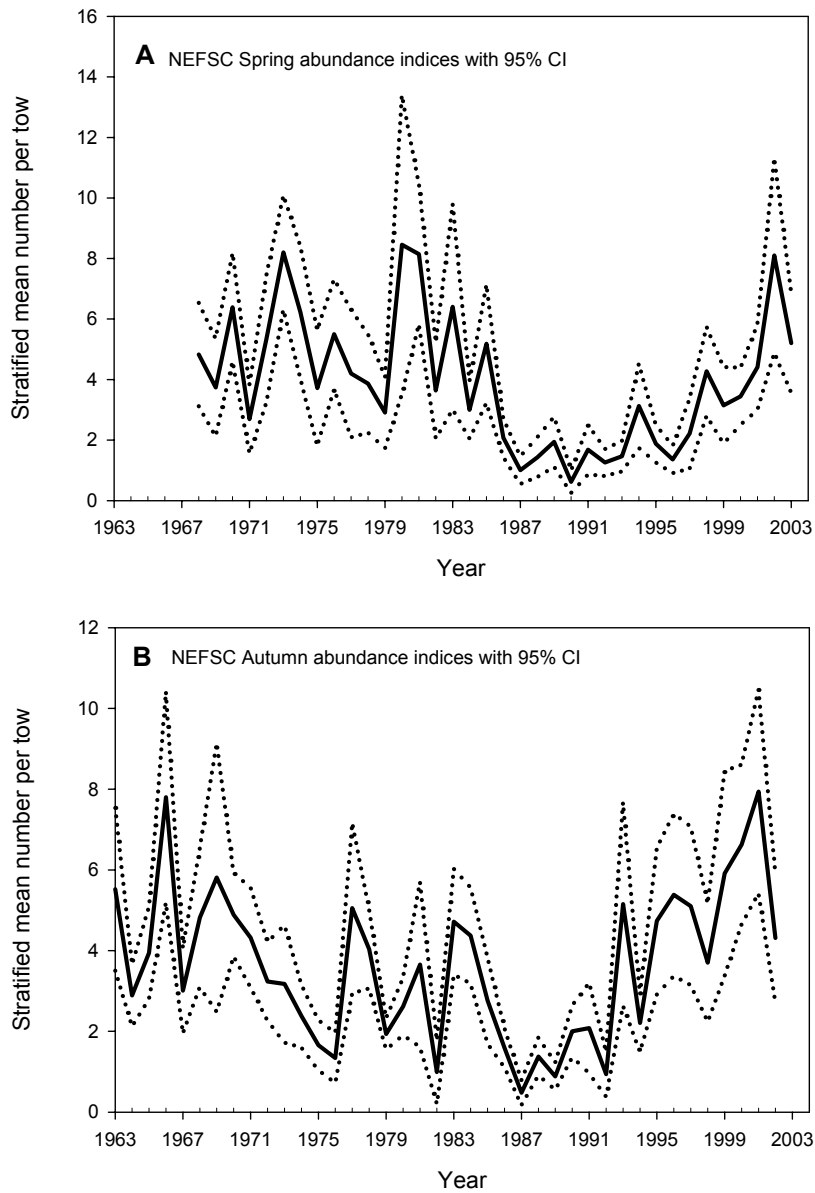


Figure A.12. Stratified mean number per tow, with 95% confidence limits, of witch flounder in the NEFSC spring (A) and autumn (B) bottom trawl surveys, 1963 – 2003.

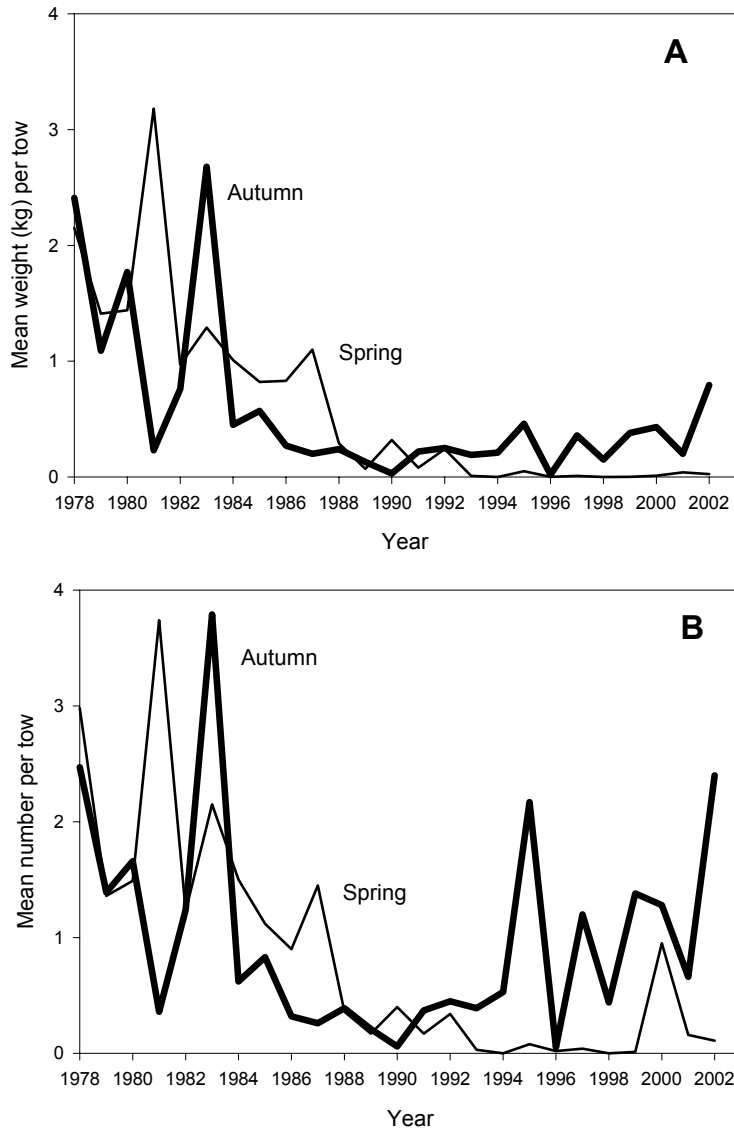


Figure A.13. Stratified mean weight (kg) per tow (A) and mean number per tow (B) of witch flounder in the Massachusetts Division of Marine Fisheries spring and autumn bottom trawl surveys in Cape Cod Bay - Mass. Bay region, 1978 – 2002.

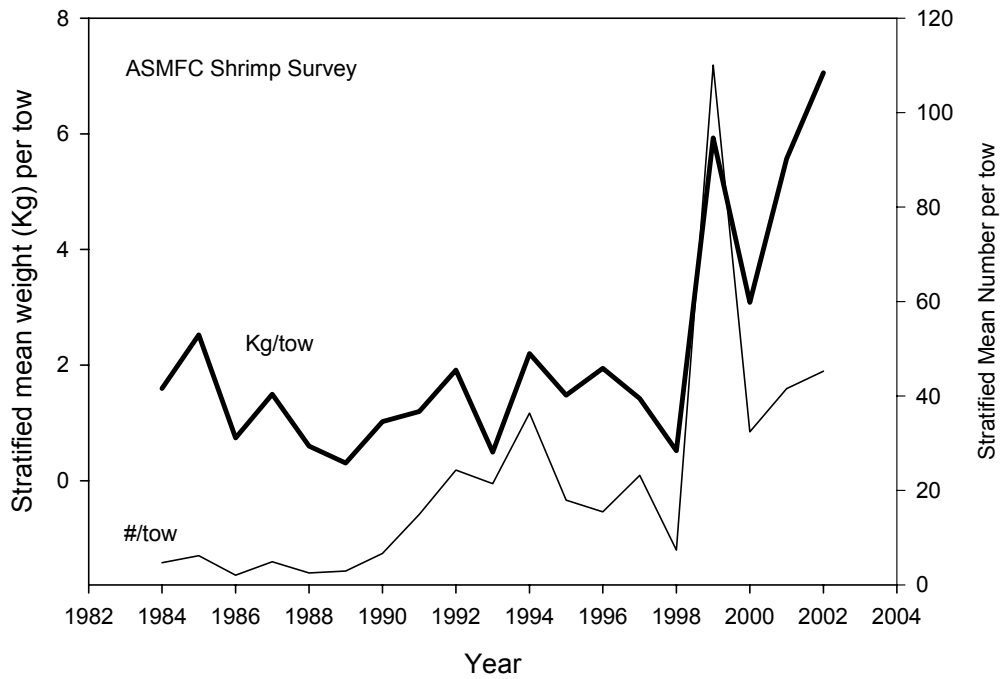


Figure A.14. Stratified mean catch per tow, in weight (kg) and numbers, of witch flounder in the Atlantic States Marine Fisheries Commission summer northern shrimp survey, 1984 – 2002.

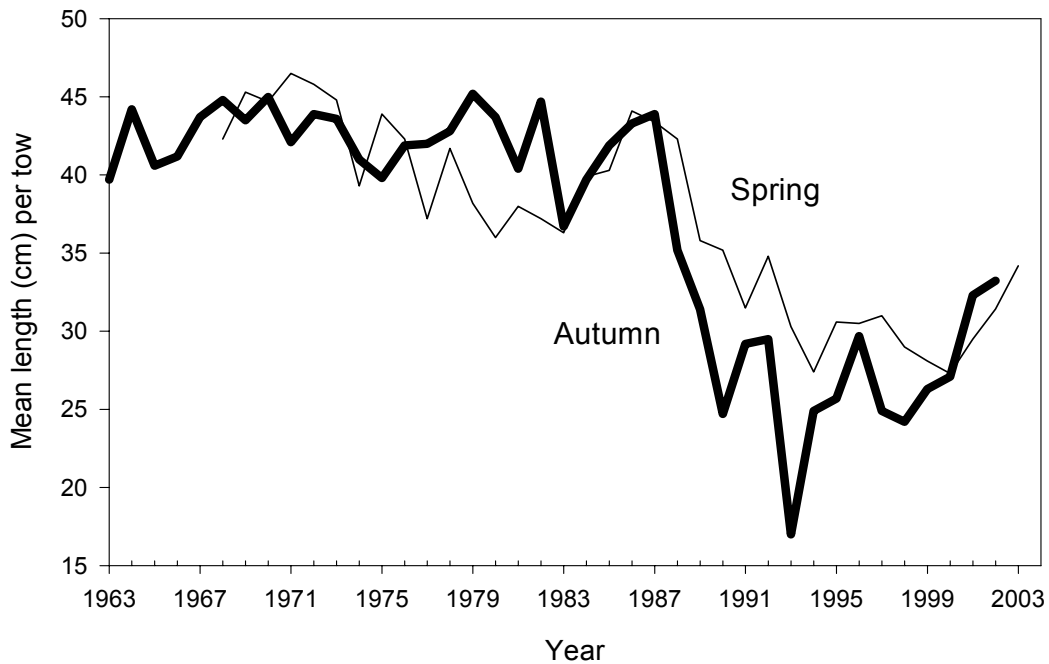


Figure A.15. Stratified mean length (cm) per tow of witch flounder in NEFSC spring and autumn bottom trawl surveys in the Georges Bank- Gulf of Maine region, 1963 – 2003.

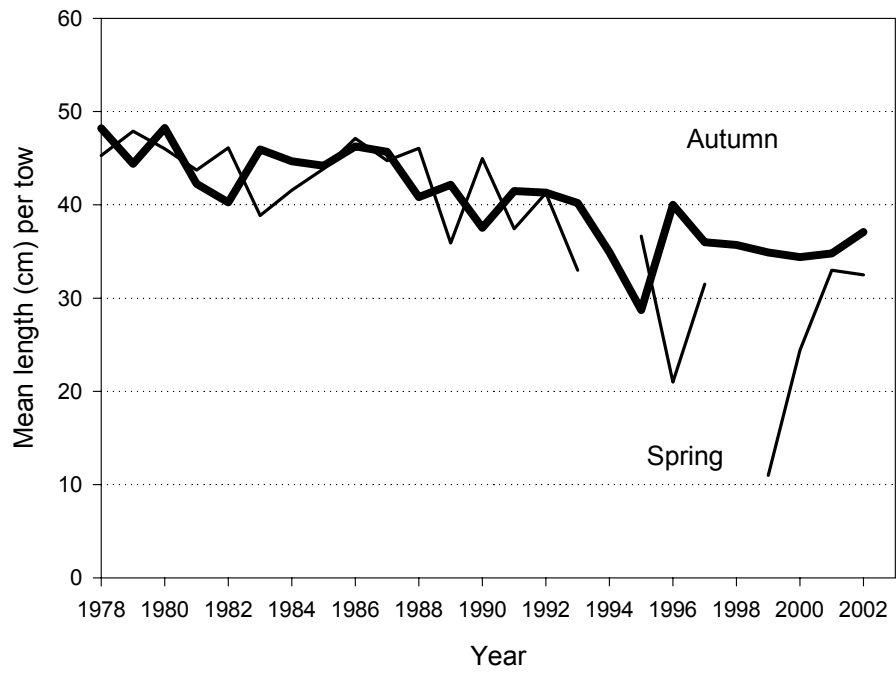


Figure A.16. Stratified mean length (cm) per tow of witch flounder in Massachusetts Division of Marine Fisheries spring and autumn bottom trawl surveys in the Cape Cod Bay – Mass. Bay region, 1978 – 2002.

### Spring Survey: Stratified mean number per tow at age

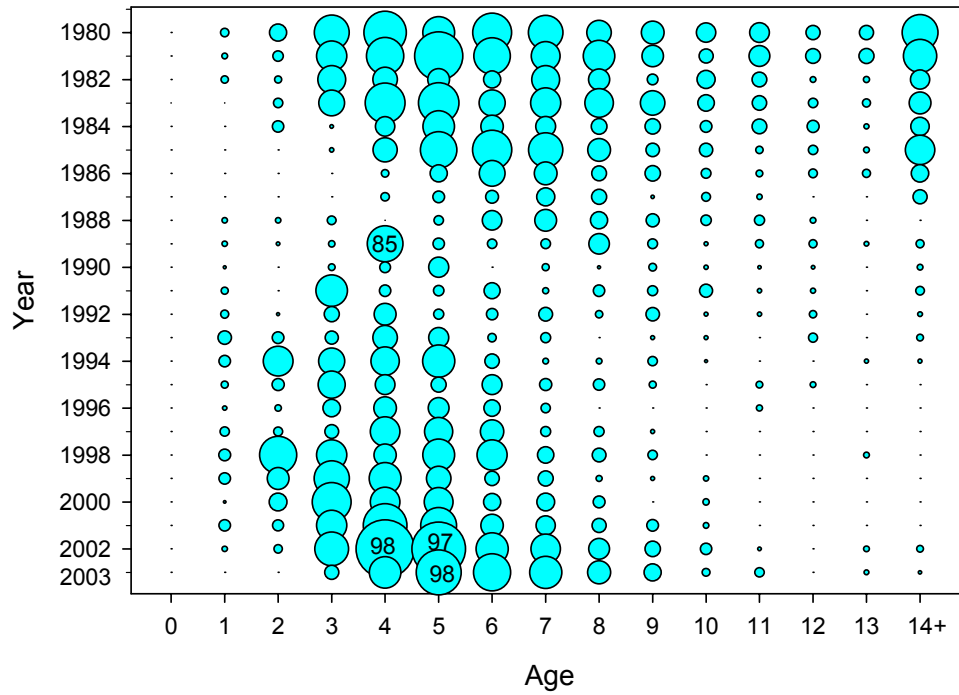


Figure A.17. Stratified mean number of witch flounder per tow at age from NEFSC spring bottom trawl surveys, 1980-2002, preliminary 2003; selected cohorts are labeled.

### Autumn Survey: Stratified mean number per tow at age

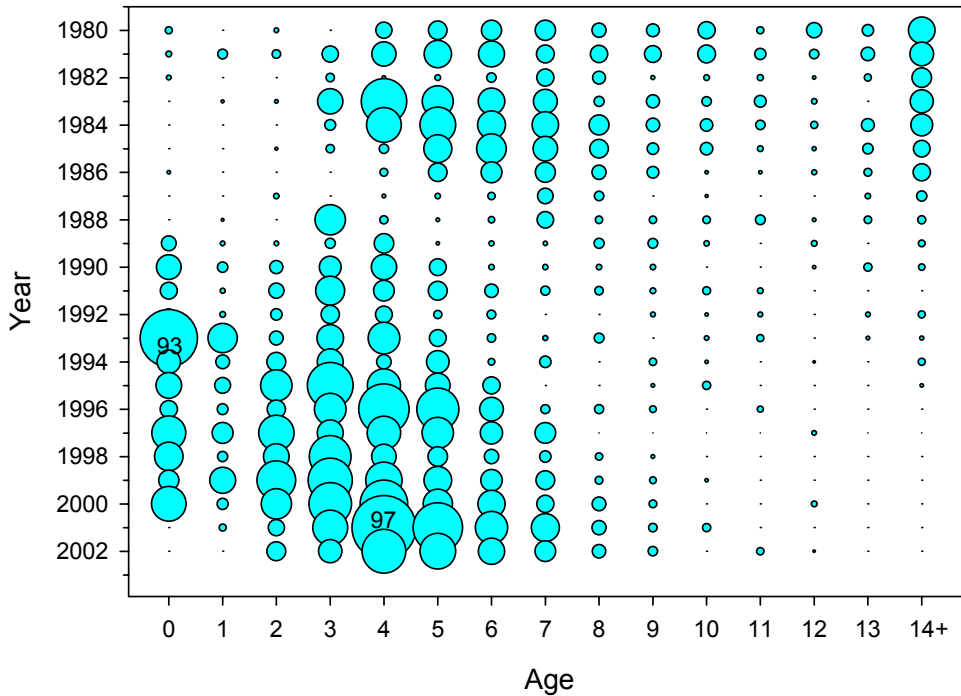


Figure A.18. Stratified mean number of witch flounder per tow at age from NEFSC autumn bottom trawl surveys, 1980-2002; selected cohorts are labeled.

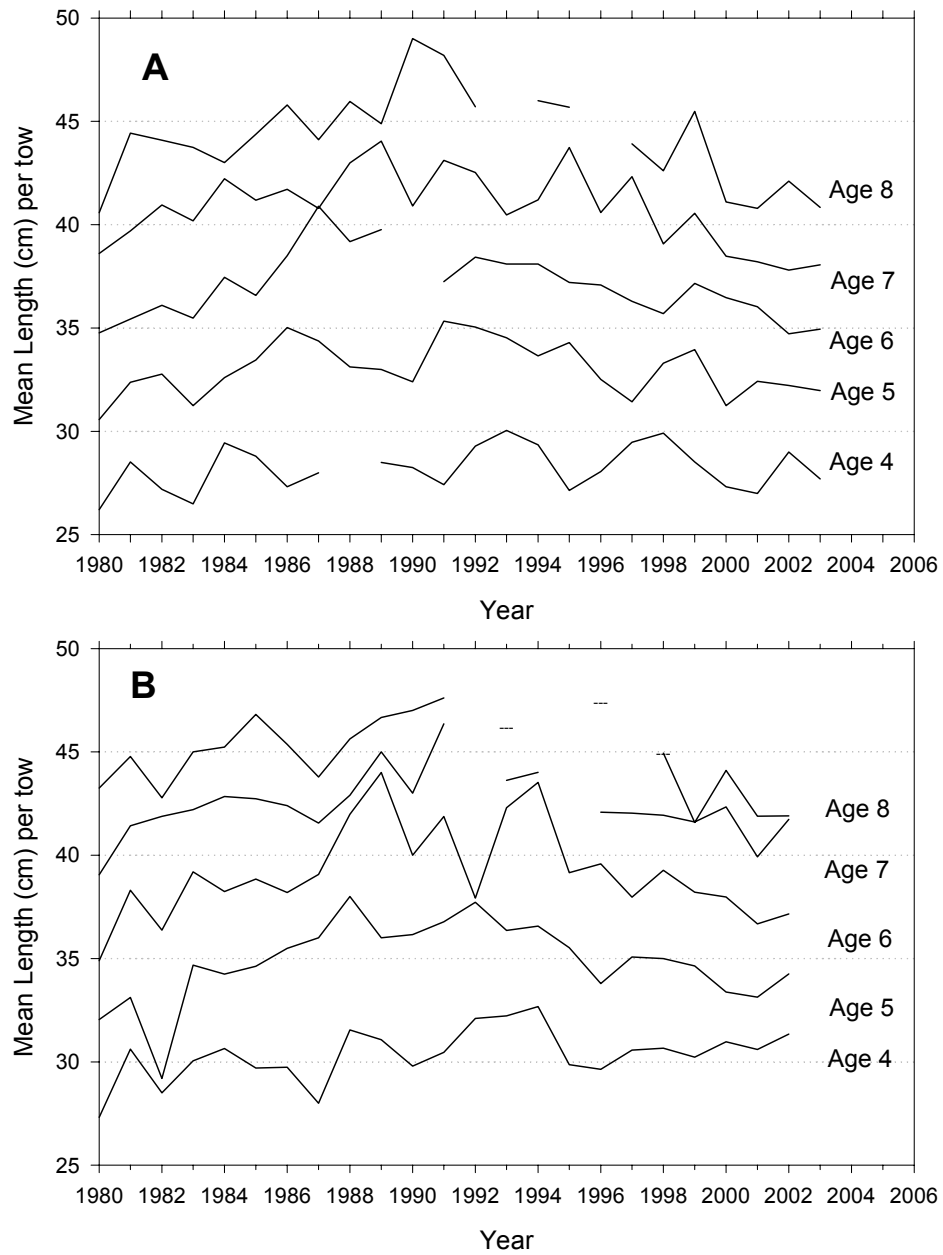


Figure A.19. Mean length (cm) at age of witch flounder for age groups 4 – 8 in spring (A) and autumn (B) NEFSC bottom trawl surveys, 1980 – 2002, preliminary 2003.

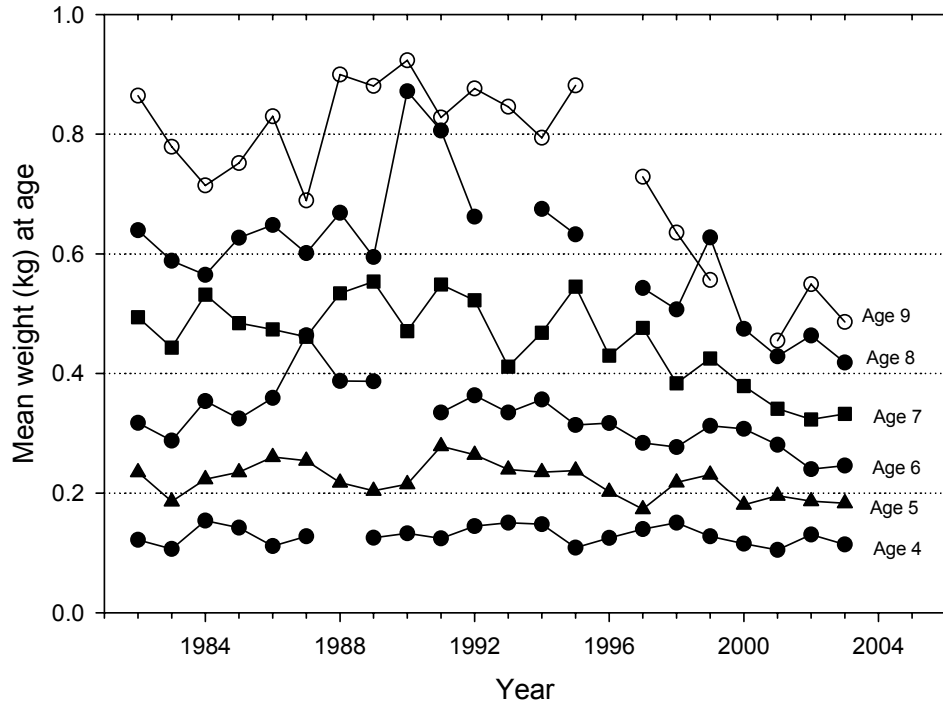


Figure A.20. Mean weight at age of witch flounder in the NEFSC spring bottom trawl survey, 1980 – 2002, preliminary 2003.

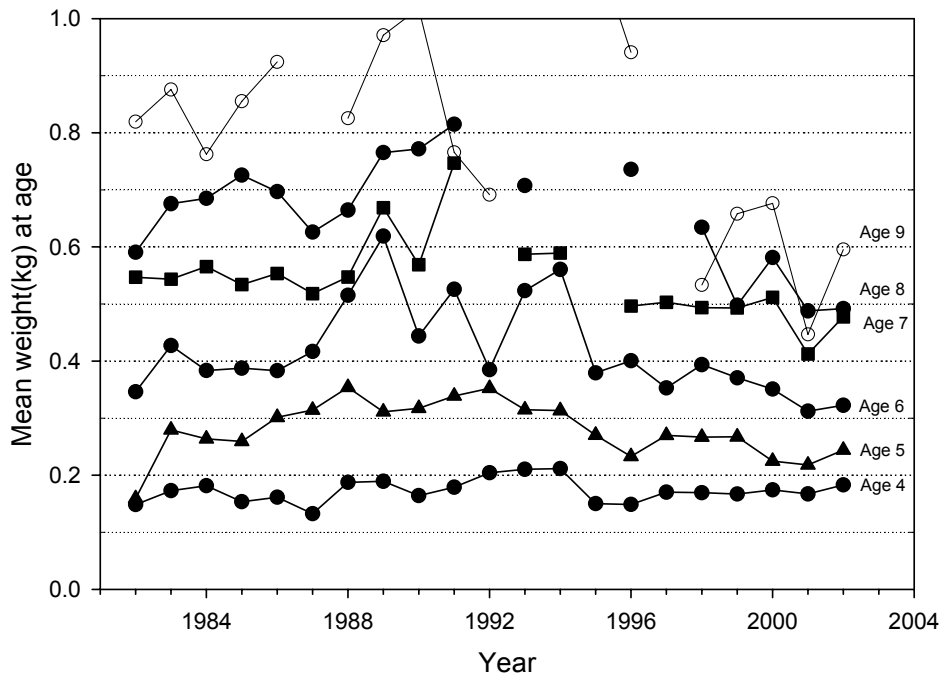


Figure A.21. Mean weight at age of witch flounder in the NEFSC autumn bottom trawl survey, 1980 – 2002.



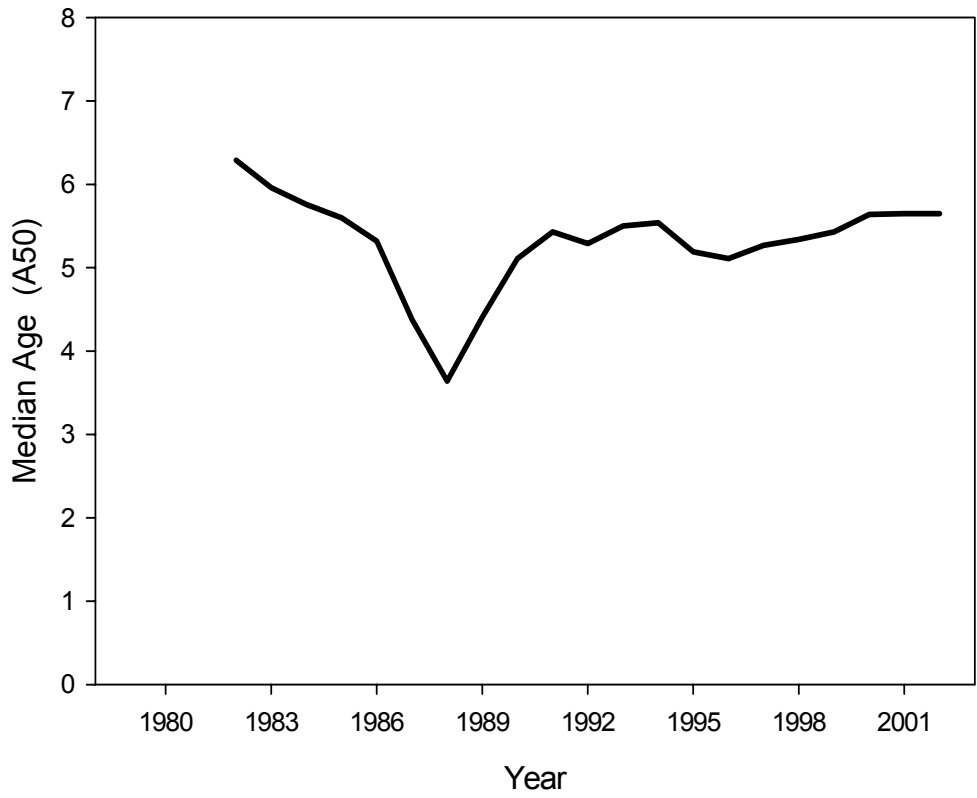


Figure A.22. Annual estimates of median age (A50) of witch flounder derived from a five-year moving time block of maturity observations collected during NEFSC spring surveys, 1980-2003.

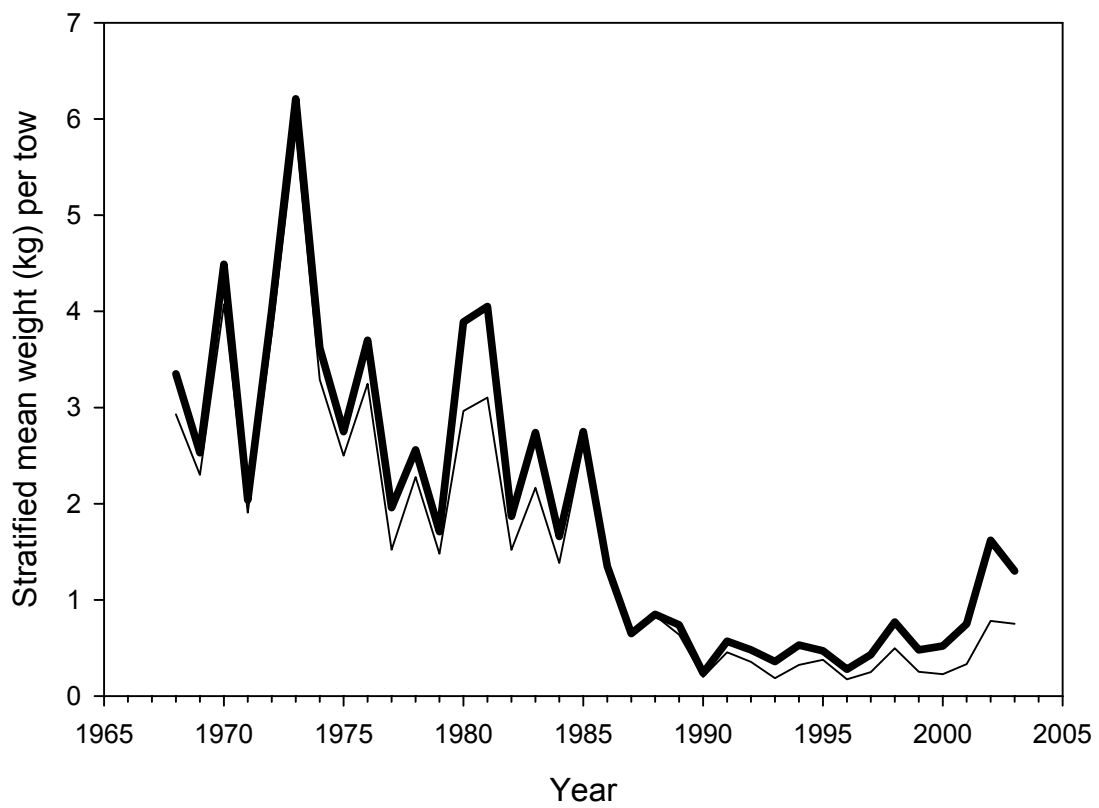


Figure A.23. Stratified mean weight (kg) per tow (thick line) and spawning biomass (kg) per tow (thin line) of witch flounder from the NEFSC spring bottom trawl surveys, 1968 □2002, preliminary 2003.

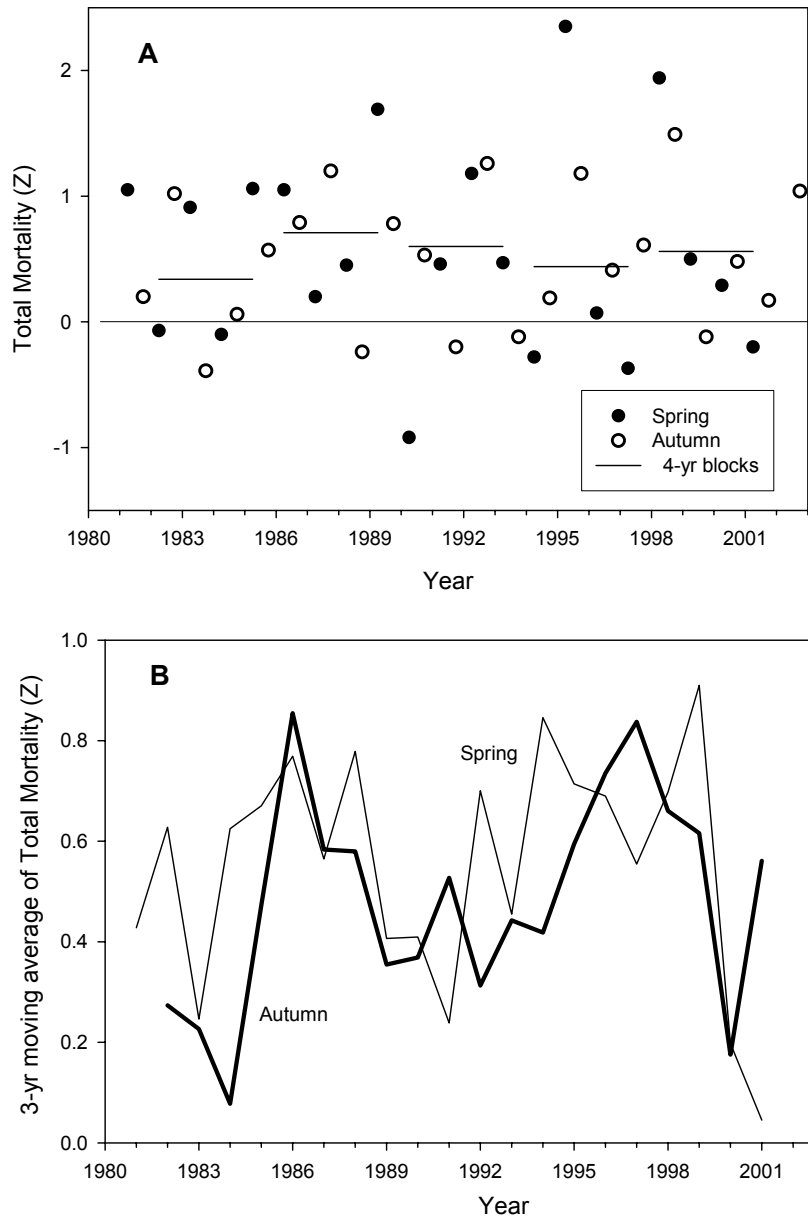


Figure A.24. Estimates of instantaneous total mortality ( $Z$ ) derived from the NEFSC spring and autumn survey catch per tow at age (log ratio  $7+ / 8+$ ) (A) and 3-yr moving average (B).

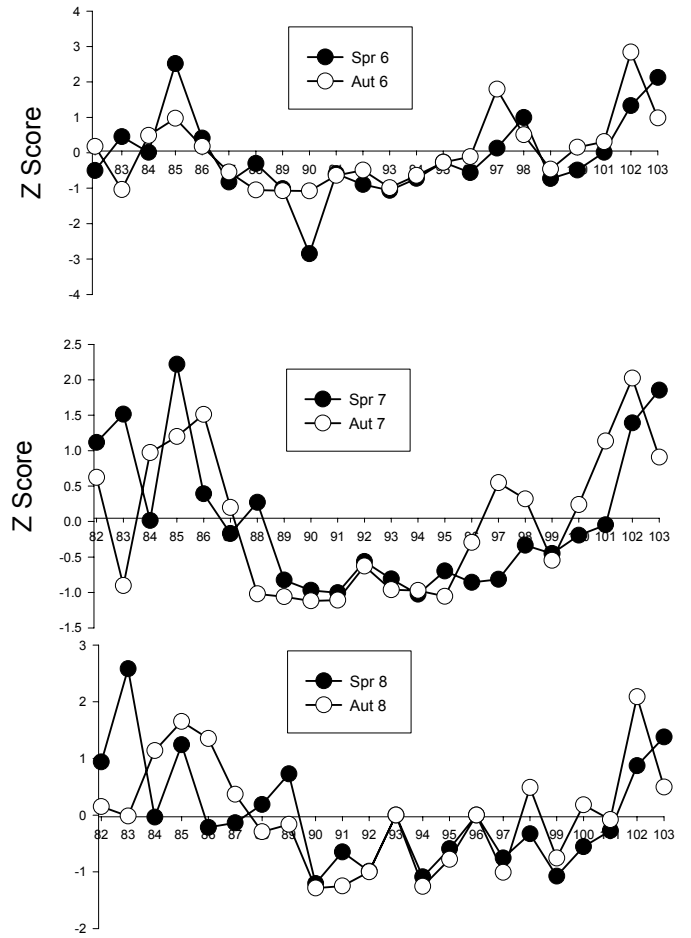
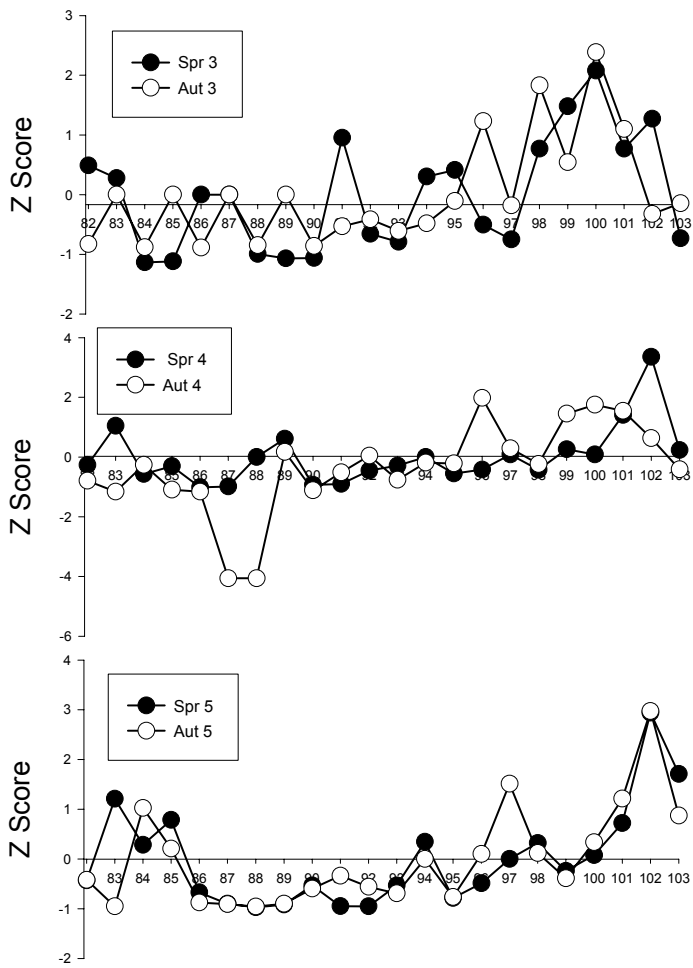


Figure A.25. Scaled (Z score) NEFSC spring and autumn survey indices for ages 3 to 11+, 1982-2003.

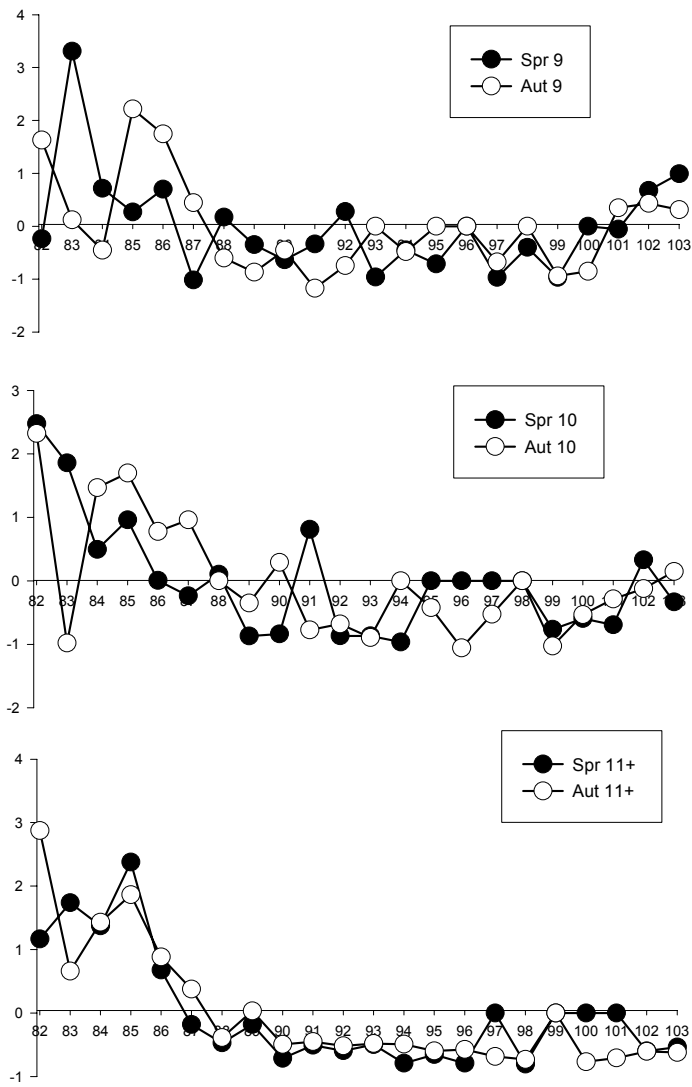


Figure A.25 continued.

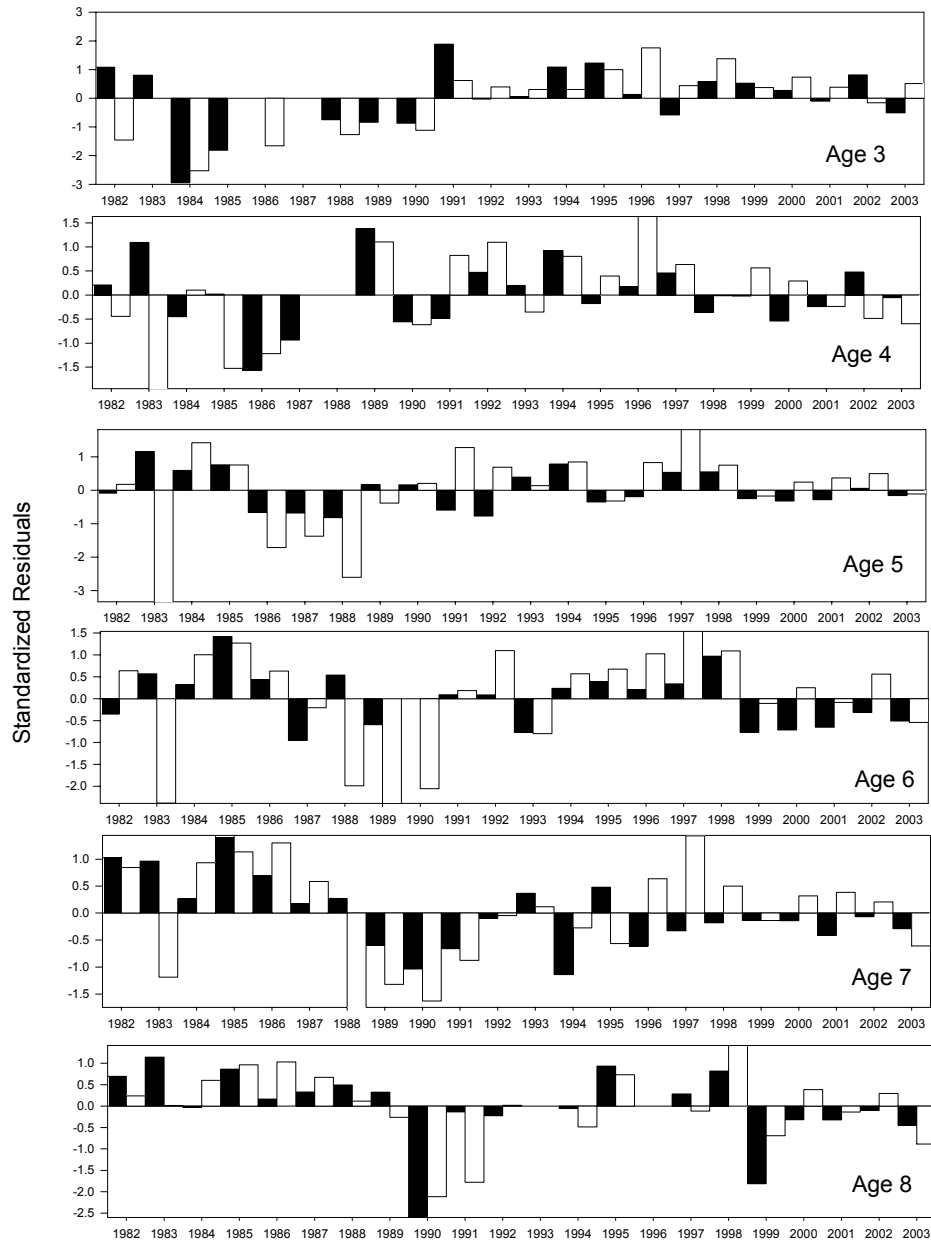


Figure A.26. Standardized residuals for survey indices (spring solid bar and autumn open bar) at age.

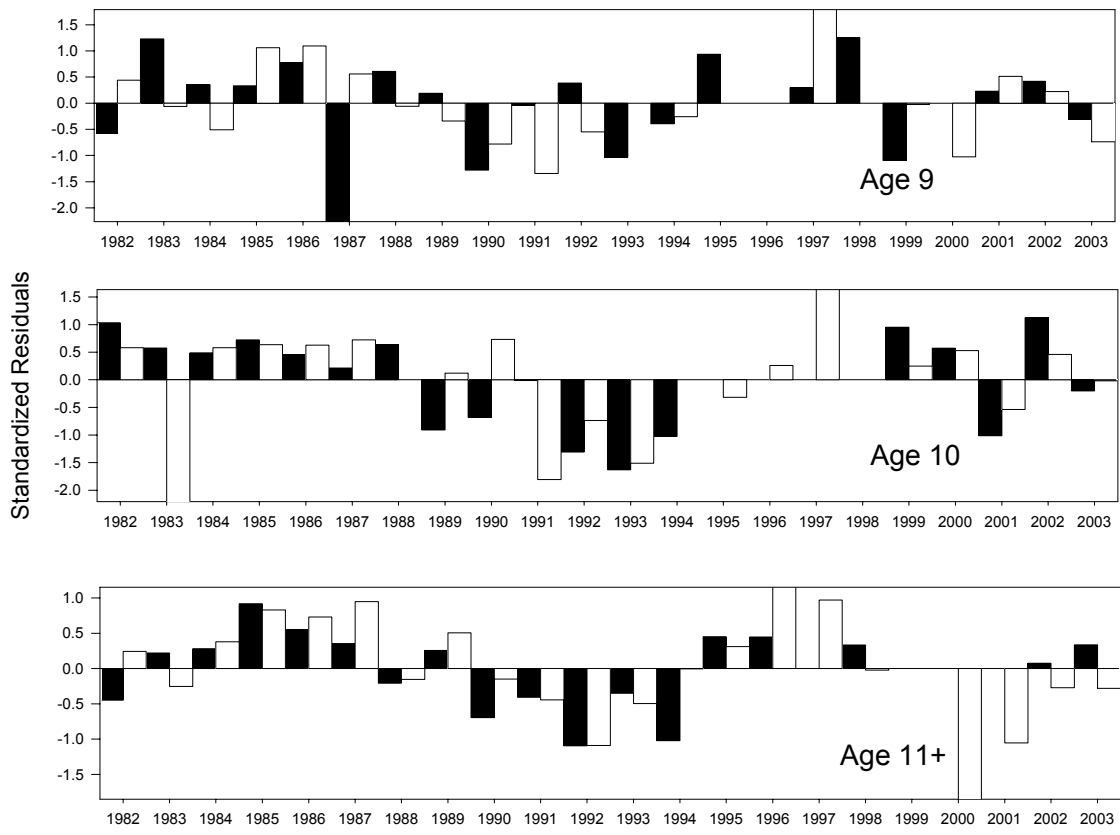


Figure A.26. continued.

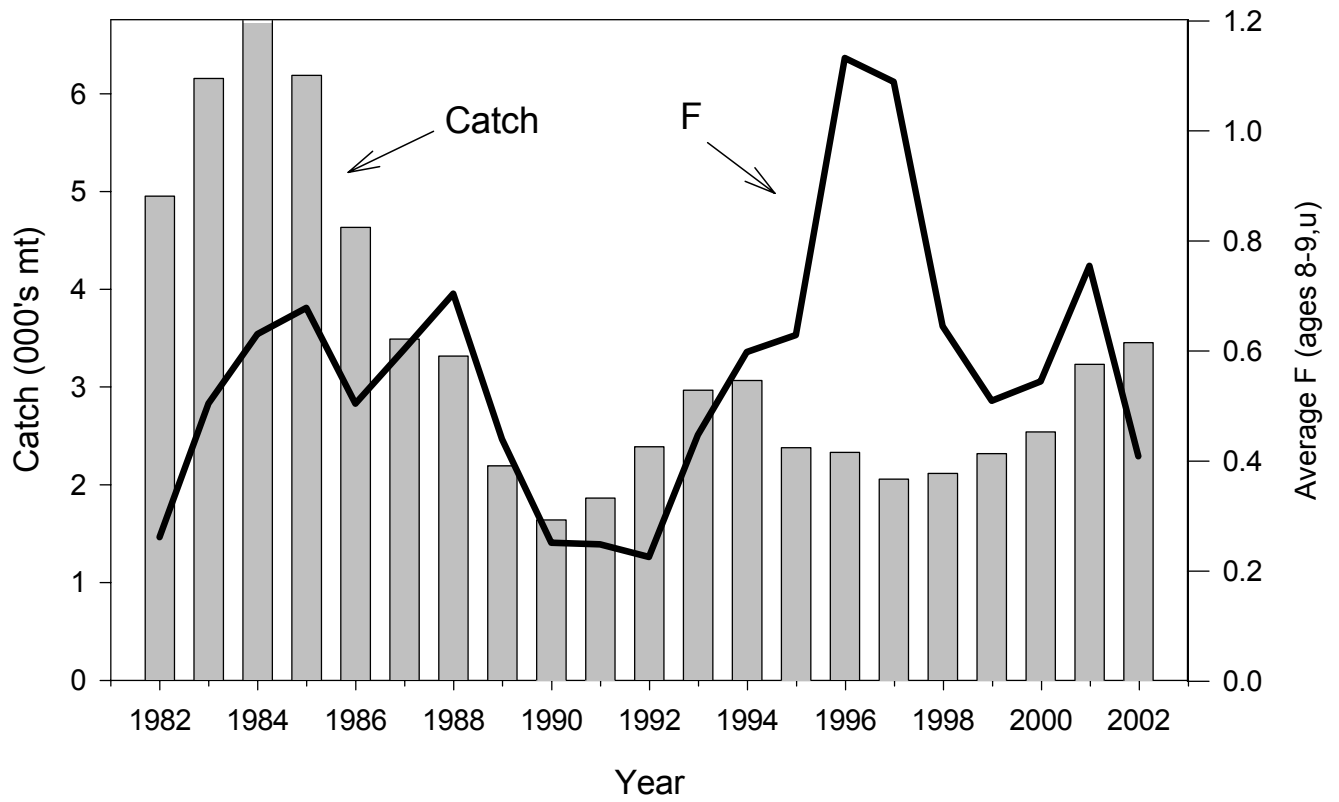


Figure A.27. Trends in total catch and fishing mortality for witch flounder, 1982-2002.



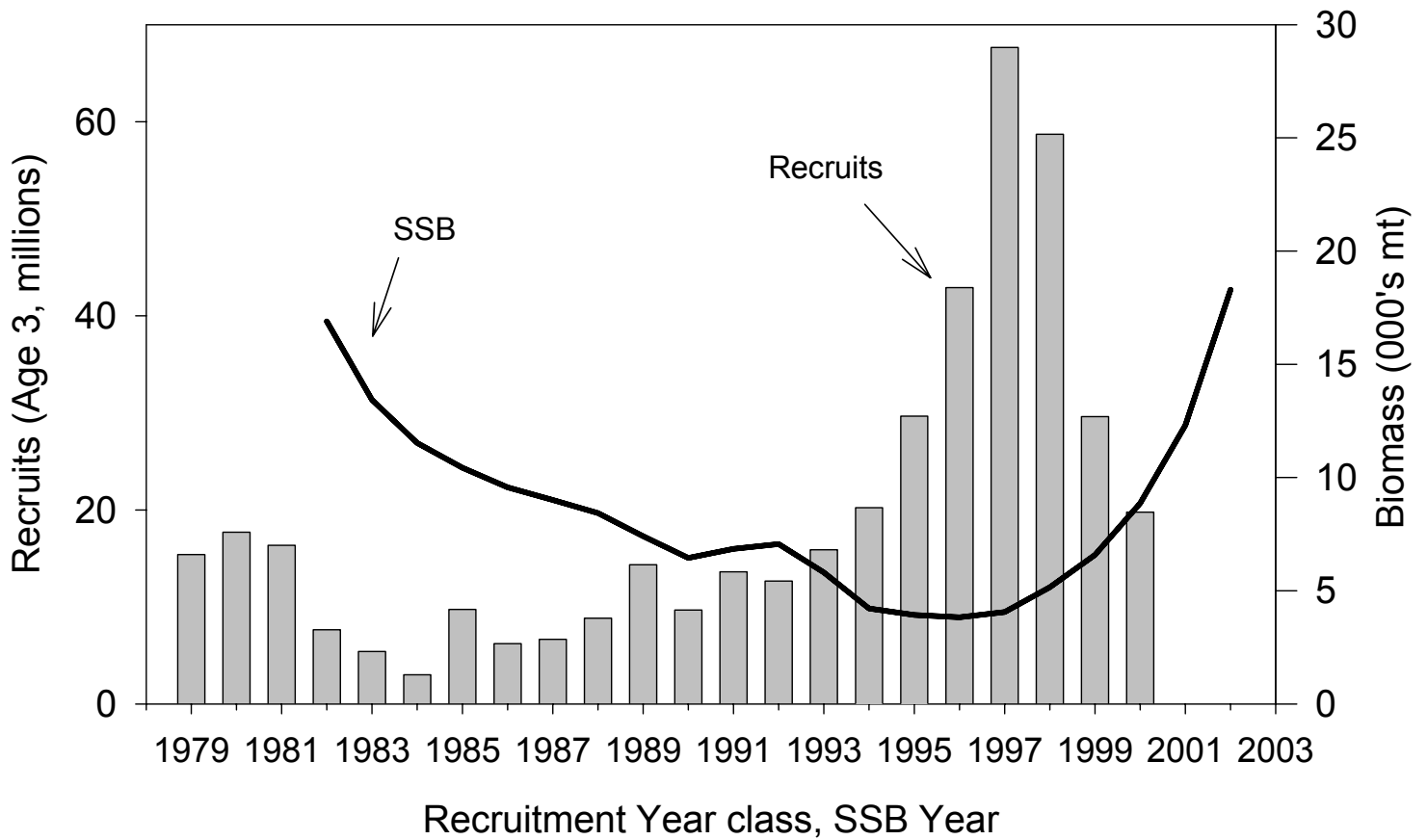


Figure A.28. Trends in spawning stock biomass and recruitment (Age 3) for witch flounder, 1982-2002.

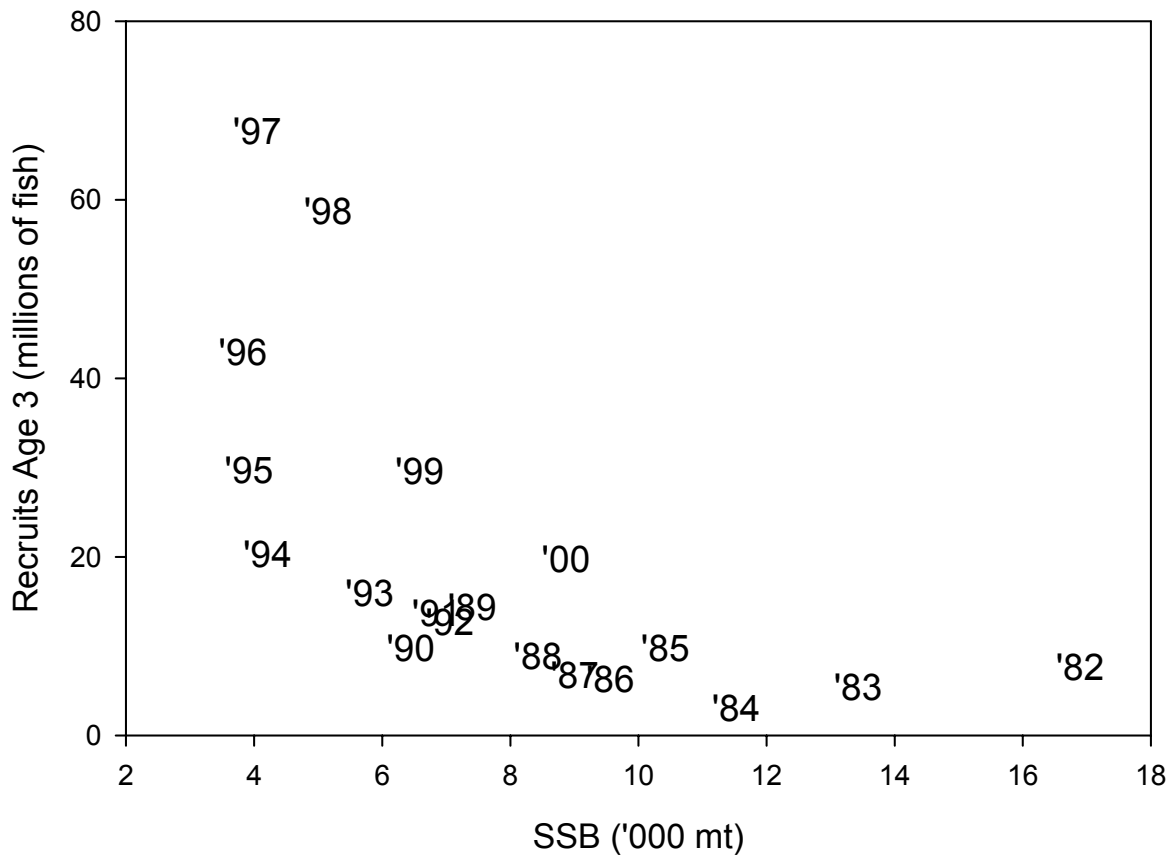


Figure A.29. Spawning stock biomass and recruits (Age 3) for witch flounder, 1982 – 2002 year classes.

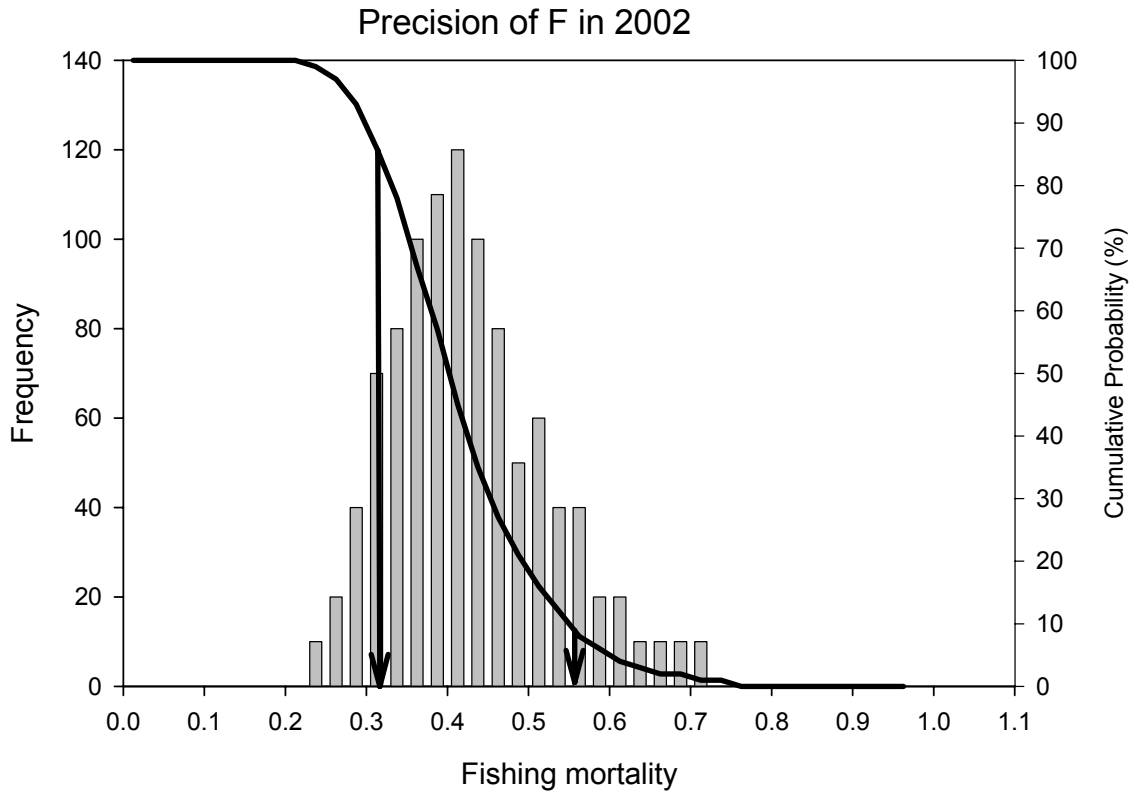


Figure A.30. Precision estimates of fishing mortality (F8-9) in 2002 for witch flounder. Vertical bars display both the range of the bootstrap estimates and the probability of individual values in the range. The arrows indicate the 80% confidence intervals.

### Precision of SSB in 2002

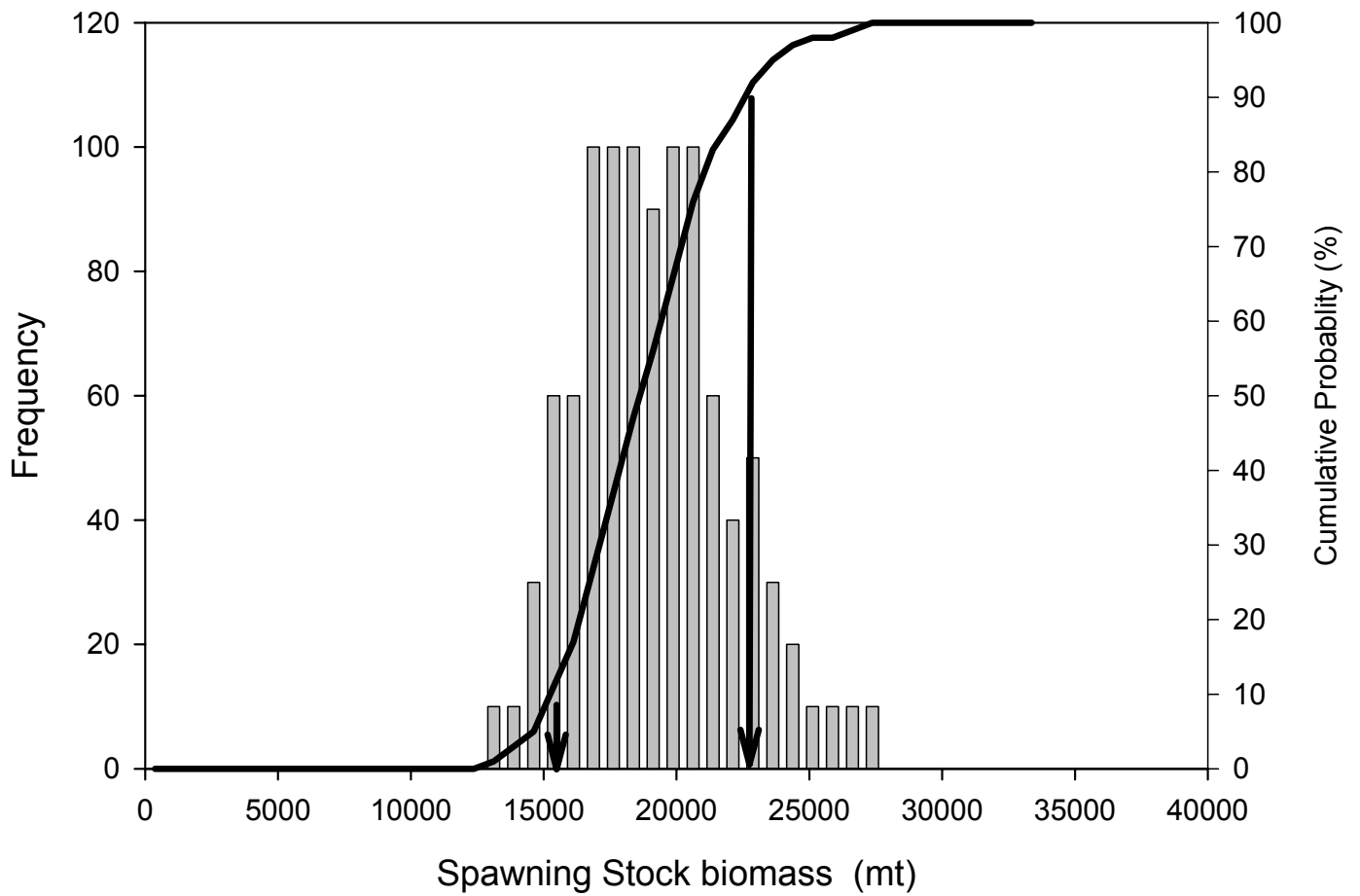


Figure A.31. Precision estimates of spawning stock biomass (mt) in 2002 for witch flounder. Vertical bars display both the range of the bootstrap estimates and the probability of individual values in the range. The arrows indicate the 80% confidence intervals.

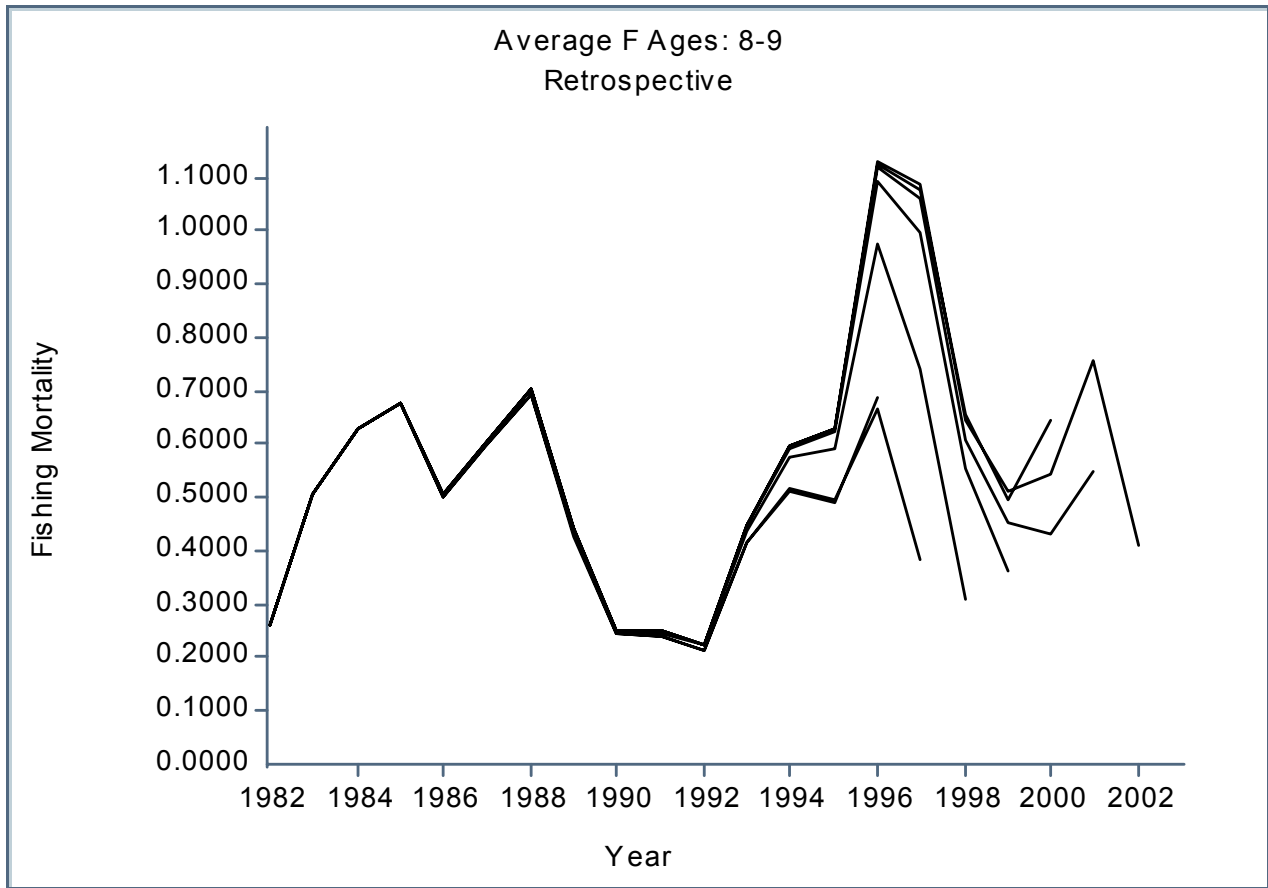


Figure A.32a. Retrospective analysis results for fishing mortality, (F8-9).

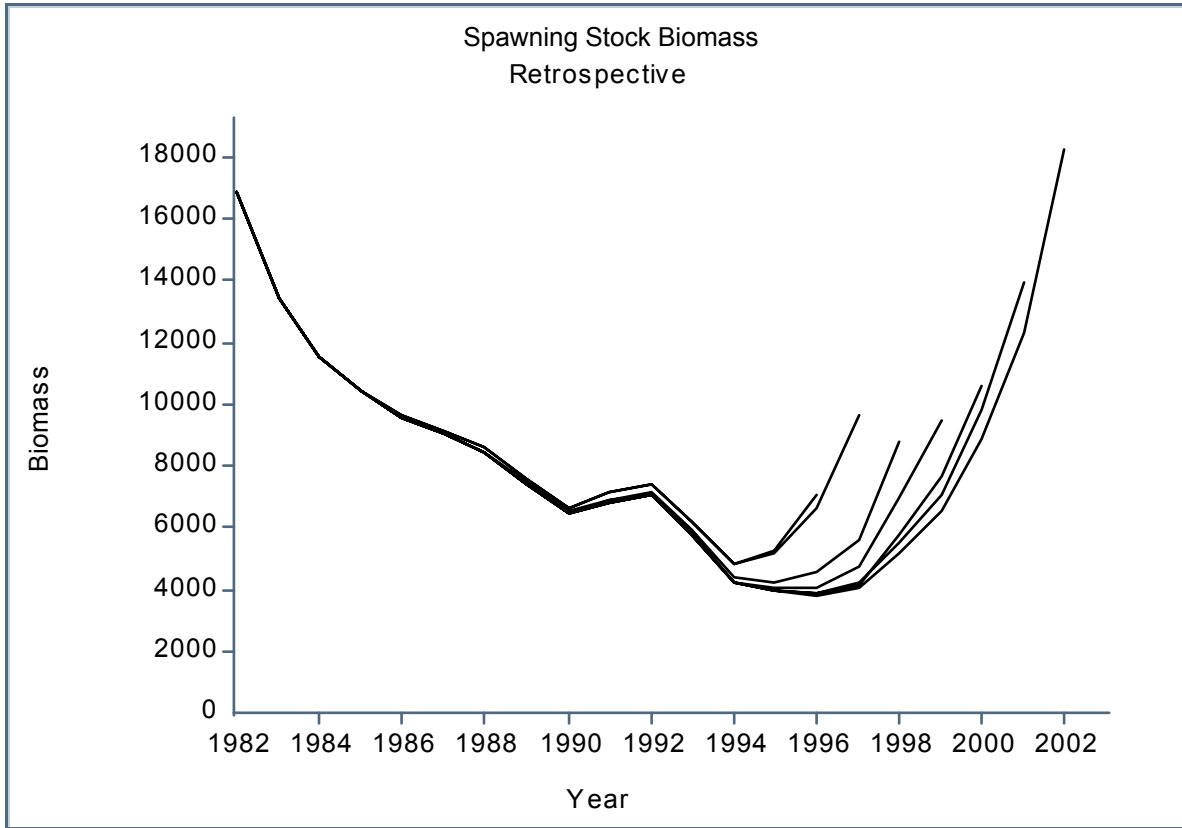


Figure A.32b. Retrospective analysis results for spawning stock biomass.

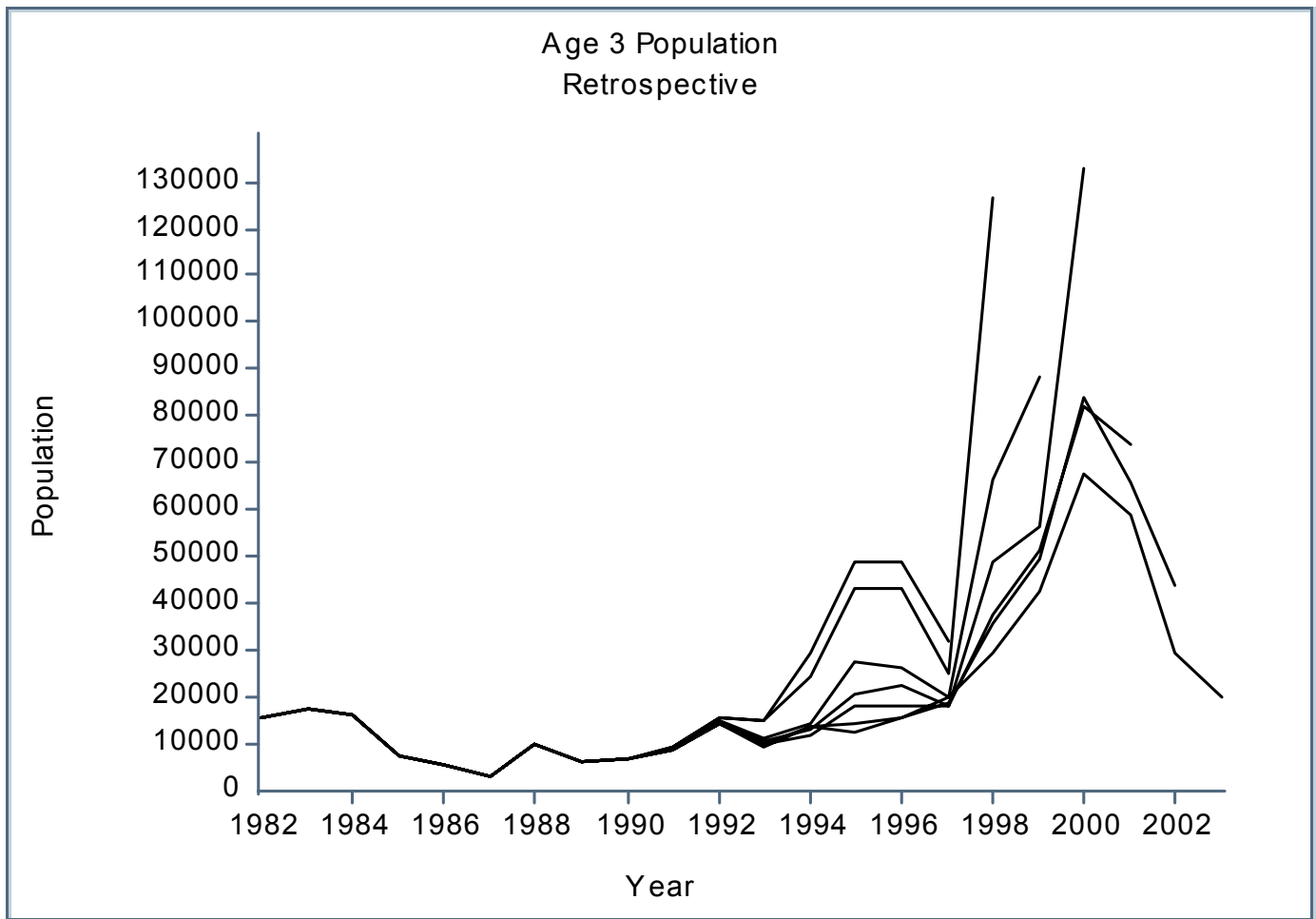


Figure A.32c. Retrospective analysis results for age 3 recruitment.

Witch Flounder Fishery Selectivity by Time Period  
Model 3: Catch Scenario 2: M=0.15

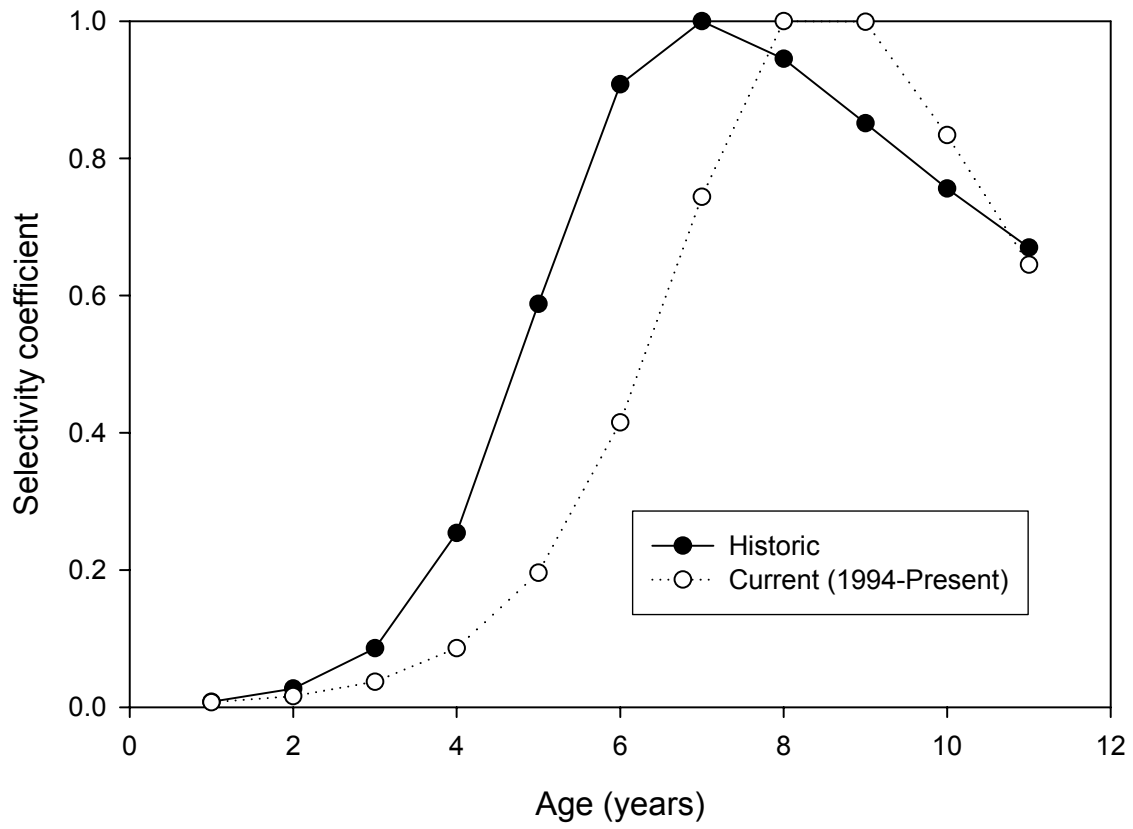


Figure A.33. Selectivity at age.



Witch Flounder Catch Biomass (mt), 1937-2002  
Catch Scenario 2: M=0.15

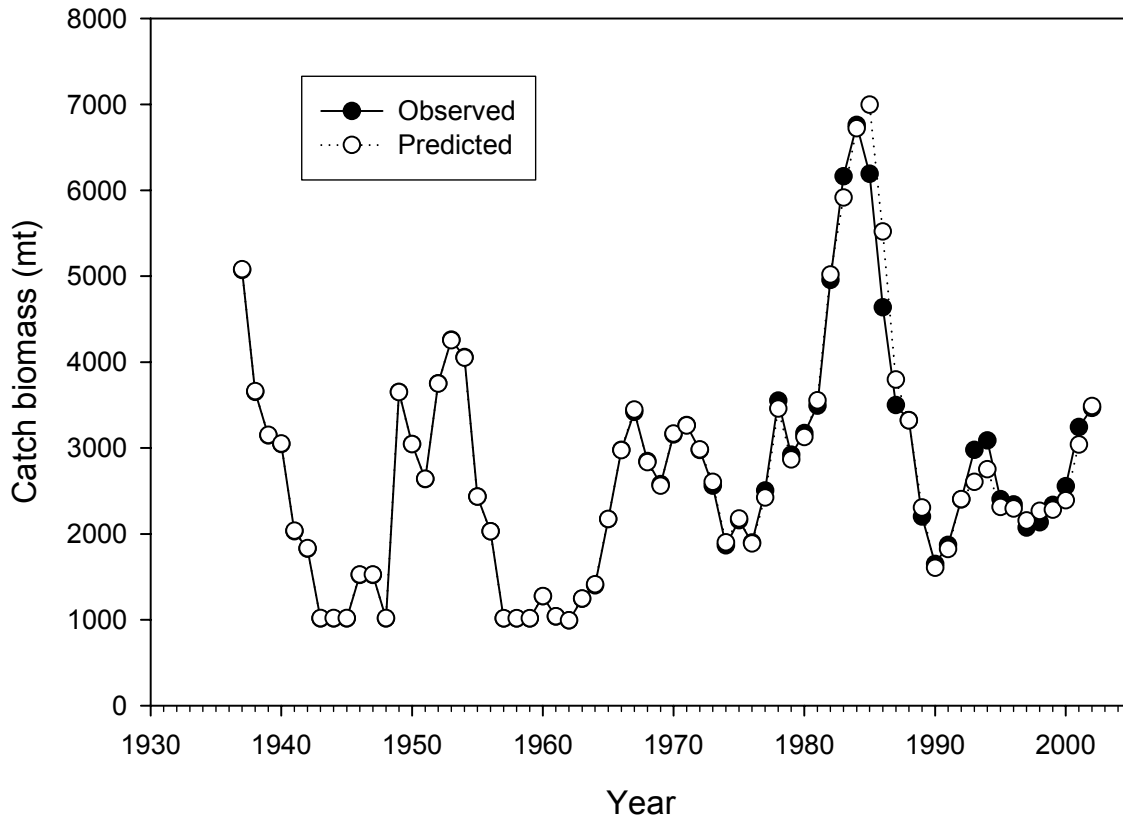


Figure A.34. Trends in catch biomass (mt), 1937 – 2002.

Witch Flounder Survey Selectivity  
Model 3: Catch Scenario 2: M=0.15

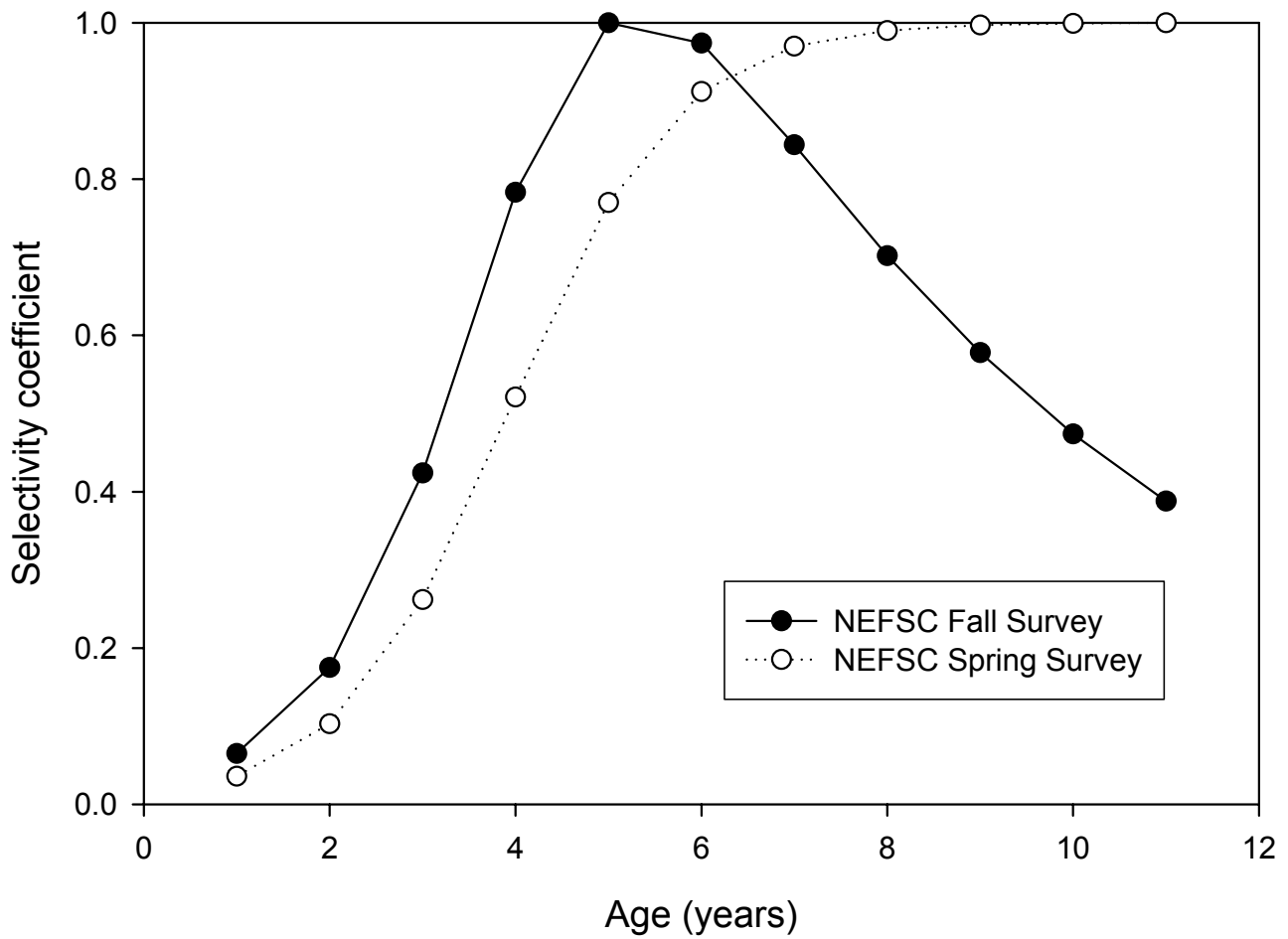


Figure A.35. Survey selectivity at age.

Witch Flounder Fall Survey Biomass Index, 1963-2002  
Model 3: Catch Scenario 2: M=0.15

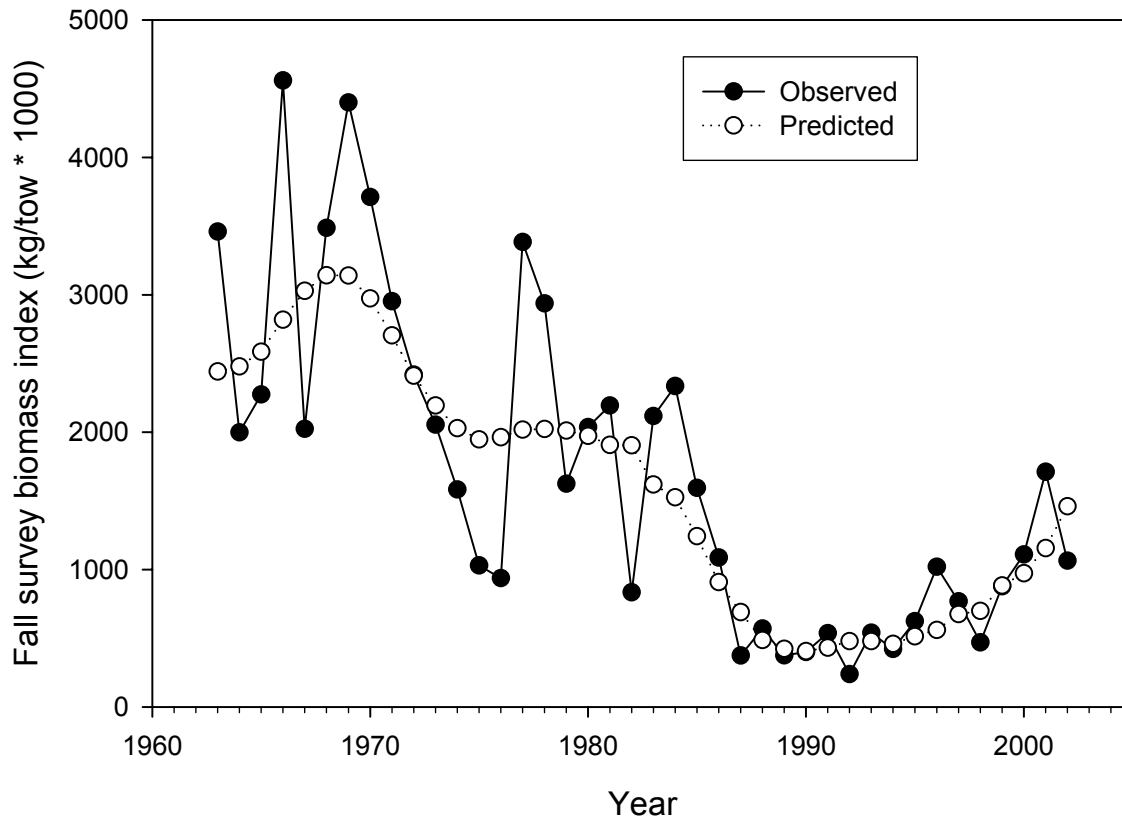


Figure A.36. Trends in NEFSC autumn survey biomass.

Witch Flounder Spring Survey Biomass Index, 1968-2002  
Model 3: Catch Scenario 2: M=0.15

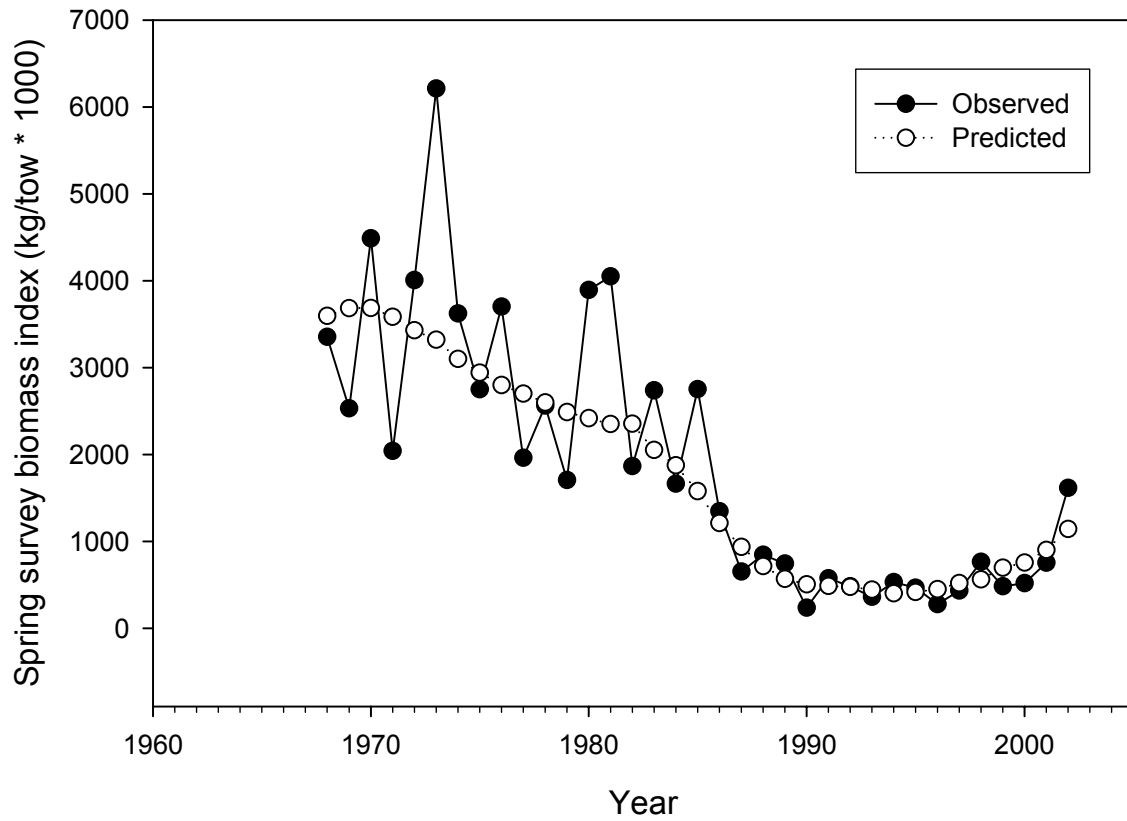


Figure A.37. Trends in NEFSC spring survey biomass.

Comparison of ADAPT virtual population analysis (VPA) and statistical catch-at-age analysis (SCAA) estimates of witch flounder spawning biomass, 1982-2002

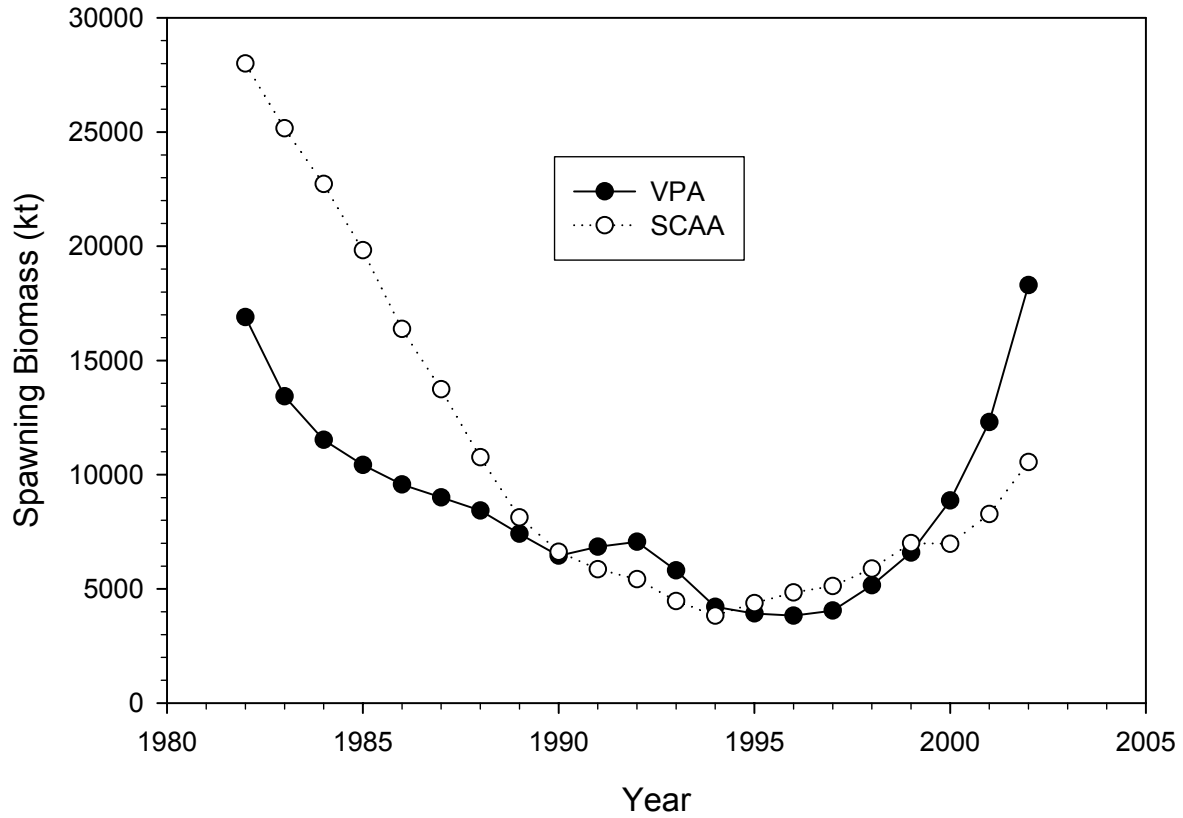


Figure A.38. Comparison of VPA and SCAA estimates of spawning stock biomass.

Comparison of ADAPT virtual population analysis (VPA) and statistical catch-at-age analysis (SCAA) estimates of witch flounder fishing mortality, 1982-2002

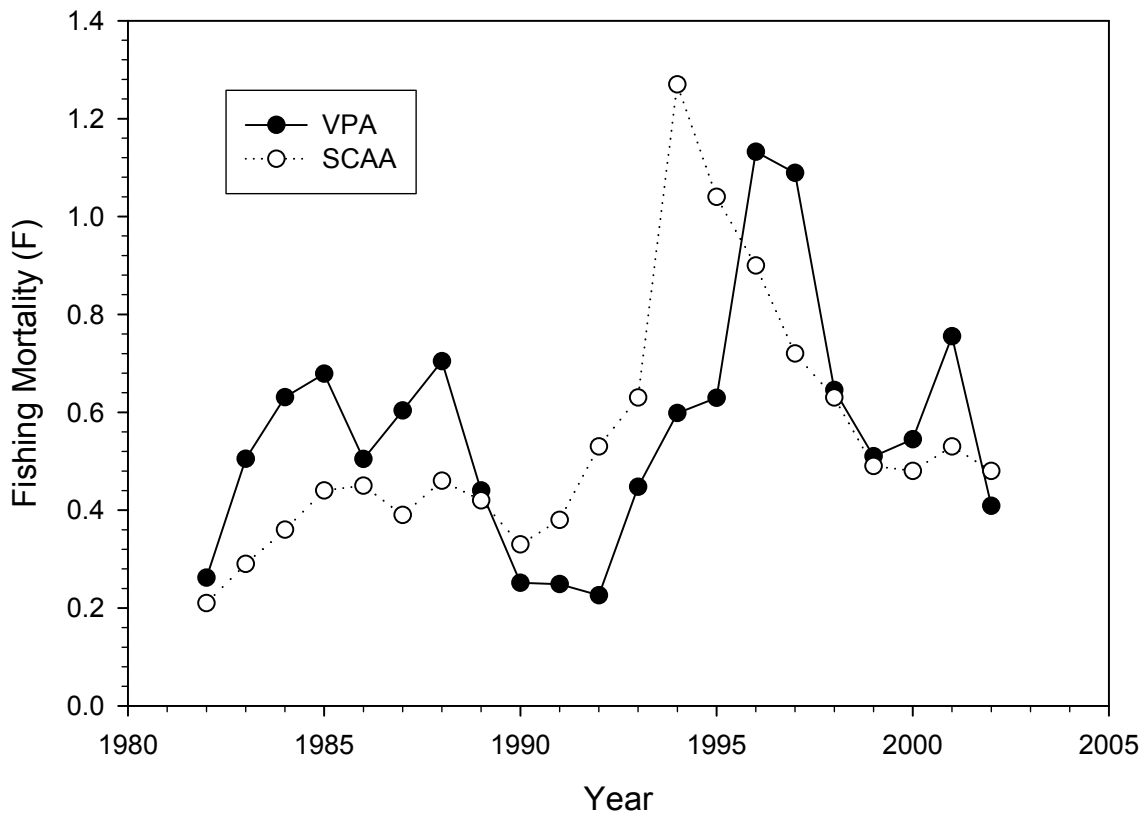


Figure A.39. Comparison of VPA and SCAA estimates of fishing mortality.

Comparison of ADAPT virtual population analysis (VPA) and statistical catch-at-age analysis (SCAA) estimates of witch flounder recruitment, 1982-2002

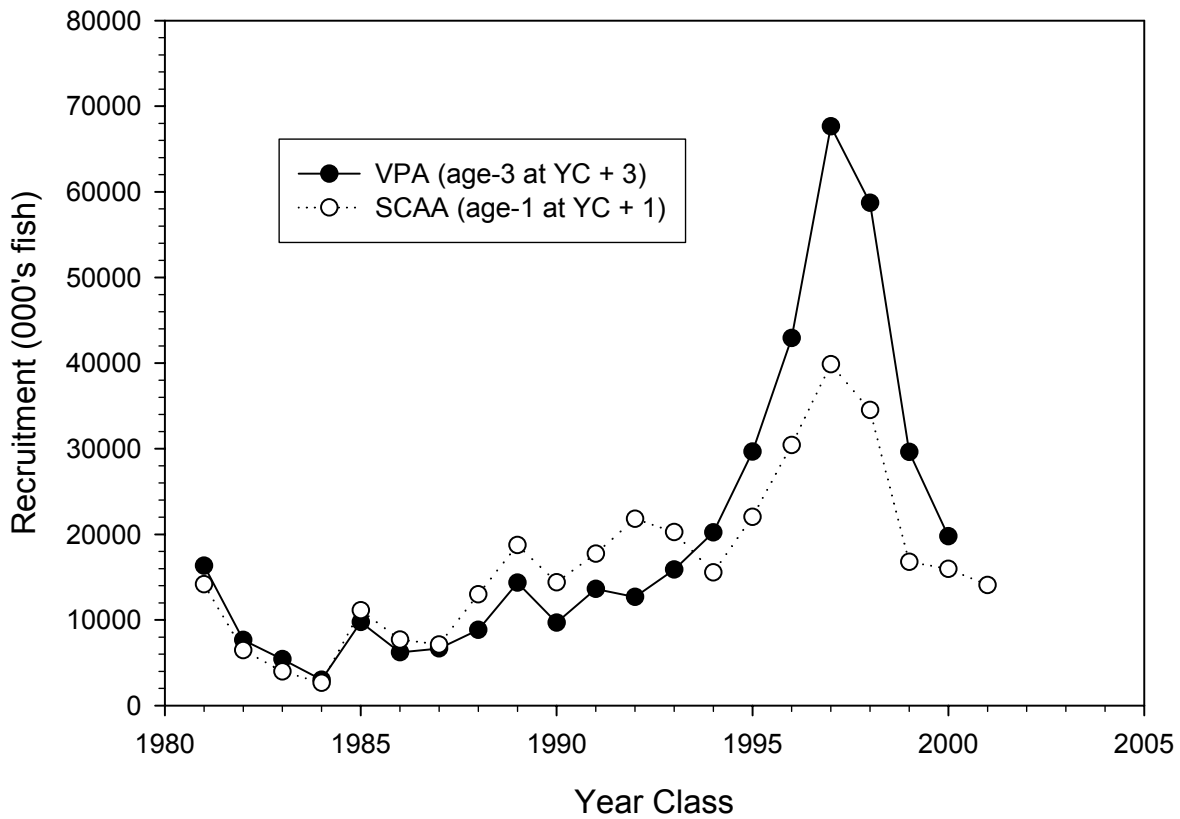


Figure A.40. Comparison of VPA and SCAA estimates of recruitment.

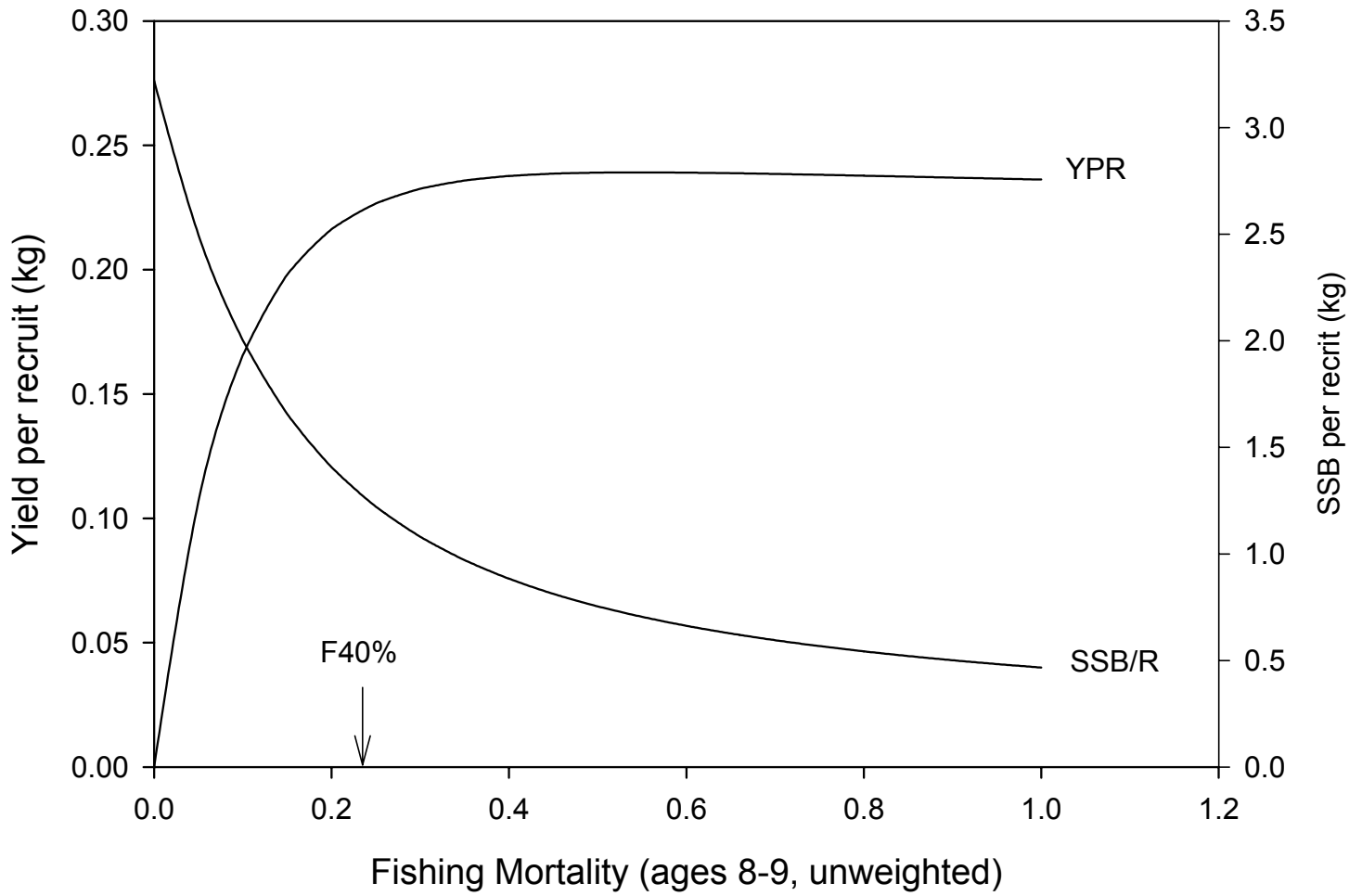


Figure A.41. Yield per recruit (YPR) and spawning stock biomass per recruit (SSB/R) estimates for witch flounder.



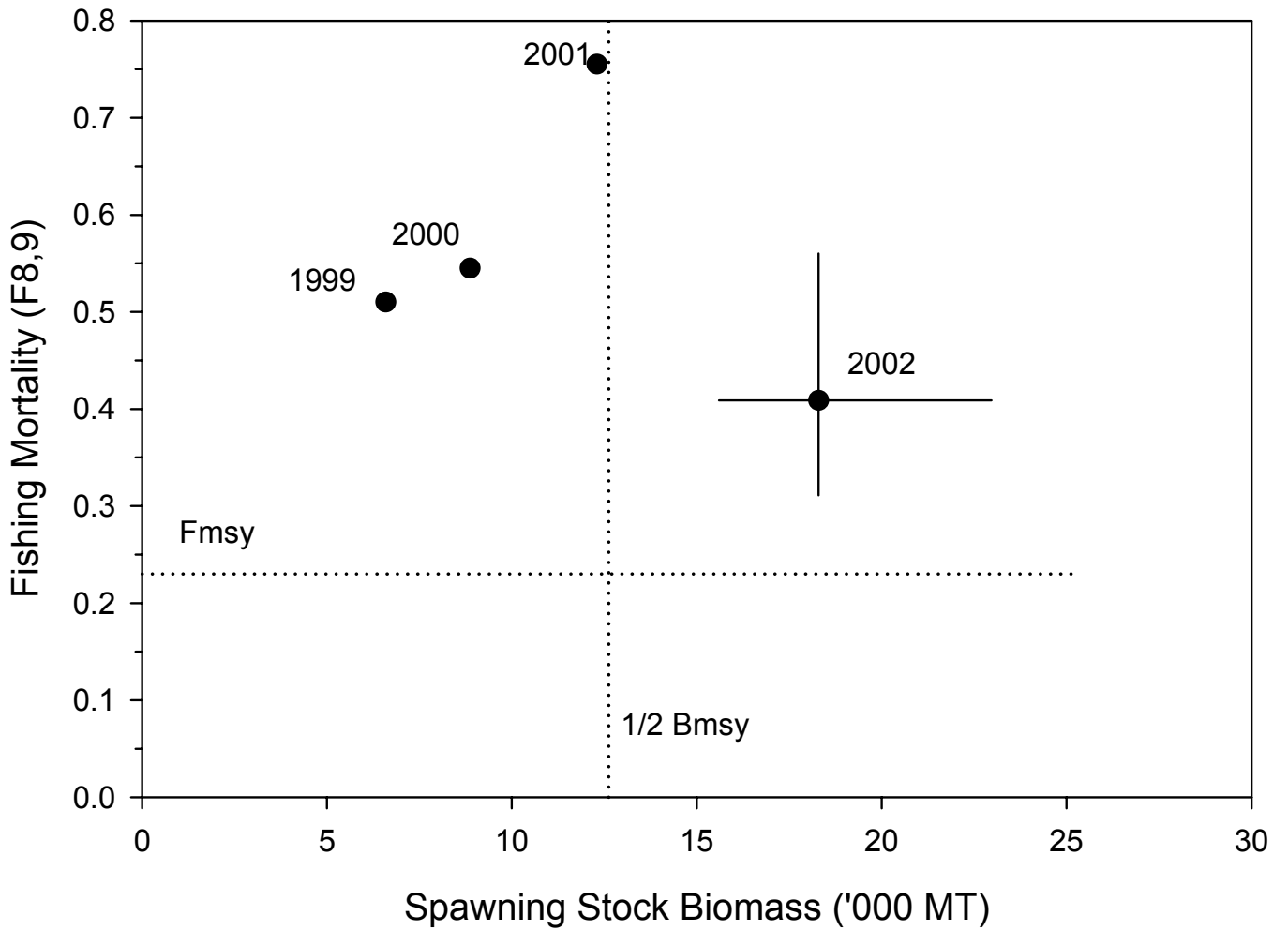


Figure A.42. Spawning stock biomass and fishing mortality (F 8-9) for witch flounder, 1999-2001, and 2002 with 80% confidence interval.

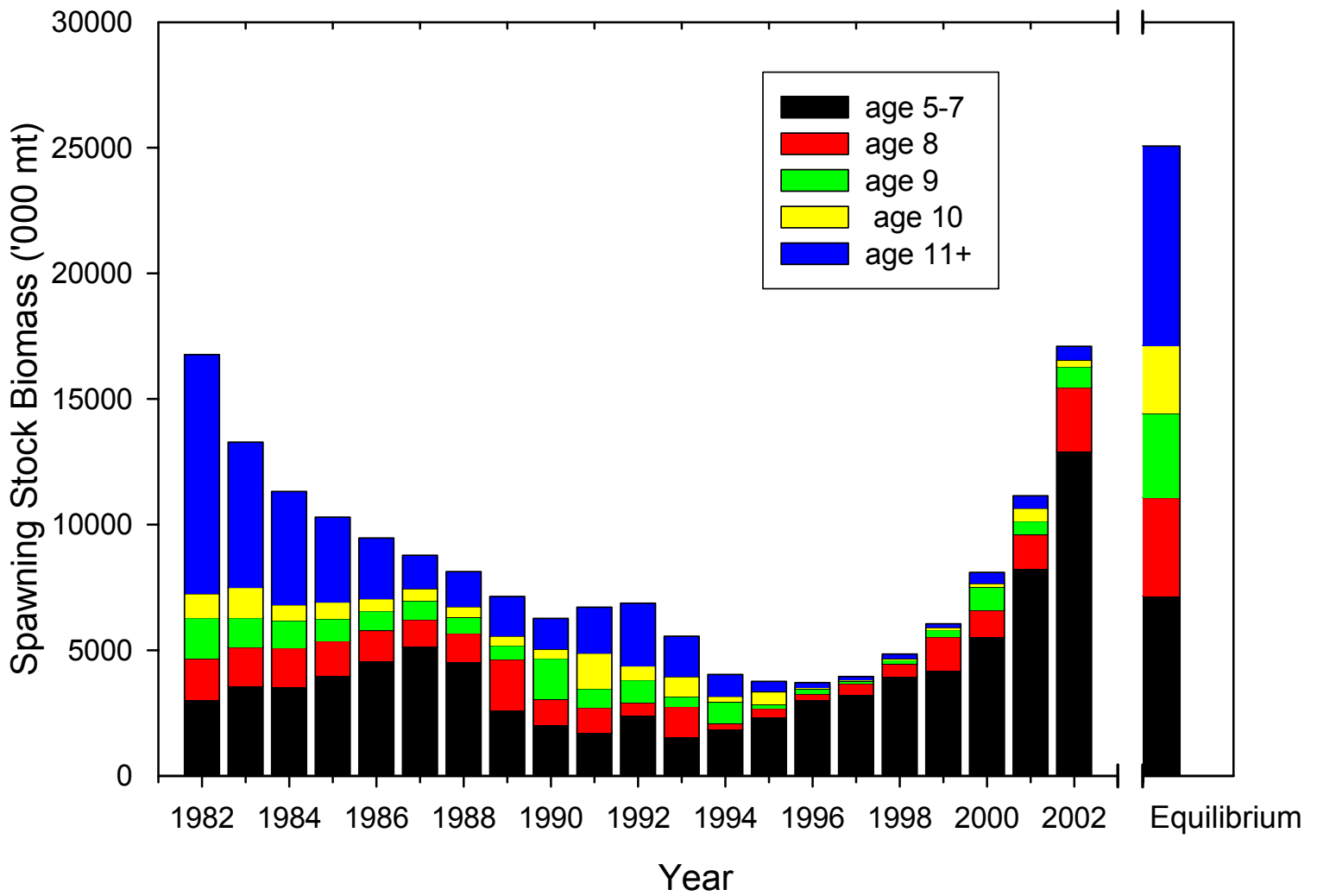


Figure A.43. Age distribution of witch flounder spawning stock biomass, 1982 – 2002 and the expected age distribution of witch flounder at equilibrium.