ATLANTIC SEA SCALLOP FIGURES

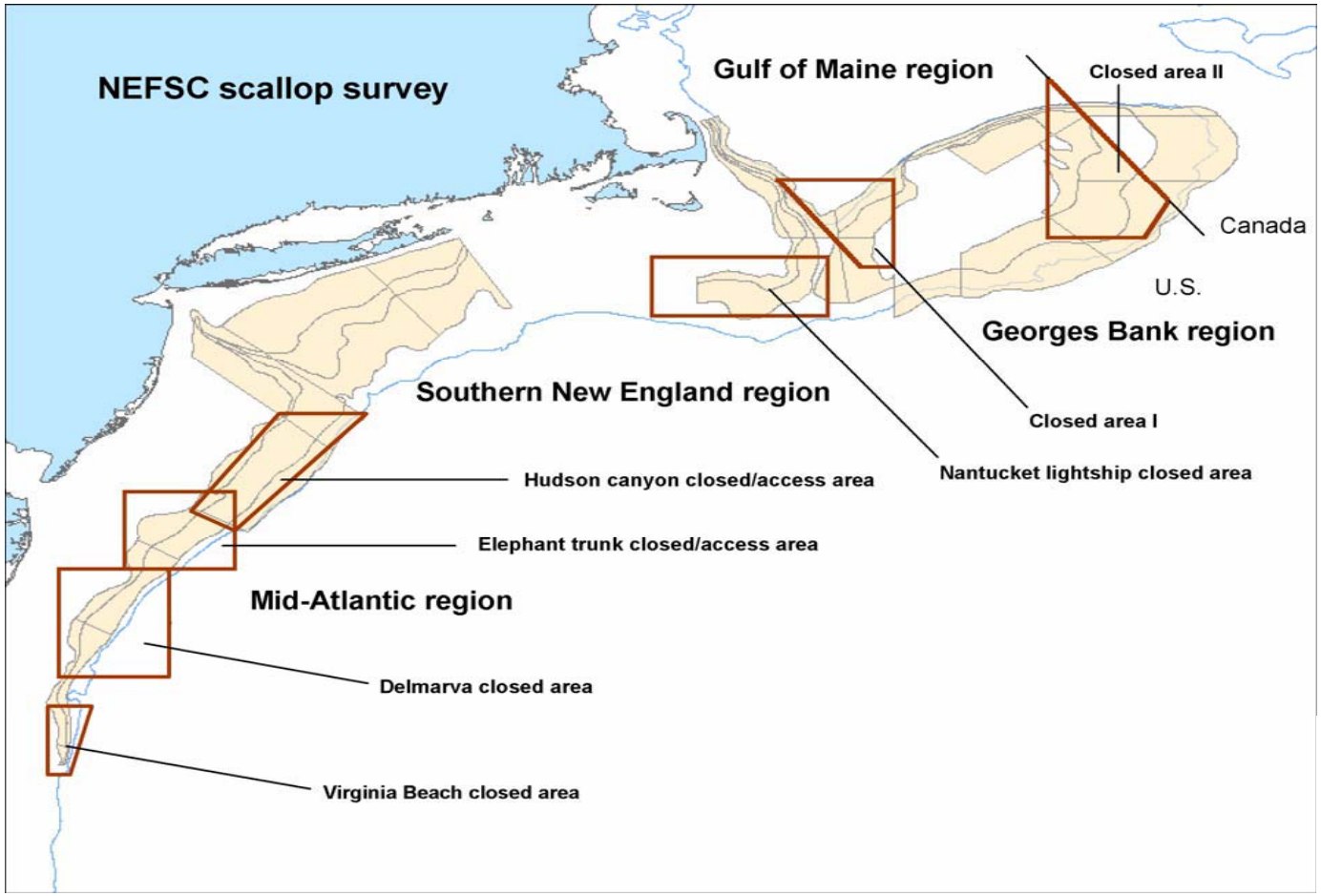
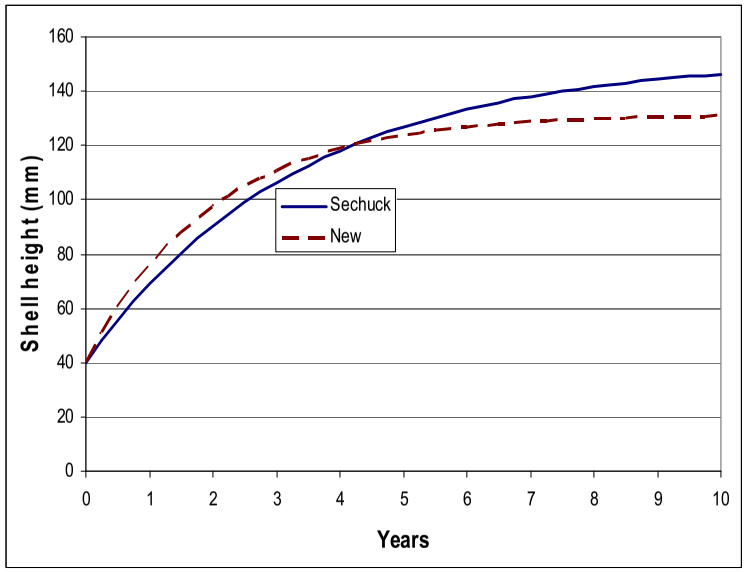


Figure B3-1. Map of sea scallop grounds and regions. The shaded regions are the shellfish strata regularly sampled in the NEFSC sea scallop survey

(a)



(b)

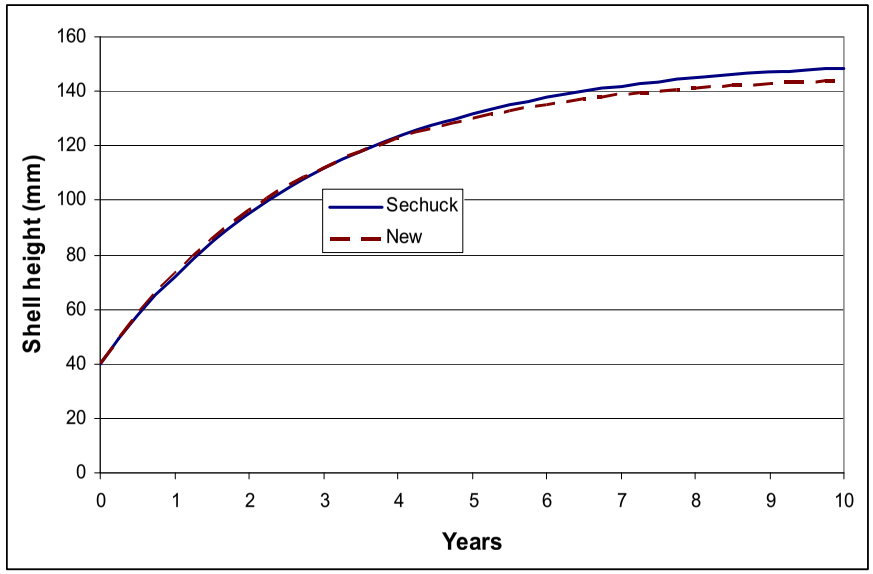
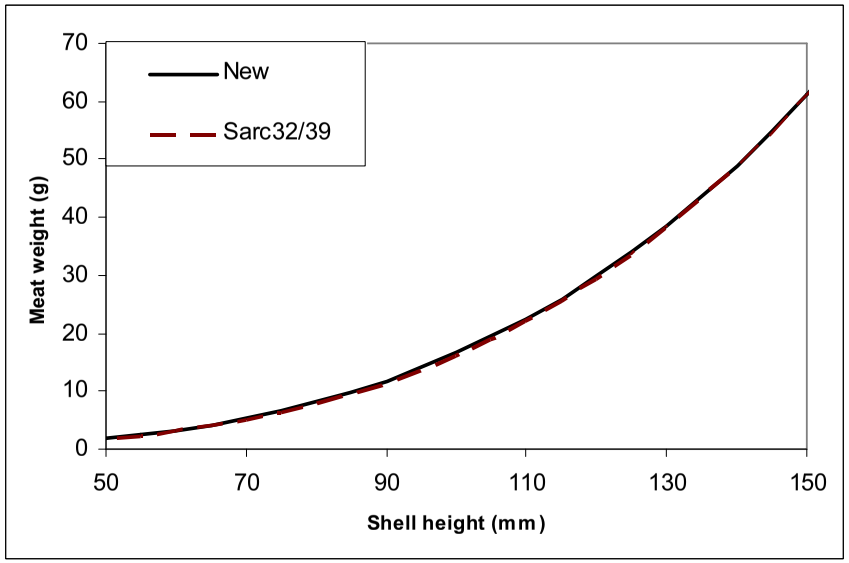


Figure B3-2. Comparison of growth rates for a hypothetical sea scallop starting at 40 mm SH based on growth curves from Serchuk et al. (1979) and new growth curves in (a) Mid-Atlantic Bight and (b) Georges Bank.

(a)



(b)

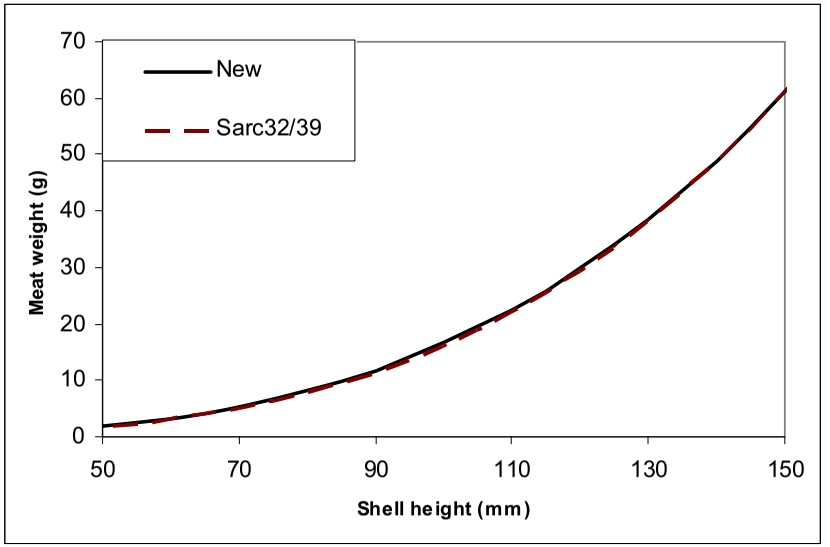
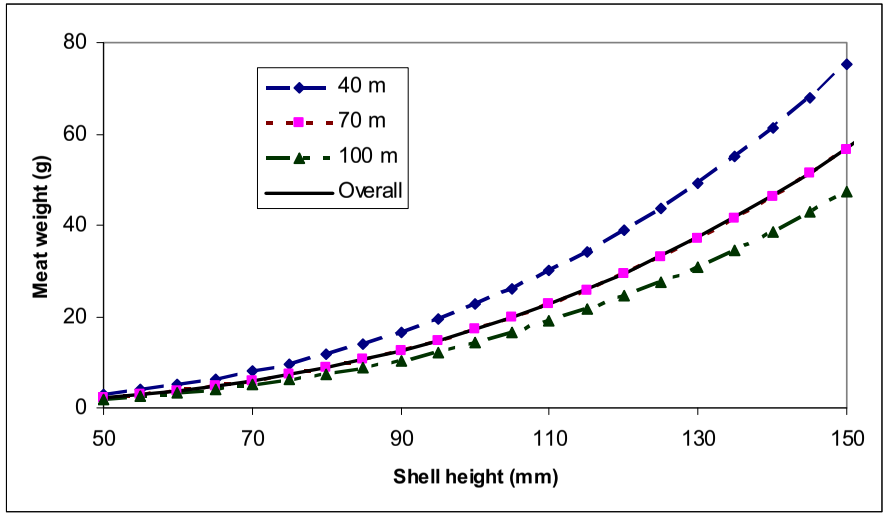


Figure B3-3. Comparison of new shell height/meat weight relationships (calculated ignoring depth effects) for (a) Georges Bank and (b) Mid-Atlantic with relationship used in the previous two assessments (NEFSC 2001, 2004).

(a)



(b)

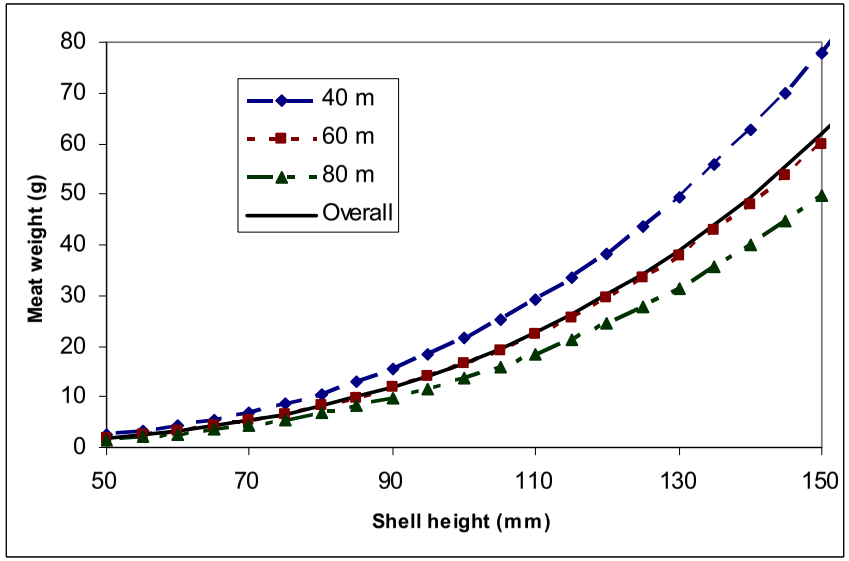
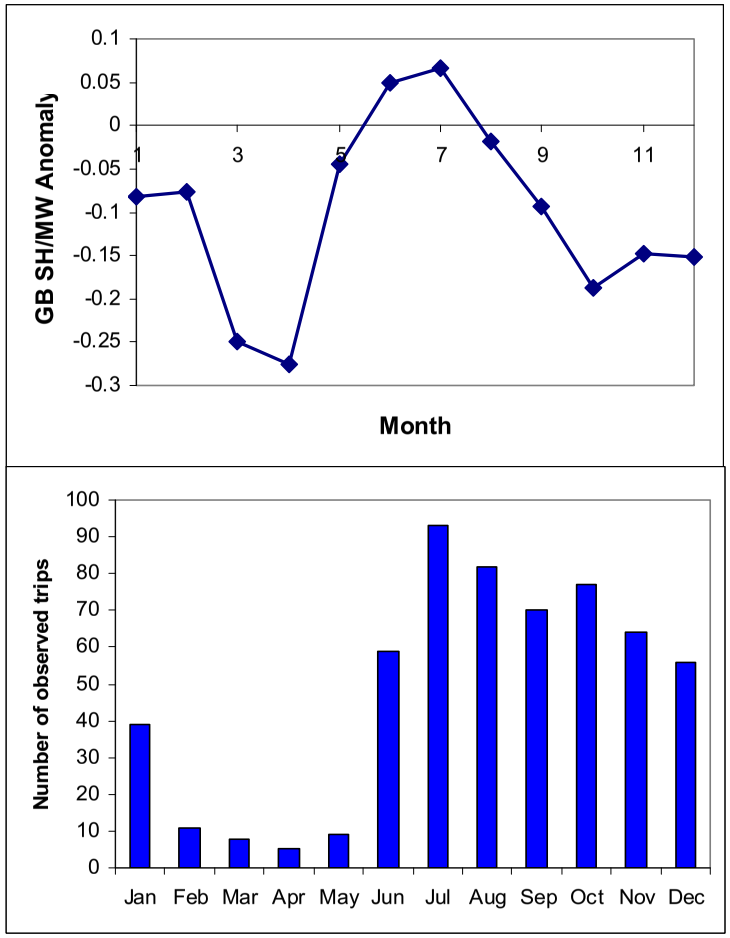


Figure B3-4. Depth effects on shell height/meat weight relationships for sea scallops (a) on Georges Bank and (b) in the Mid-Atlantic.

(a)



(b)

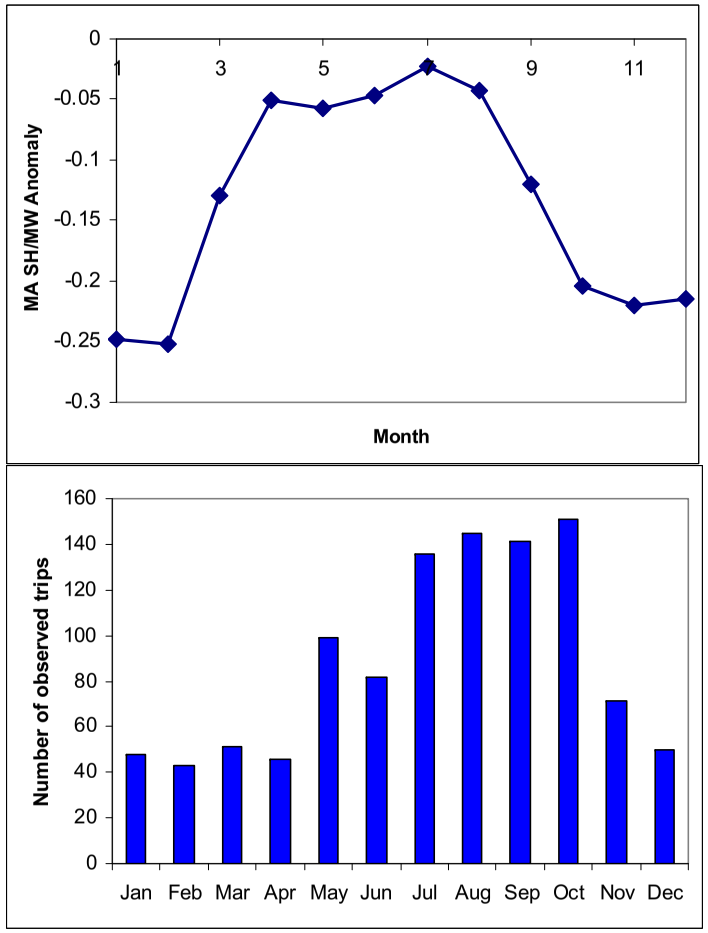


Figure B3-5. Monthly shell height/meat weight anomalies on (a) Georges Bank and (b) in the Mid-Atlantic, together with the number of observed trips by month.

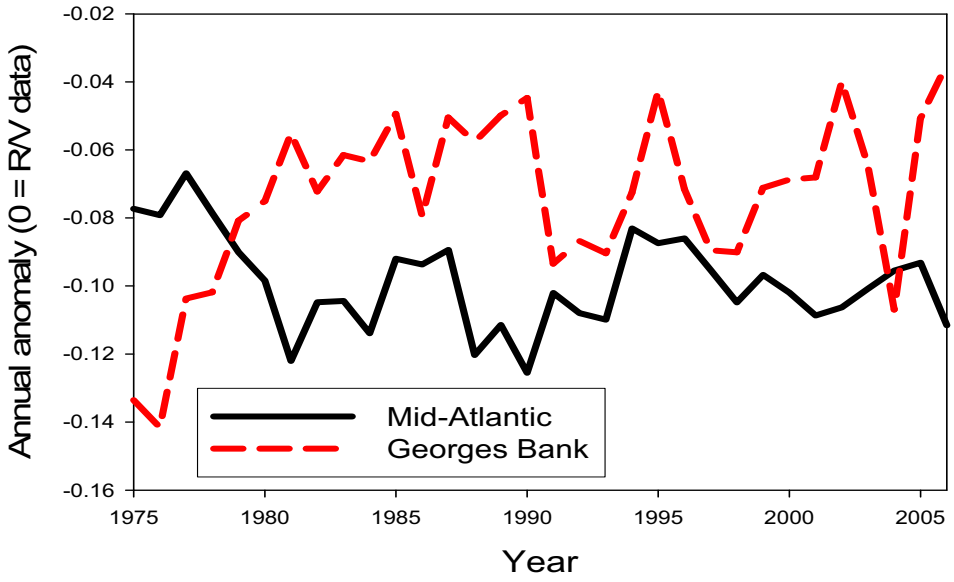


Figure B3-6. Estimated annual shell height/meat weight anomalies for sea scallops on Georges Bank and in the Mid-Atlantic, with no adjustment for water uptake.

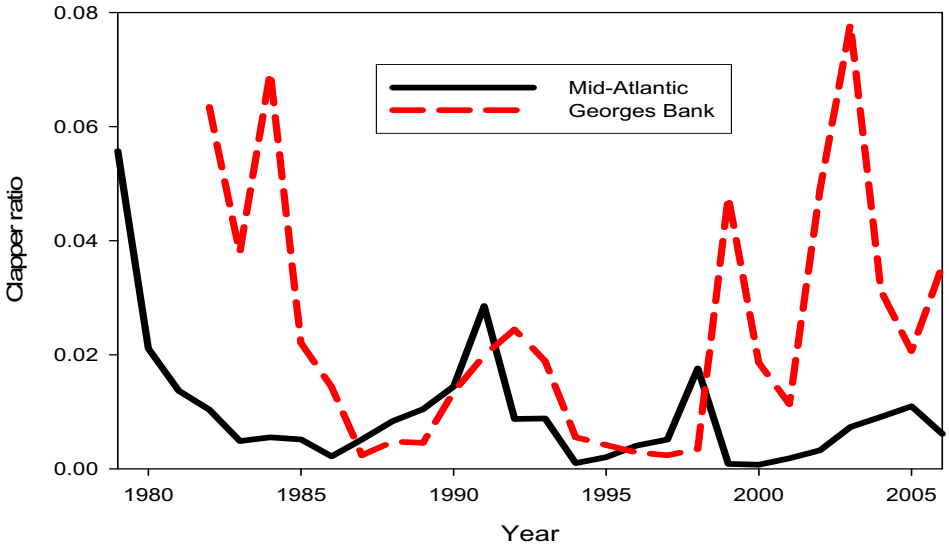


Figure B3-7. Ratio of clapper to live sea scallops in the NEFSC sea scallop survey

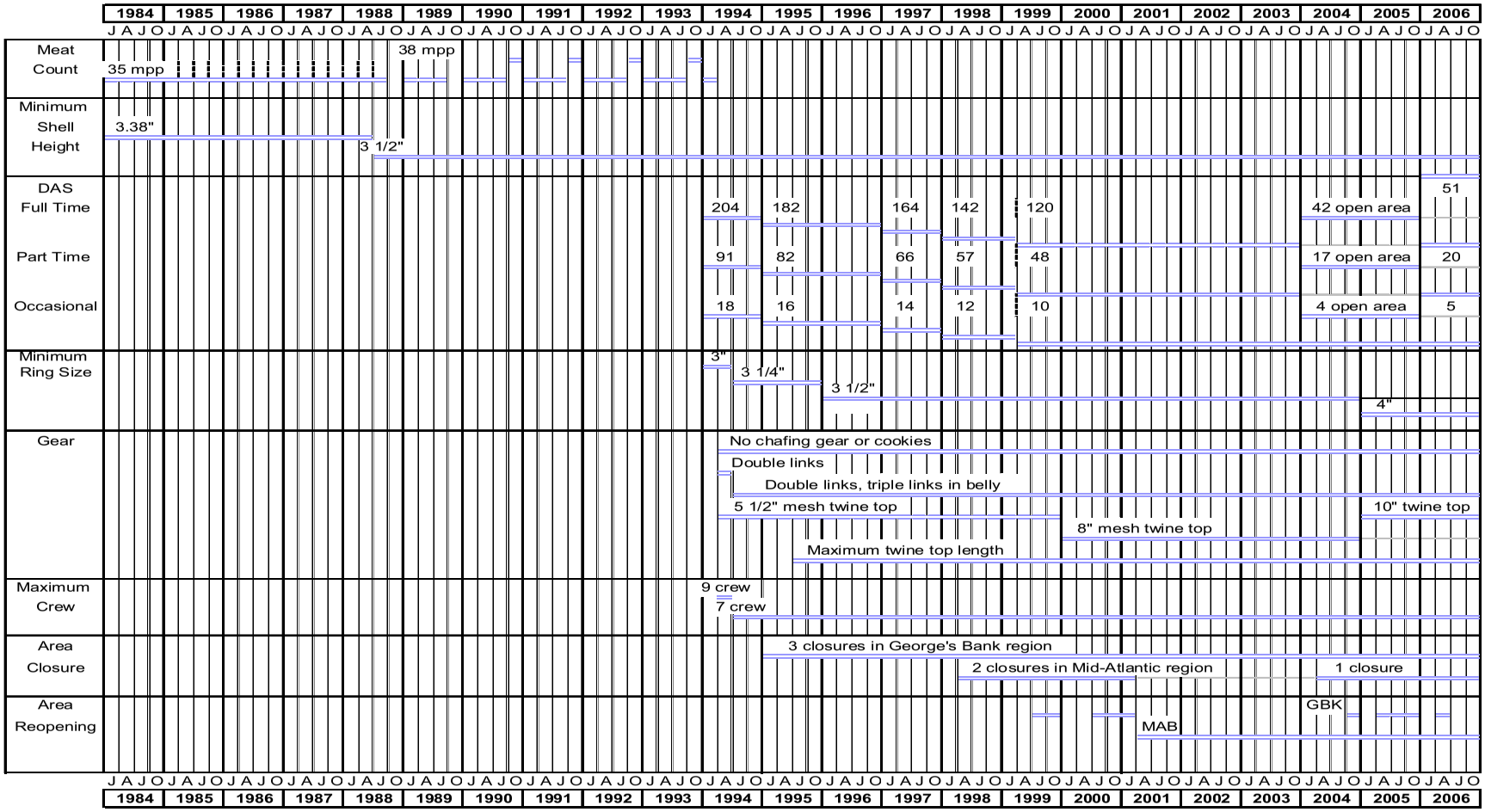


Figure B4-1. Summary of management measures from 1984-2006. “mpp” means meats per pound.

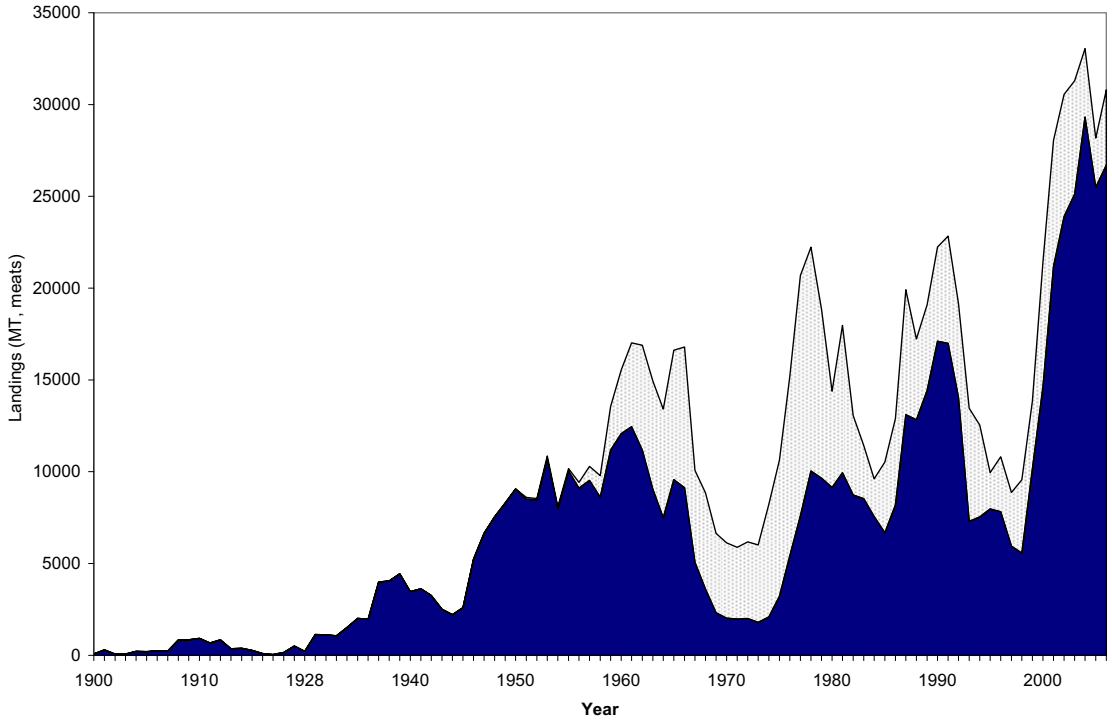


Figure B4-2. Sea scallop landings in NAFO areas 5 and 6 (US plus the Canadian portion of Georges Bank). US landings are shown by dark fill. Canadian landings are shown by light fill.

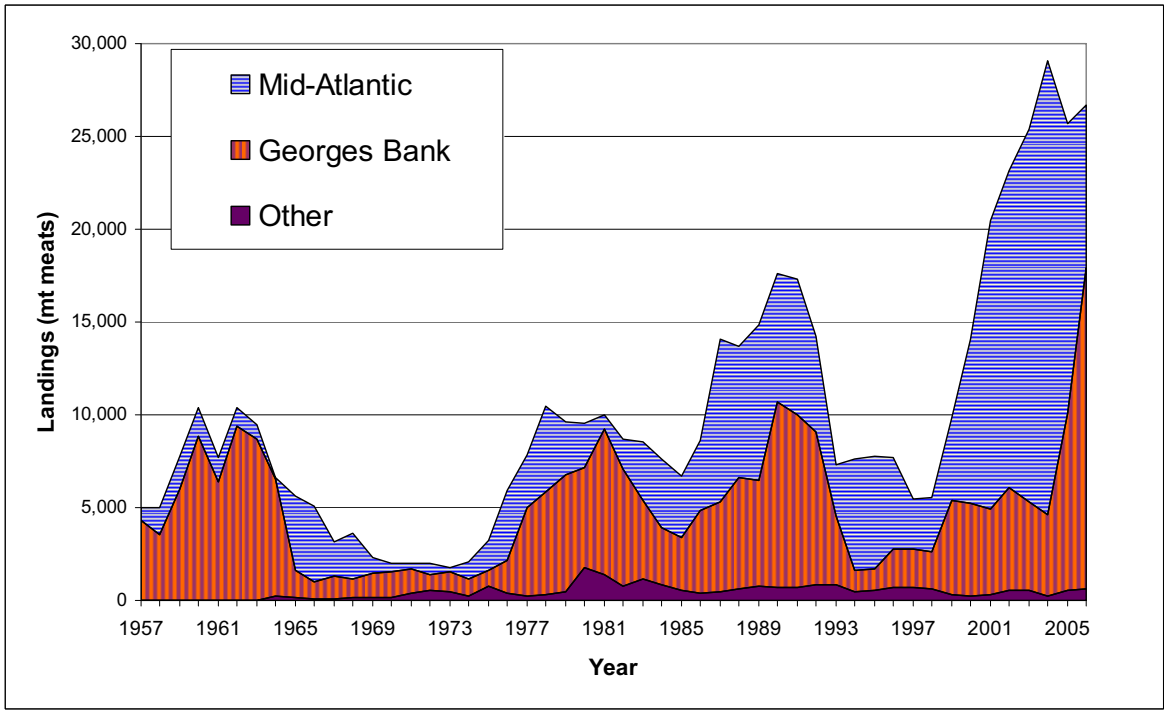


Figure B4-3. US sea scallop landings by area, 1957-2006. "Other" landings (i.e., southern New England and the Gulf of Maine) are not available prior to 1964.

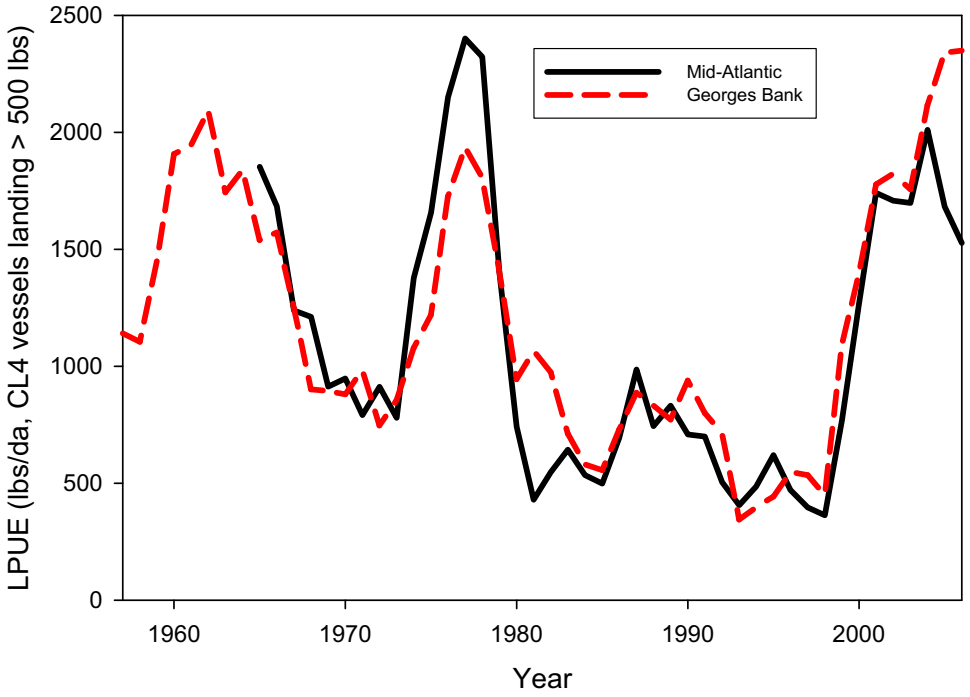


Figure B4-4. Landings per unit effort (lbs meats per days absent for vessels >150 GRT and trips >500 lbs meats) in the sea scallop fishery.

(a) (b)

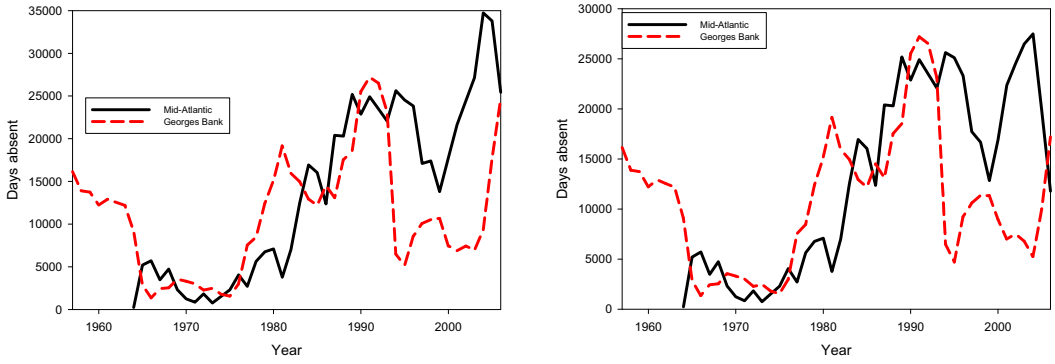
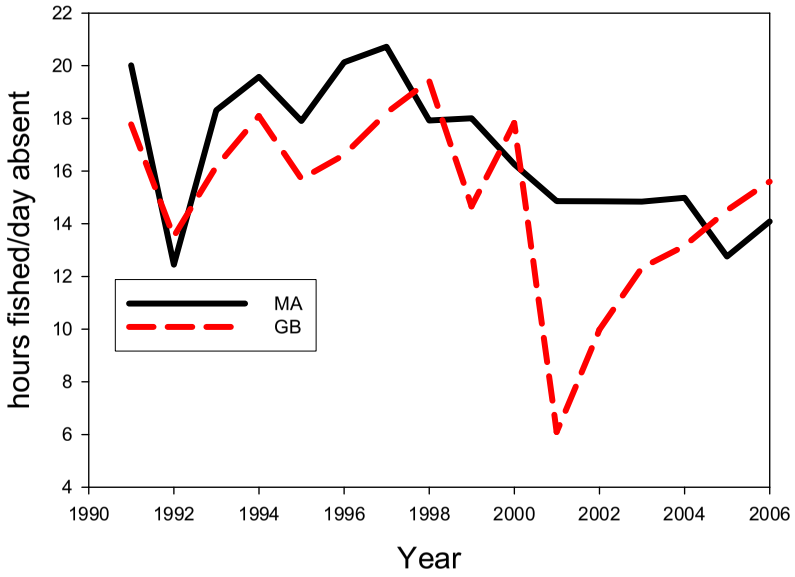


Figure B4-5. Fishing efforts (days absent) for the sea scallops fishery. (a) unadjusted, (b) adjusted for trips landing less than 500 lbs meats.

(a)



(b)

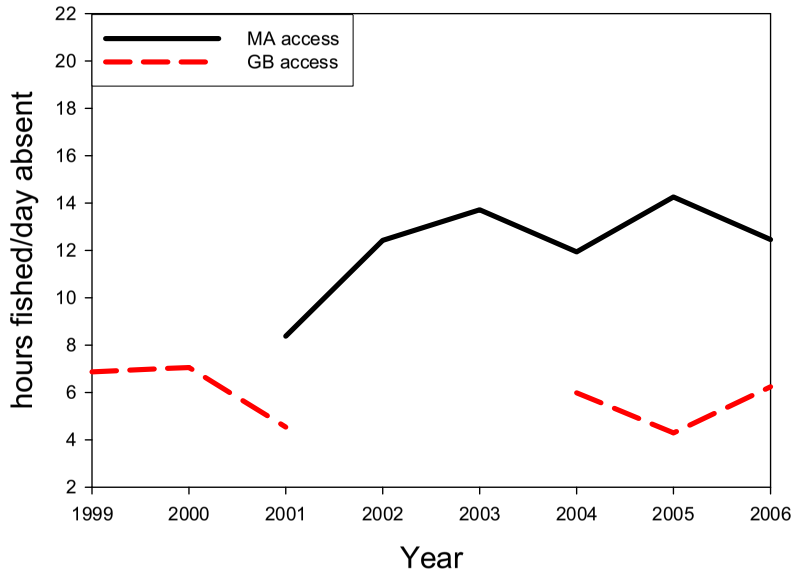
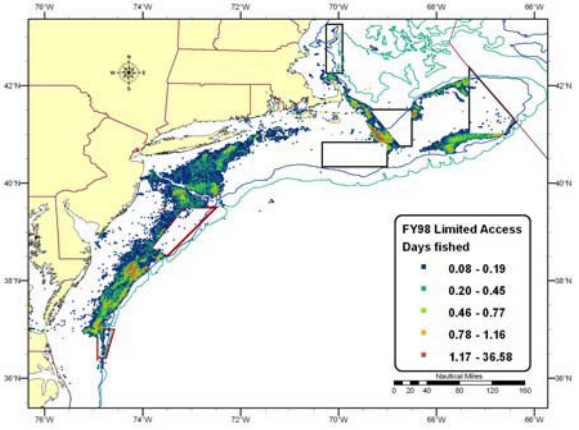
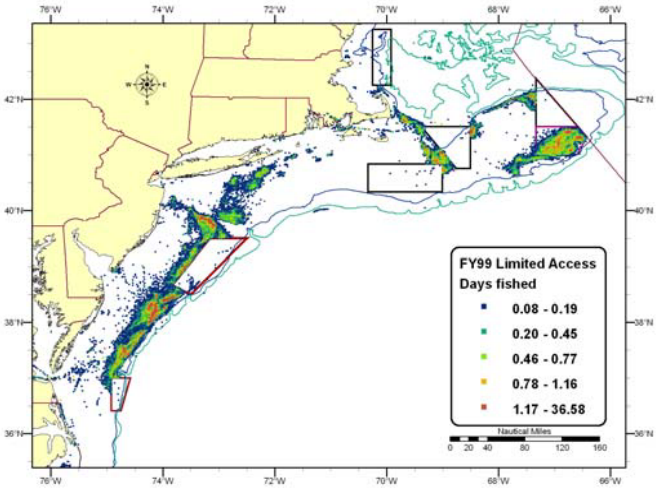
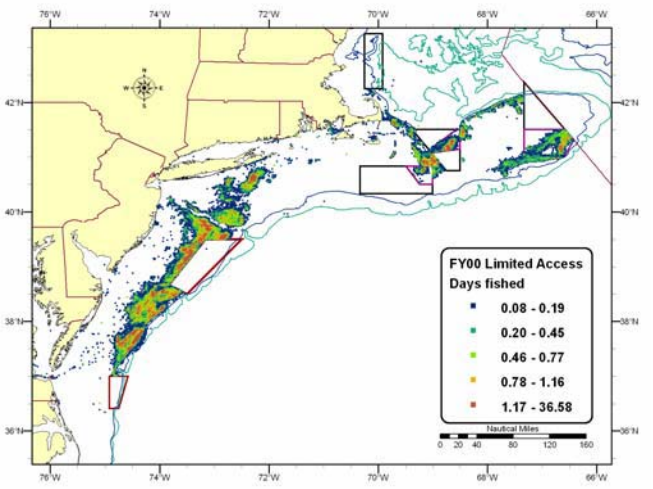


Figure B4-6. Hours fished per day absent in (a) regular trips in open area, and (b) special access area trips in previously closed areas, derived from observer sea sampling data

Figure B4-7. The spatial distribution of fishing effort based on VMS data for the limited access scallop fleet during 1998-2006 (through Sept. 15), and general category vessels during 2006 (through Sept. 15). Effort categories are classified based on 20th percentiles of effort during FY 2000.







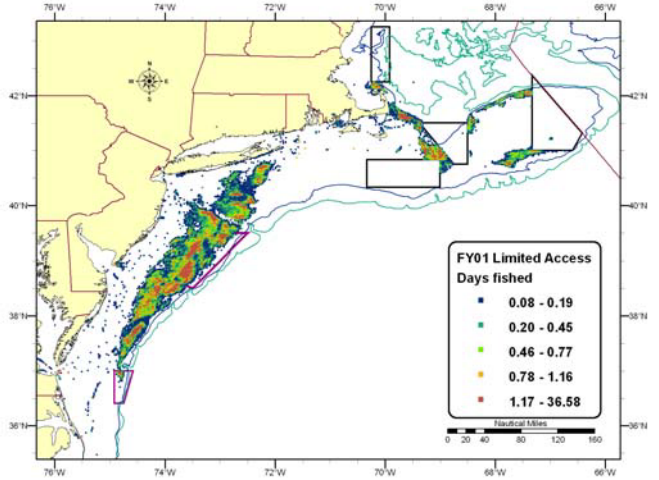


Figure B4-7 continued

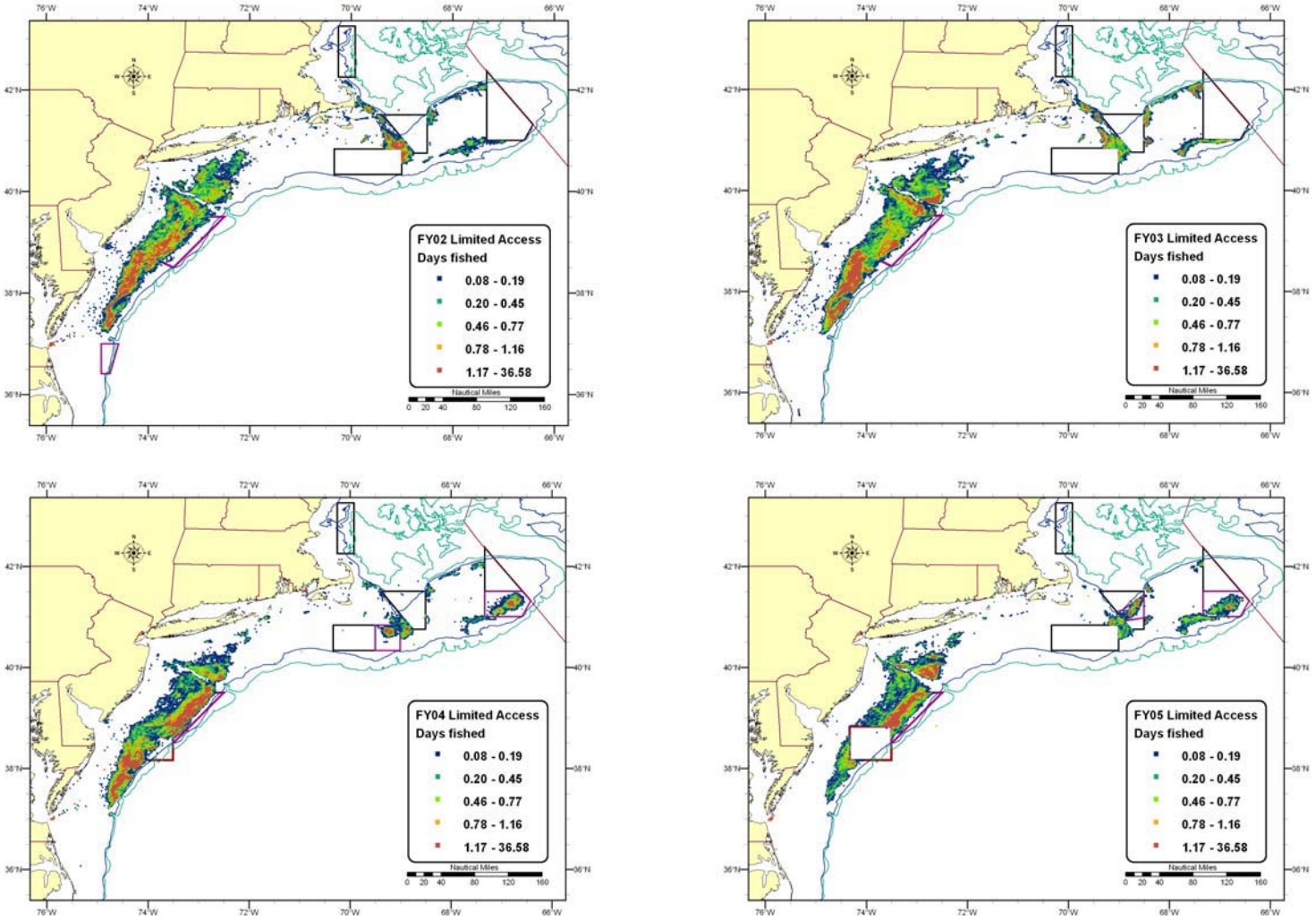
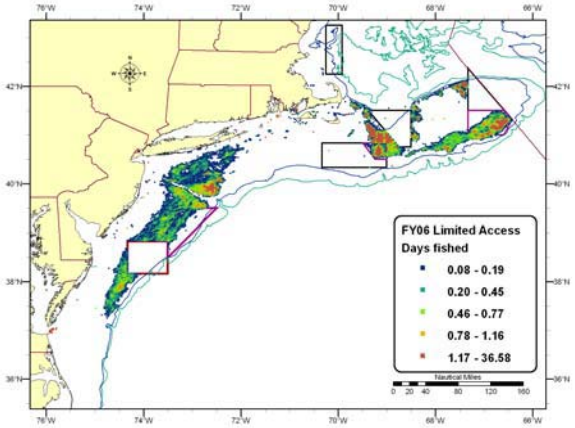
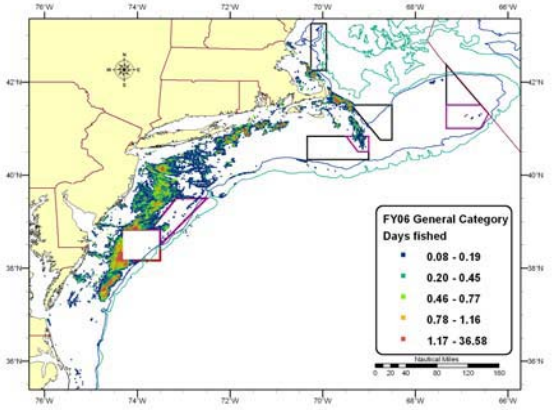


Figure B4-7 continued





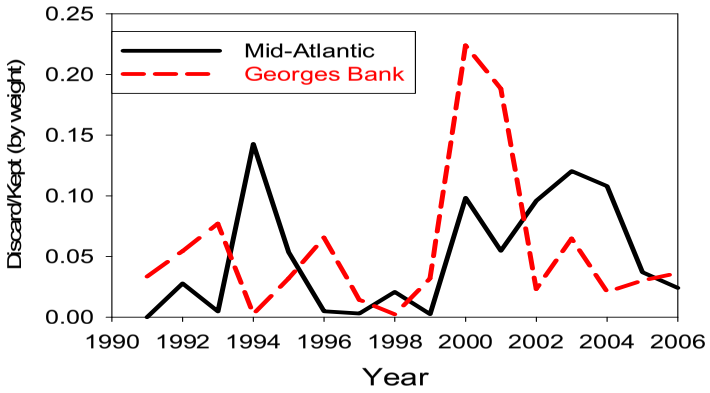


Figure B4-8. Discard to kept ratio for sea scallops in directed sea scallop trips.

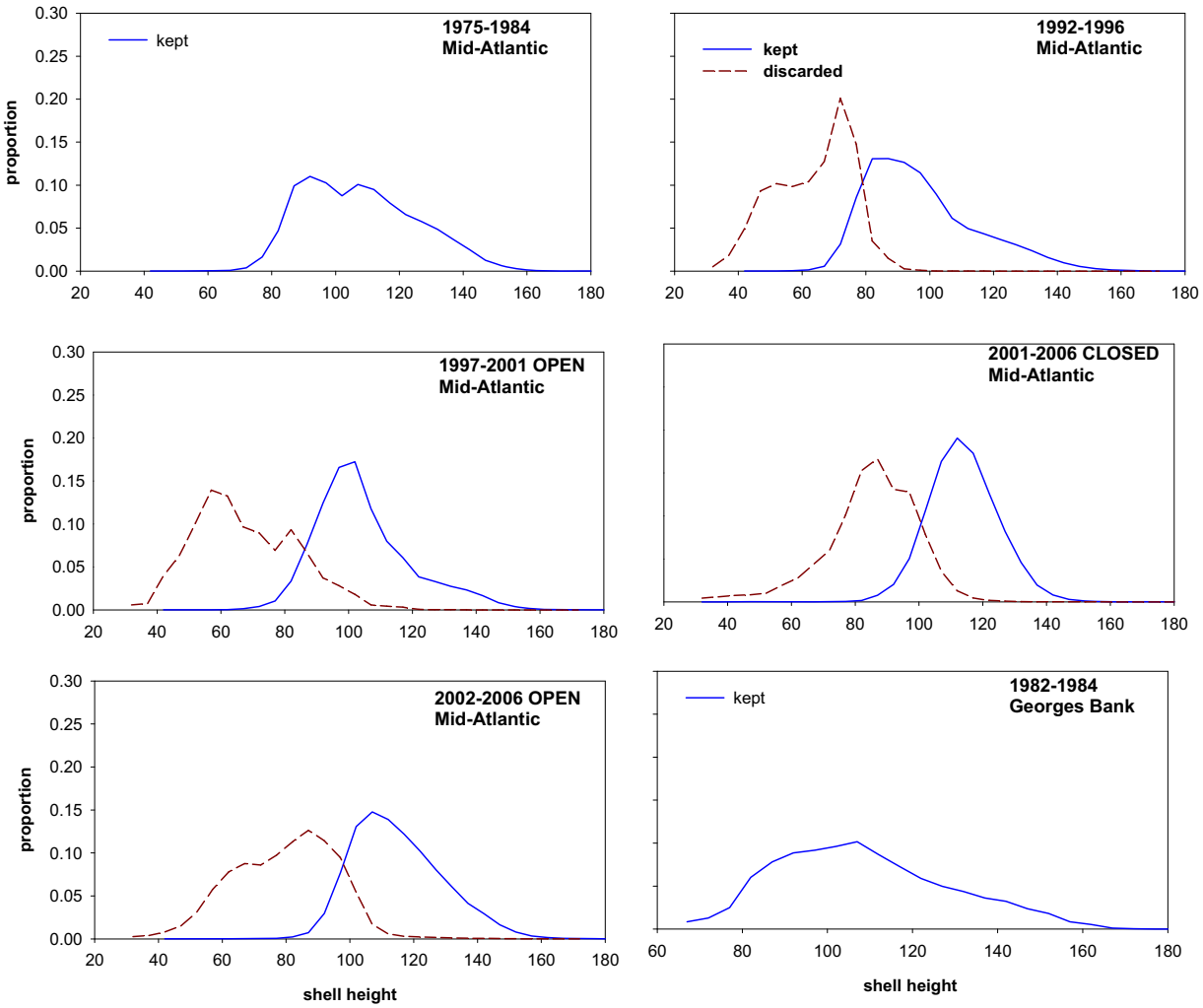
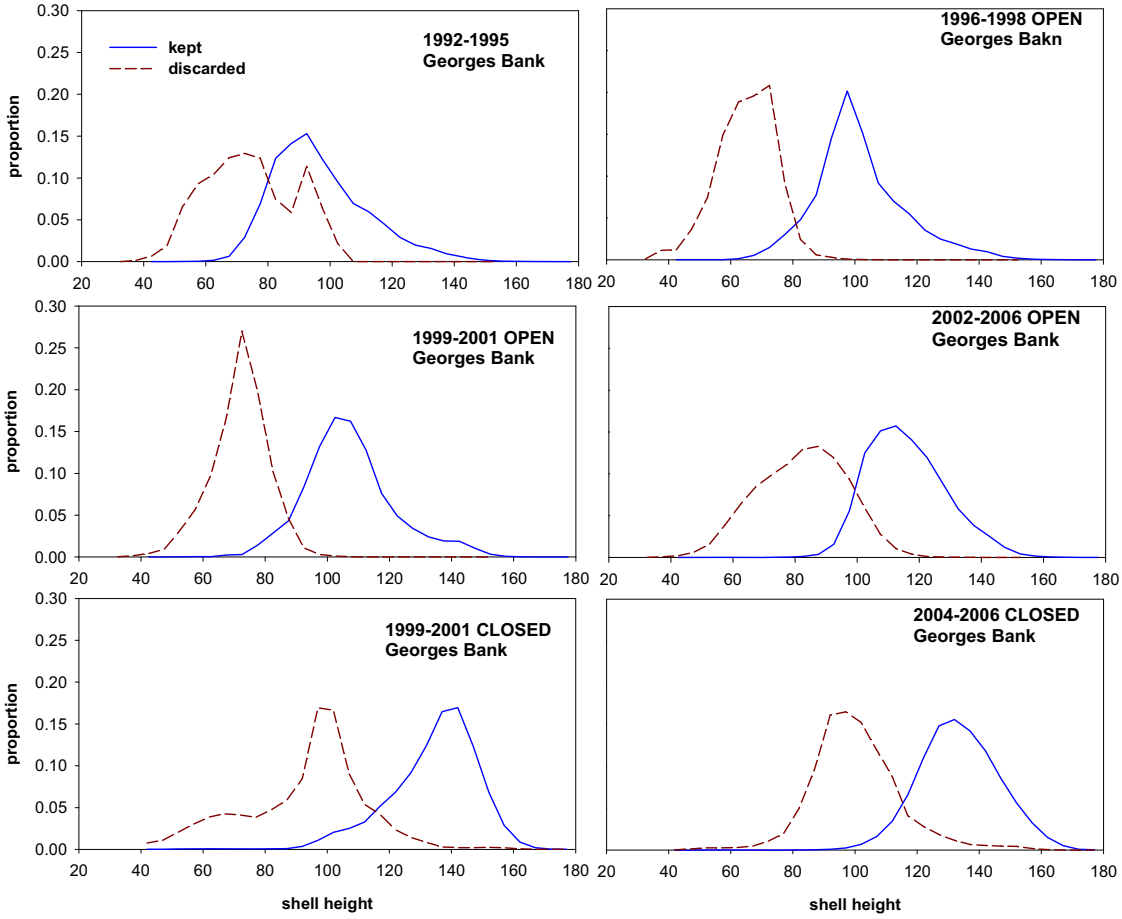


Figure B4-9. Shell heights of commercial kept (solid line) and discarded (dashed line) sea scallops, from port sampling (1975-1984) and sea sampling (1992-2006).

Figure B4-9 continued



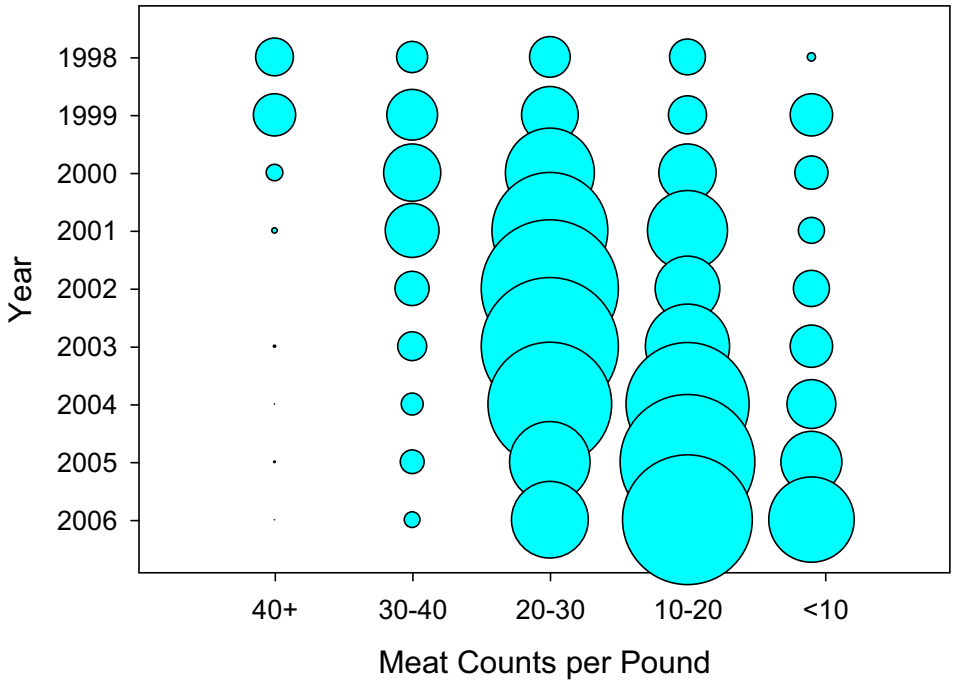


Figure B4-10. Commercial landings by meat count category, 1998-2006.

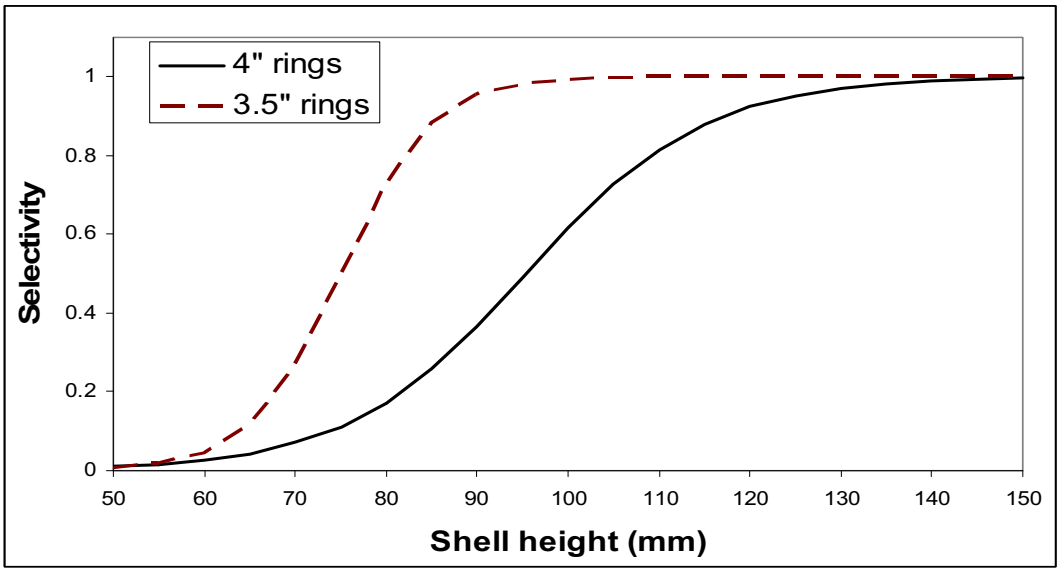


Figure B4-11. Selectivity of commercial scallop dredges with 3.5" and 4" rings (Yochum 2006, Appendix 5). The 3.5" ring selectivity is from NEFSC (2004).

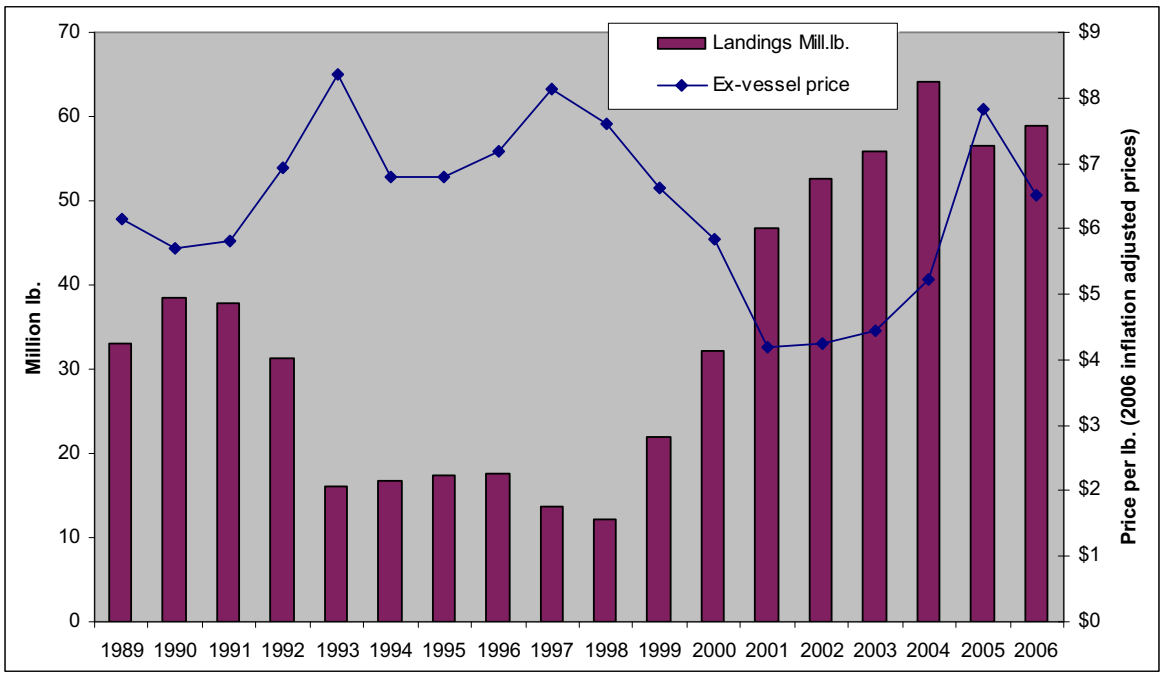


Figure B4-12. Trends in landings and ex-vessel prices in the U.S. sea scallop fishery.

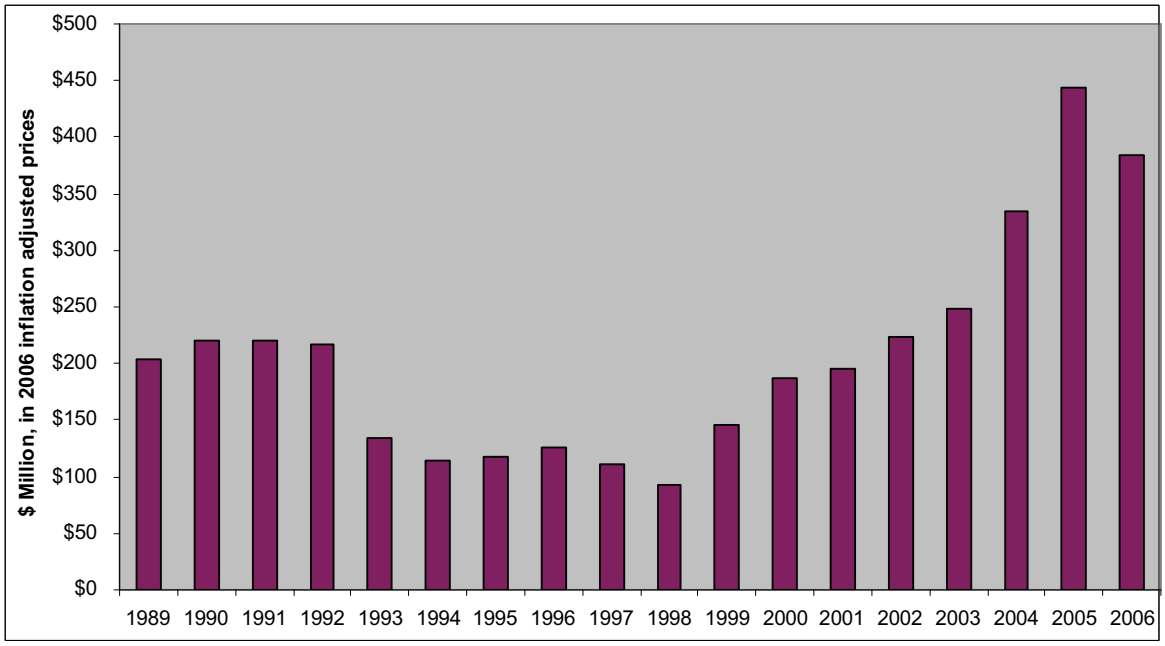


Figure B4-13. Trends in U.S. ex-vessel sea scallop revenues (adjusted for inflation to 2006 equivalent prices)

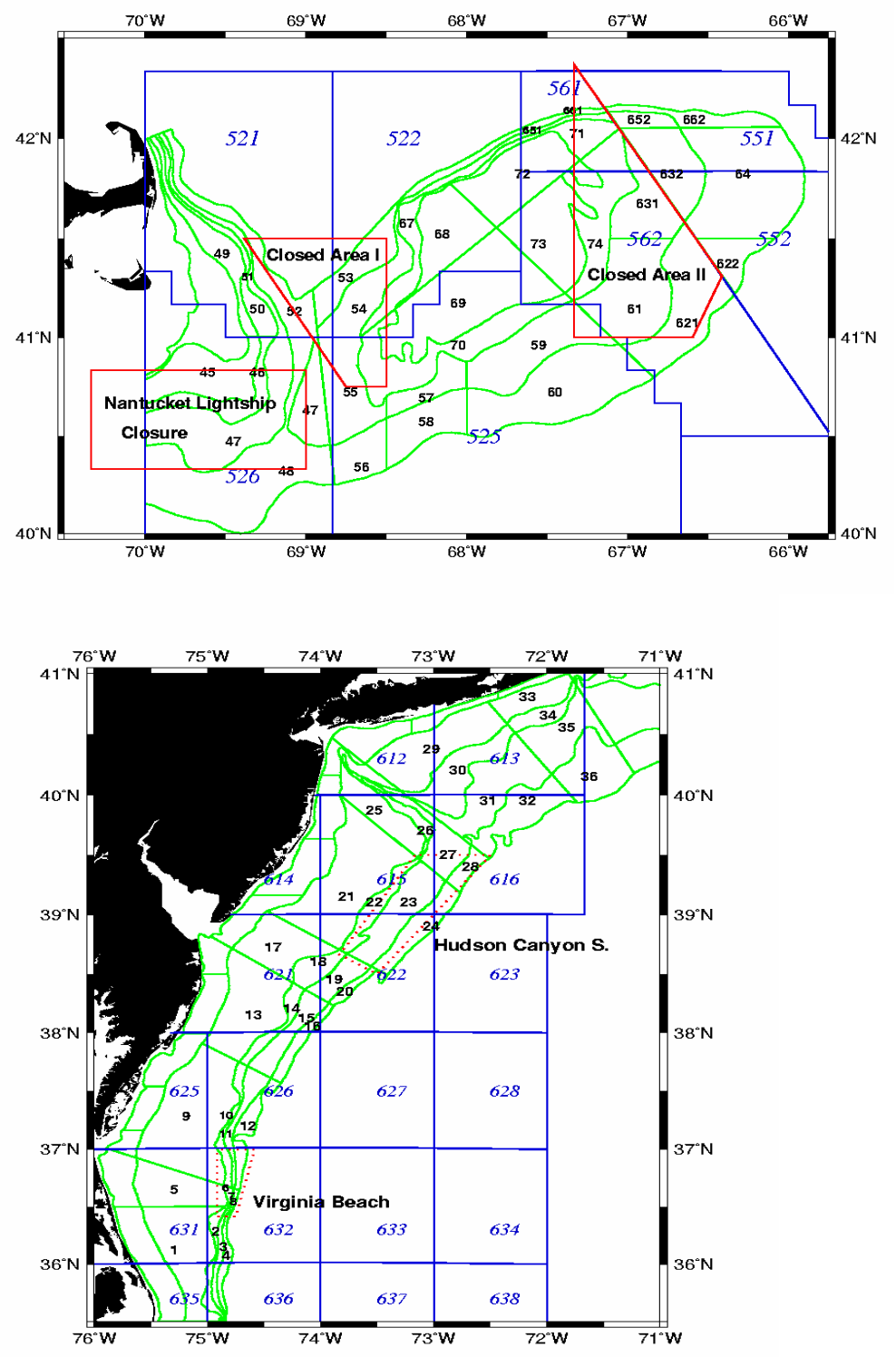


Figure B5-1. Georges Bank and Mid-Atlantic shellfish strata, statistical areas, groundfish closed areas and the original Mid-Atlantic rotational areas.

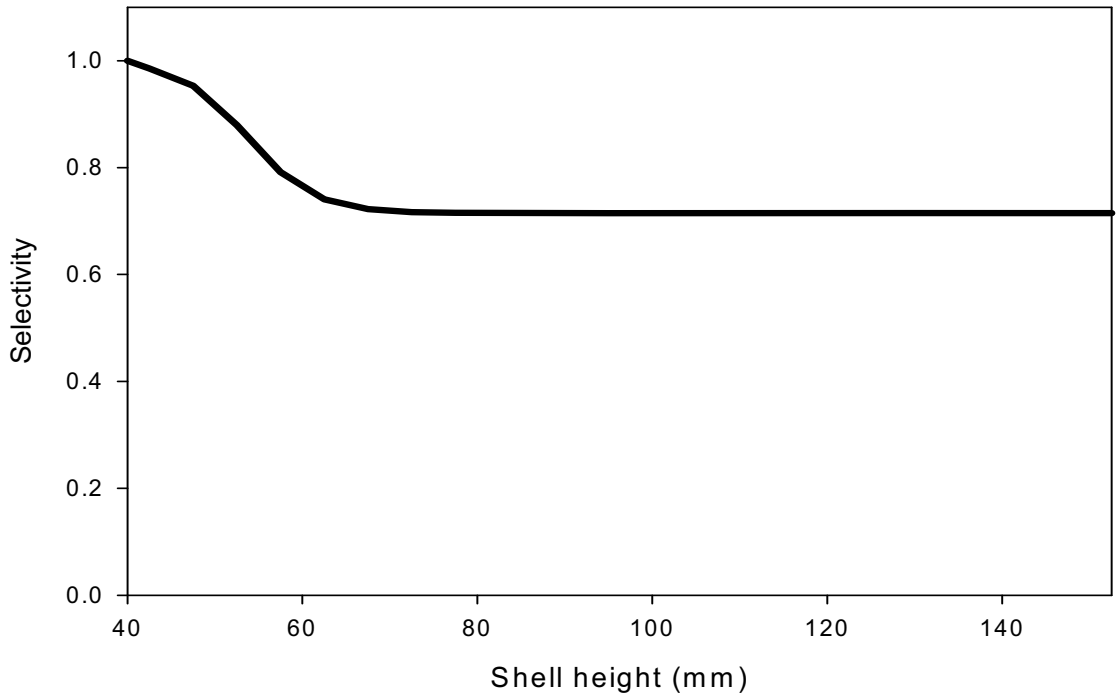
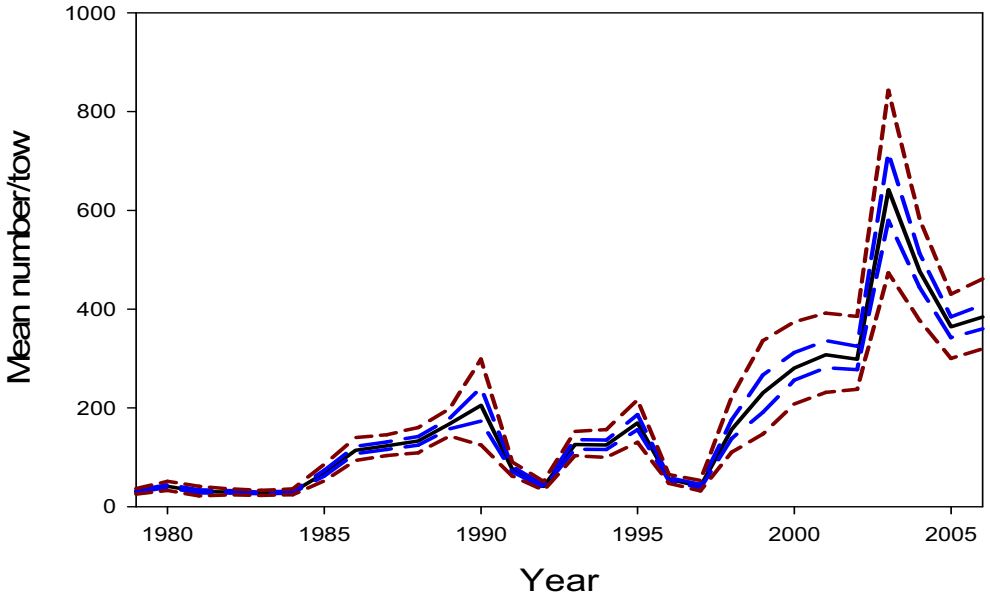


Figure B5-2. Selectivity of the lined dredge assumed in previous assessments (e.g., NEFSC 2001, 2004).

(a)



(b)

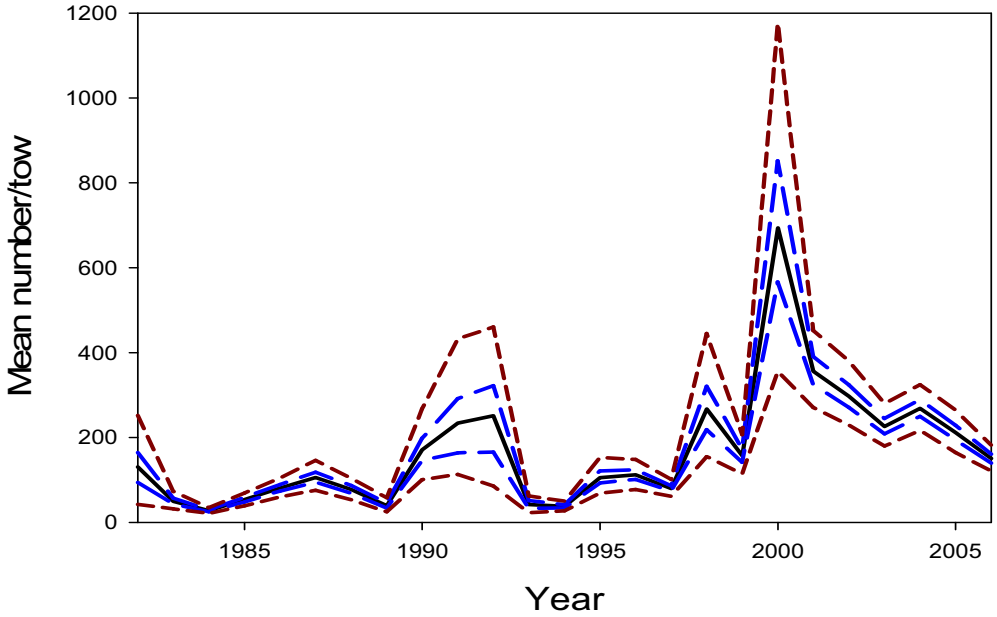


Figure B5-3. Bootstrapped estimates of abundance from NEFSC sea scallop survey for (a) Mid-Atlantic and (b) Georges Bank, showing median (solid line), 1st and 3rd quartiles (long dash), and 95% confidence interval (short dashed lines).

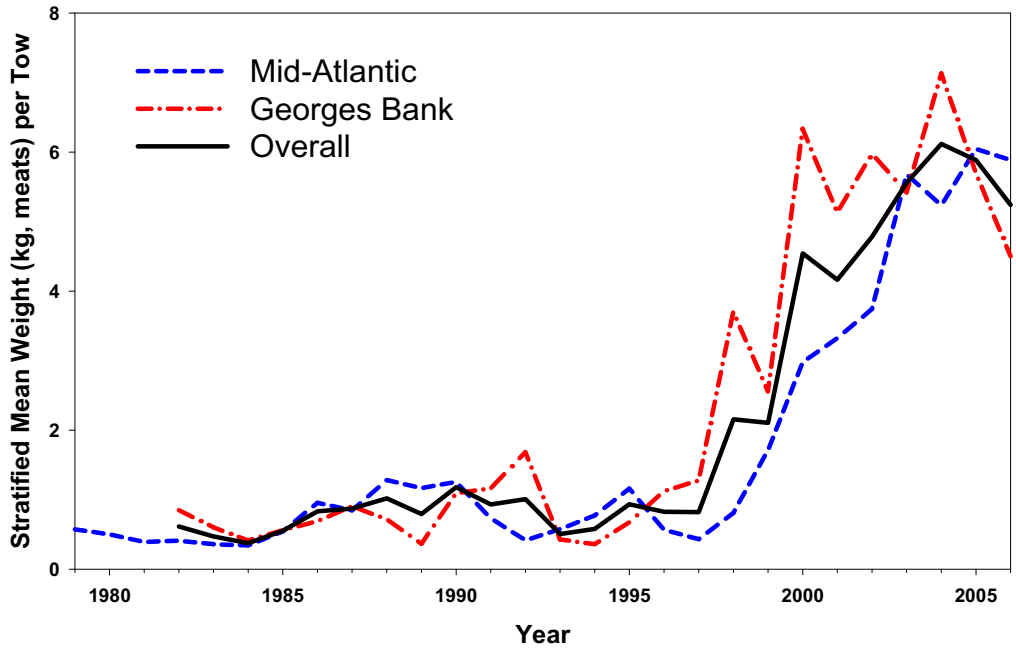
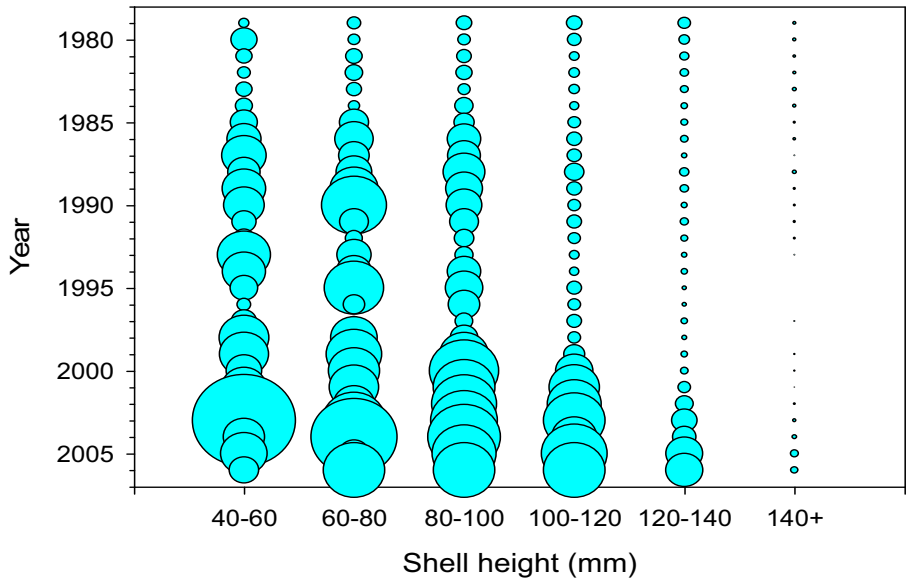


Figure B5-4. NEFSC sea scallop biomass indices.

(a)



(b)

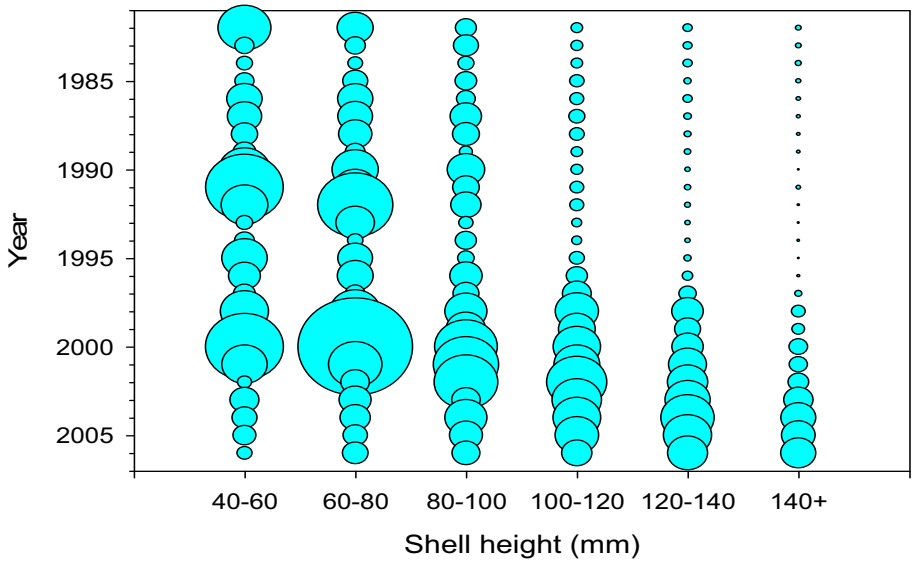
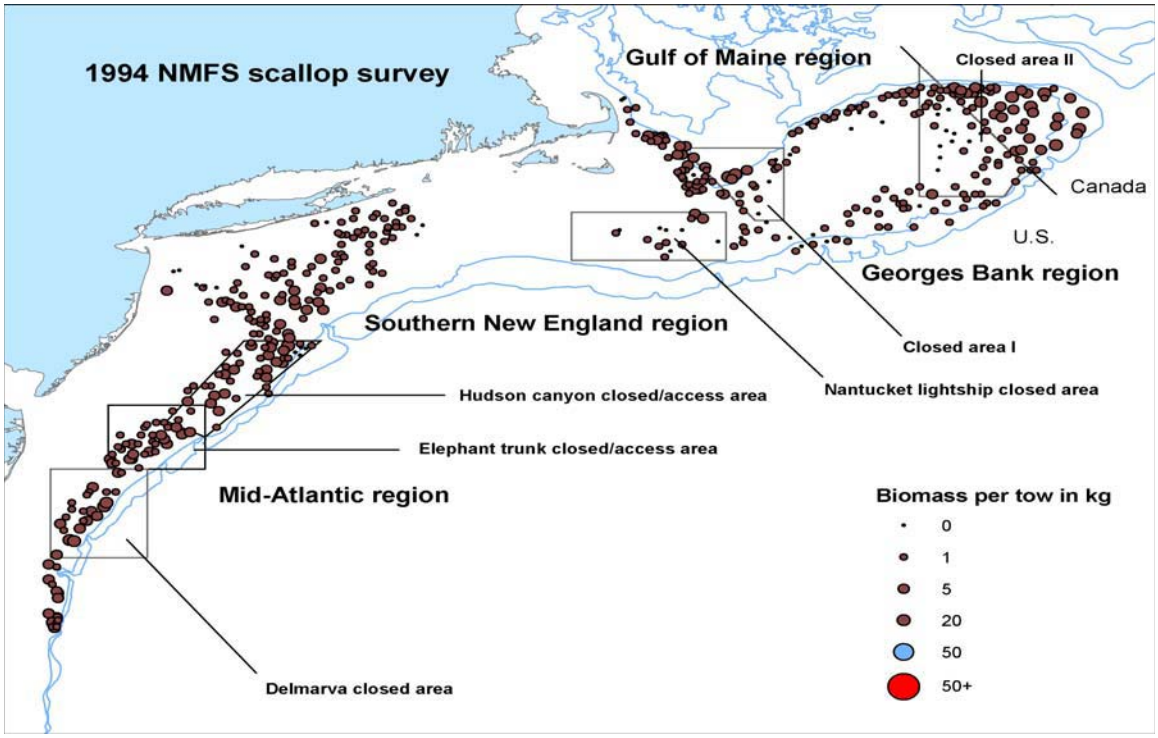


Figure B5-5. NEFSC sea scallop survey numbers at shell heights, in 20 mm intervals for (a) Mid-Atlantic Bight and (b) Georges Bank

(a)



(b)

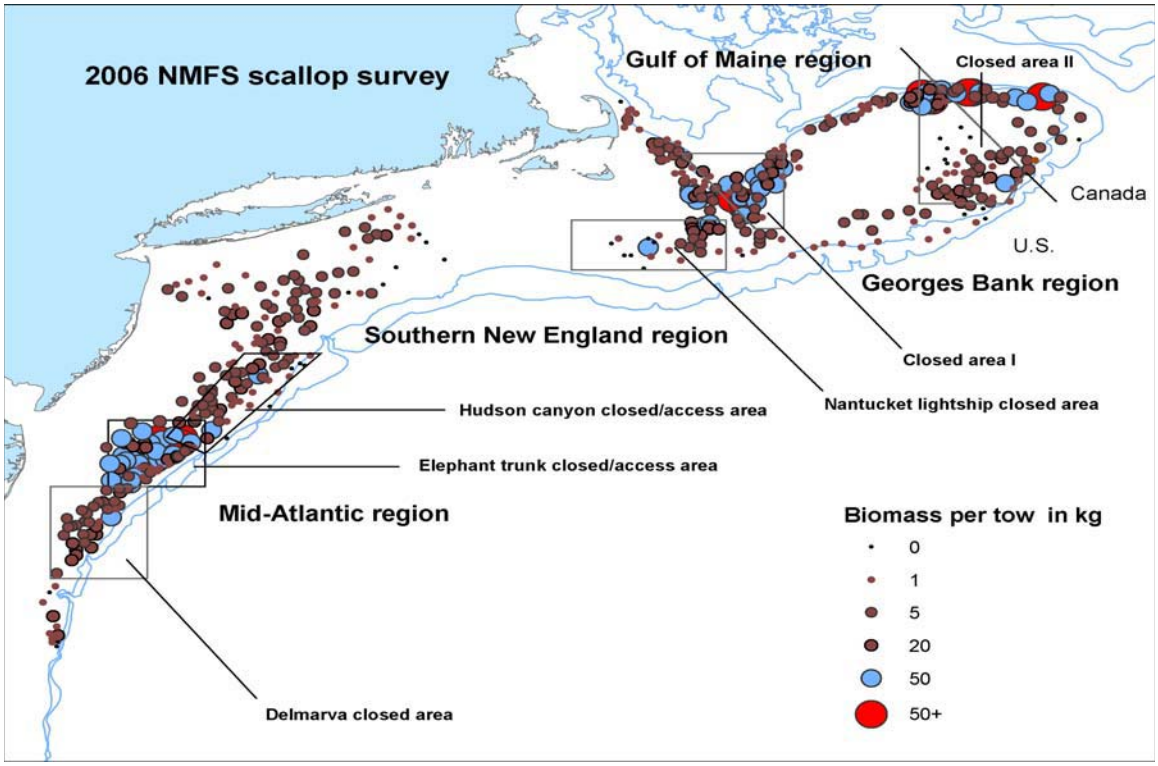


Figure B5-6. Distributions of sea scallops from the NEFSC sea scallop survey in (a) 1994 and (b) 2006.

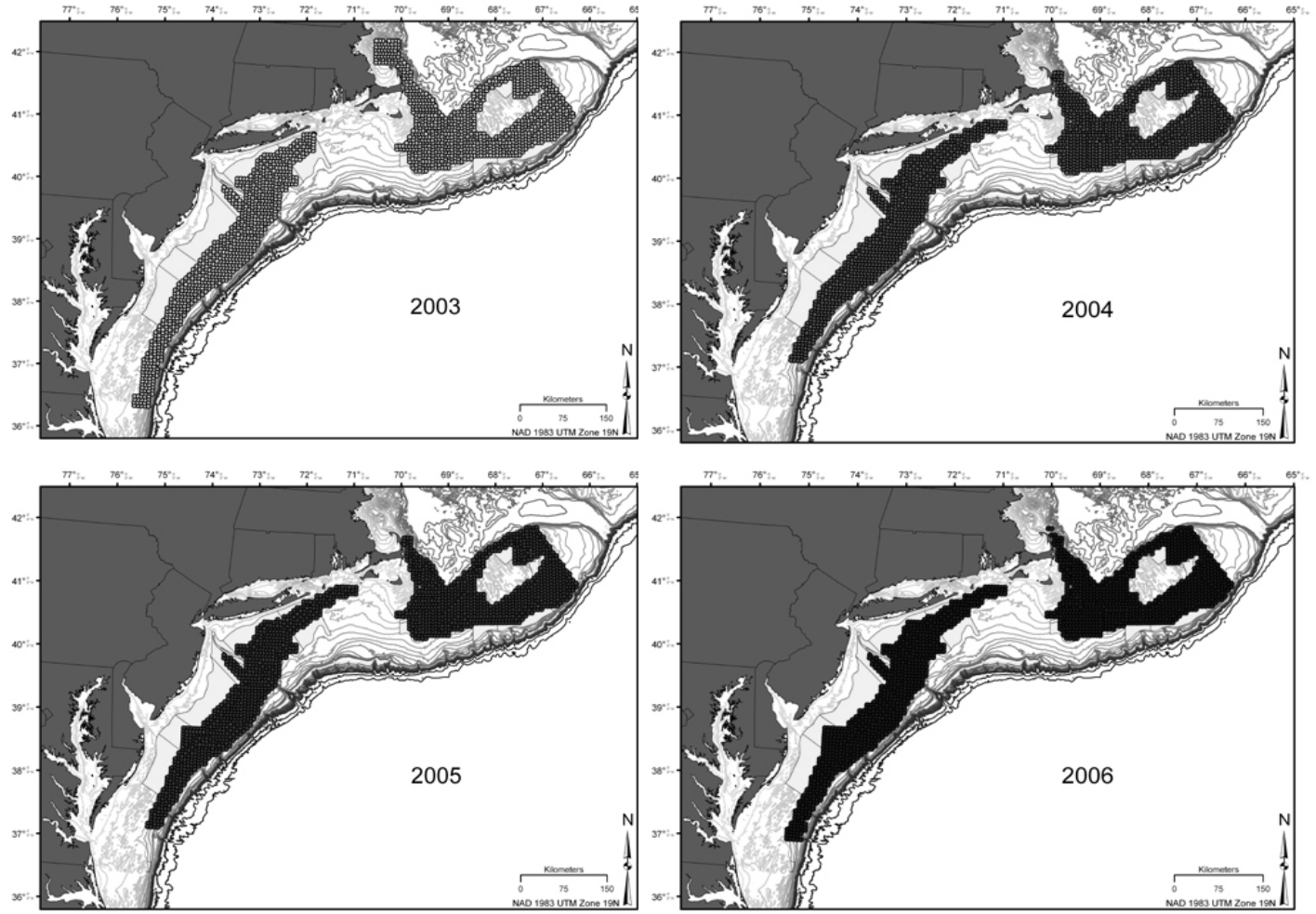
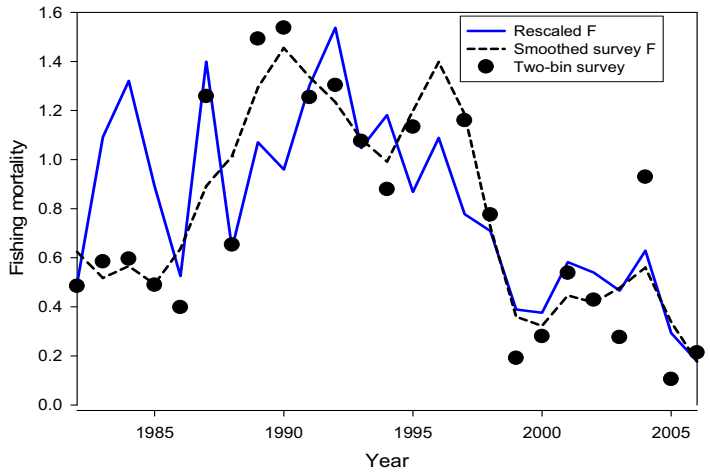
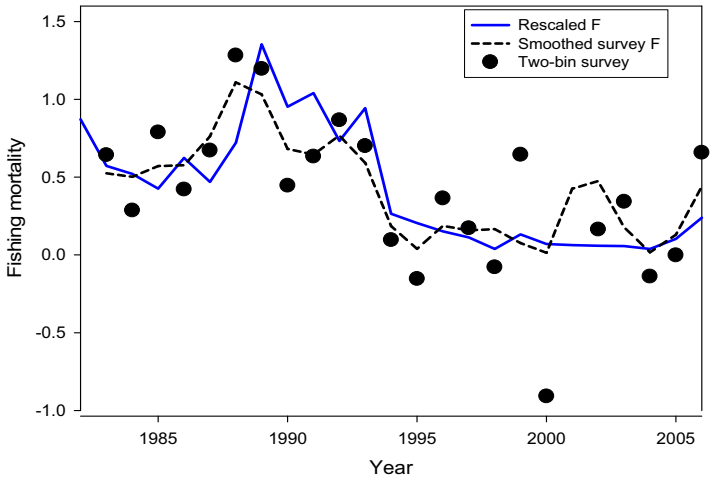


Figure B5-7. Stations occupied in SMAST video surveys during 2003-2006. NEFSC shellfish strata are shown for comparison.

(a)



(b)



(c)

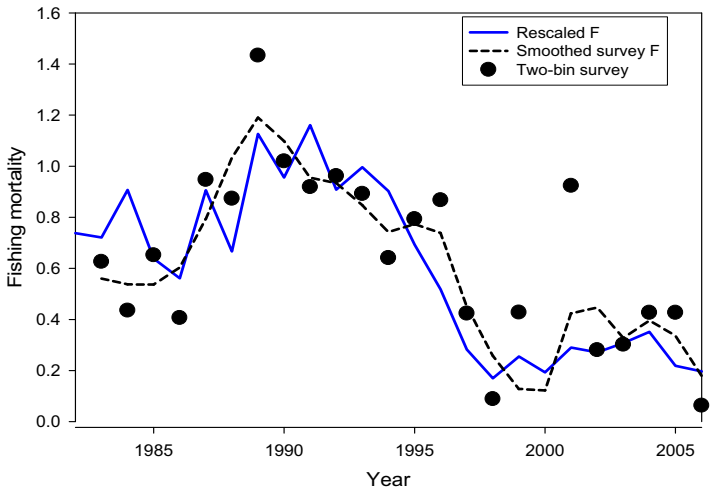


Figure B5-8. Survey-based (with moving average smoother) and rescaled-F estimates of fishing mortality for sea scallops (a) in the Mid-Atlantic, (b) on Georges Bank, and (c) overall.

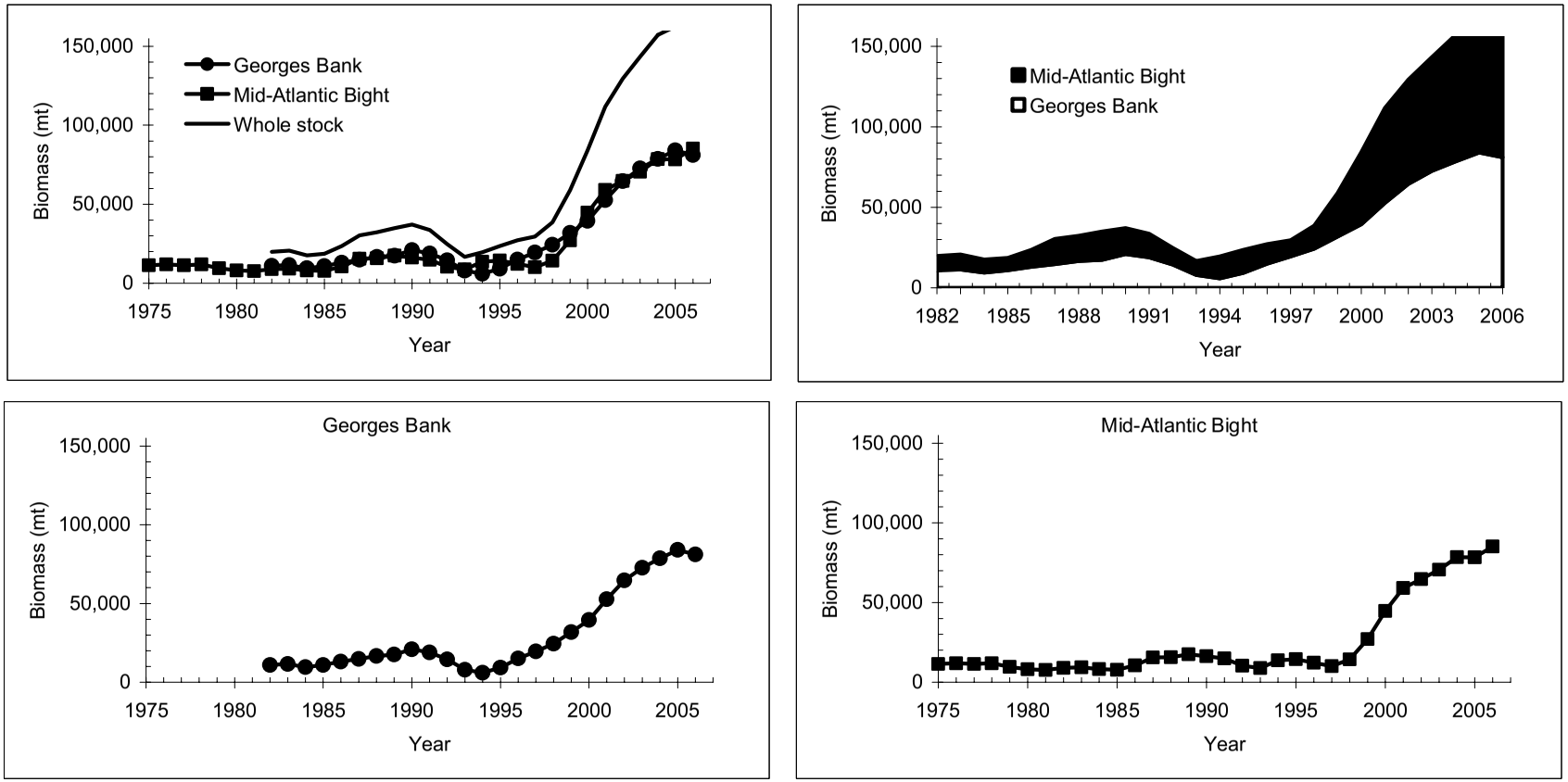


Figure B5-9. Biomass estimates (40+ mm on January 1) from the CASA model for sea scallops on Georges Bank during 1982-2006, in the Mid-Atlantic Bight during 1975-2006 and for the whole stock during 1982-2006.

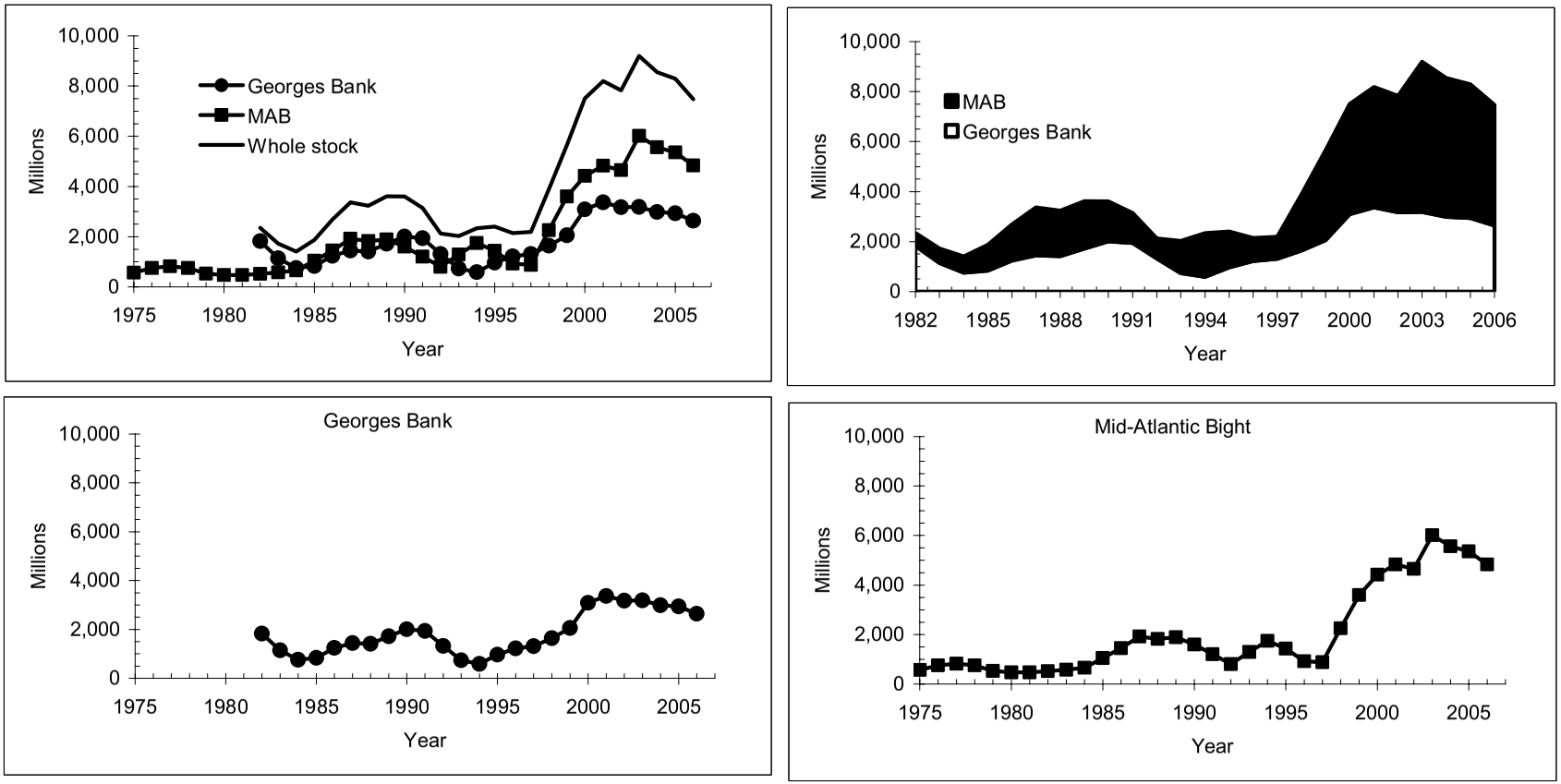


Figure B5-10. Abundance estimates (40+ mm on January 1) from the CASA model for sea scallops on Georges Bank during 1982-2006, in the Mid-Atlantic Bight during 1975-2006 and for the whole stock during 1982-2006.

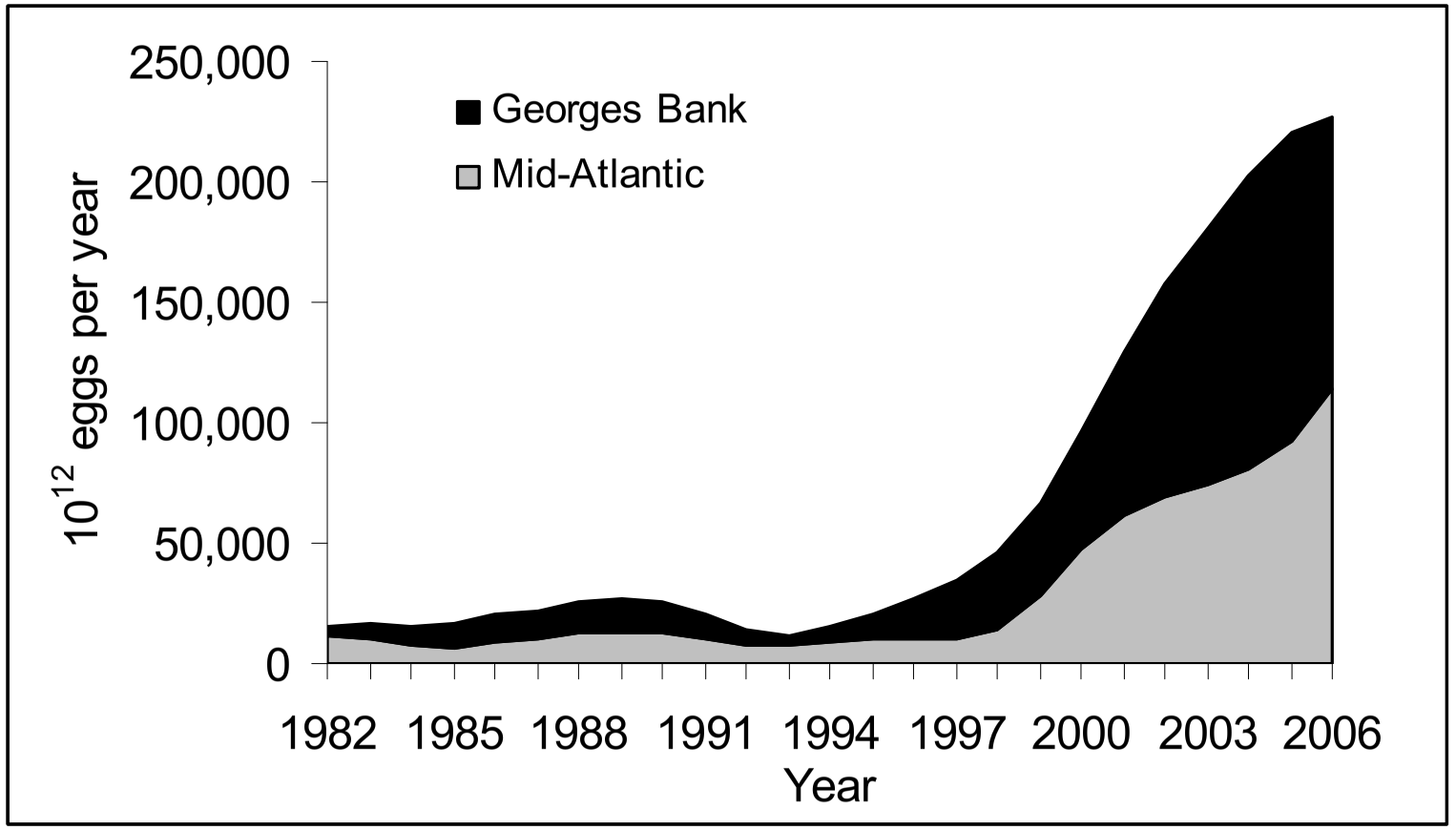


Figure B5-11. Estimated annual egg production by the sea scallop stock during 1982-2006.

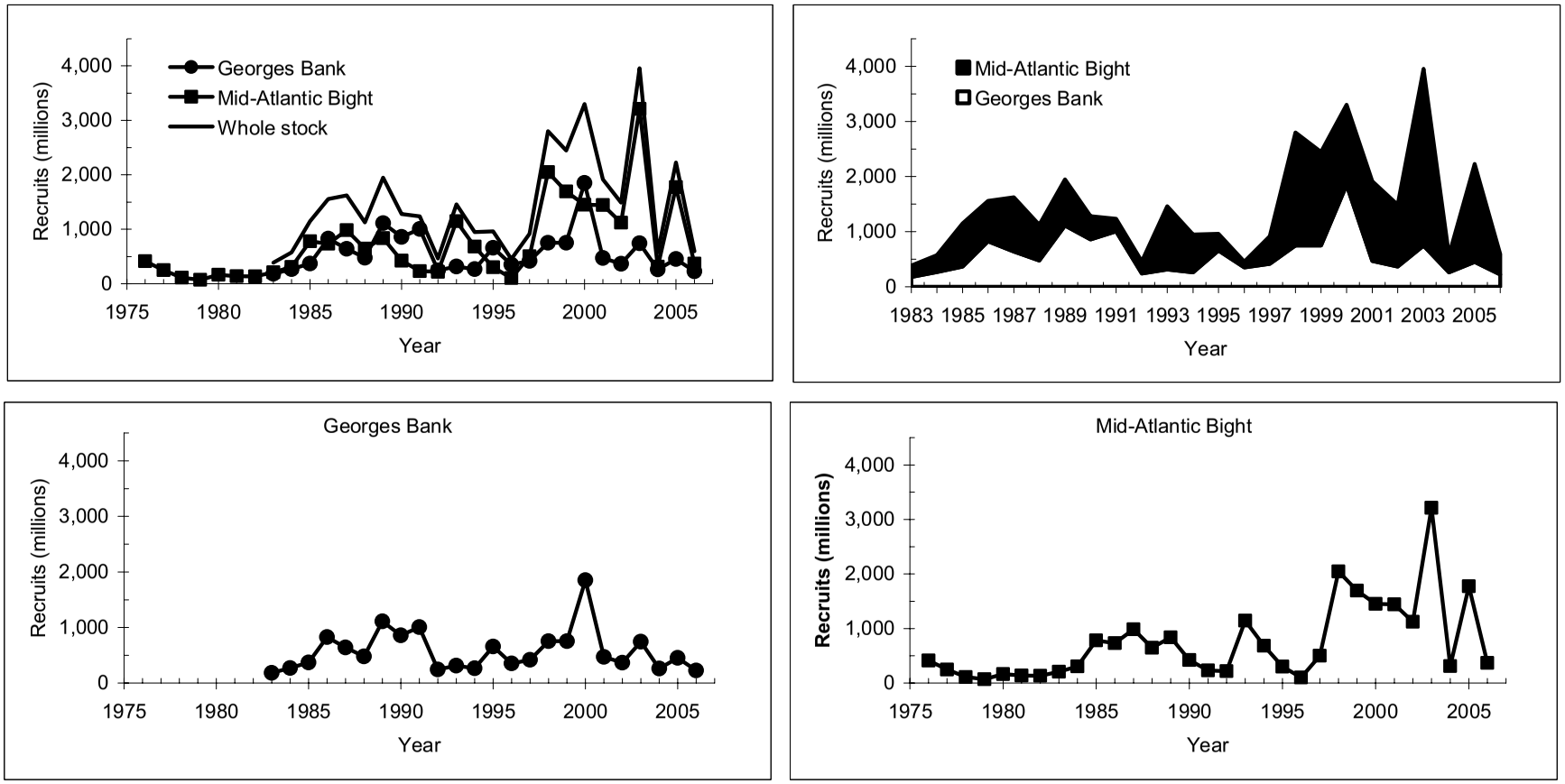


Figure B5-12. Recruitment estimates (40+ mm on January 1) from the CASA model for sea scallops on Georges Bank during 1983-2006, in the Mid-Atlantic Bight during 1976-2006 and for the whole stock during 1983-2006.

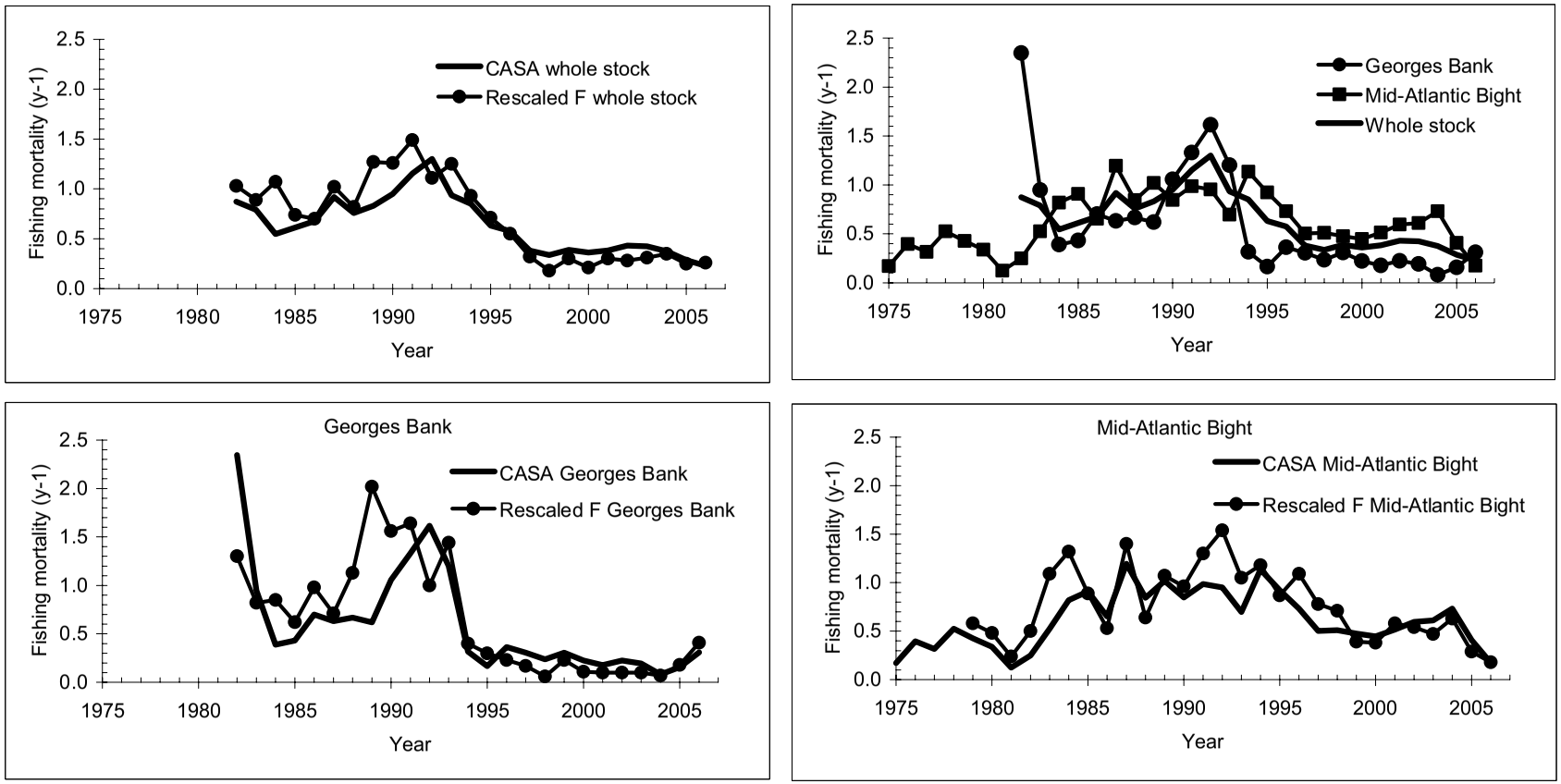


Figure B5-13. Fishing mortality estimates (y^{-1}) from the CASA model for sea scallops on Georges Bank, in the Mid-Atlantic Bight and for the whole stock during 1975-2006.

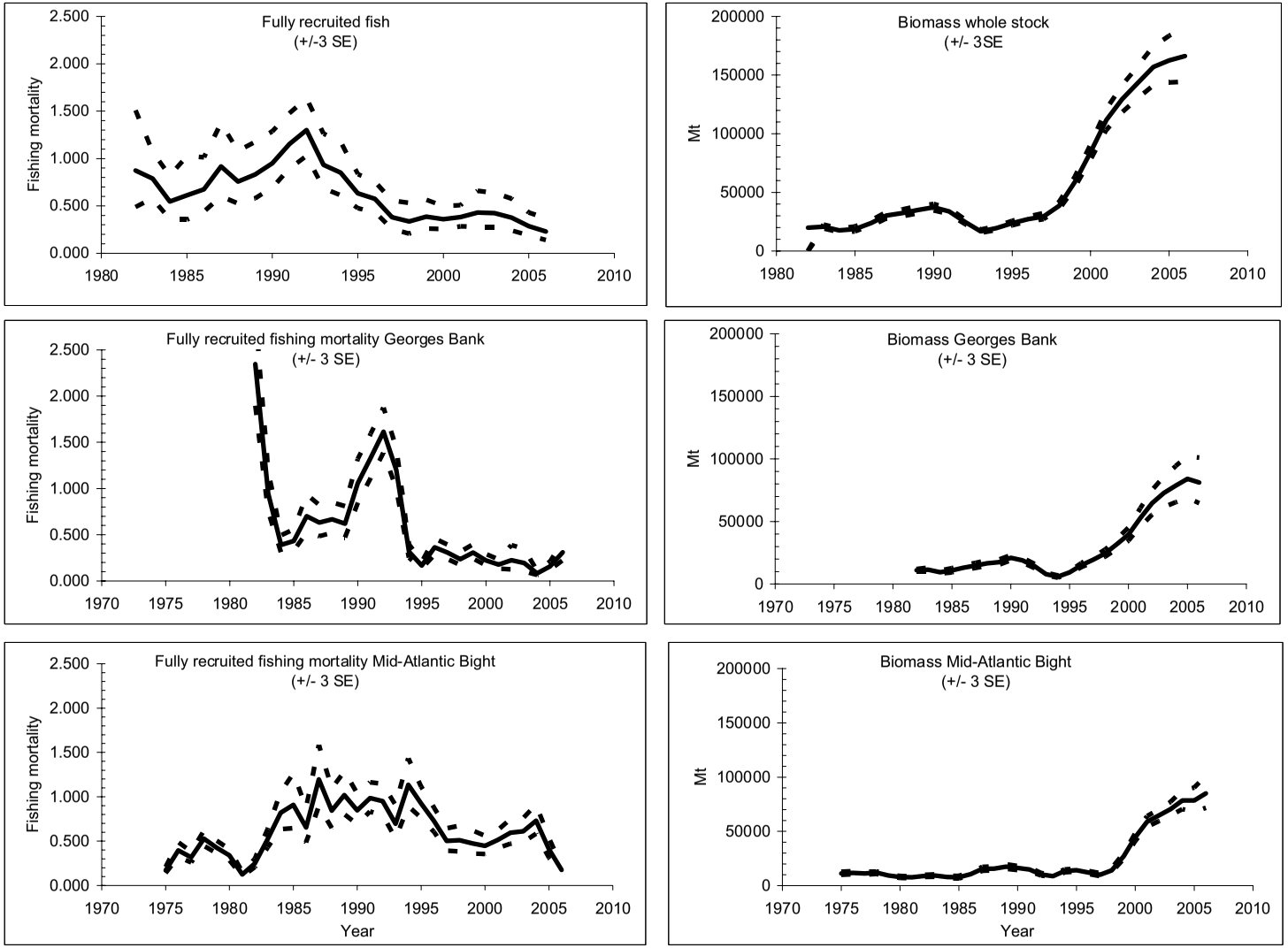


Figure B5-14. CASA model estimates of fishing mortality and biomass (± 3 standard errors) for sea scallops on Georges Bank, the Mid-Atlantic Bight and for the stock as a whole.

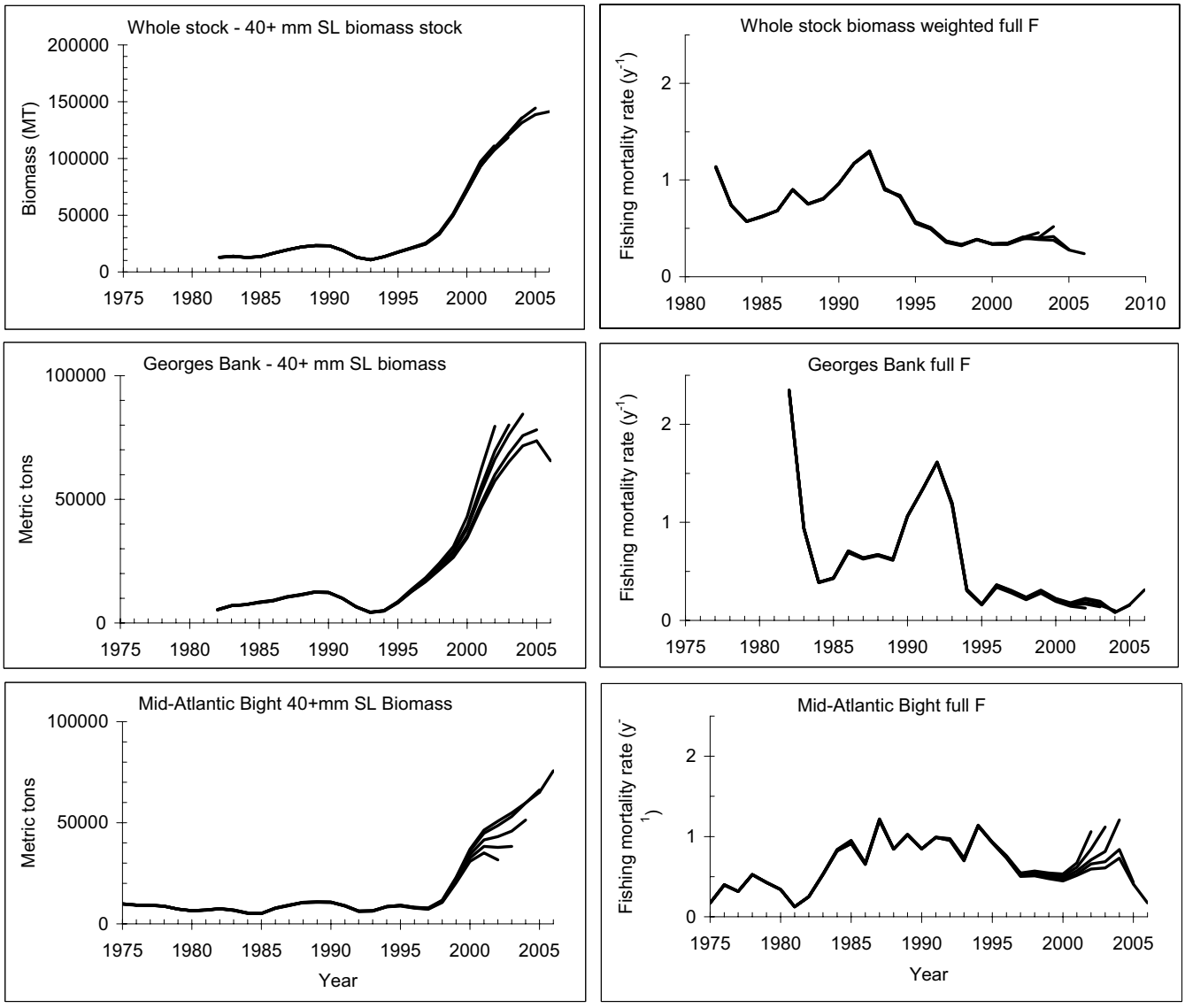


Figure B5-15. Retrospective analysis for basecase CASA model estimates of sea scallop stock biomass on Georges Bank, in the Mid-Atlantic Bight and for the stock as a whole. Fishing mortality rates for the whole stock are the biomass weighted fully recruited fishing mortality rates for Georges Bank and the Mid-Atlantic Bight, rather than catch numbers divided by mean fishable abundance, because biomass weighted values were easier to compute in retrospective analyses and should give approximately the same result.

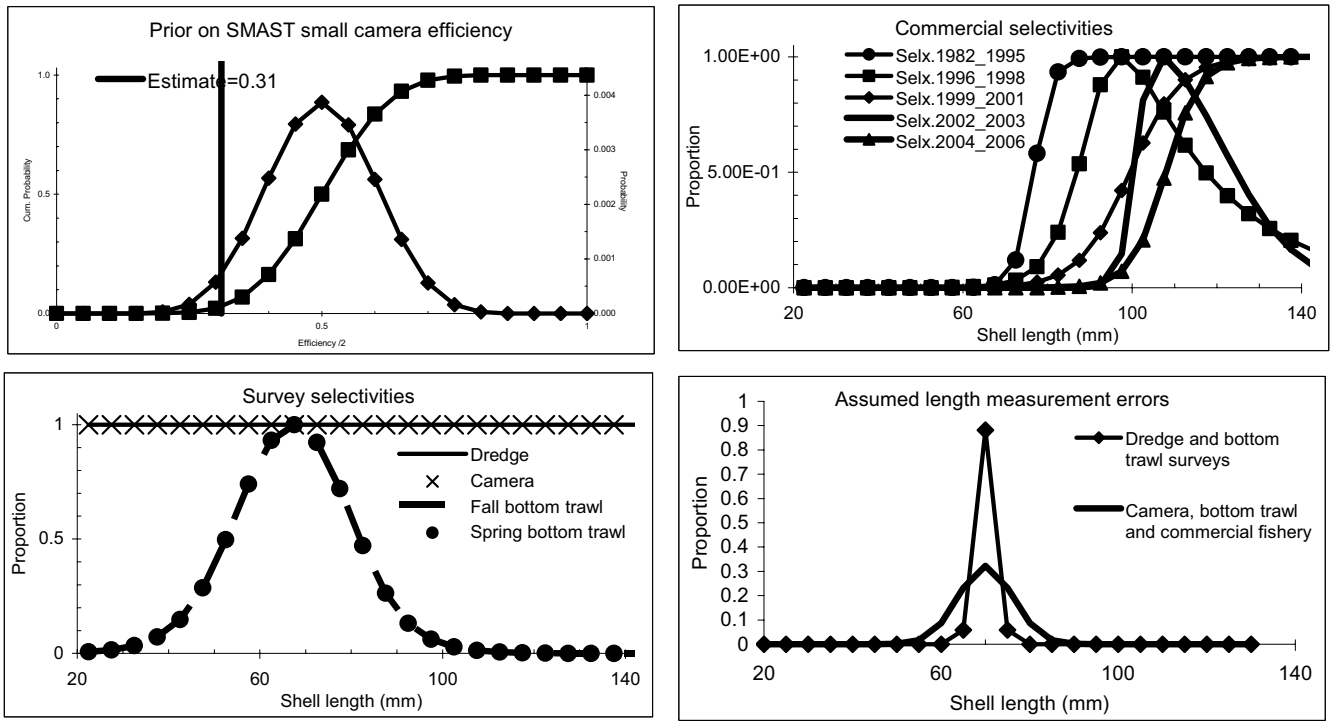
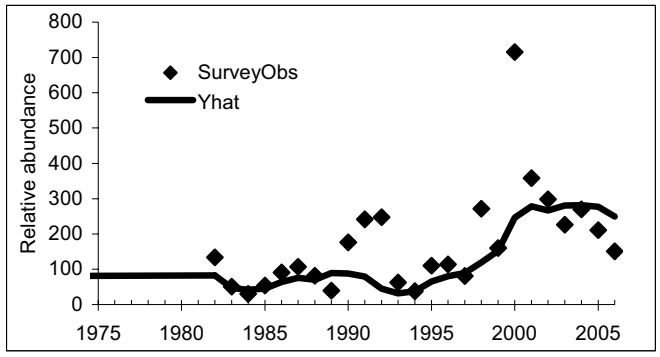
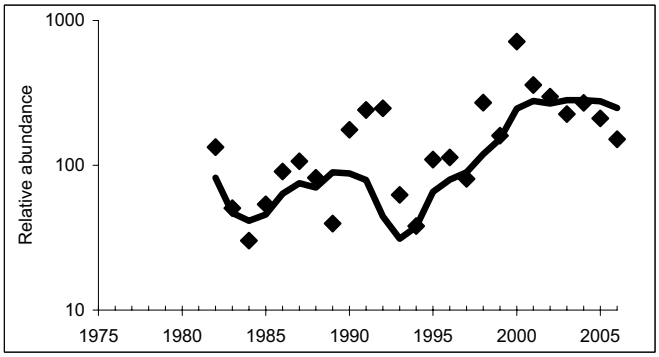
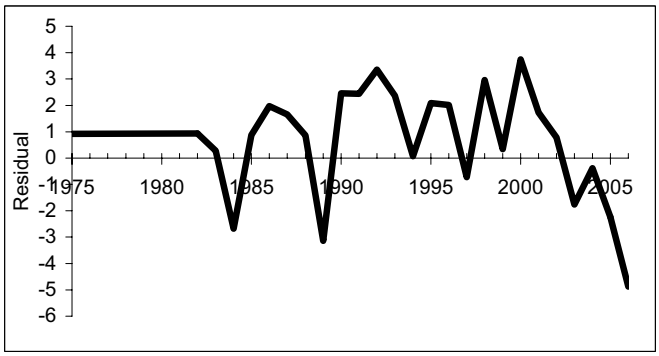


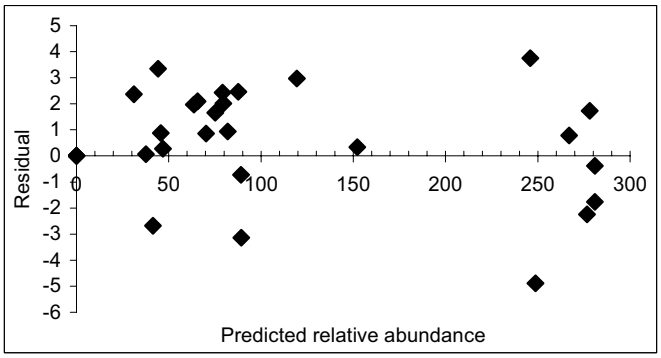
Figure B5-16. Diagnostics from basecase CASA model for sea scallops on Georges Bank.

Dredge survey









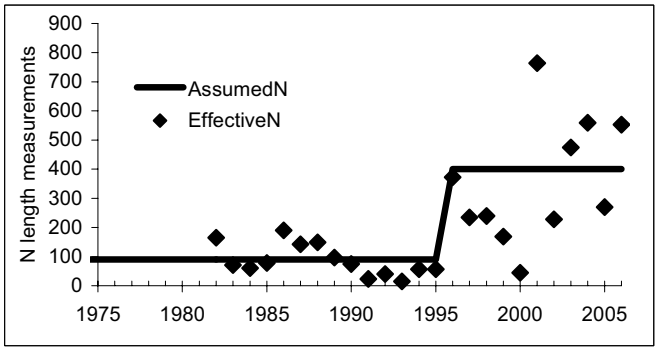
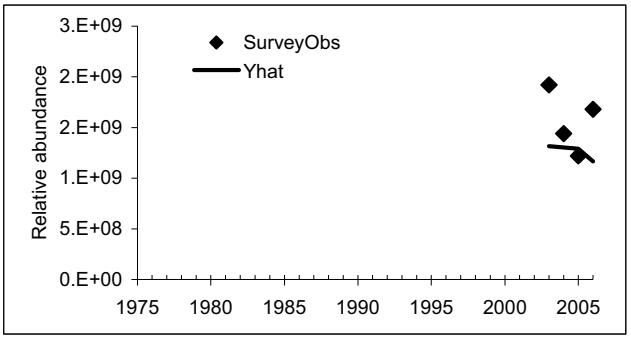
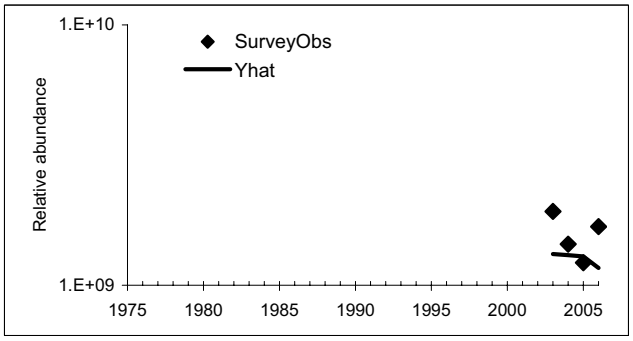
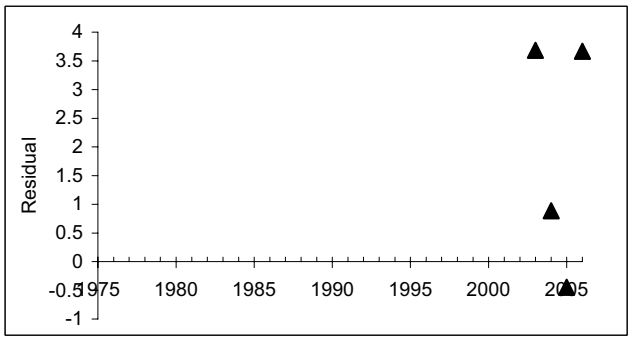


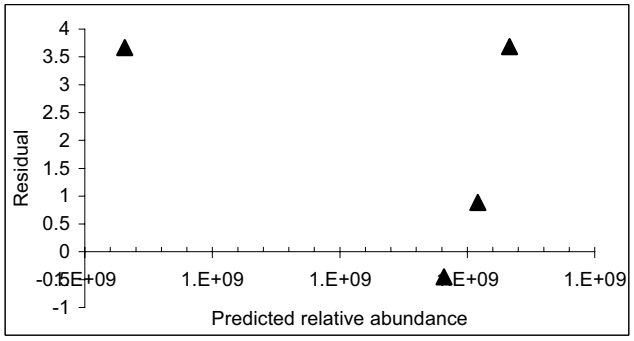
Figure B5-16 continued.

Small camera survey









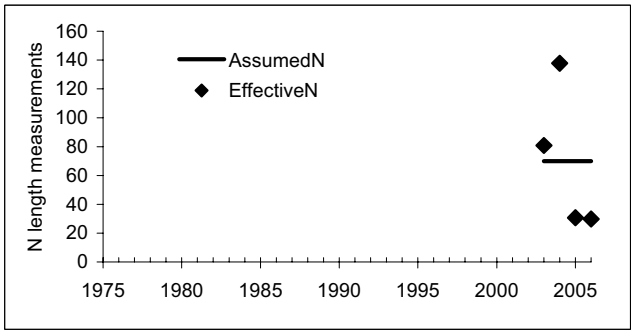


Figure B5-16 continued.

Landings per unit effort (LPUE)

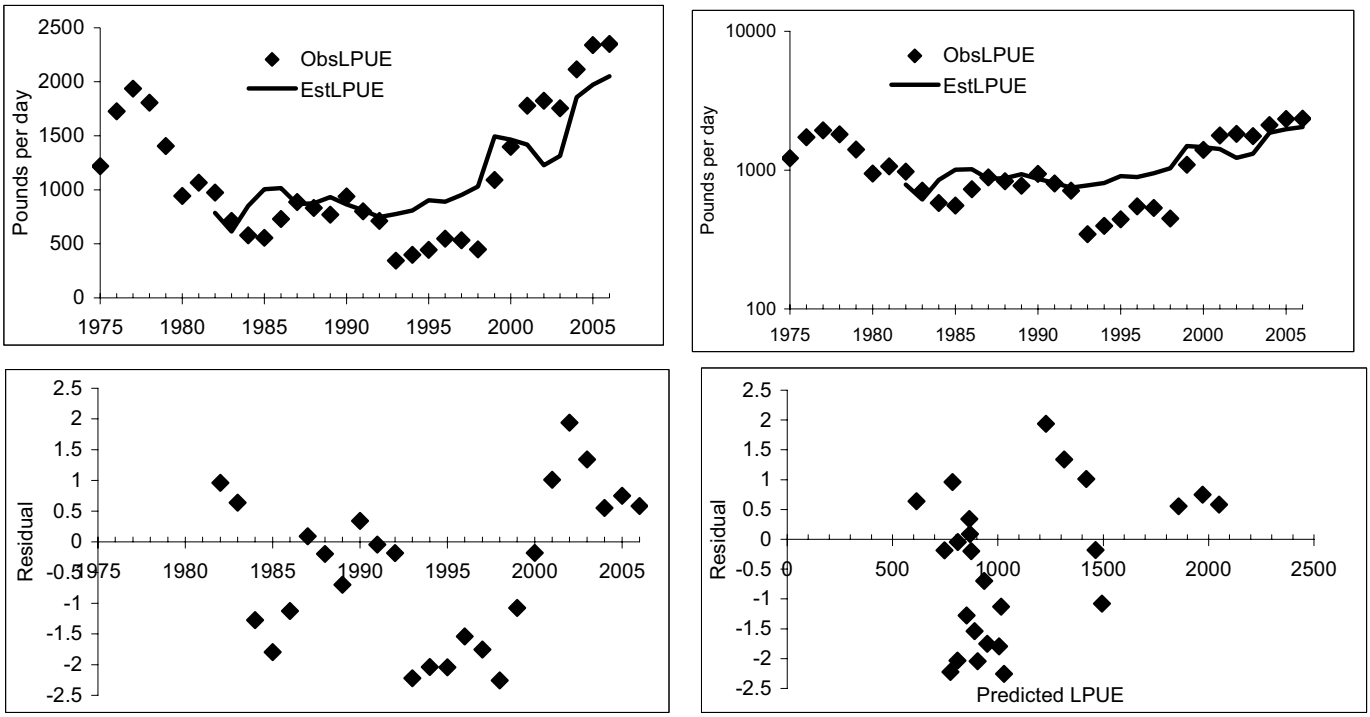
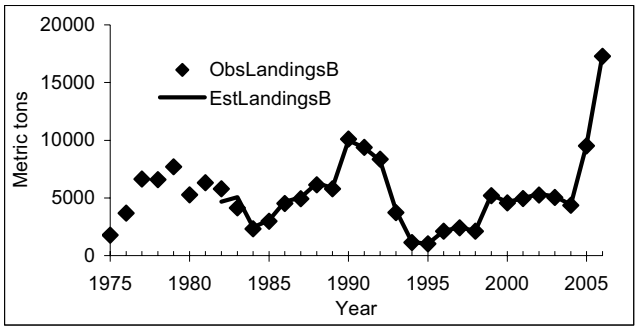
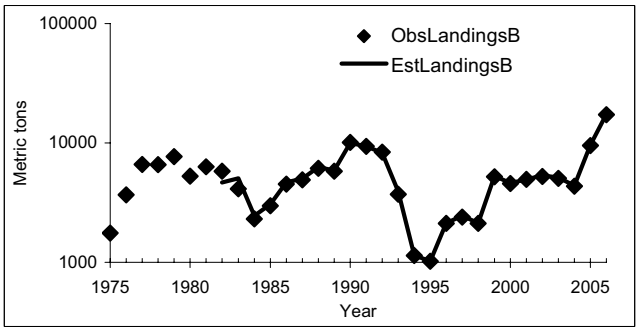
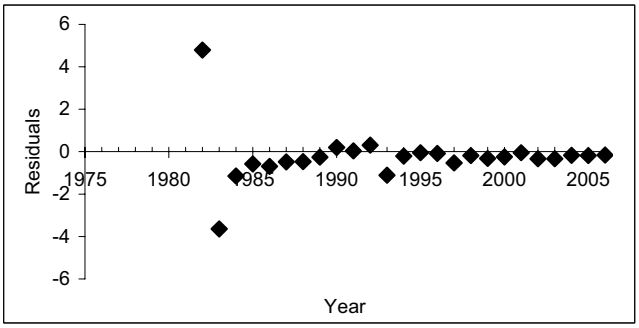


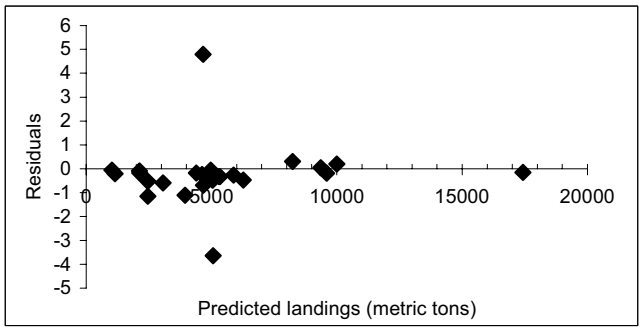
Figure B5-16 continued.

Landings









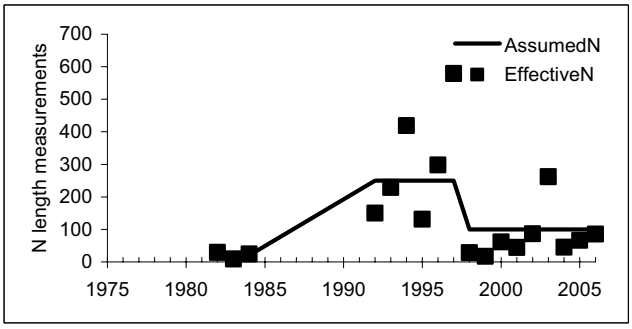


Figure B5-16 continued.

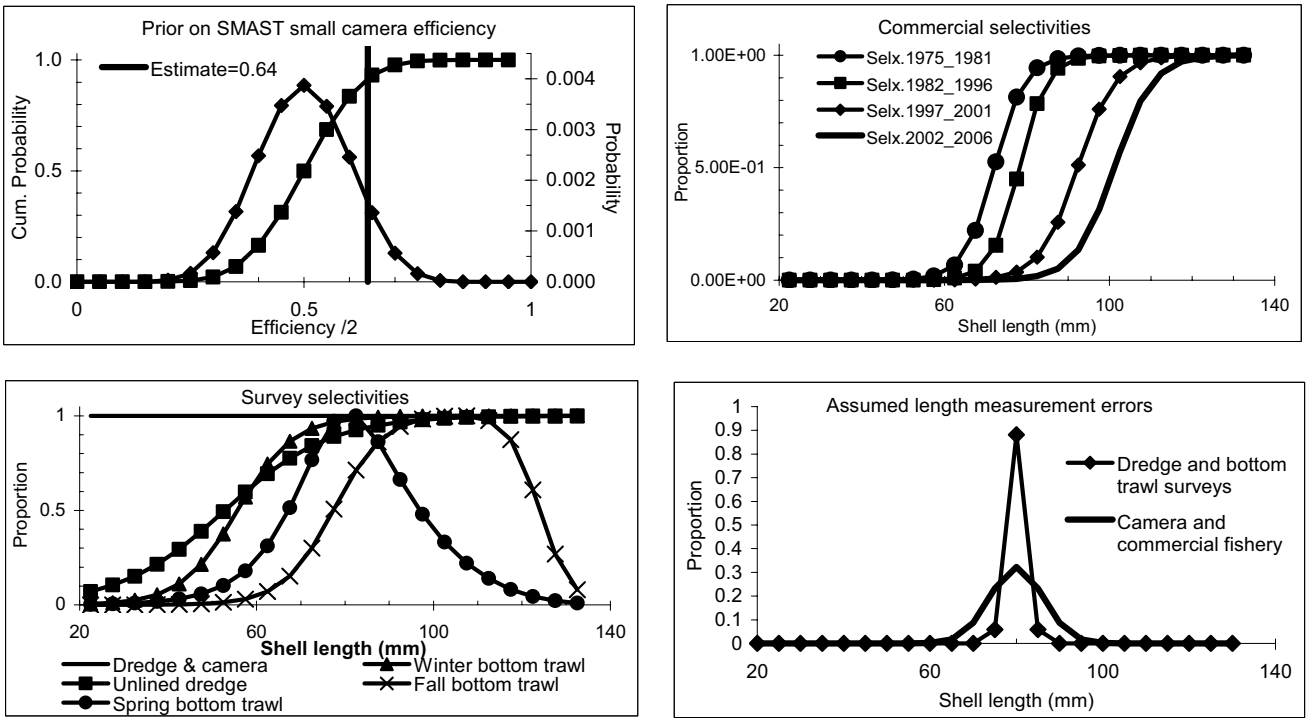


Figure B5-17. Diagnostics from basecase CASA model for sea scallops in the Mid-Atlantic Bight.

Dredge survey

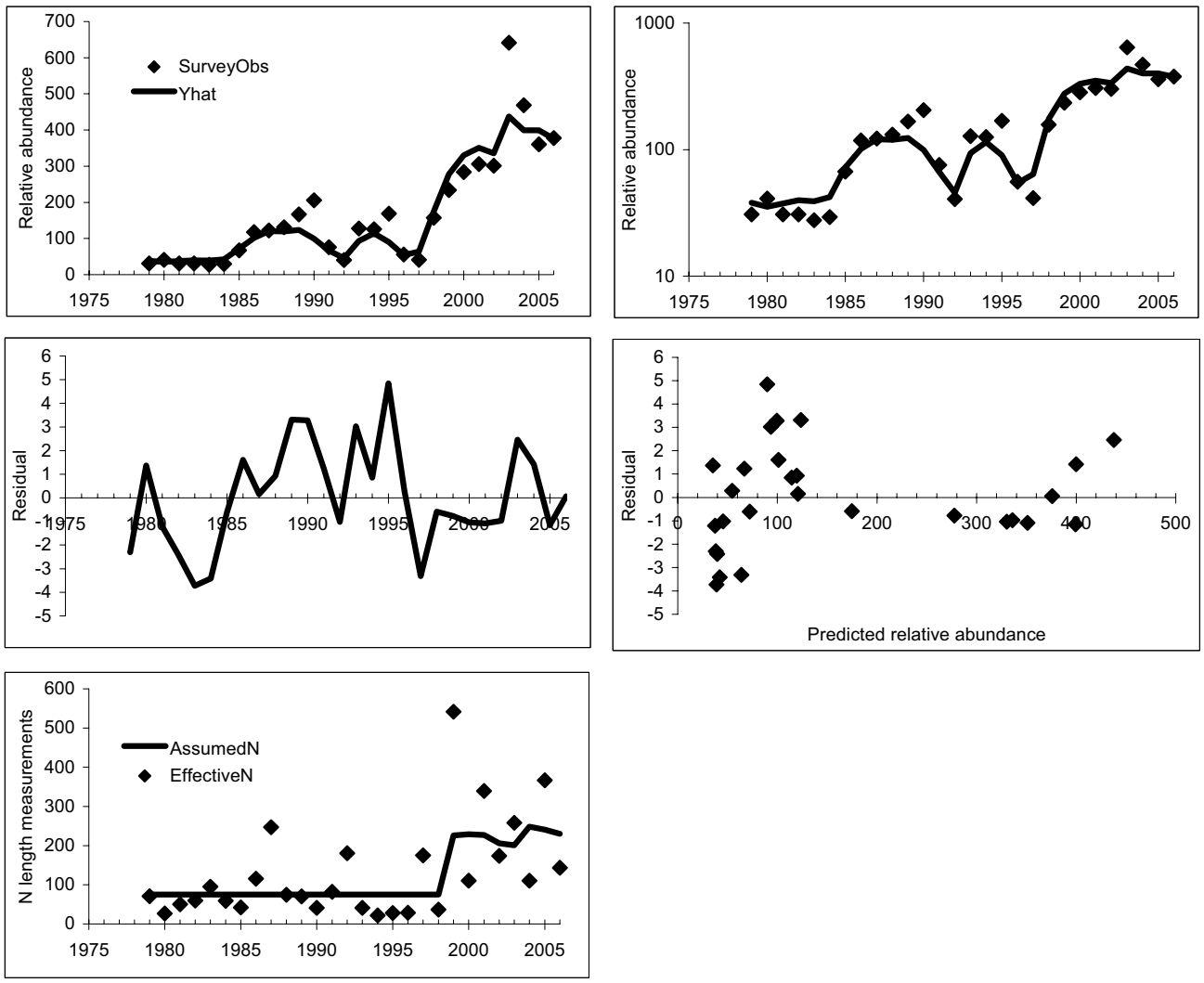
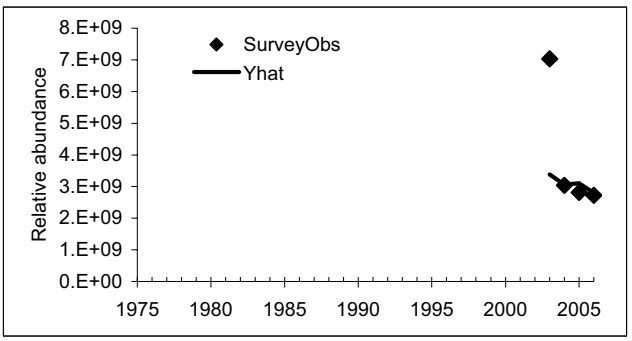
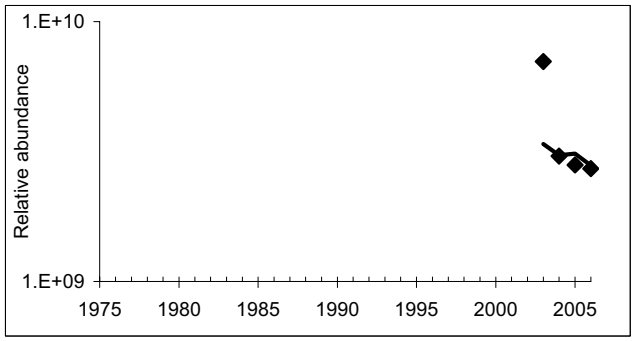
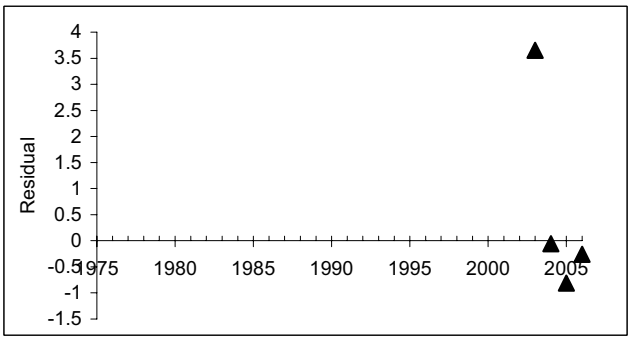


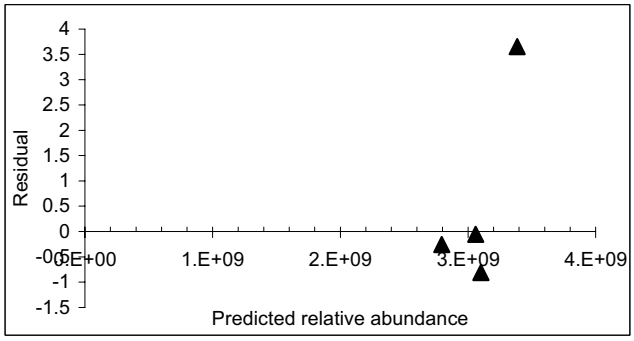
Figure B5-17 continued.

Small camera survey









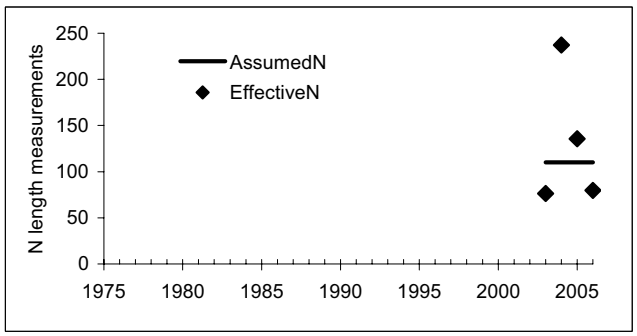


Figure B5-17 continued.

Winter bottom trawl survey

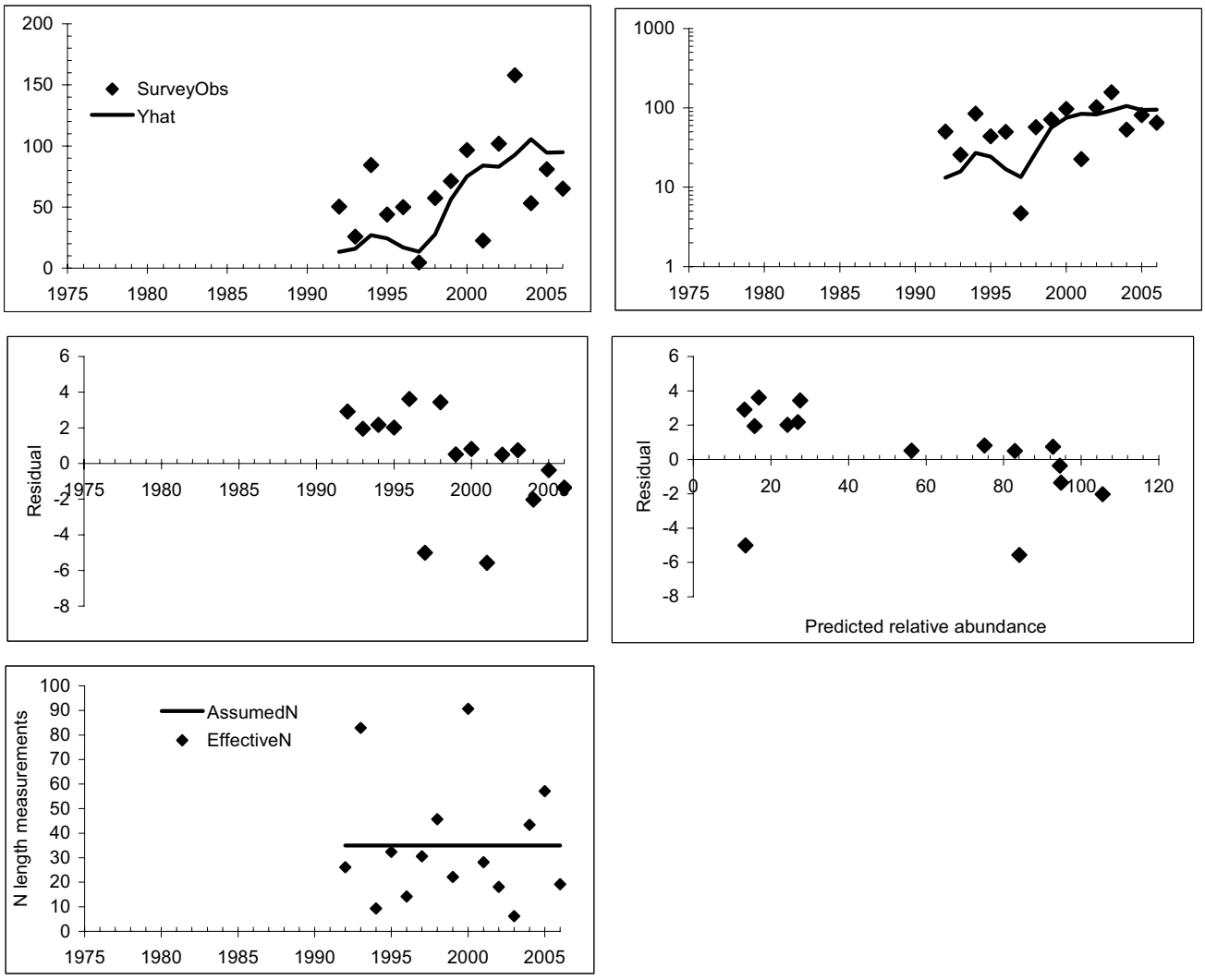


Figure B5-17 continued.

Unlined dredge

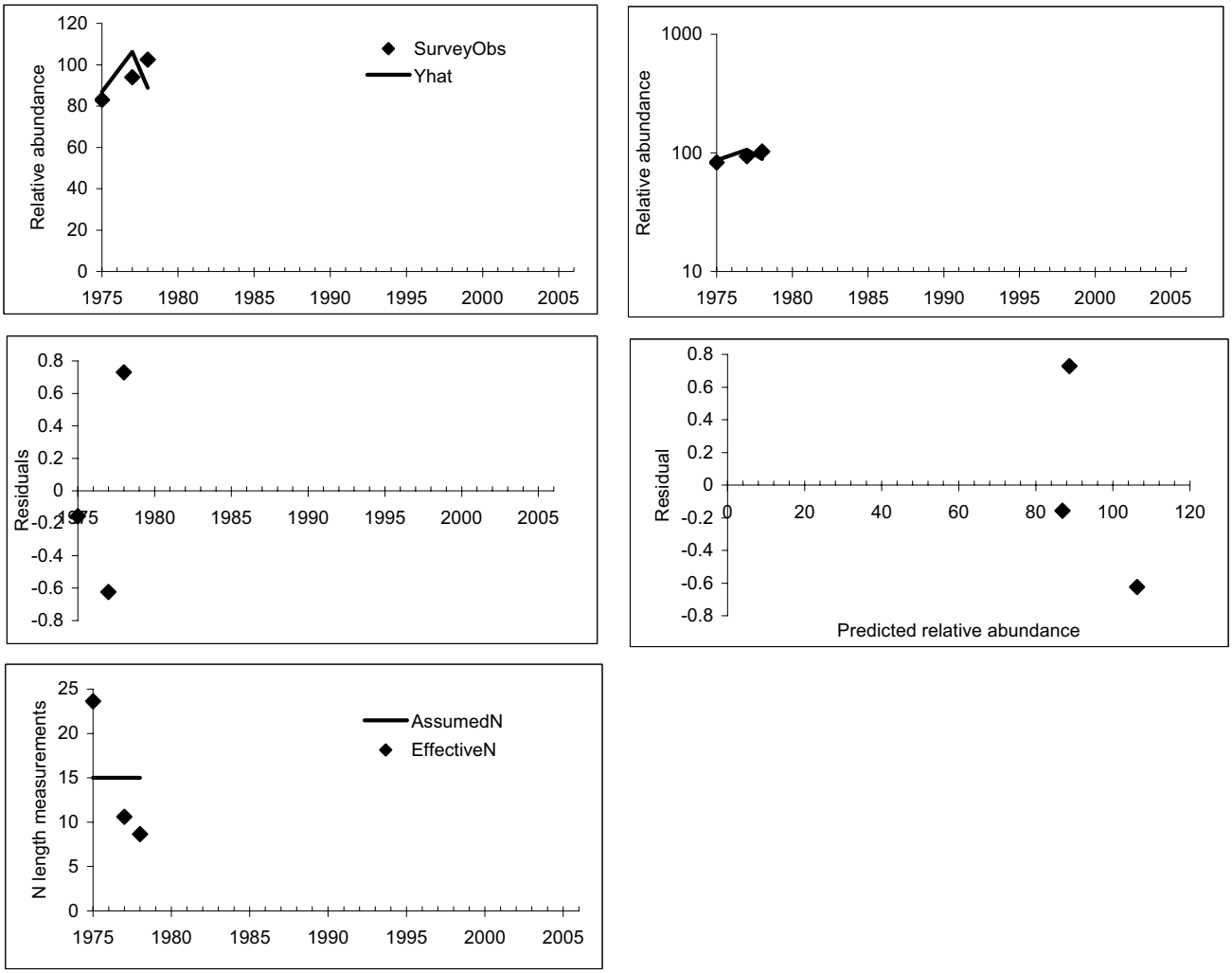


Figure B5-17 continued.

LPUE

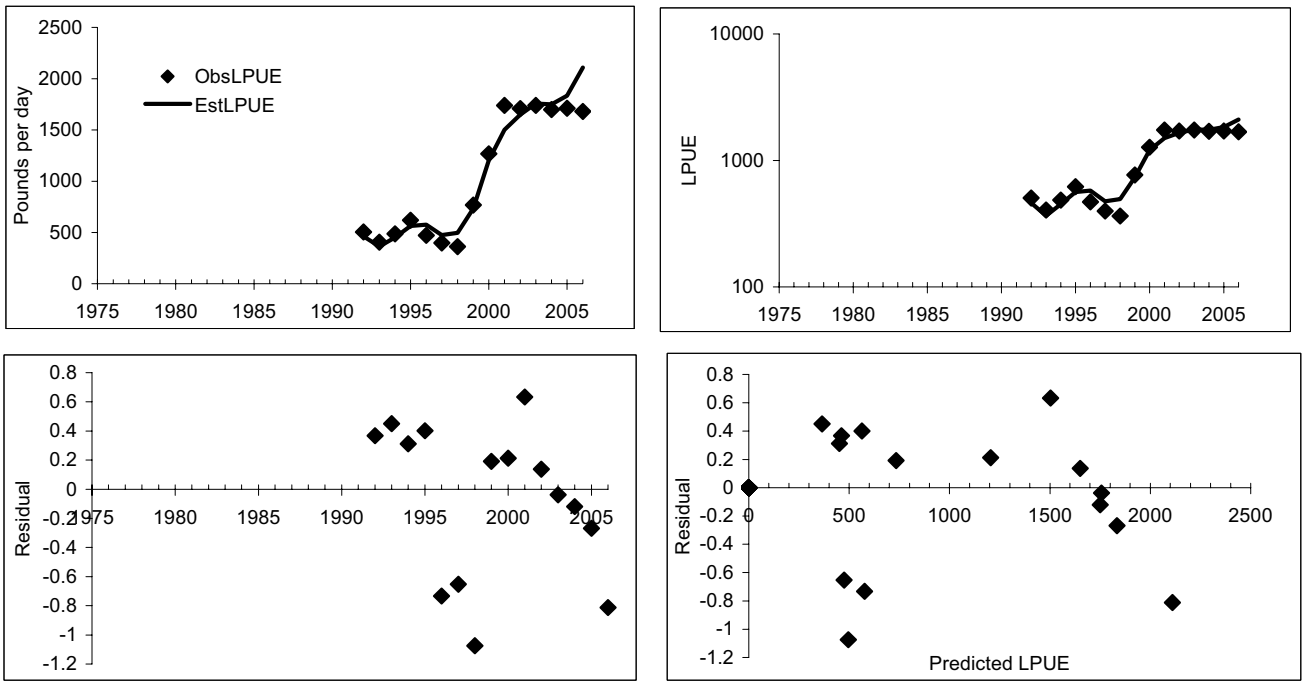


Figure B5-17 continued.

Landings

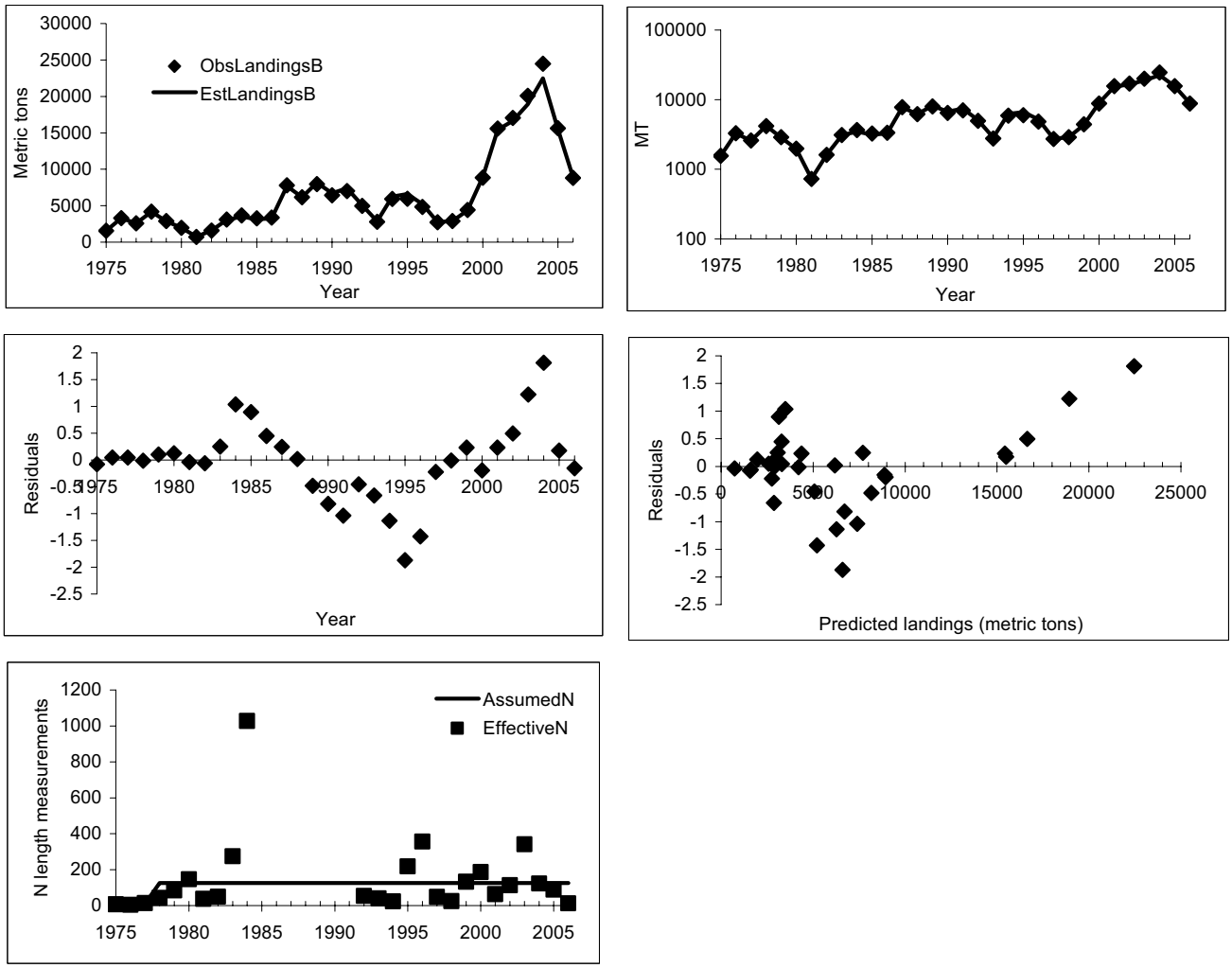


Figure B5-17 continued.

Fall bottom trawl (for illustration only, does not affect CASA estimates)

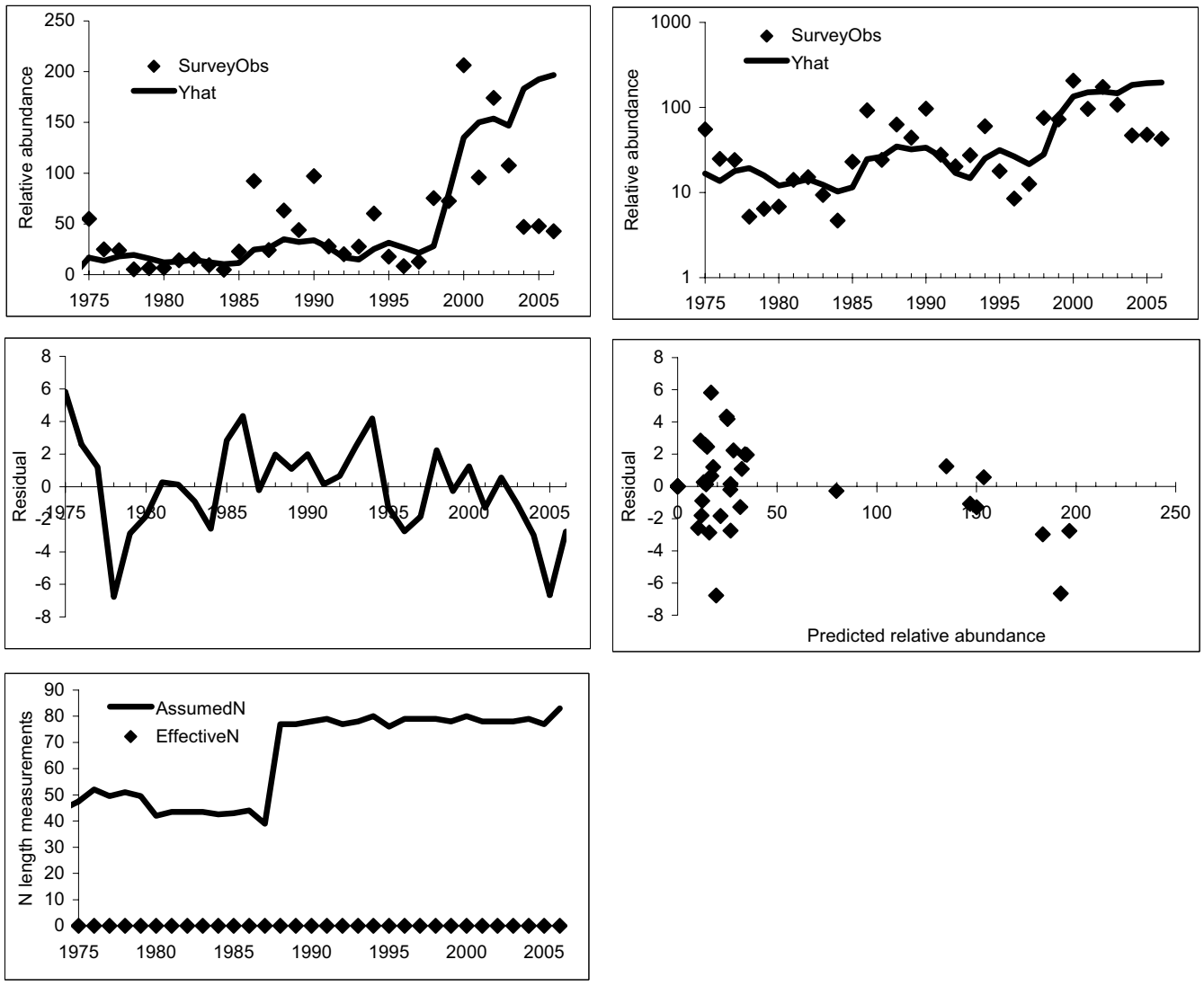


Figure B5-17 continued. Fall and spring bottom trawl data were used in the CASA model for sea scallops in the Mid-Atlantic for comparison only. Survey trend and shell height data from the fall and spring bottom trawl survey did not affect model estimates.

Spring bottom trawl (for illustration only, does not affect CASA estimates)

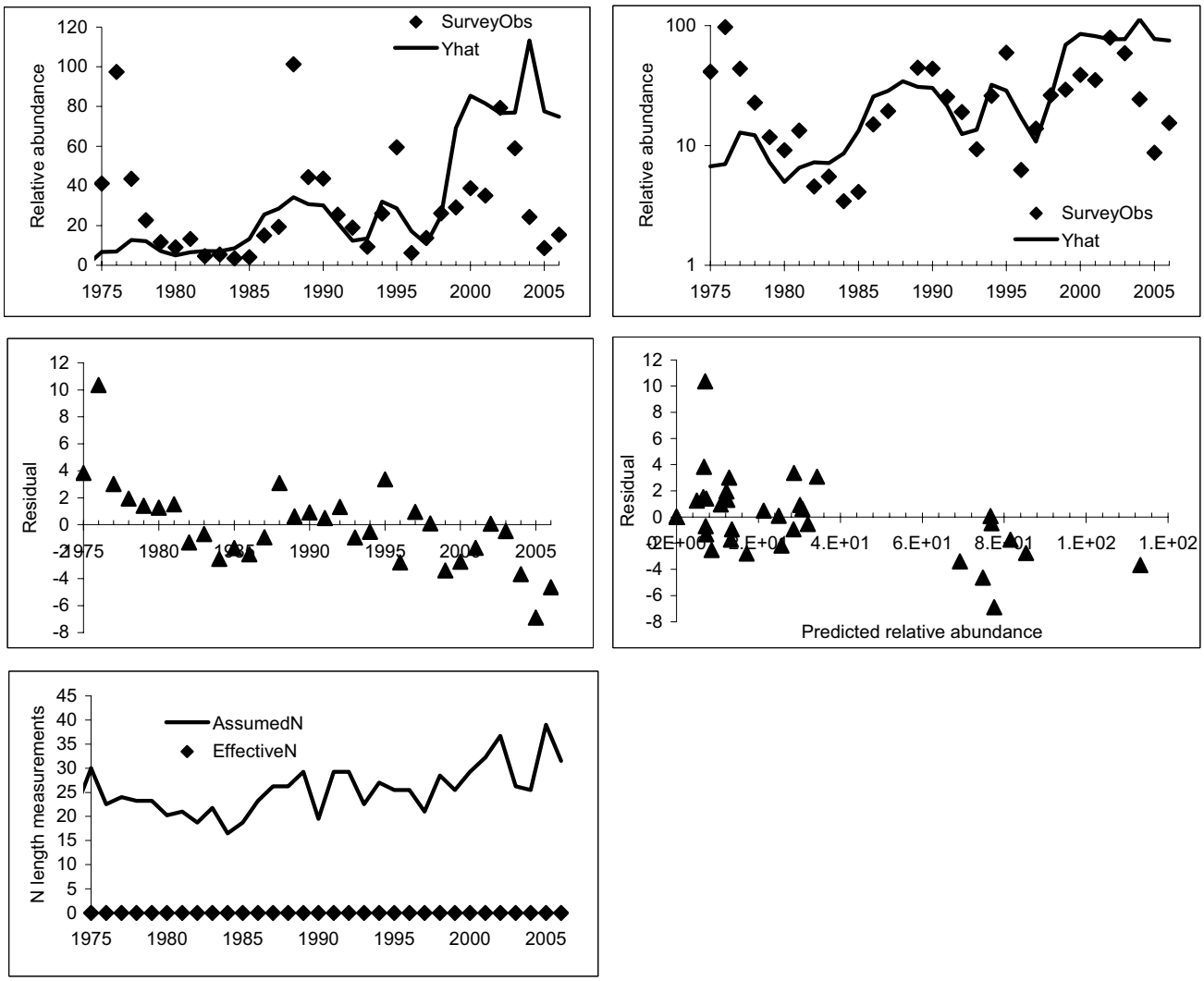


Figure B5-17 continued. Fall and spring bottom trawl data were used in the CASA model for sea scallops in the Mid-Atlantic for comparison only. Survey trend and shell height data from the fall and spring bottom trawl survey did not affect model estimates.

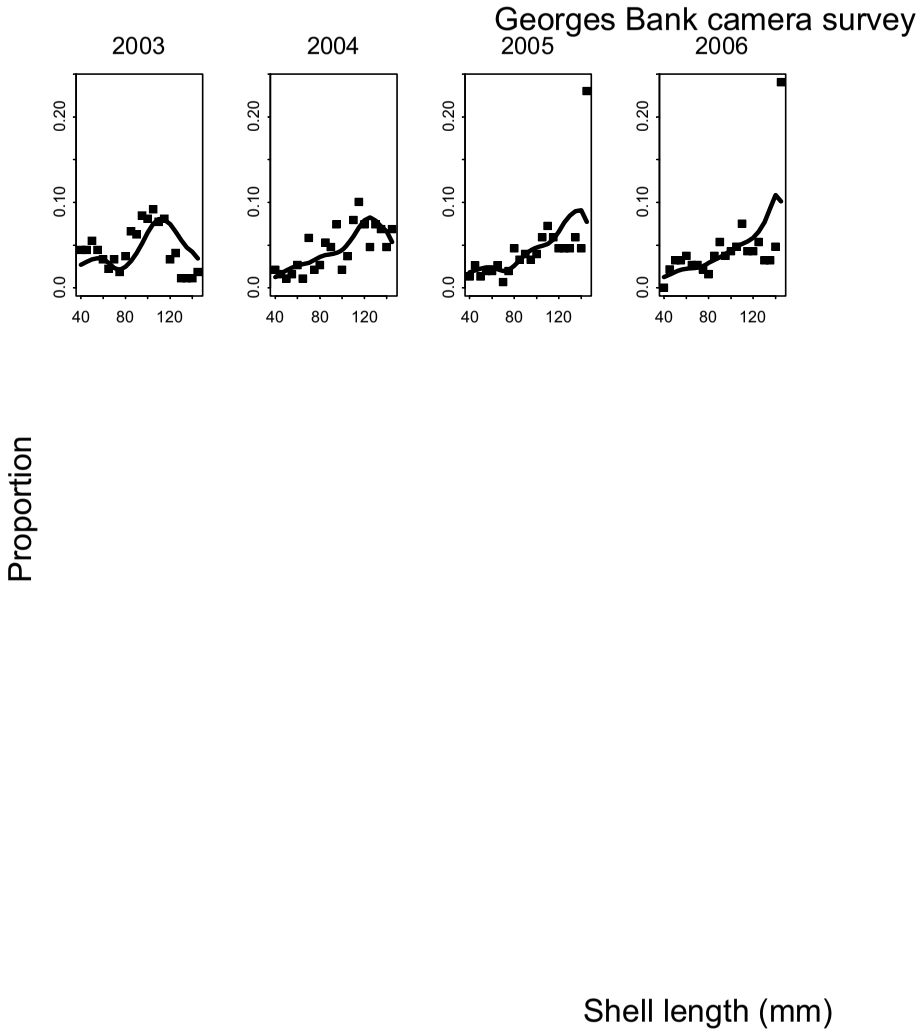


Figure B5-18. Observed and predicted shell height composition data from the basecase CASA model for sea scallops on Georges Bank.

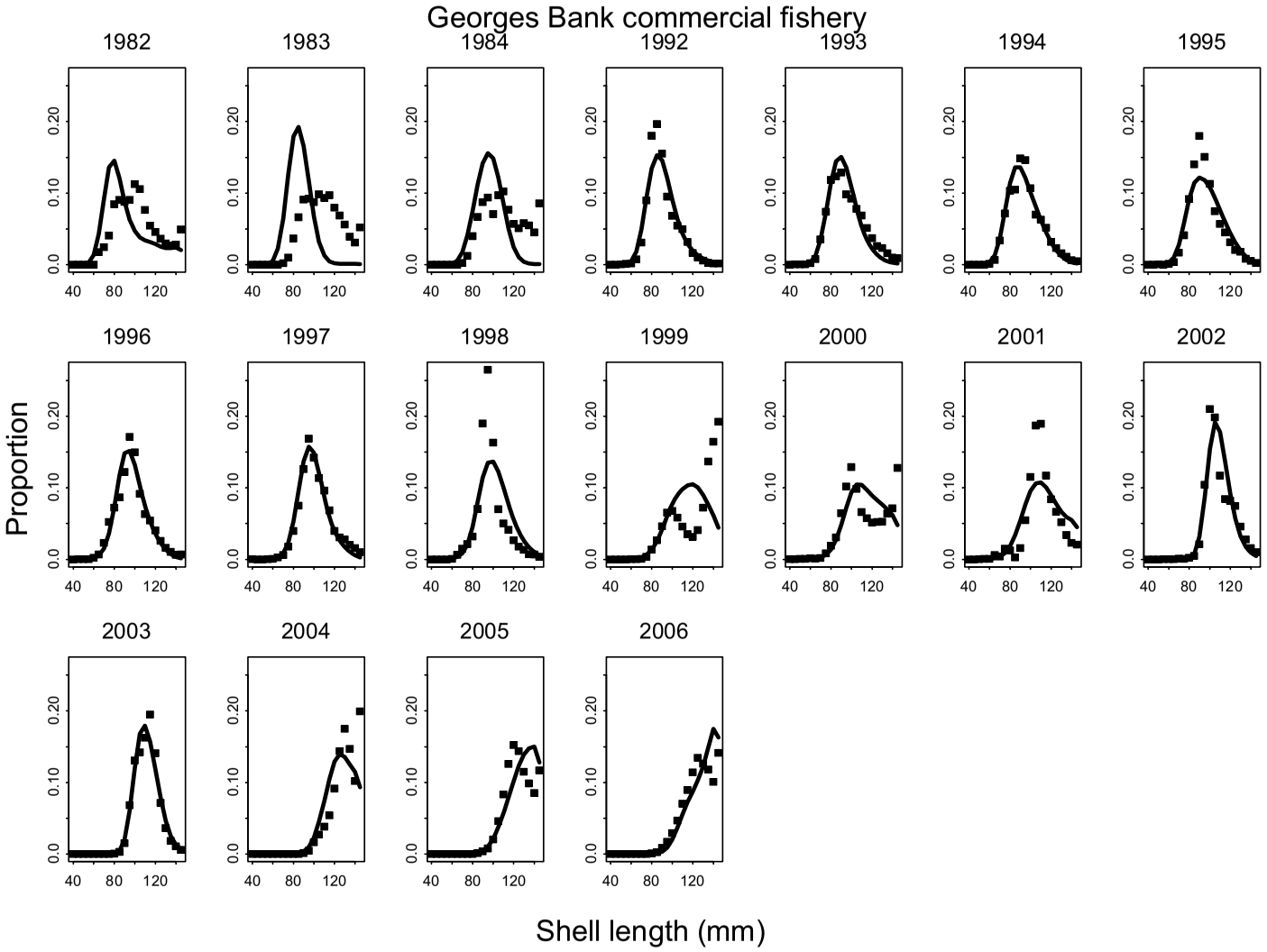


Figure B5-18 continued.

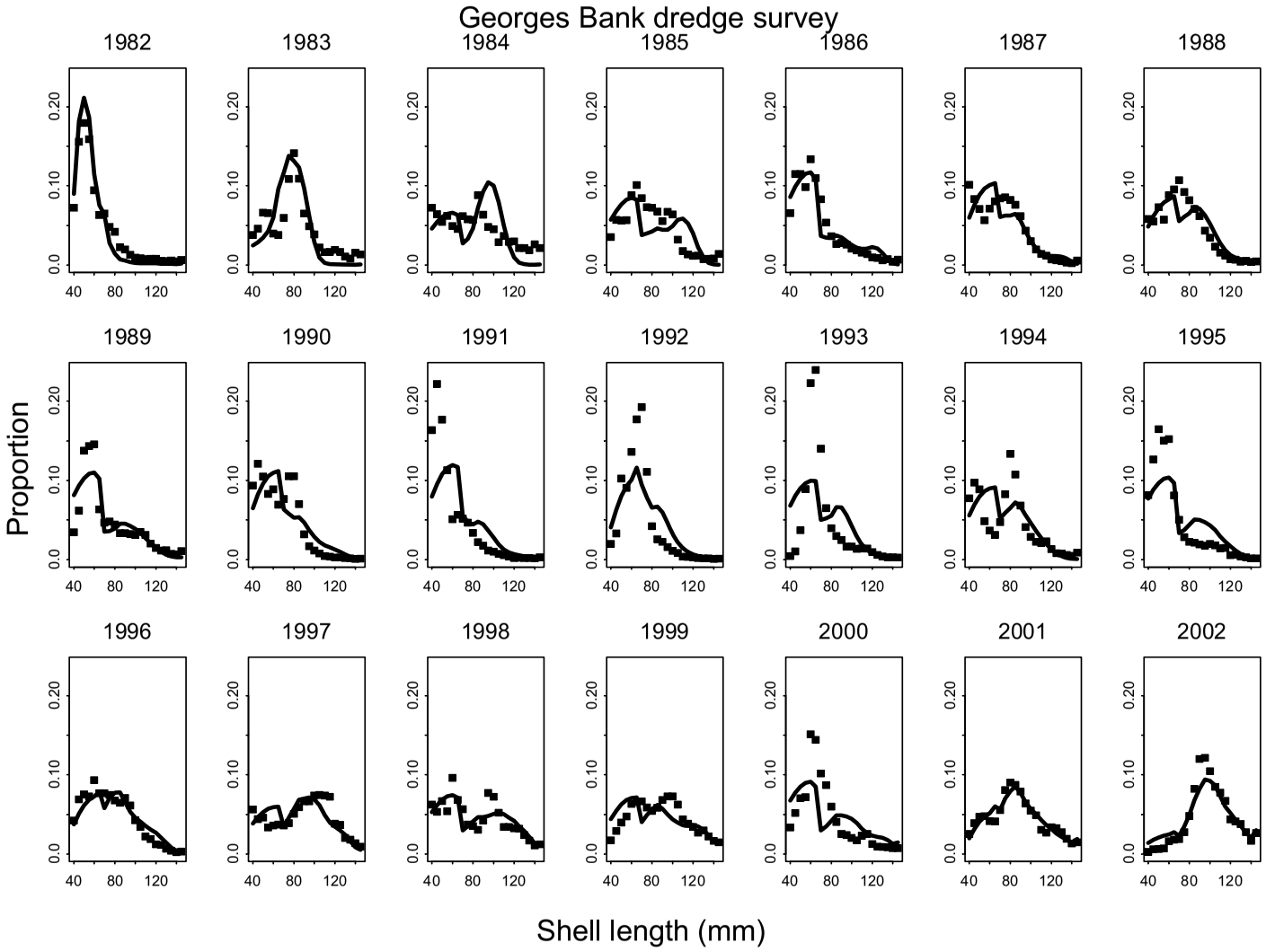


Figure B5-18 continued.

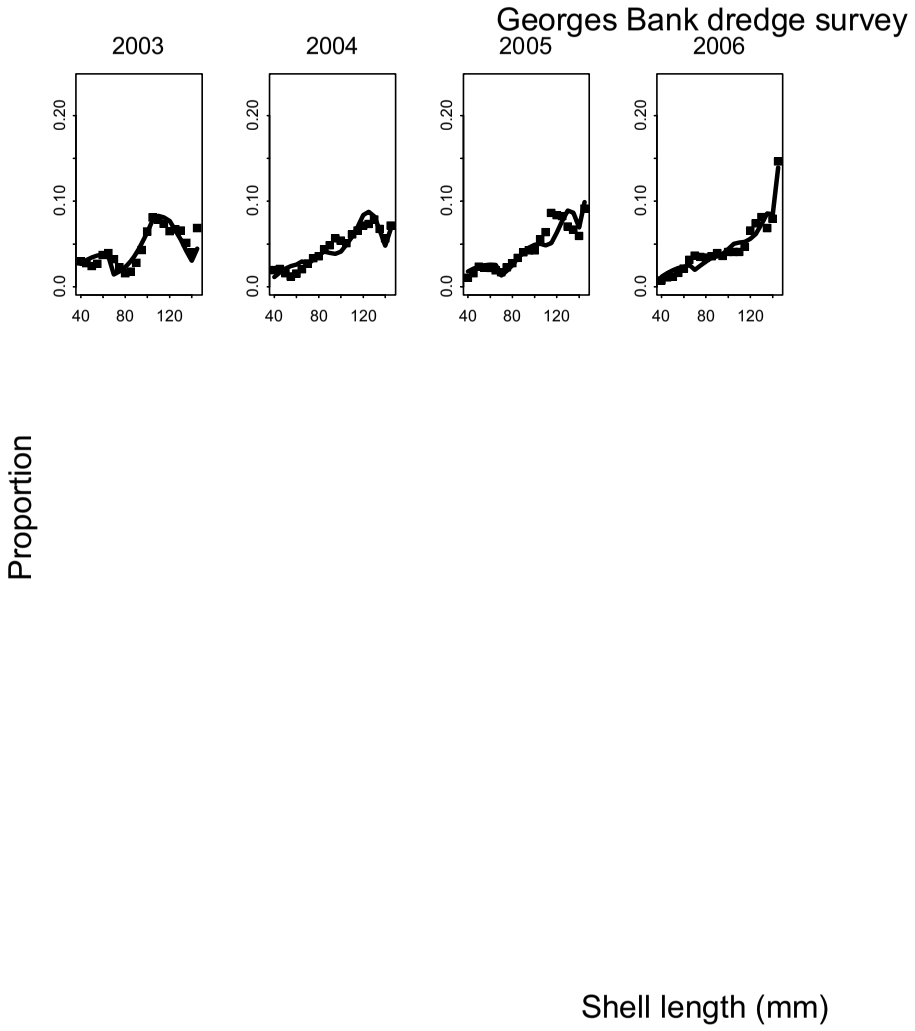


Figure B5-18 continued.

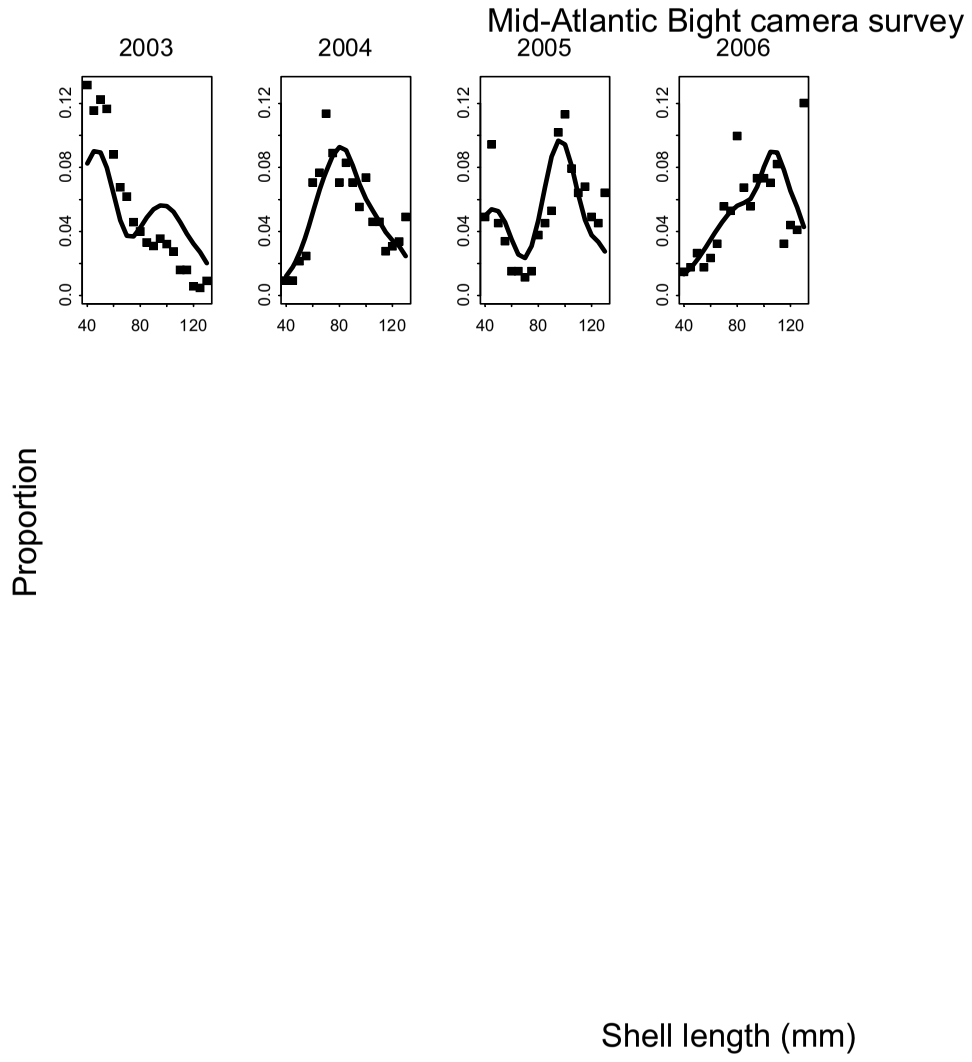


Figure B5-19. Observed and predicted shell height composition data from the basecase CASA model for sea scallops in the Mid-Atlantic.

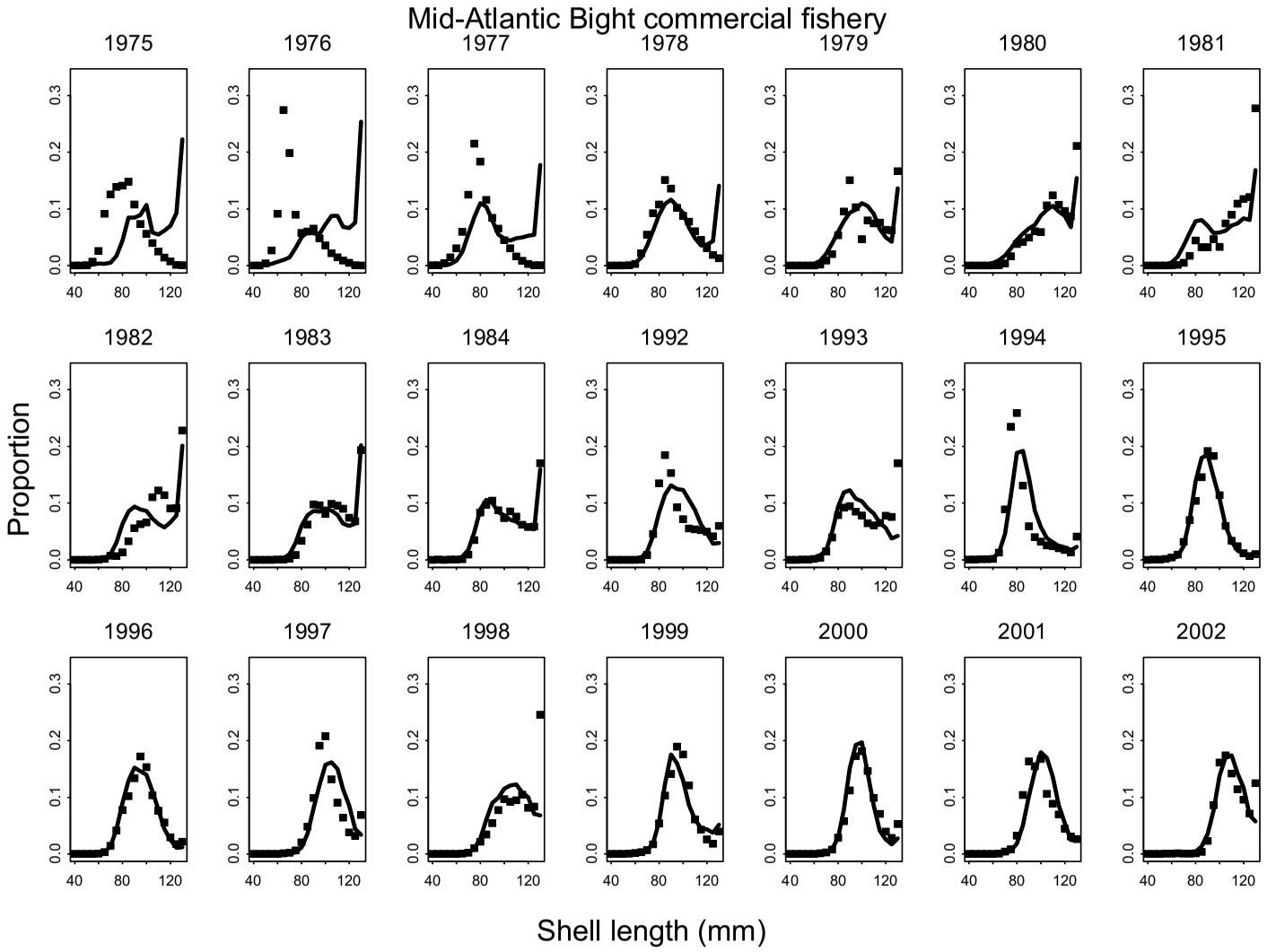


Figure B5-19 continued.

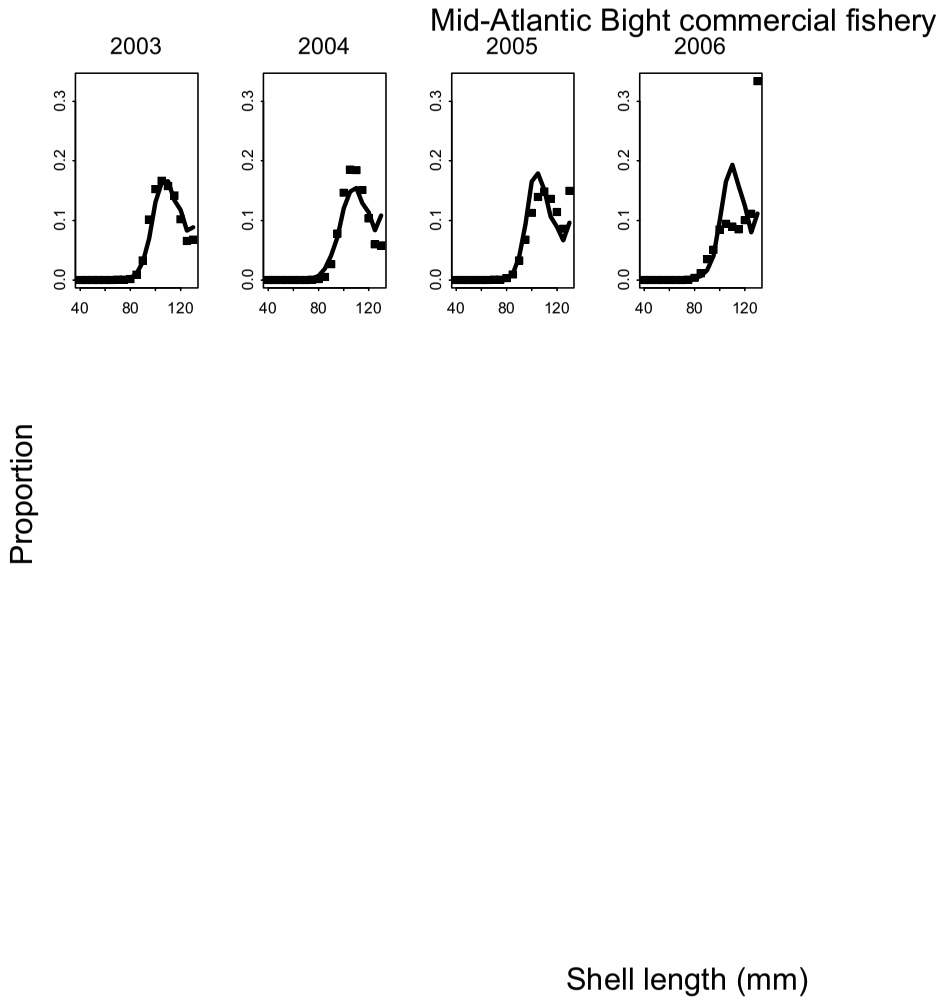


Figure B5-19 continued.

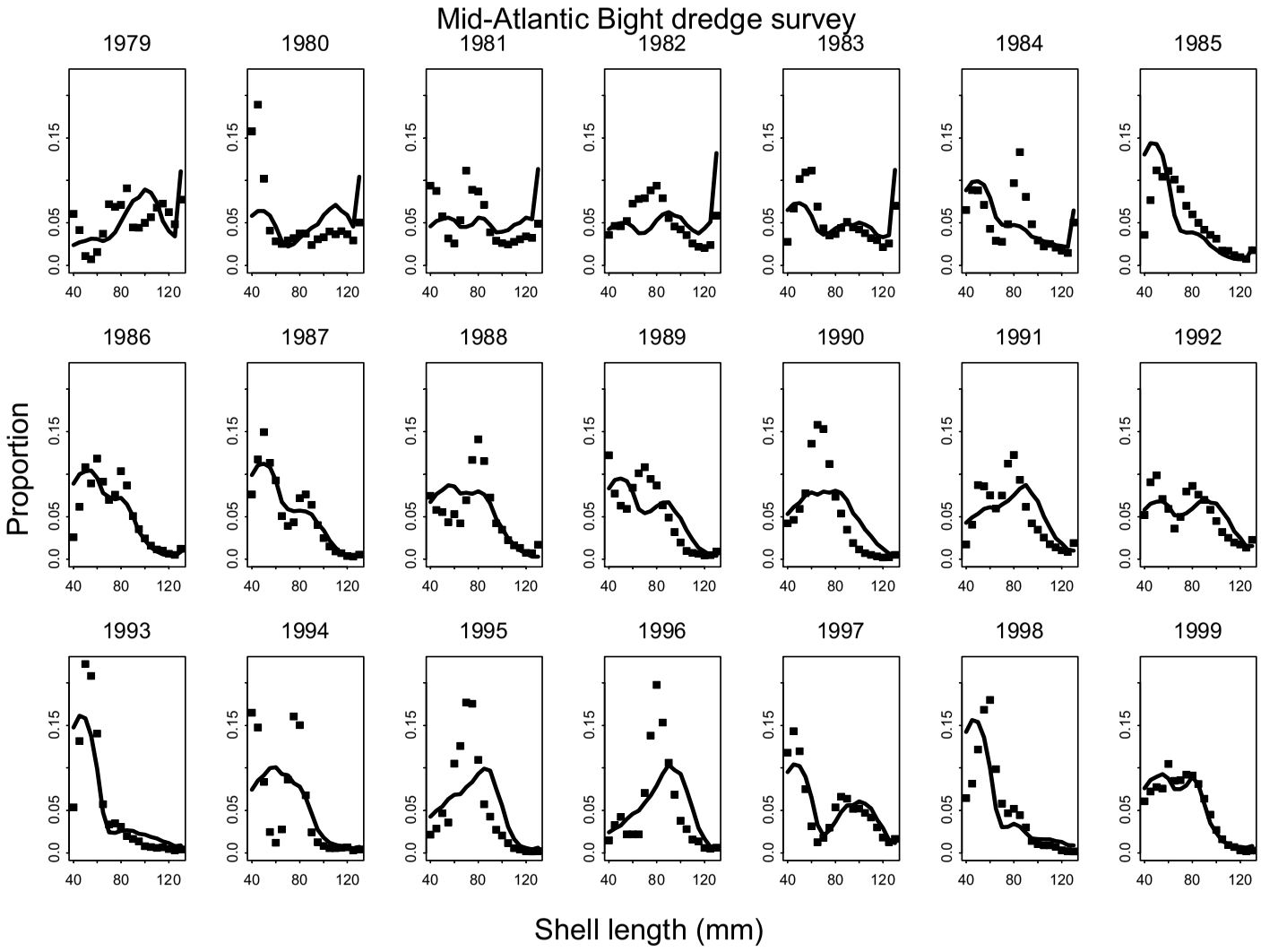


Figure B5-19 continued.

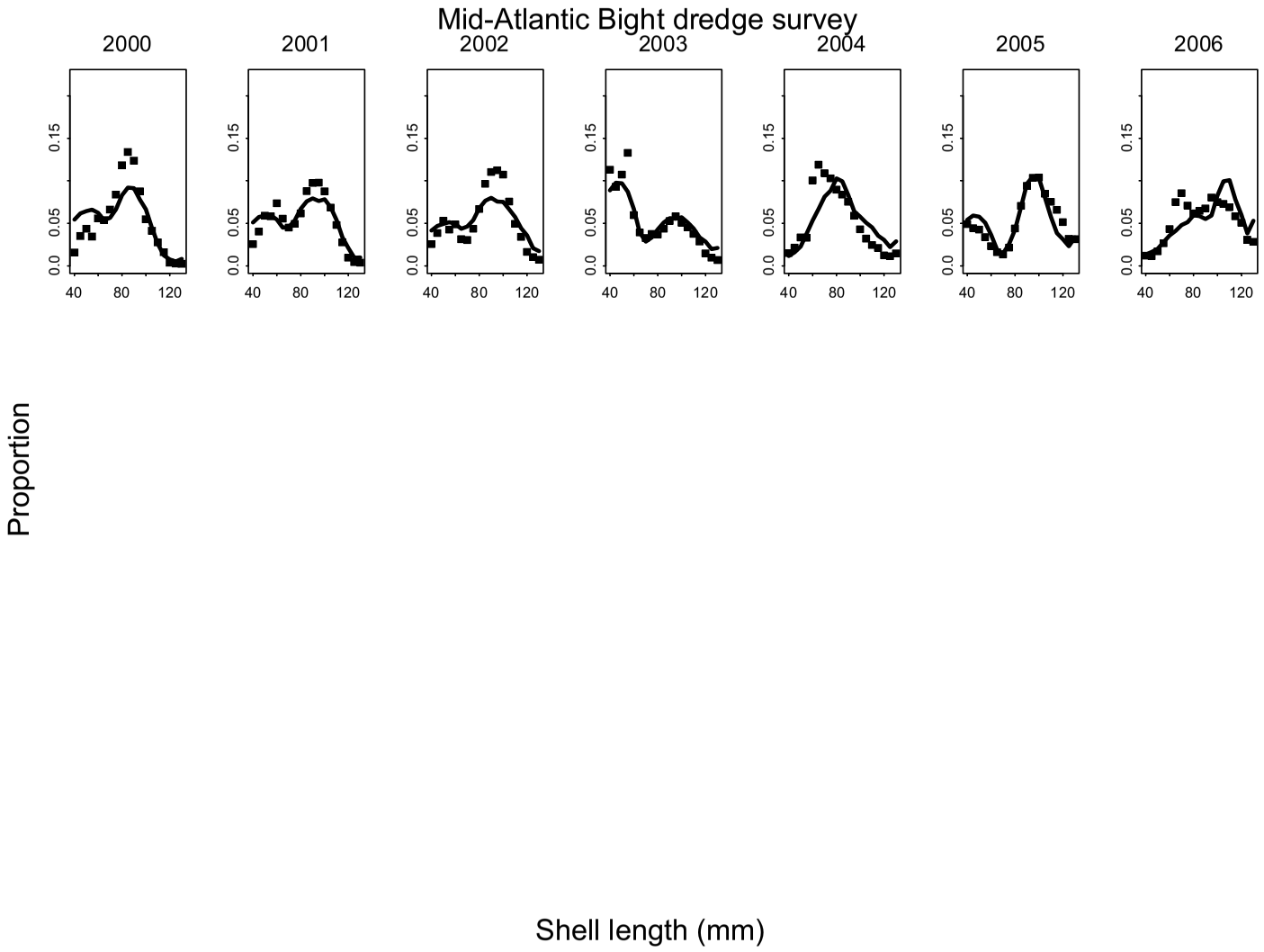


Figure B5-19 continued.

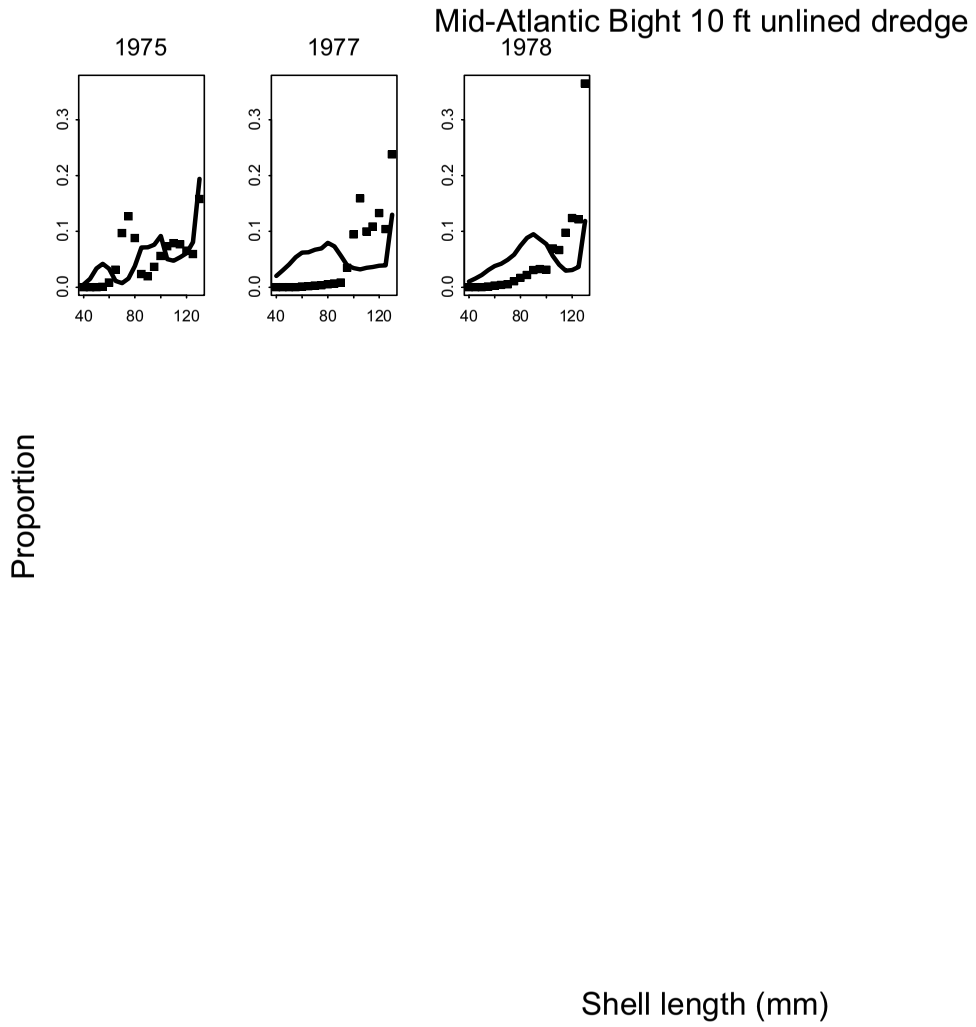


Figure B5-19 continued.

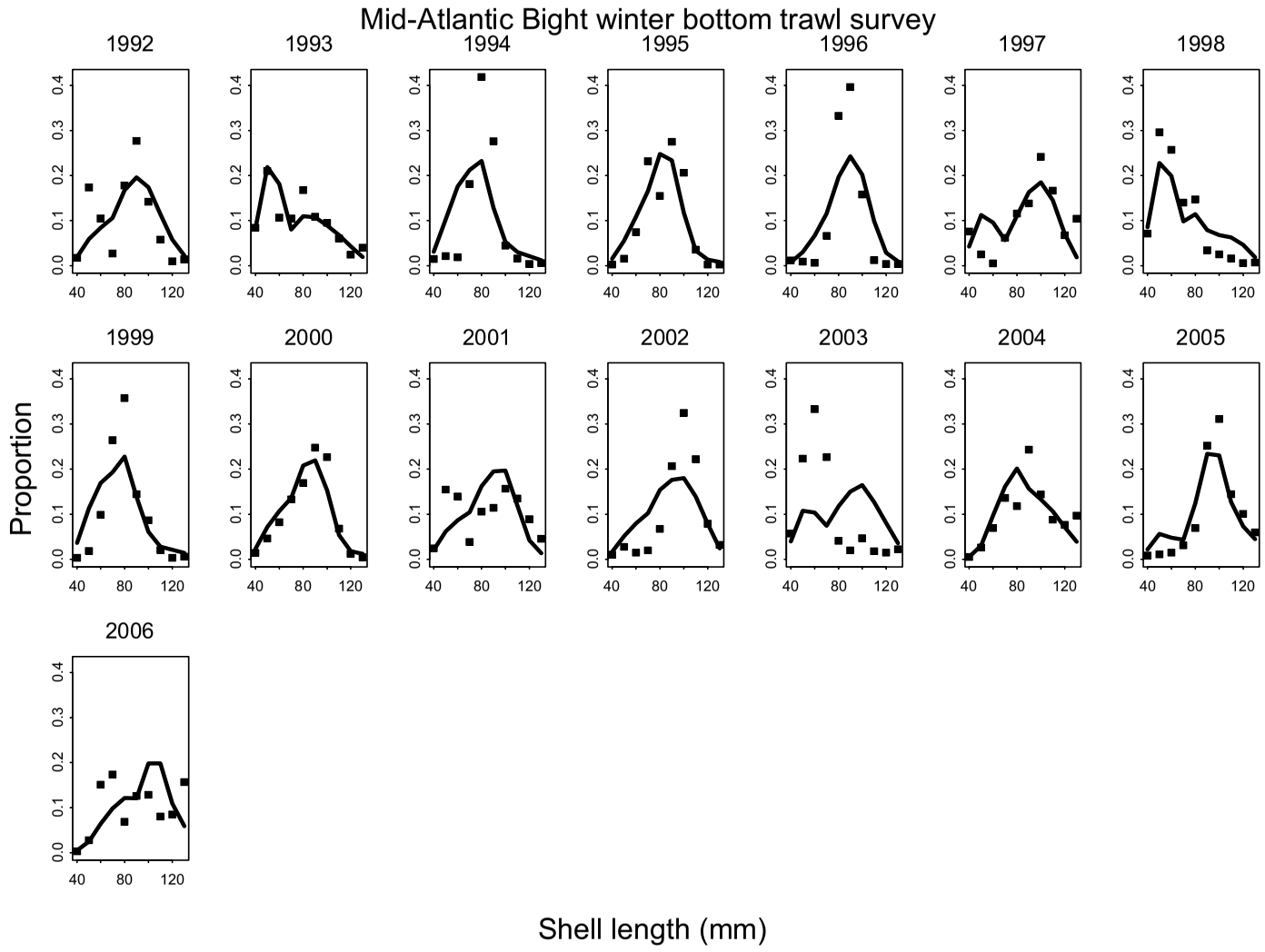


Figure B5-19 continued.

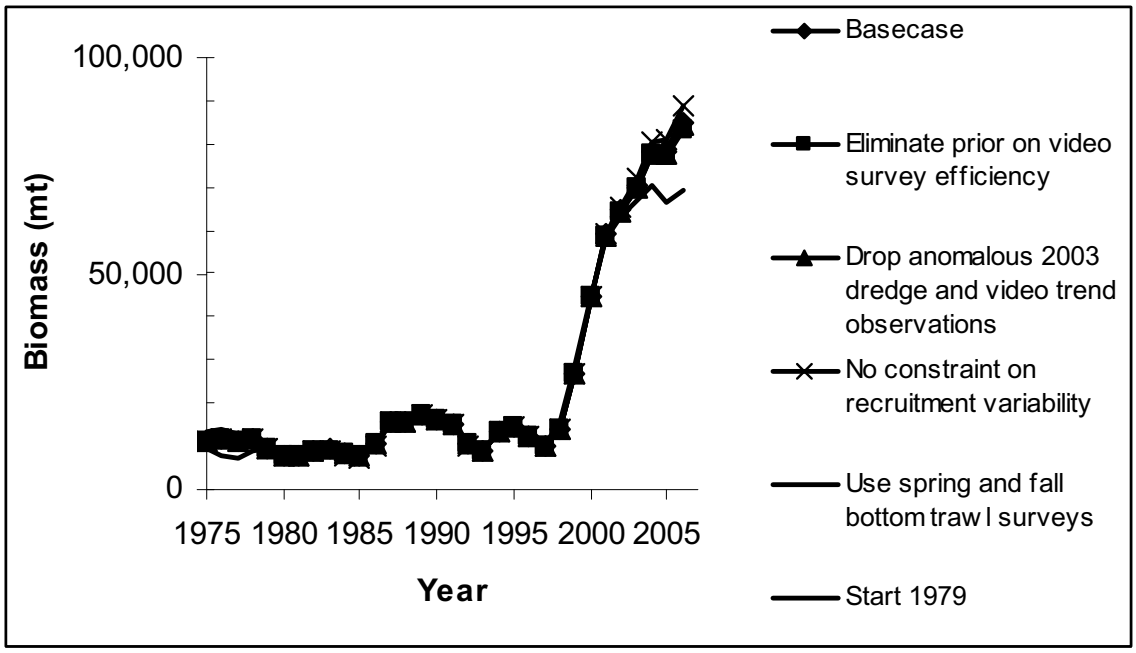


Figure B5-20. Biomass estimates for sea scallops in the Mid-Atlantic Bight from the basecase and a variety of sensitivity analysis runs.

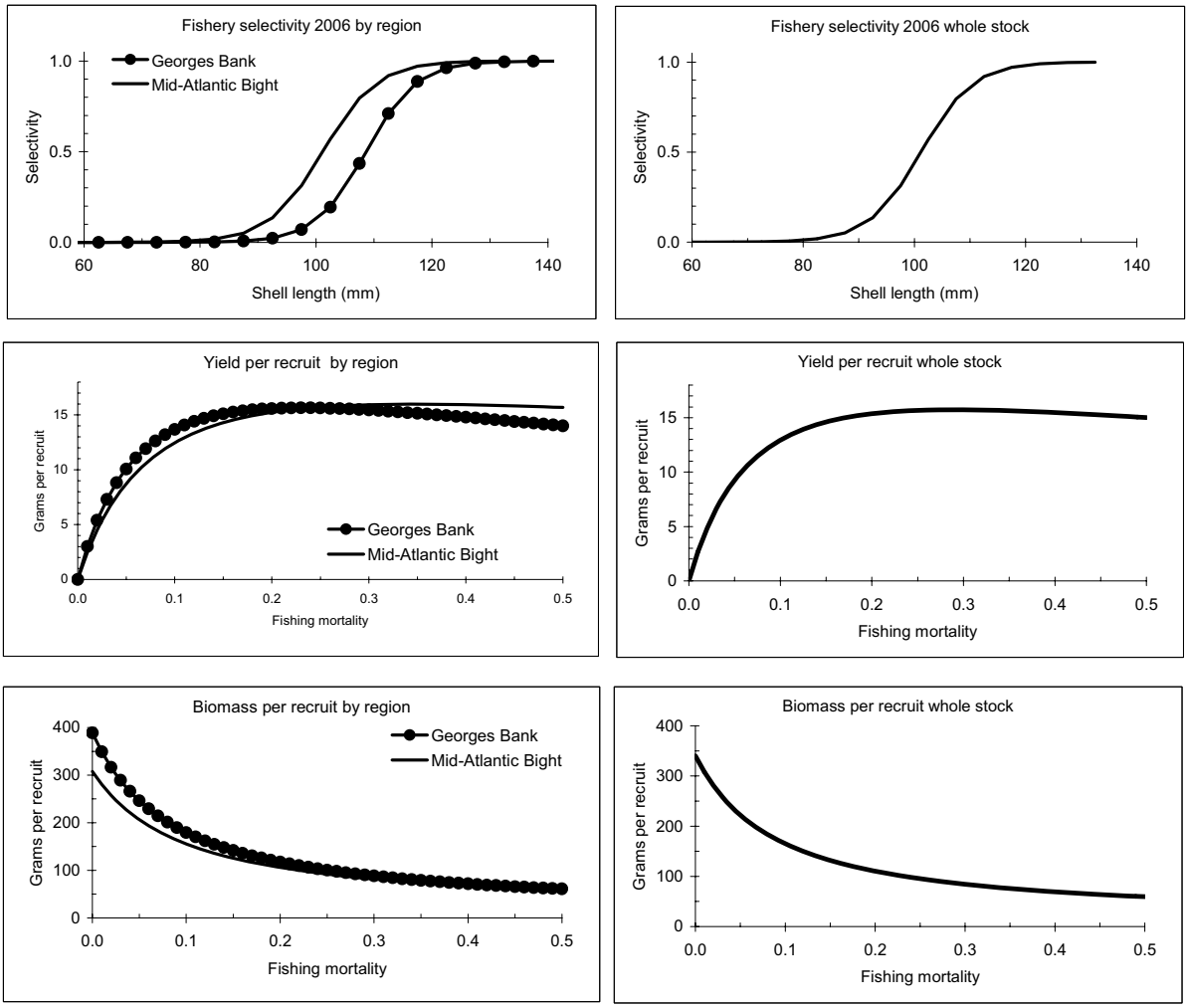


Figure B6-1. Fishery selectivity, yield per recruit, and biomass per recruit curves for the Mid-Atlantic Bight, Georges Bank and for the whole stock. Estimates for the whole stock are averages weighted by median recruitment during 1983-2006 in the Mid-Atlantic Bight and Georges Bank. The whole stock selectivity curve was not used in calculations and is shown as information only.

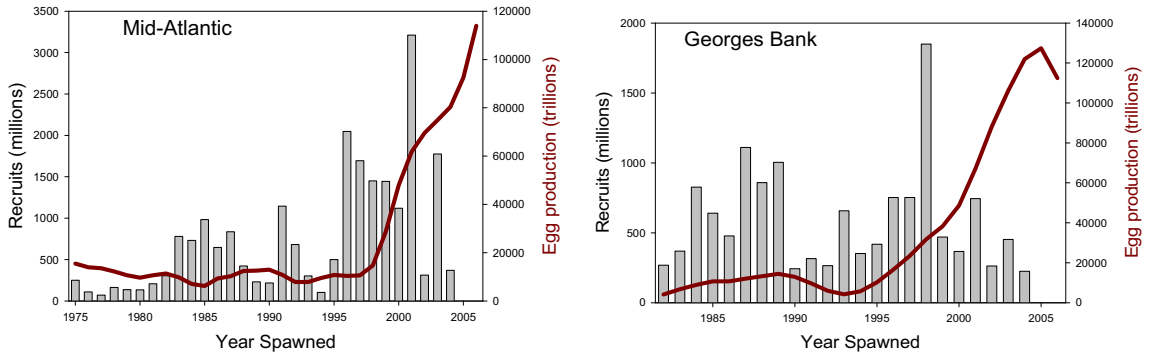


Figure B6-2. Sea scallop recruitment (bars) and egg production (lines) in the Mid-Atlantic and Georges Bank.

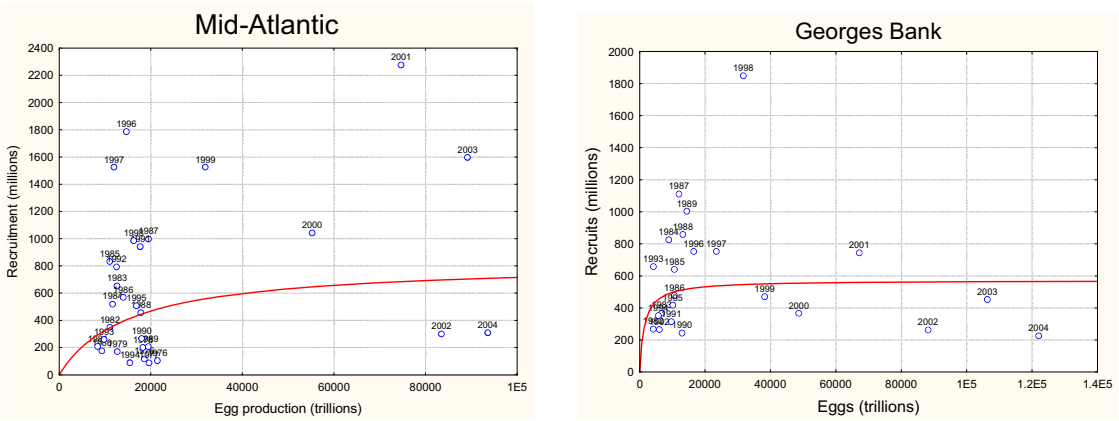


Figure B6-3. Stock-recruit plots and estimated Beverton-Holt stock-recruitment fits for the Mid-Atlantic and Georges Bank.

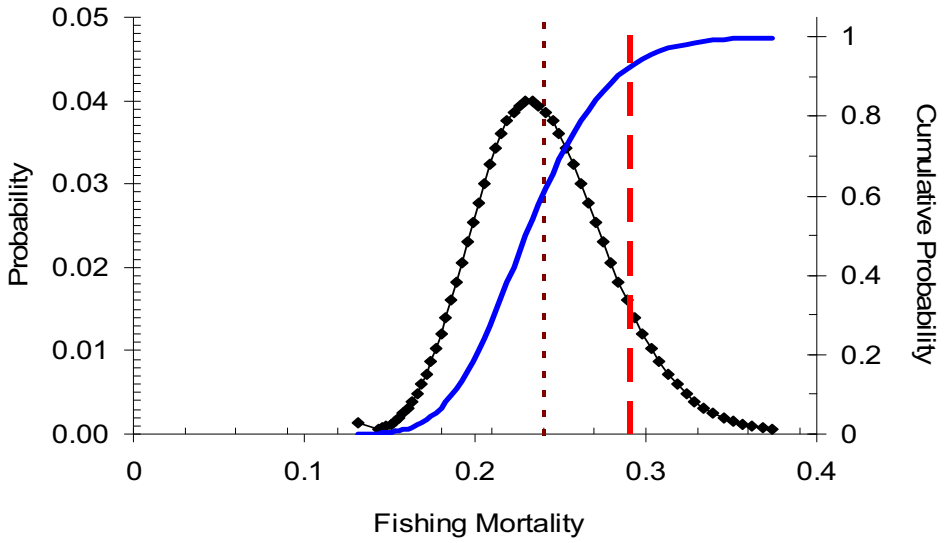


Figure B7-1. Uncertainty in estimated fishing mortality during 2006 from the (baseline) CASA model run. The proposed (dashed line) and current (dotted line) overfishing thresholds are shown.

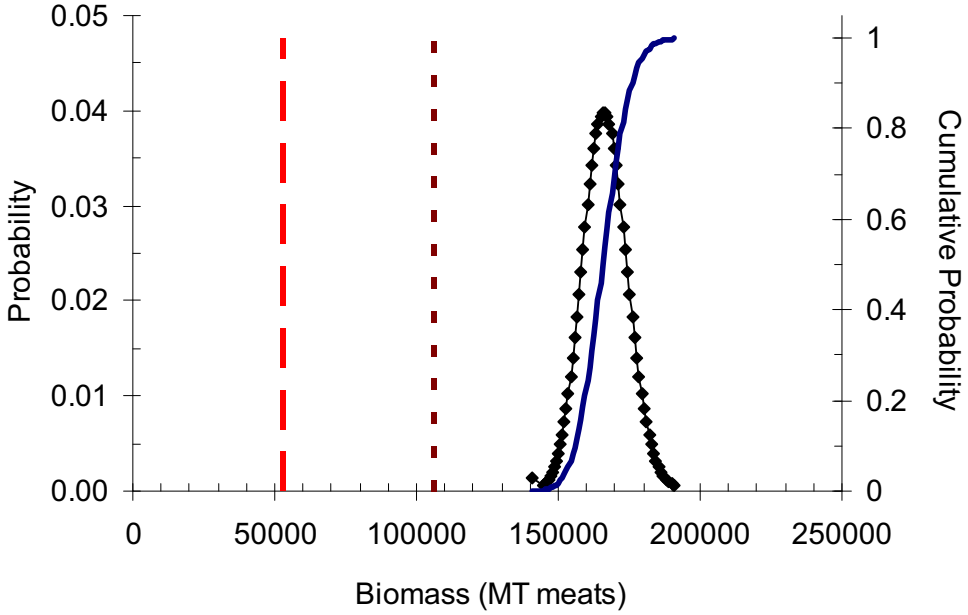
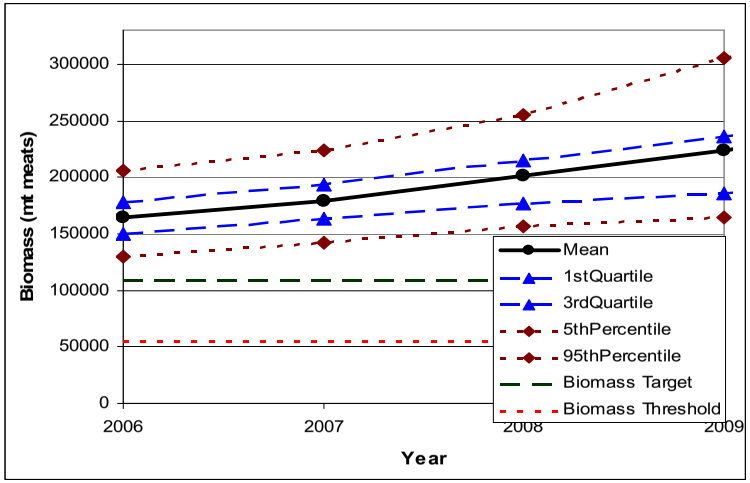
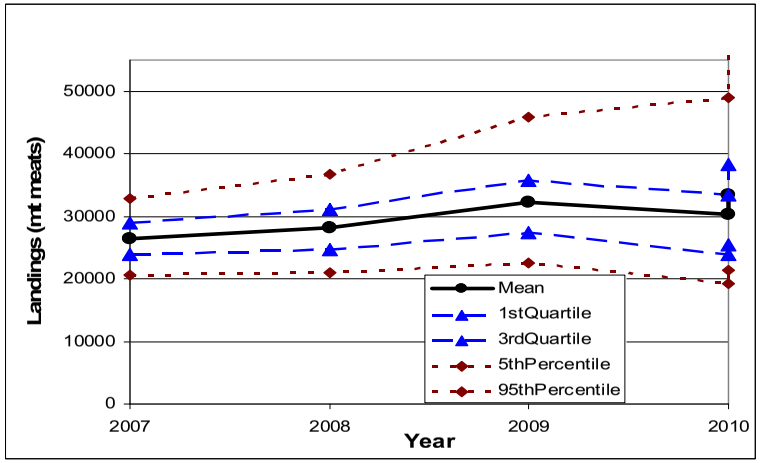


Figure B7-2. Uncertainty in estimated biomasses from the (baseline) CASA model run. The new proposed biomass target (dotted line) and threshold (dashed line) are also shown.

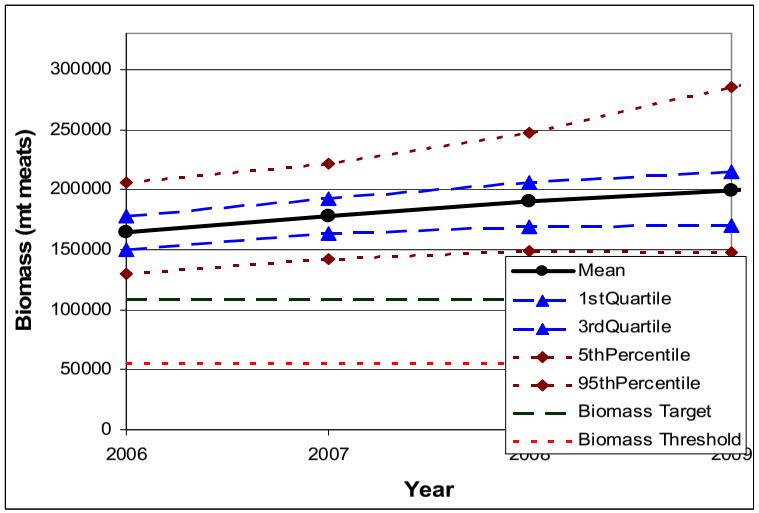
(a)



(b)



(c)



(d)

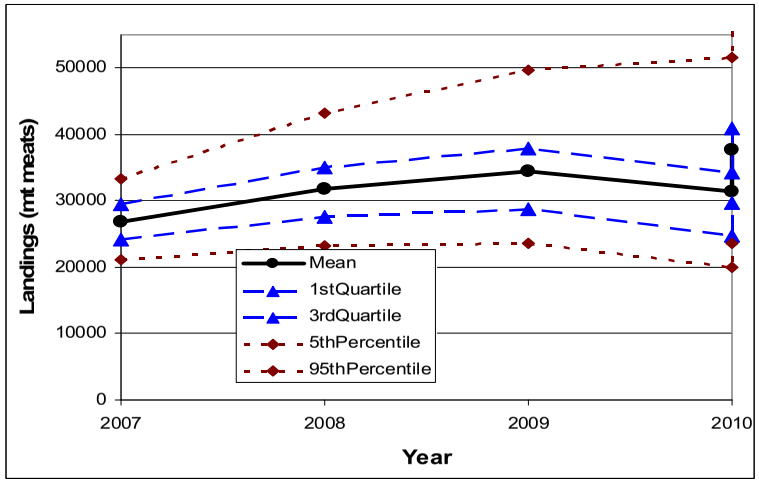


Figure B8-1. Short-term projections of the US sea scallop biomass (a, c) and landings (b, d) assuming 2007-2009 fishing mortalities are F = 0.20 (a, b) and F = 0.24 (c, d). The mean of 400 stochastic runs is shown, together with the 5th, 25th, 75th, and 95th percentiles. The simulations were initialized in July 2006, so that biomass estimates are for July, and landings in a given year represent landings from July of the previous year until June of that year.

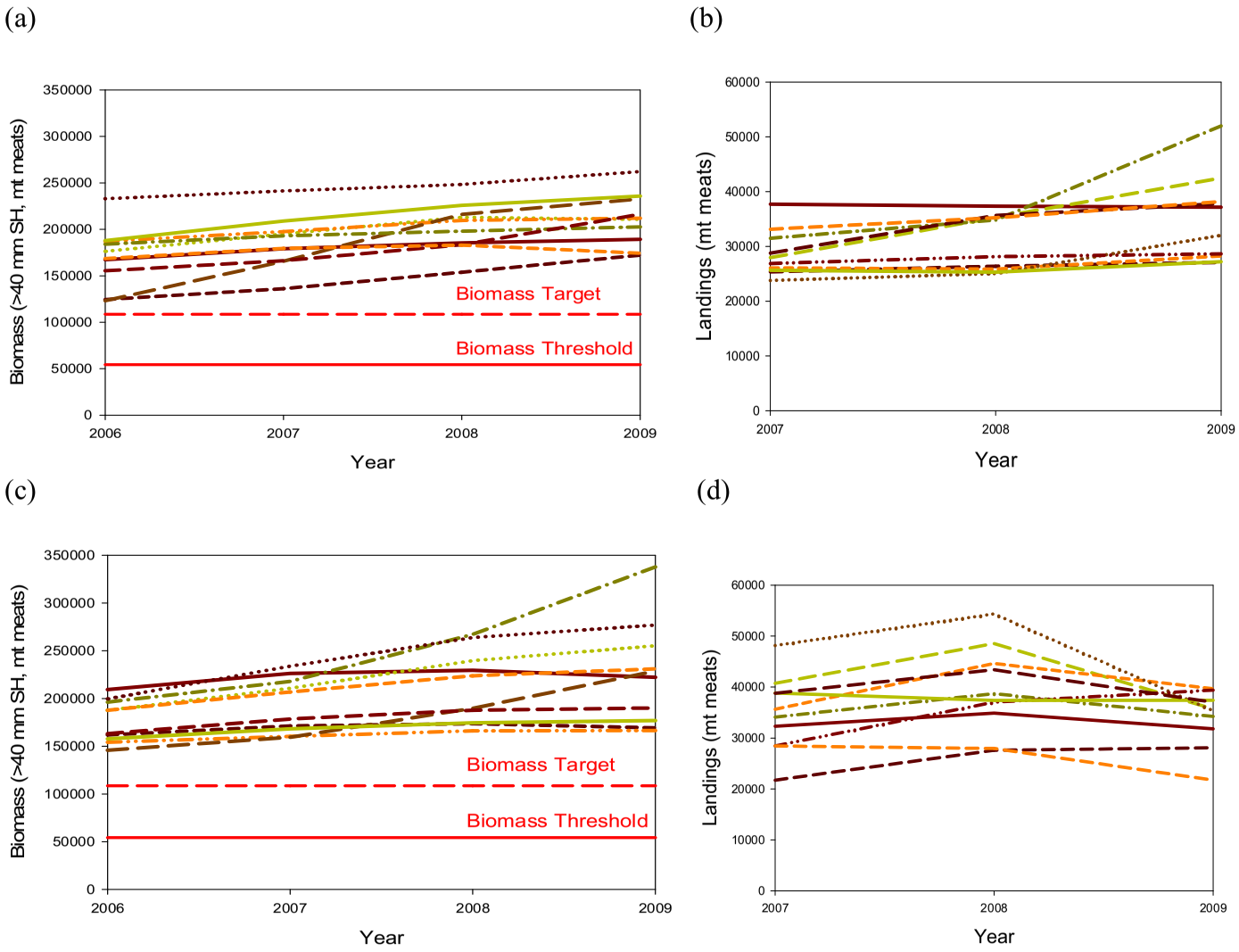


Figure B8-2. Ten example trajectories of the short-term sea scallop projections with differing initial population bootstraps and stochastic recruitment streams. Sea scallop biomass (a, c) and landings (b, d) assume 2007-2009 fishing mortalities are F = 0.20 (a, b) and F = 0.24 (c, d). The simulations were initialized in July 2006, so that biomass estimates are for July, and landings in a given year represent landings from July of the previous year until June of that year.