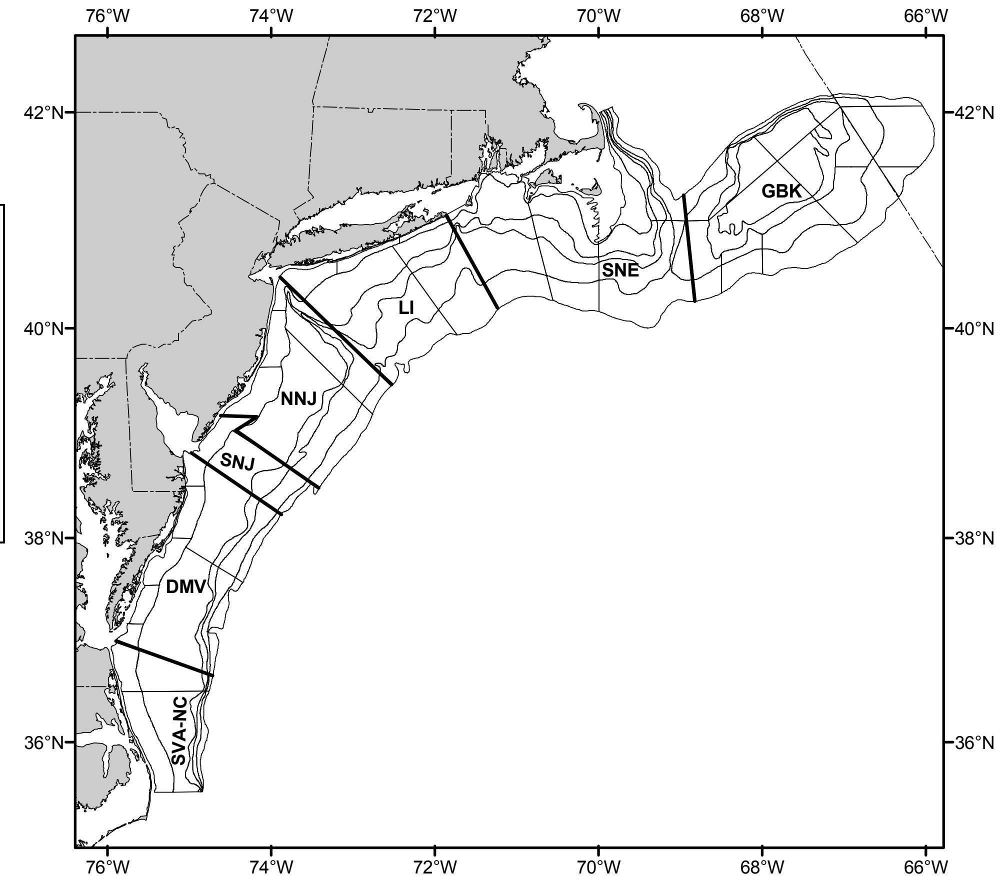
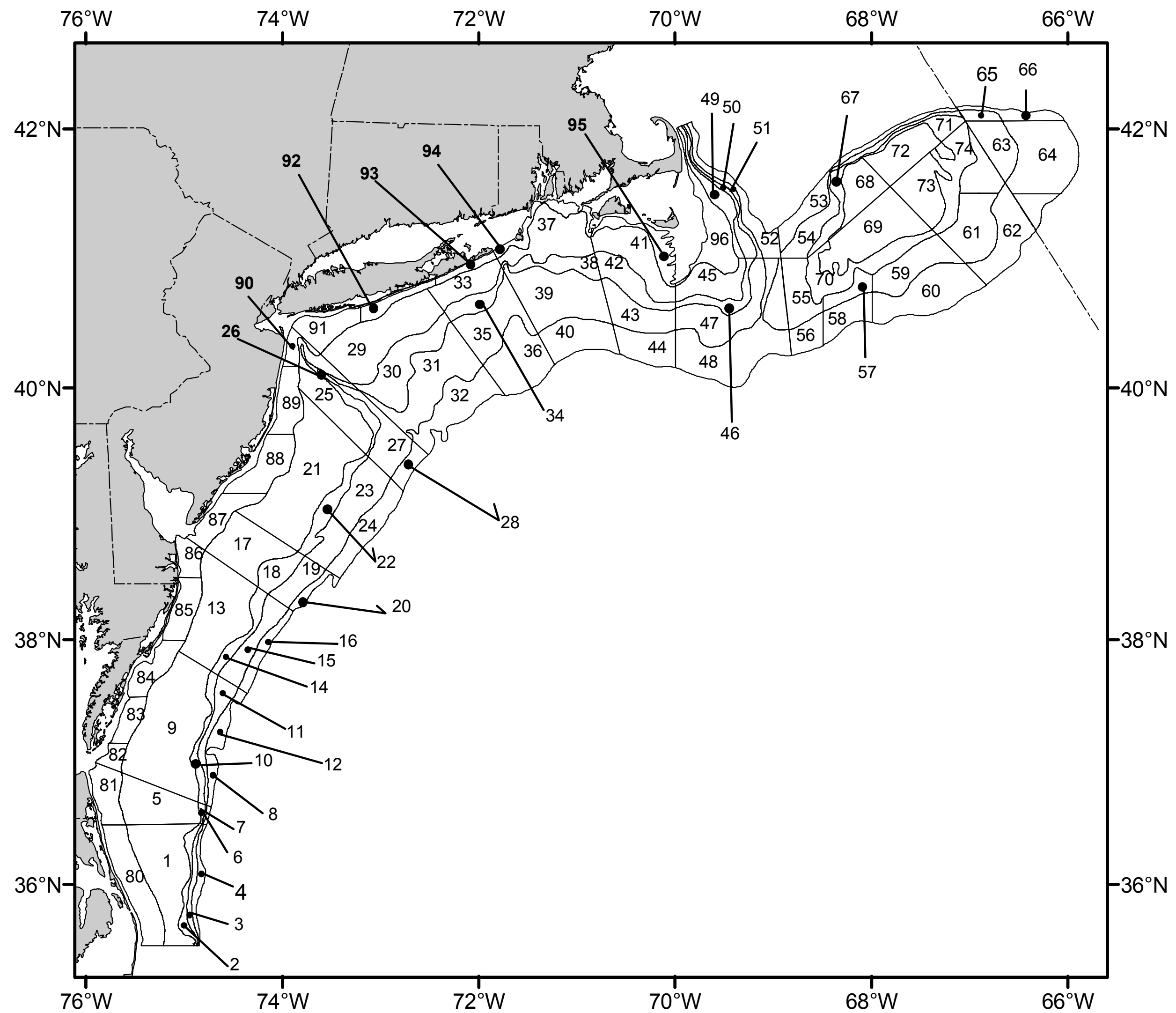
Figure A1. Regions and strata used in NMFS clam surveys and assessments.
USA – Canada border is shown. Depths of strata, in fathoms, are: 5-15, 16-25, 26-30, 31-40, and 41-60.





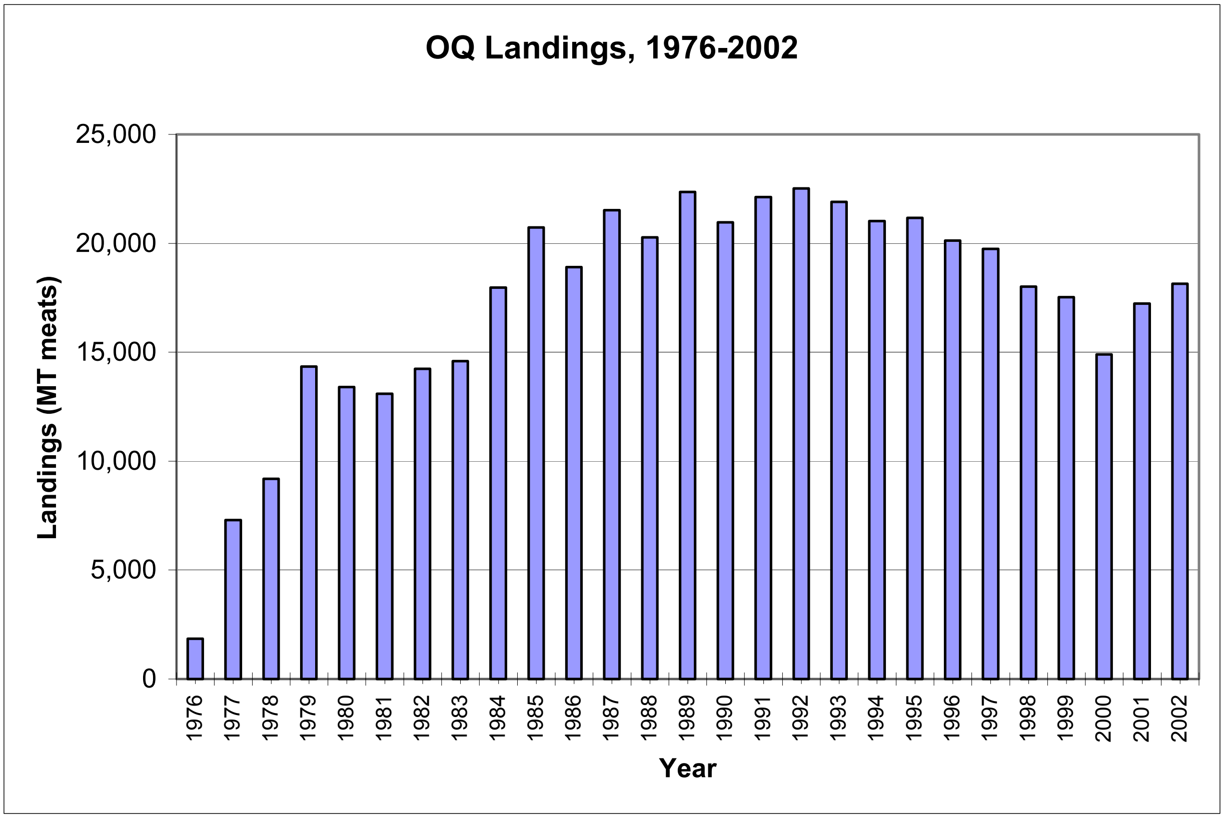


Figure A2. Landings of ocean quahogs from EEZ waters, 1976-2002.

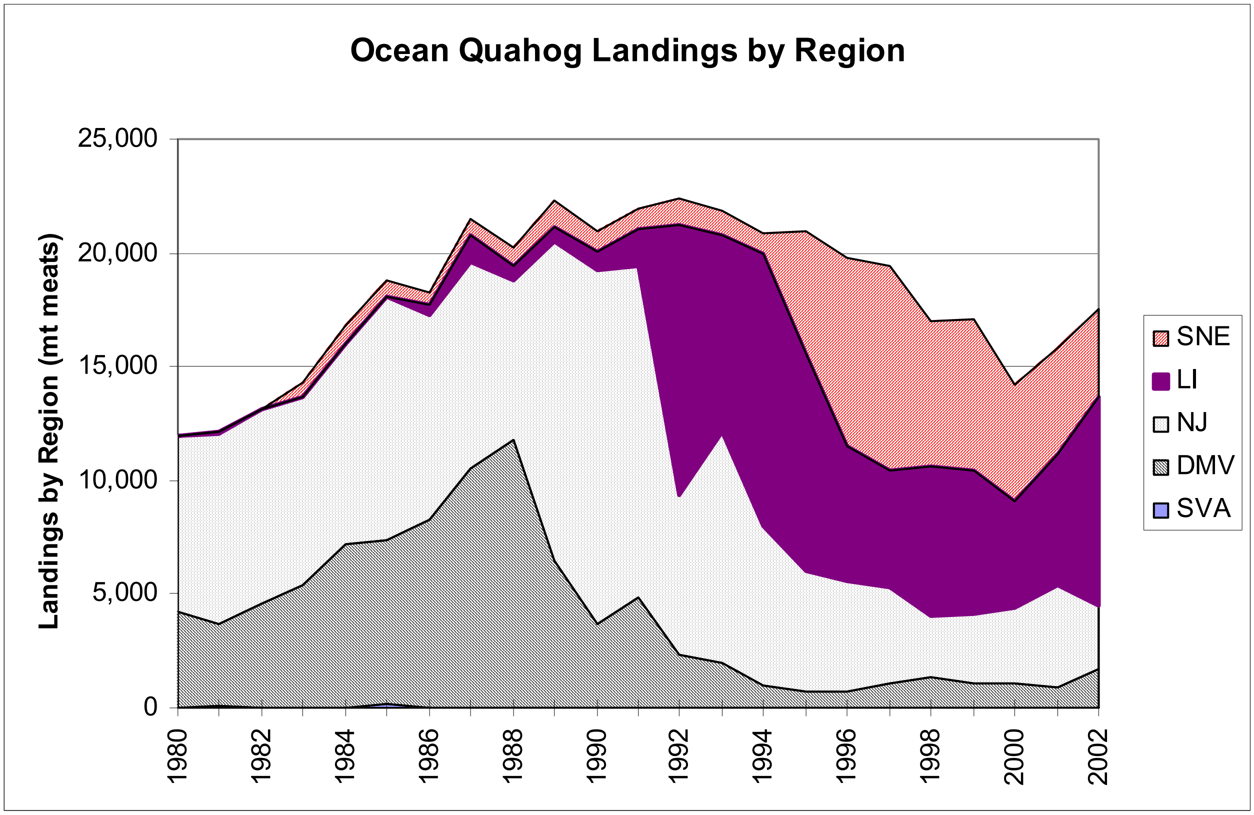


Figure A3. Ocean quahog landings in weight (calculated from number of bushels reported in logbooks) for the US EEZ, by stock assessment region. GBK not shown because the landings and effort were zero.

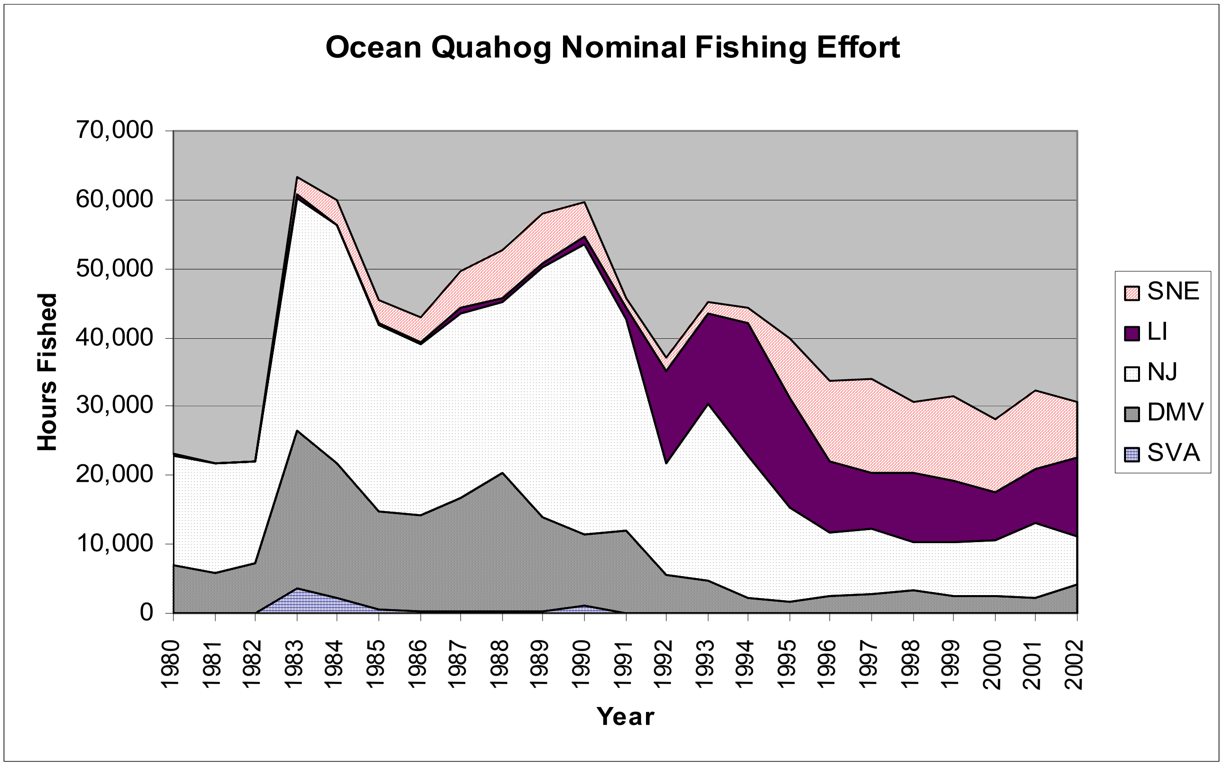


Figure A4. Nominal fishing effort for ocean quahogs in the US EEZ, by stock assessment region from logbooks. GBK not shown because the landings were zero.

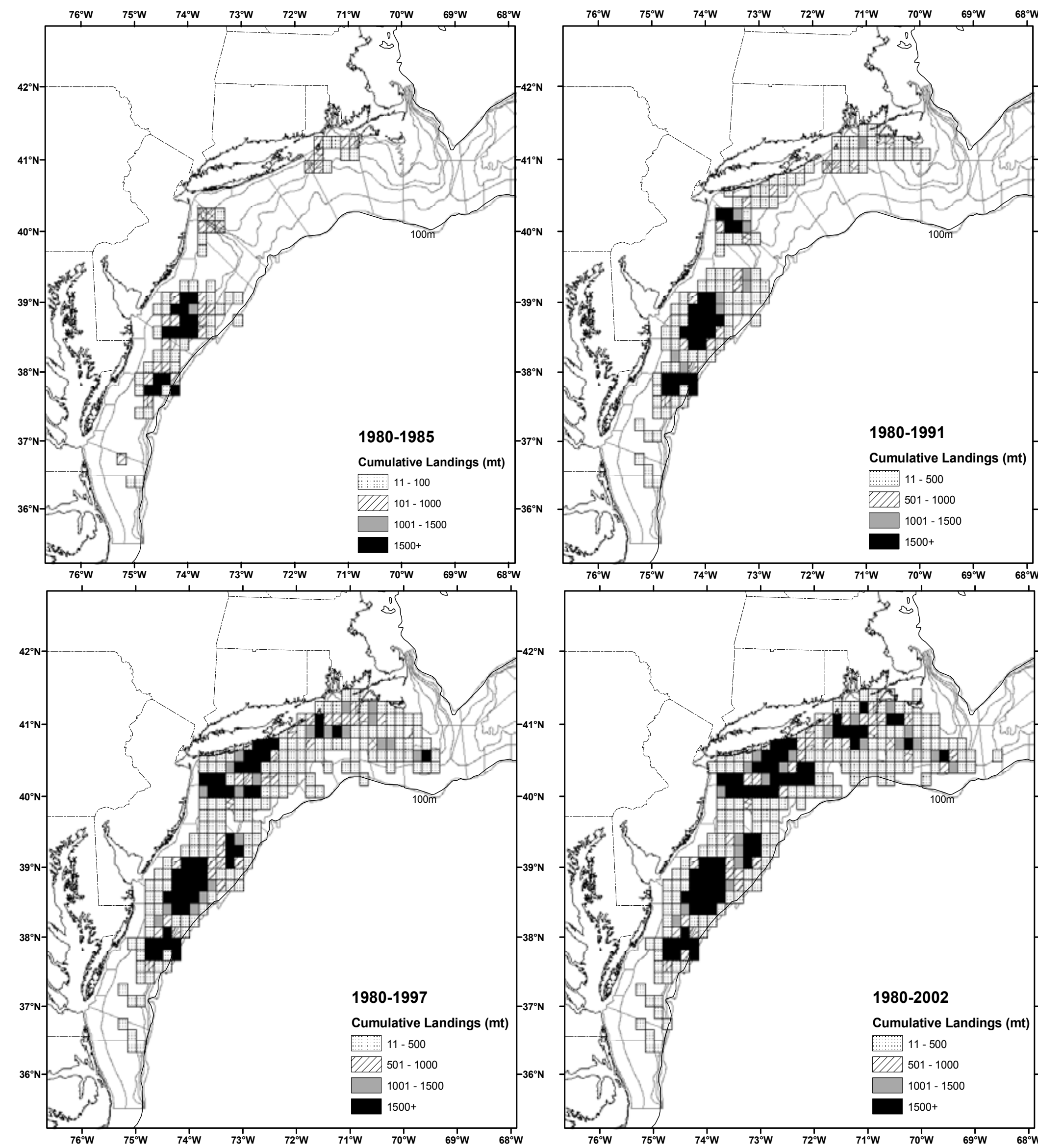


Figure A5. Cumulative landings of ocean quahogs from the EEZ, by TNMS.

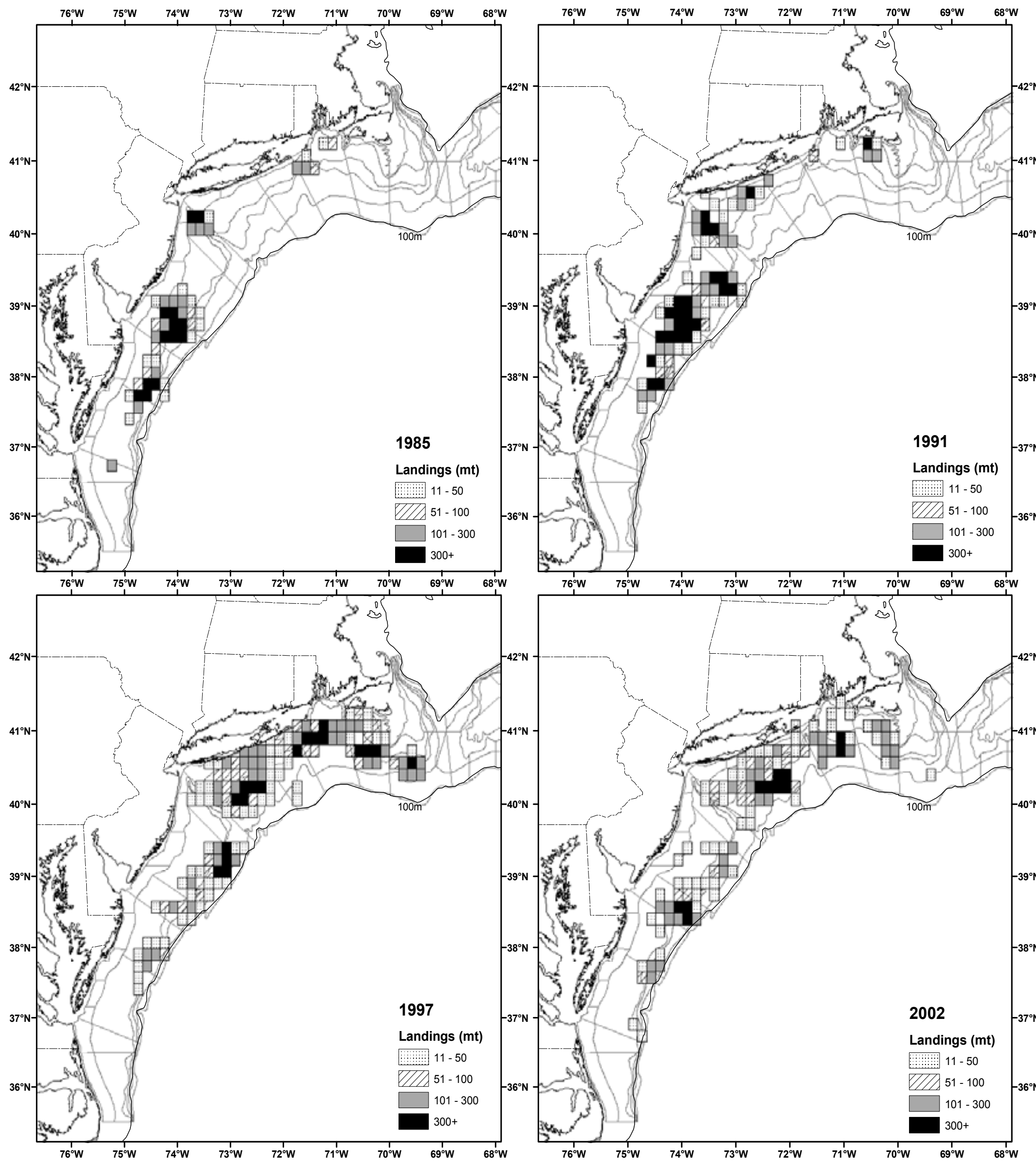


Figure A6. Annual landings of ocean quahogs from the EEZ, by TNMS.

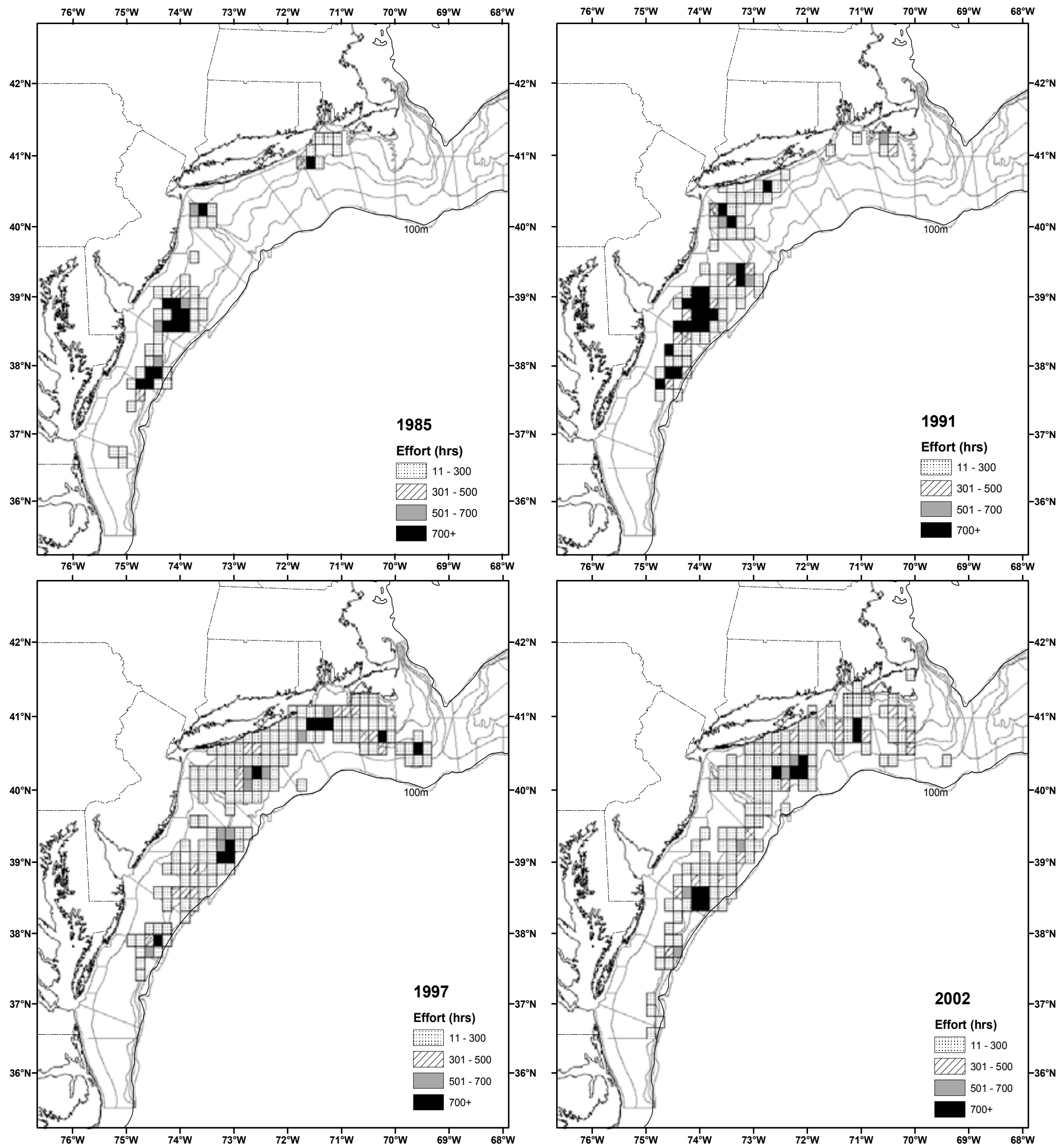


Figure A7. Annual fishing effort for ocean quahogs from the EEZ, by TNMS.

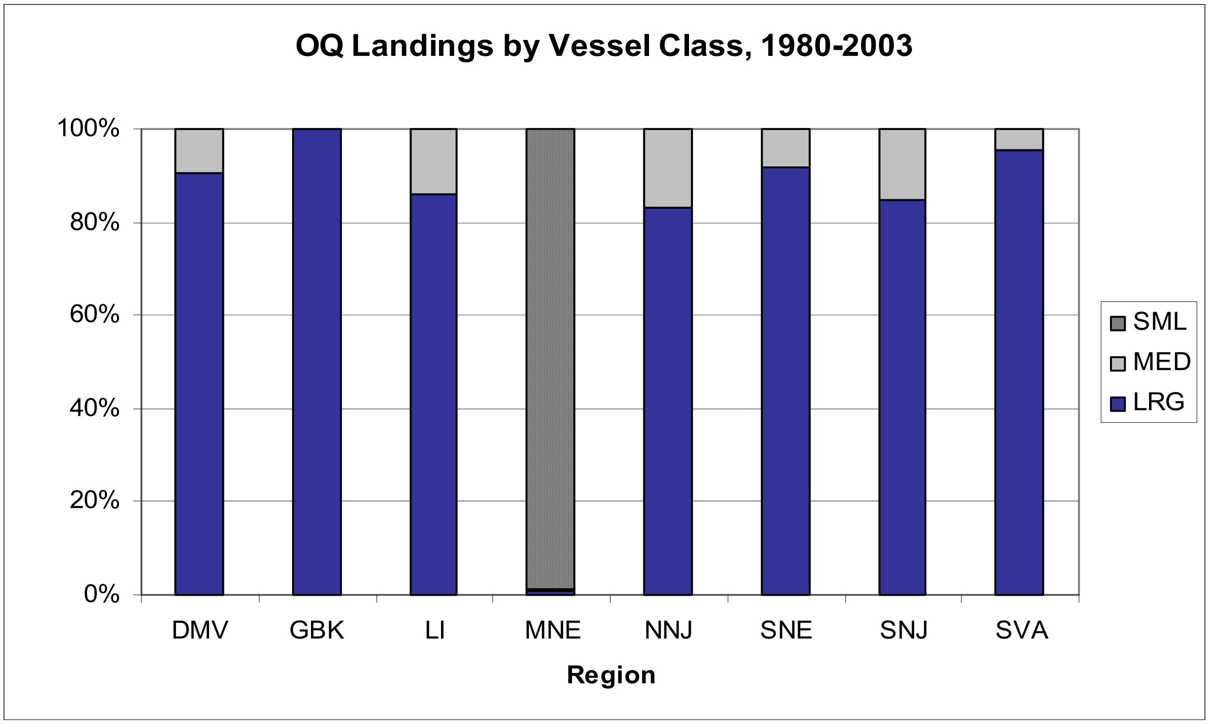


Figure A8. Landings by vessel class.

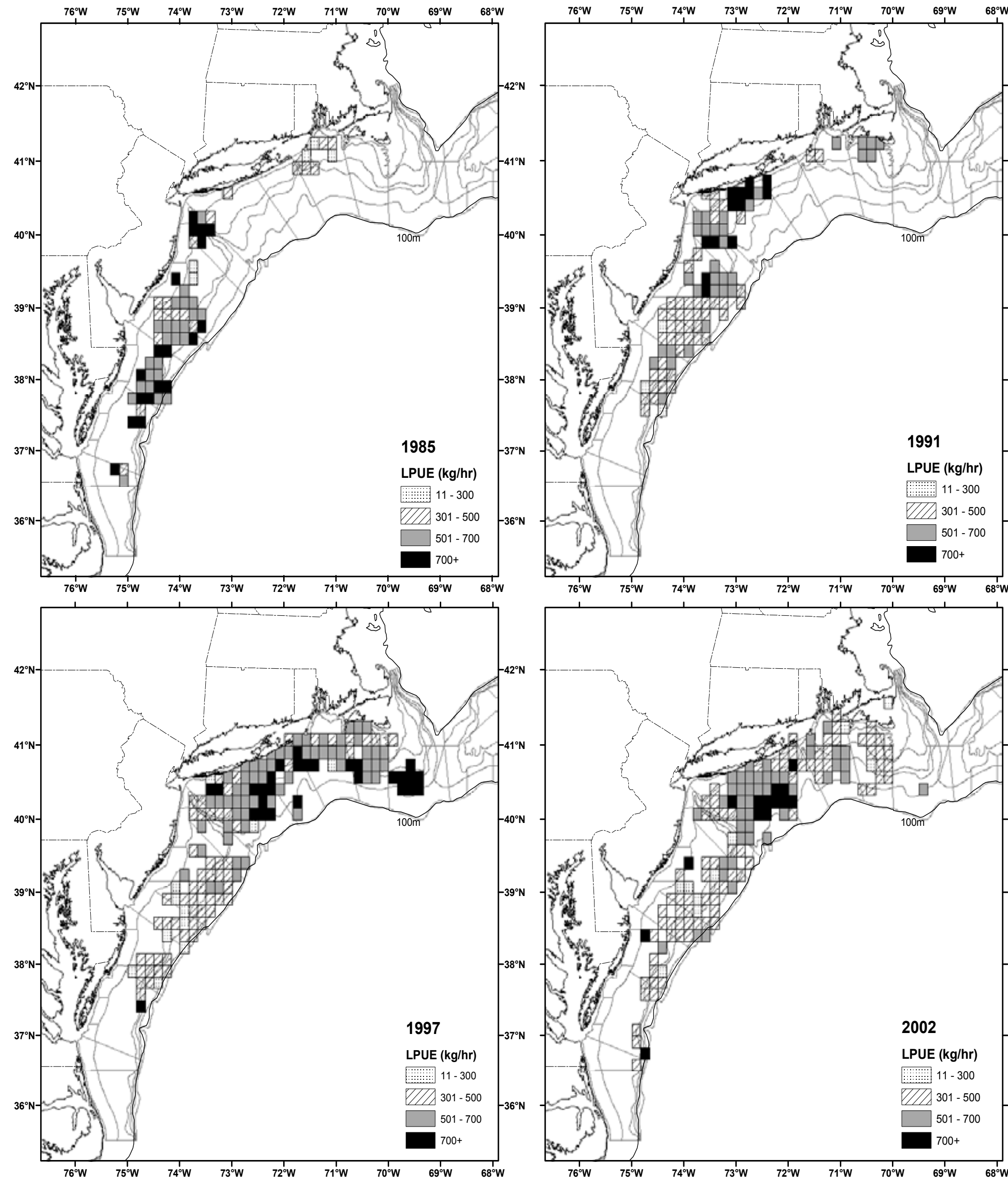


Figure A9. Landings per unit effort, by year and TNMS.

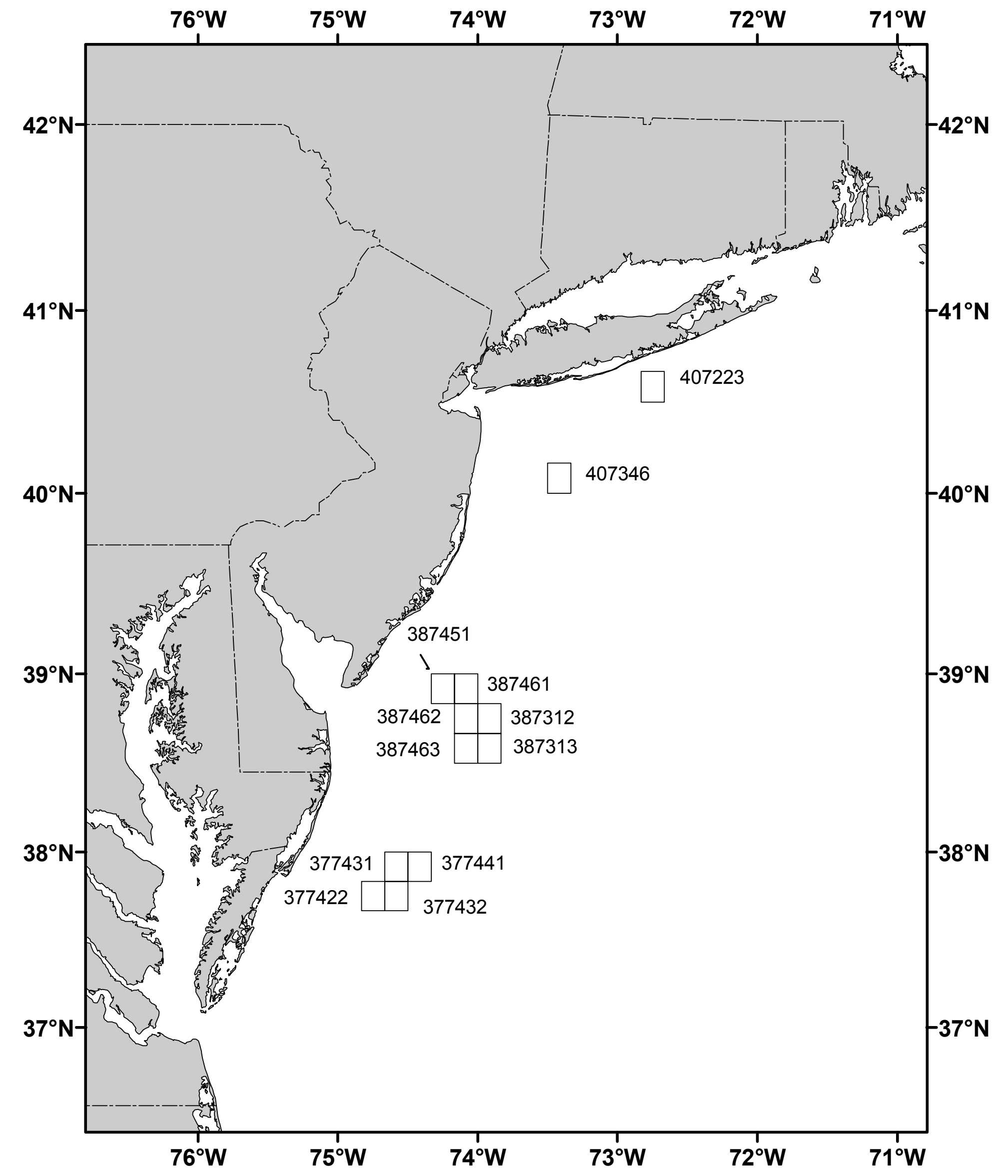


Figure A10. 12 ten-minute squares in the EEZ that have had the largest cumulative catch of ocean quahogs , 1980-2002.

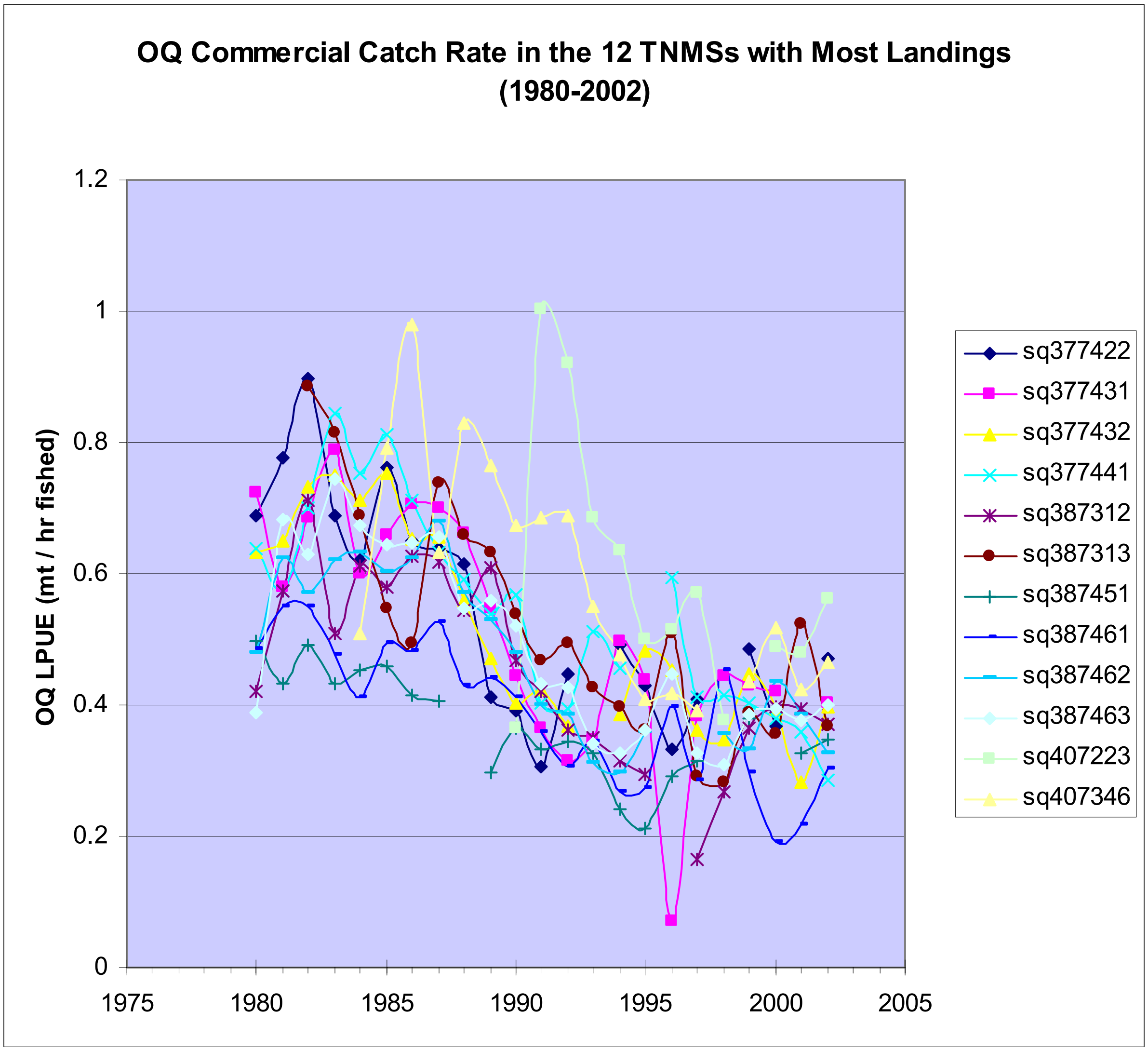
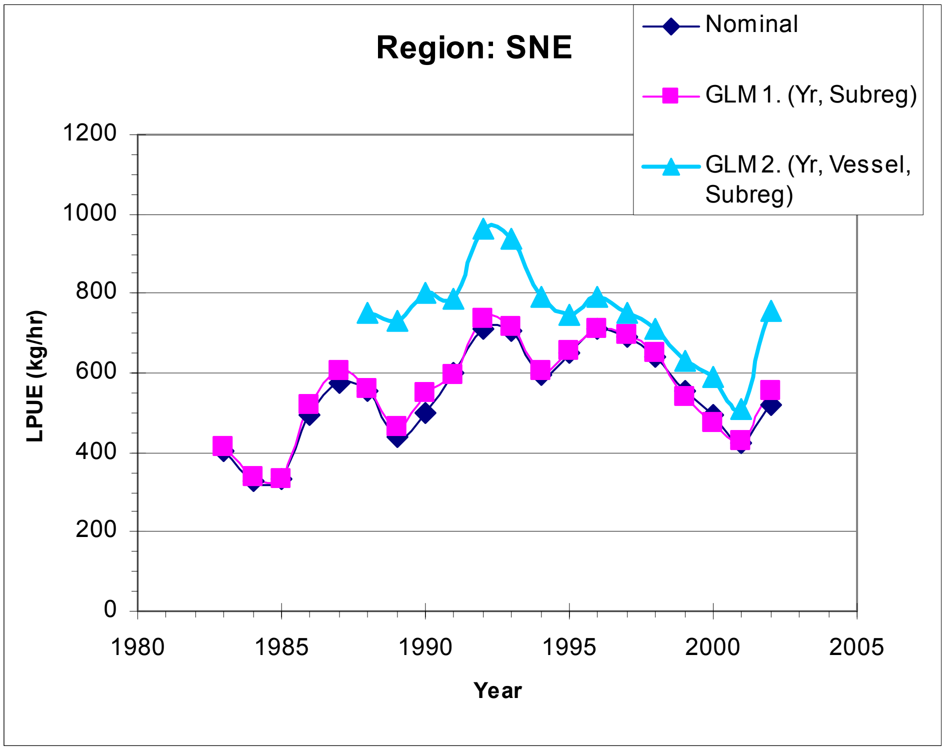


Figure A11. Commercial catch rates of large vessels in the 12 ten-minute squares in the EEZ that have had the largest cumulative catch of ocean quahogs , 1980-2002.



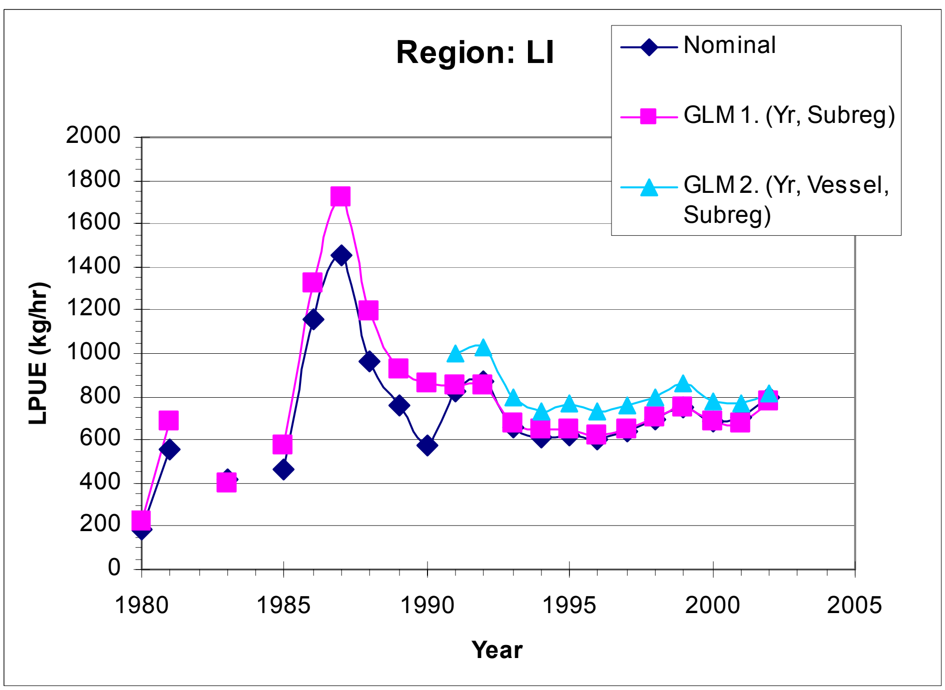
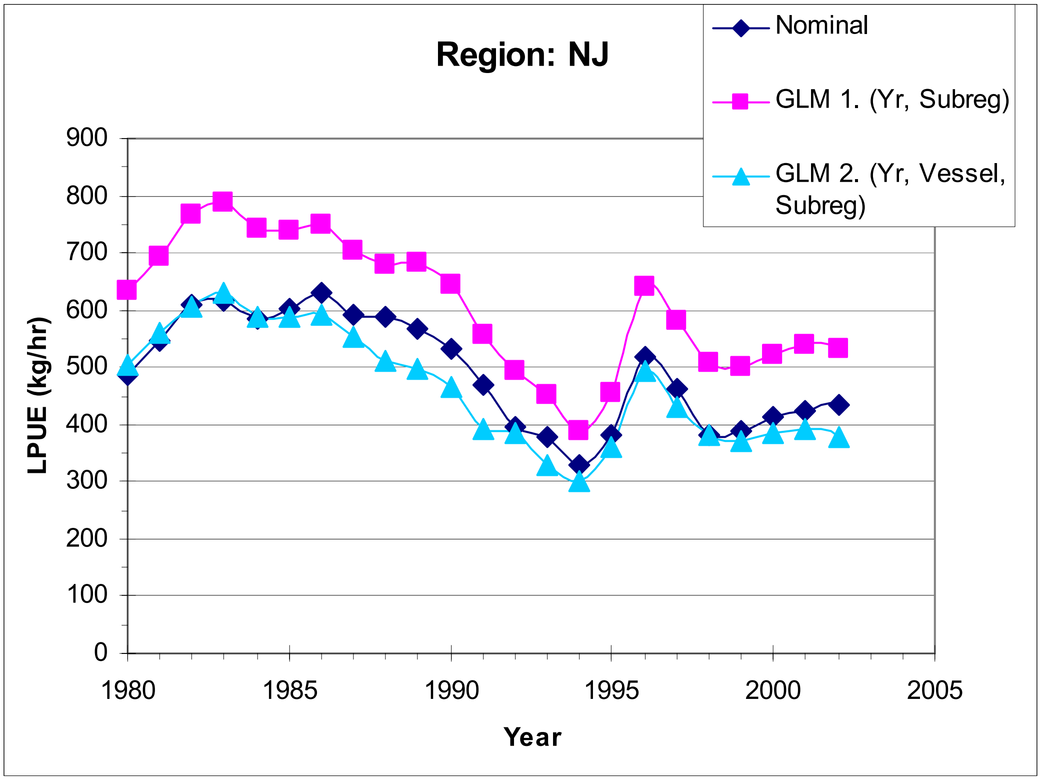


Figure A12. Landings per unit effort based on nominal values and 2 general linear models. Northern Regions.



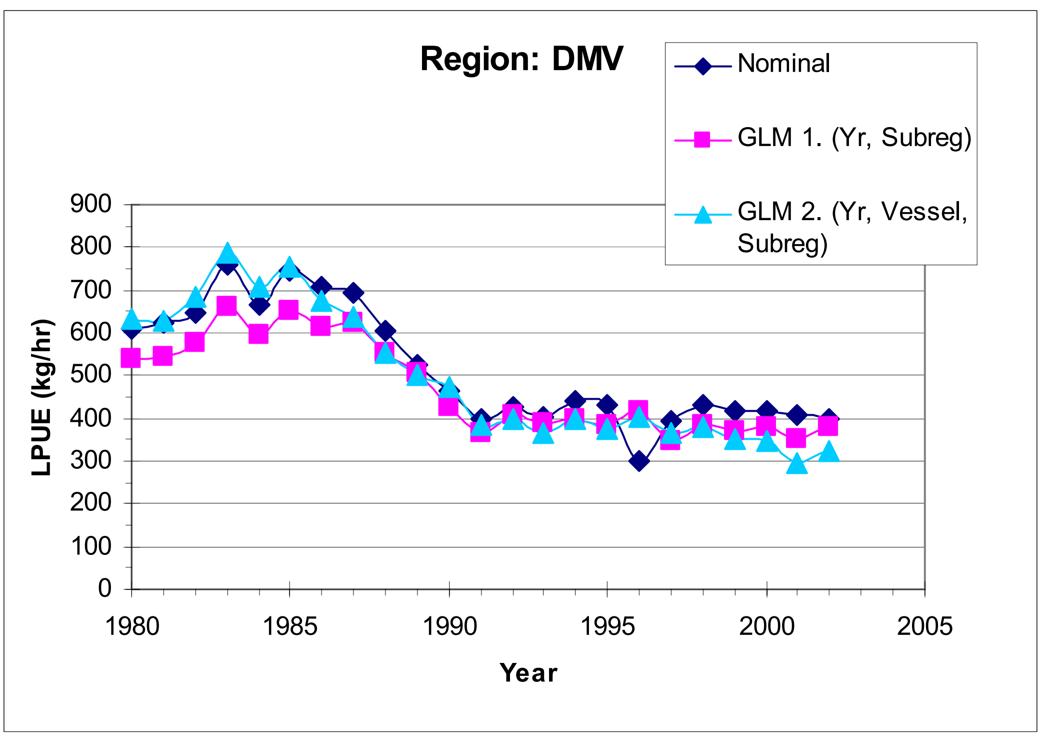


Figure A13. Landings per unit effort based on nominal values and 2 general linear models. Southern Regions.

Figure A14. Frequency distribution of commercial catch rates, by TNMS, over time (DMV).

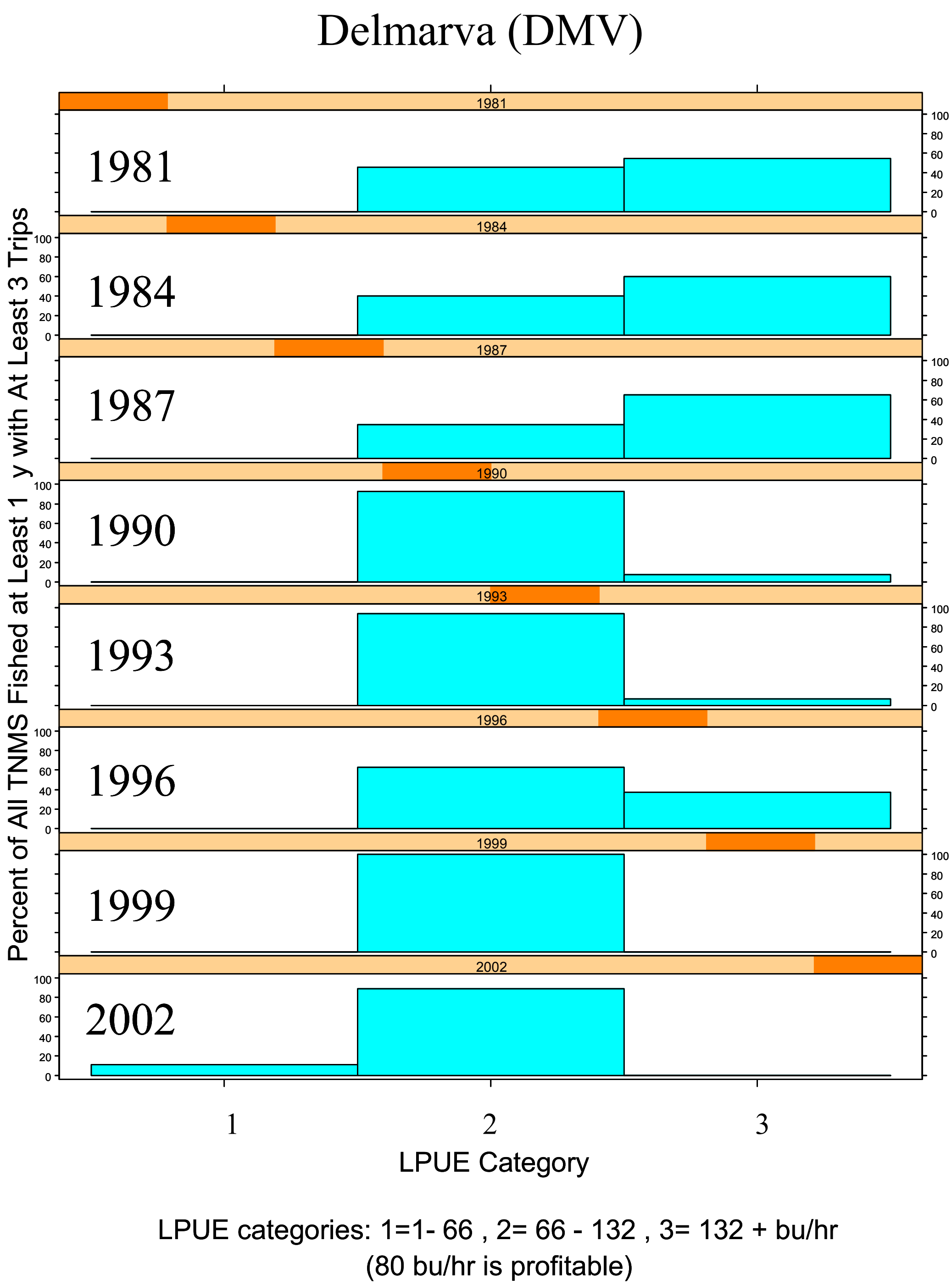
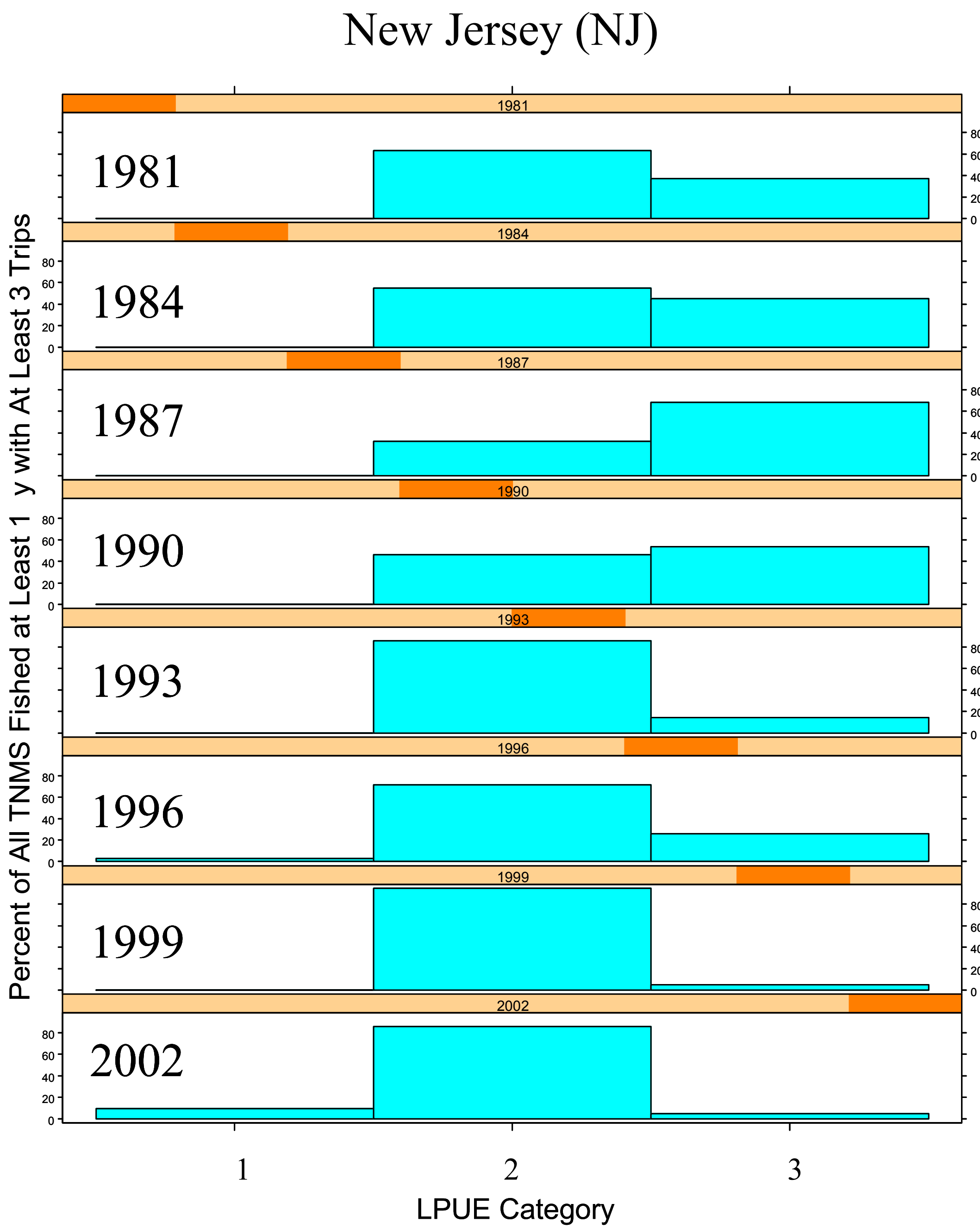
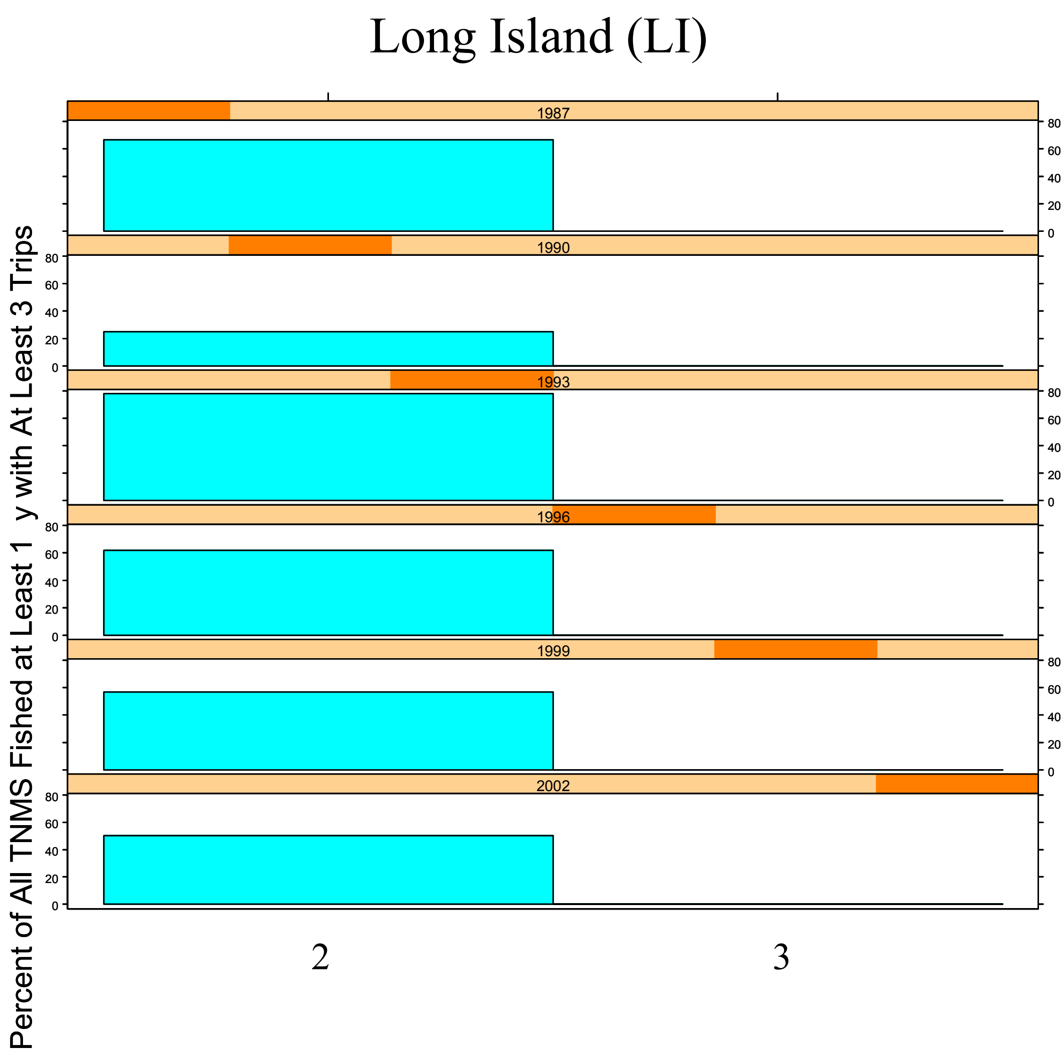


Figure A15. Frequency distribution of commercial catch rates, by TNMS, over time (NJ).



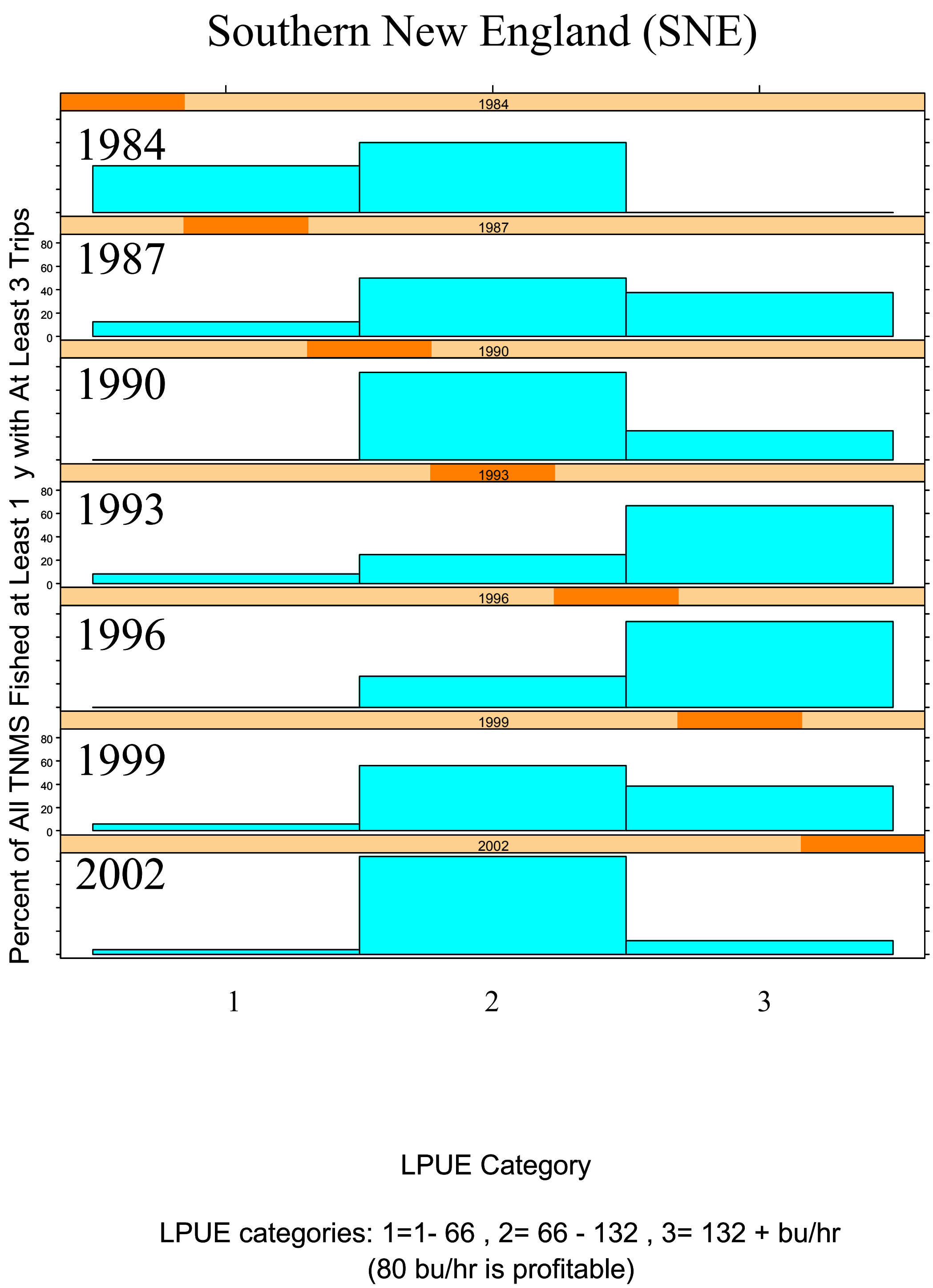
LPUE categories: 1=1- 66 , 2= 66 - 132 , 3= 132 + bu/hr
(80 bu/hr is profitable)

Figure A16. Frequency distribution of commercial catch rates, by TNMS, over time (LI).



LPUE categories: 1=1- 66 , 2= 66 - 132 , 3= 132 + bu/hr
(80 bu/hr is profitable)

Figure A17. Frequency distribution of commercial catch rates, by TNMS, over time (SNE).



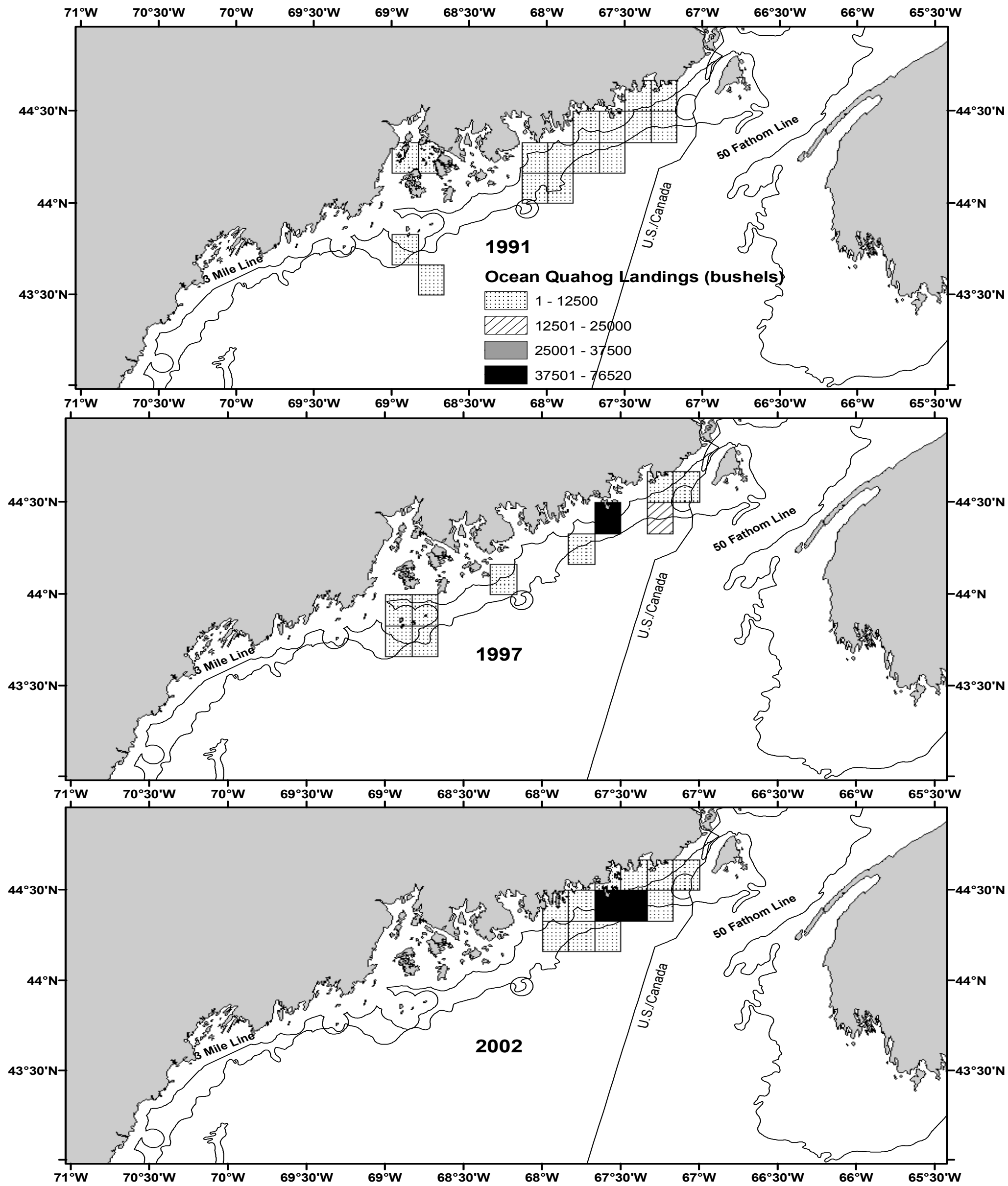


Figure A18. Ocean quahog landings from Ten Minute Squares (TNMS) off the coast of Maine.

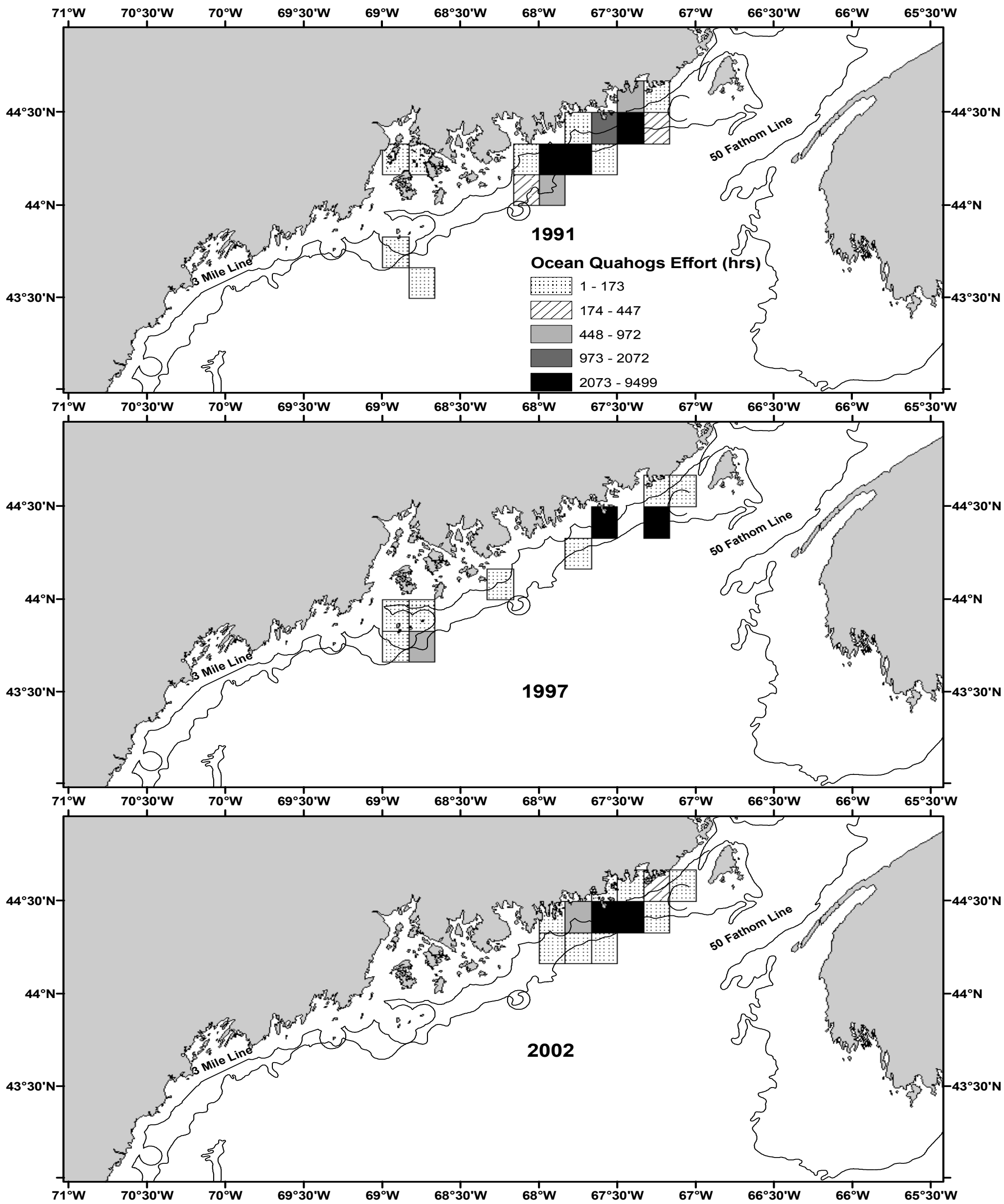


Figure A19. Ocean quahog fishing effort from Ten Minute Squares (TNMS) off the coast of Maine.

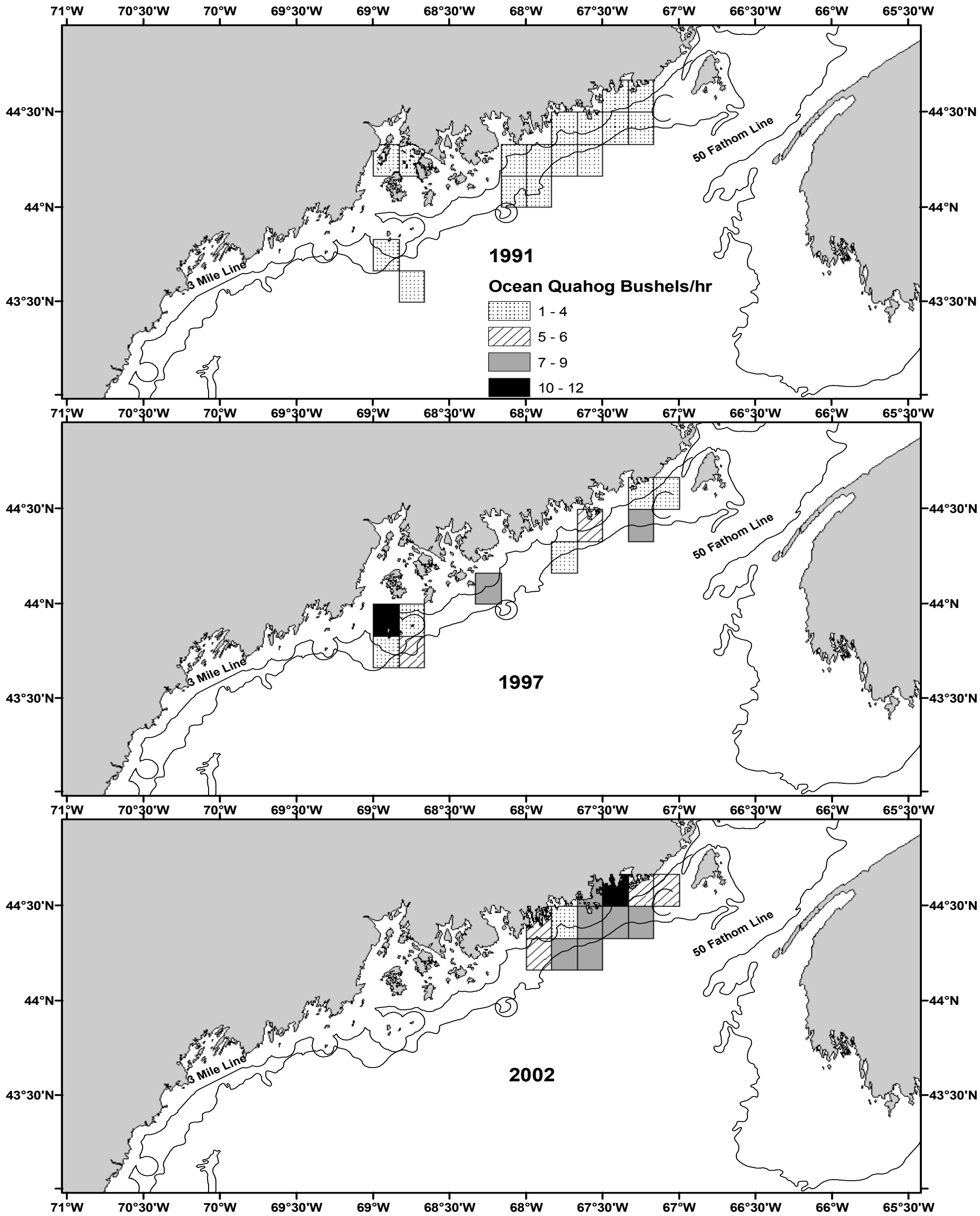


Figure A20. Ocean quahog landings per unit effort from Ten Minute Squares (TNMS) off the coast of Maine.

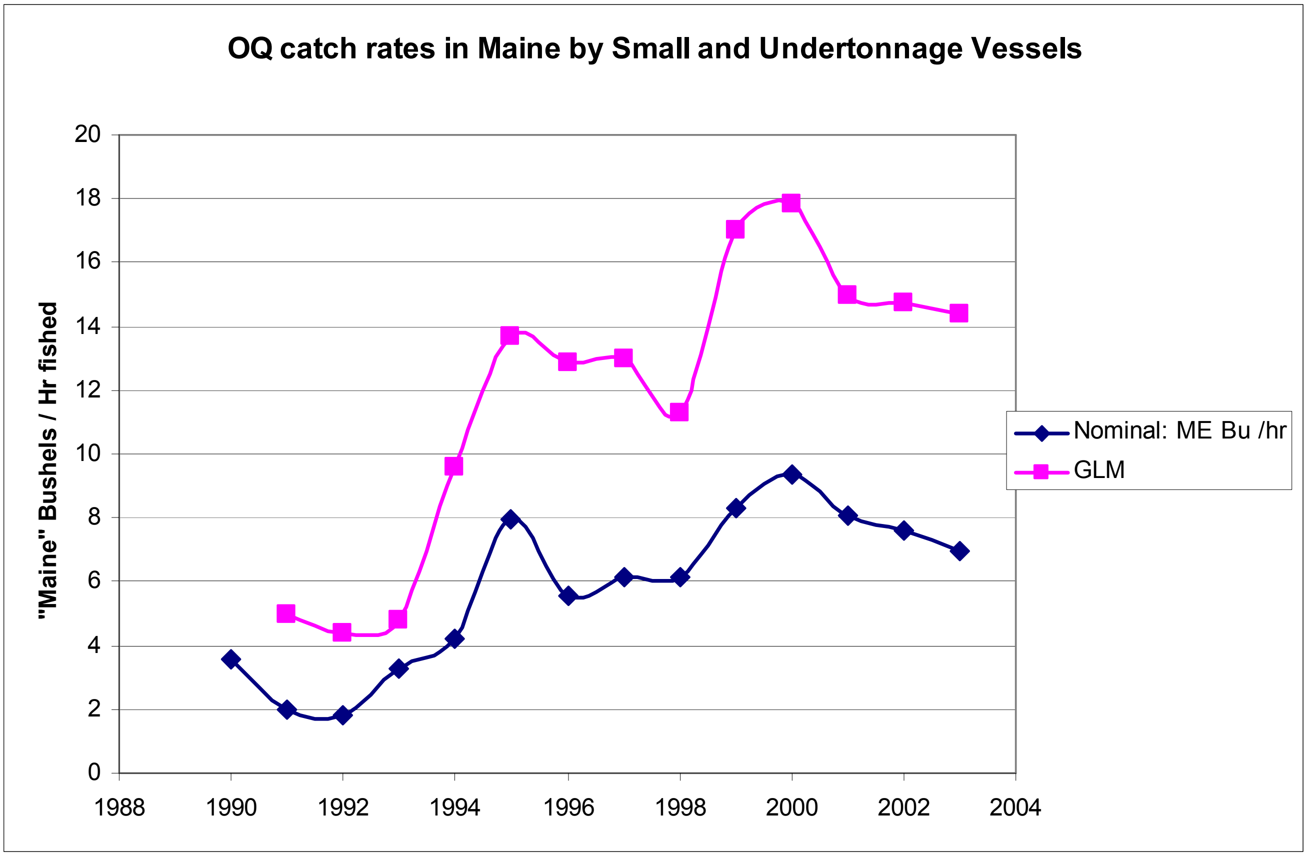


Figure A21. Ocean quahog landings per unit effort from off the coast of Maine. There are nominal values as well as standardized values from a General Linear Model (GLM).

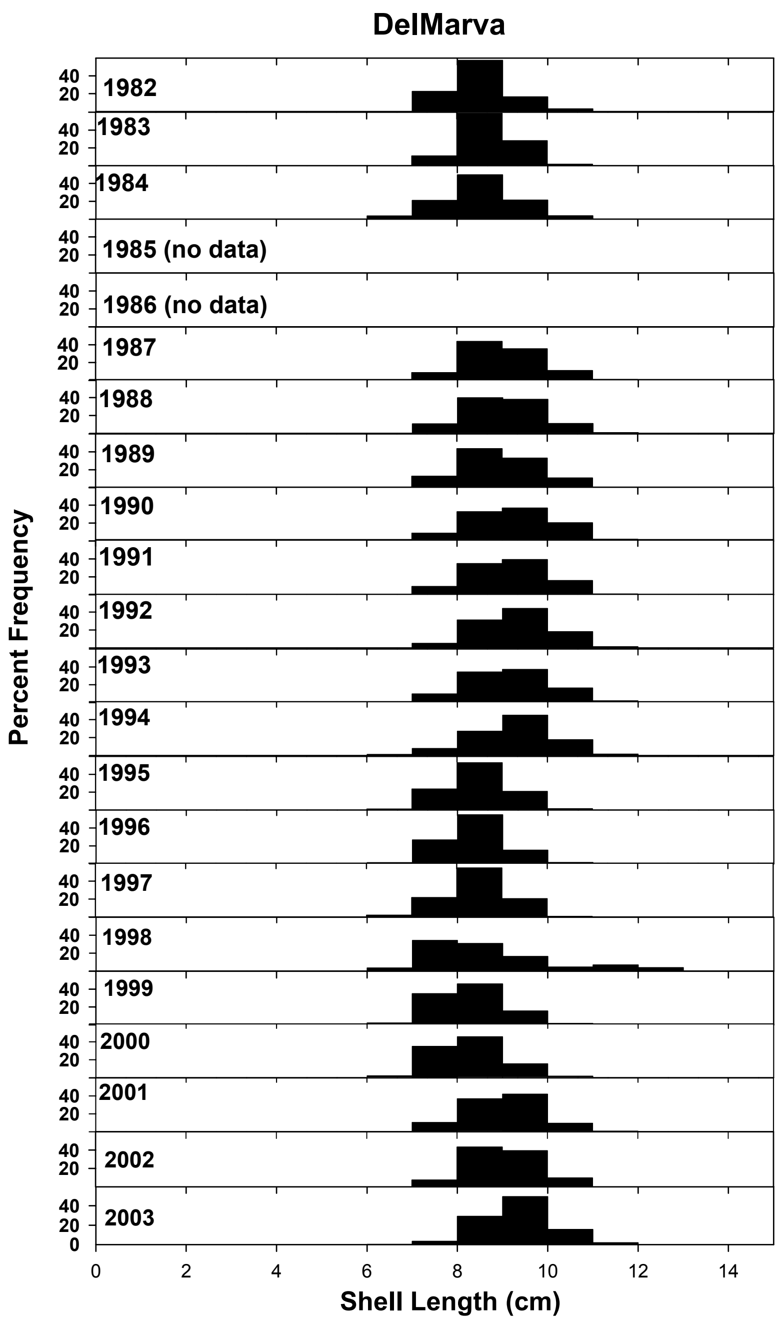


Figure A22. Length frequencies of ocean quahogs from port samples. Trips were catch-weighted.

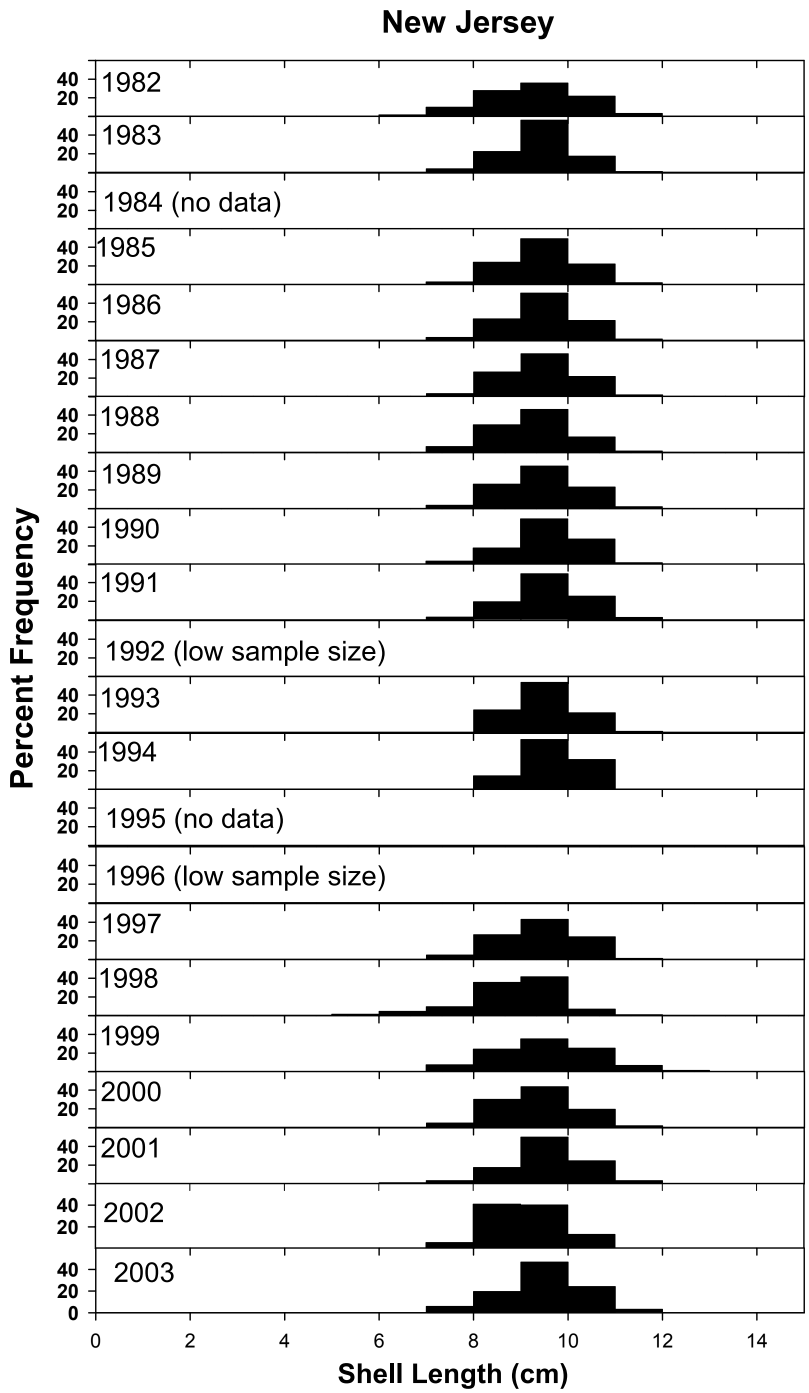


Figure A23. Length frequencies of ocean quahogs from port samples. Trips were catch-weighted.

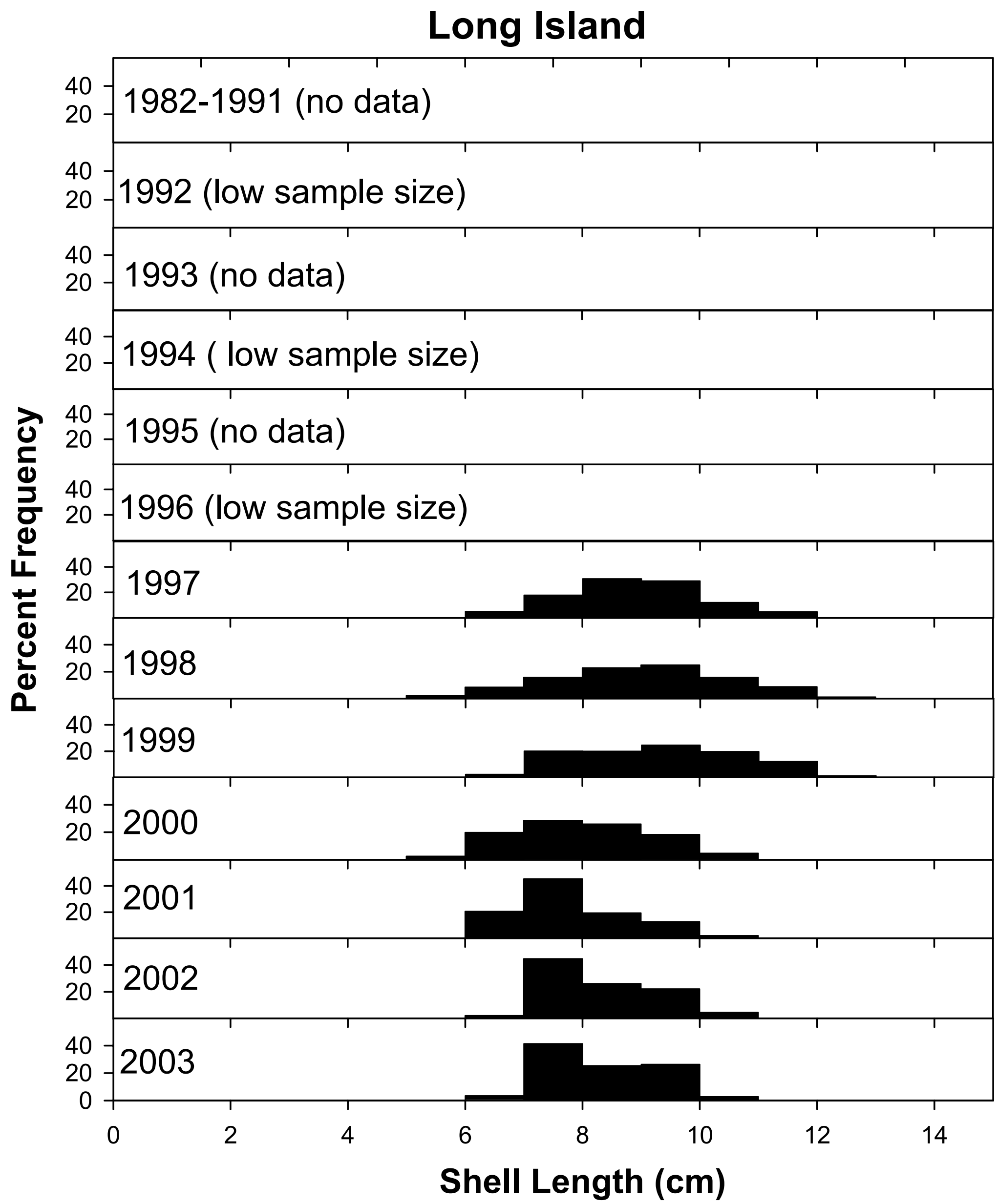


Figure A24. Length frequencies of ocean quahogs from port samples. Trips were catch-weighted.

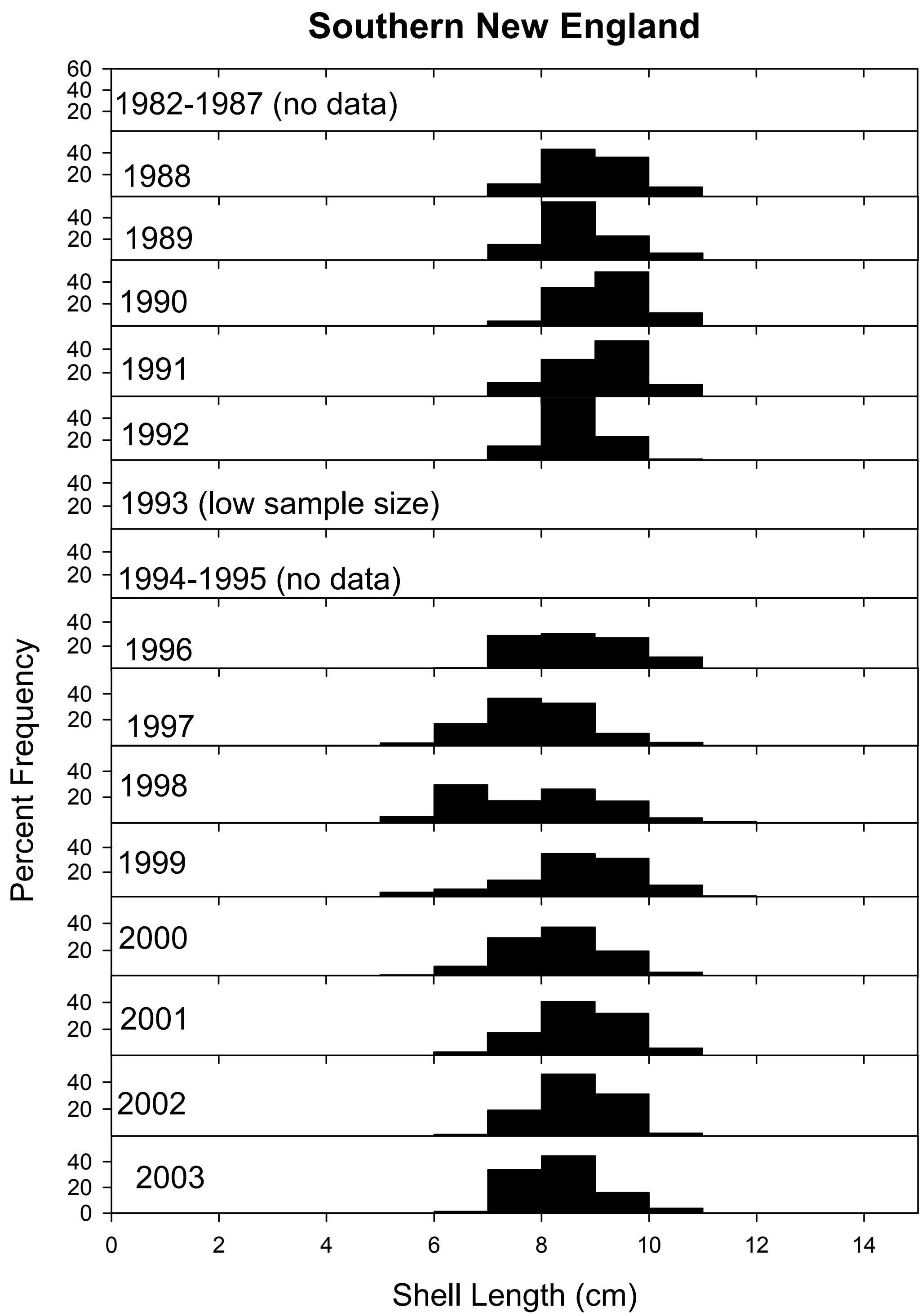


Figure A25. Length frequencies of ocean quahogs from port samples. Trips were catch-weighted.

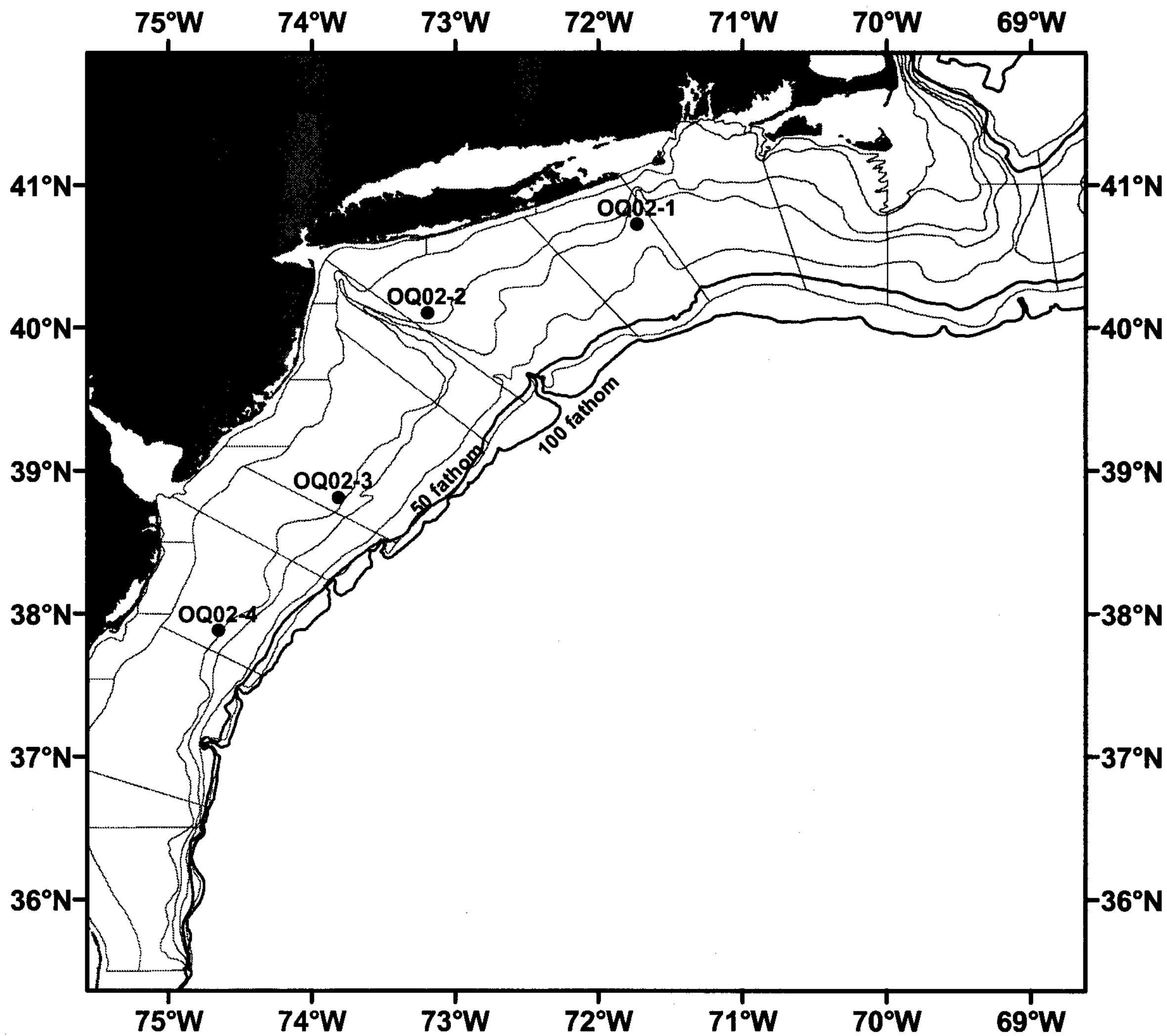


Figure A26.
Sites of ocean quahog depletion experiments with FV Lisa Kim in 2002.

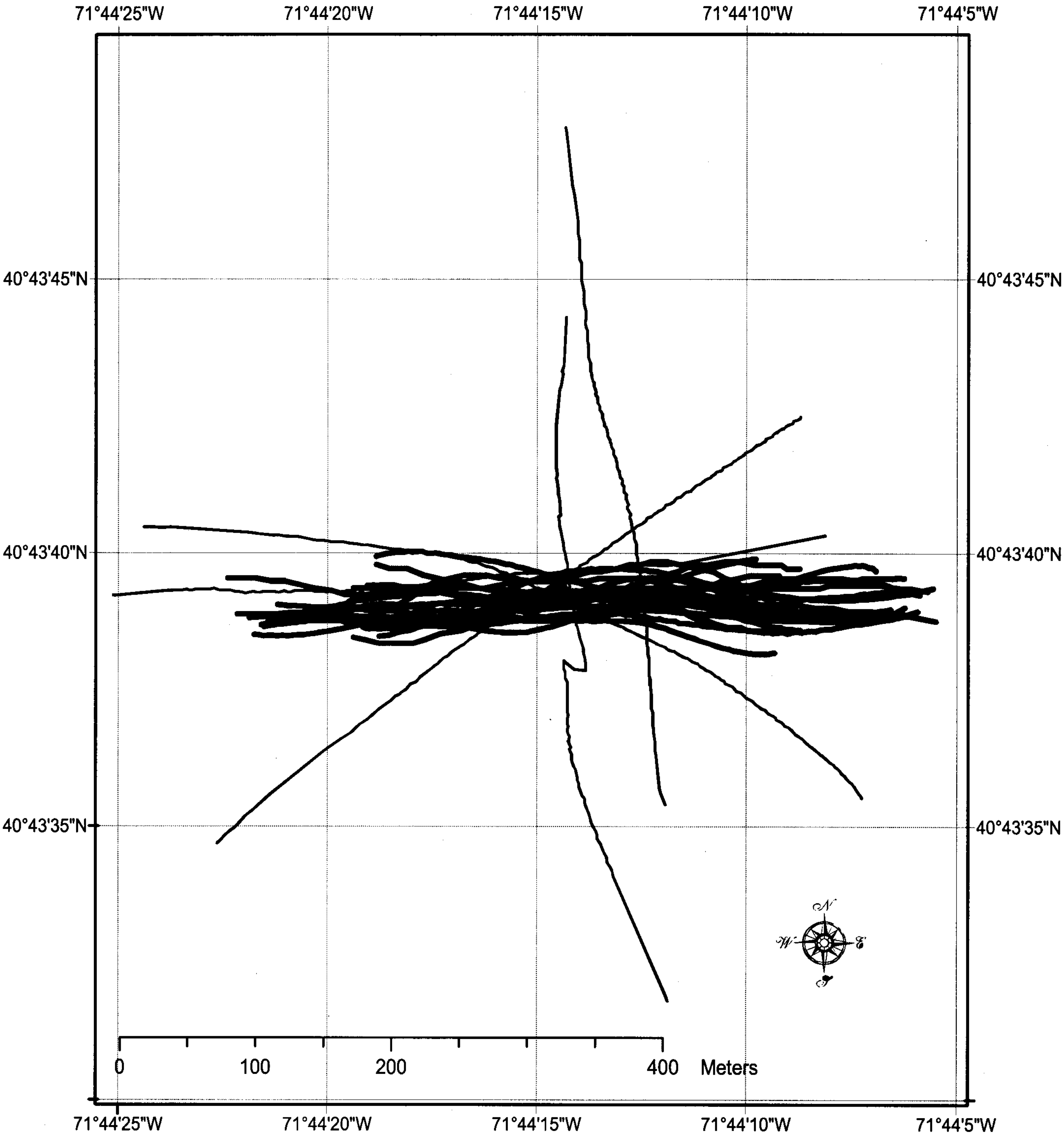


Fig. A27. Towpaths by the *R/V Delaware-II* setup tows (lighter lines) and the *F/V Lisa Kim* (darker lines), 2002, off LI (E) at site: oq02-1.

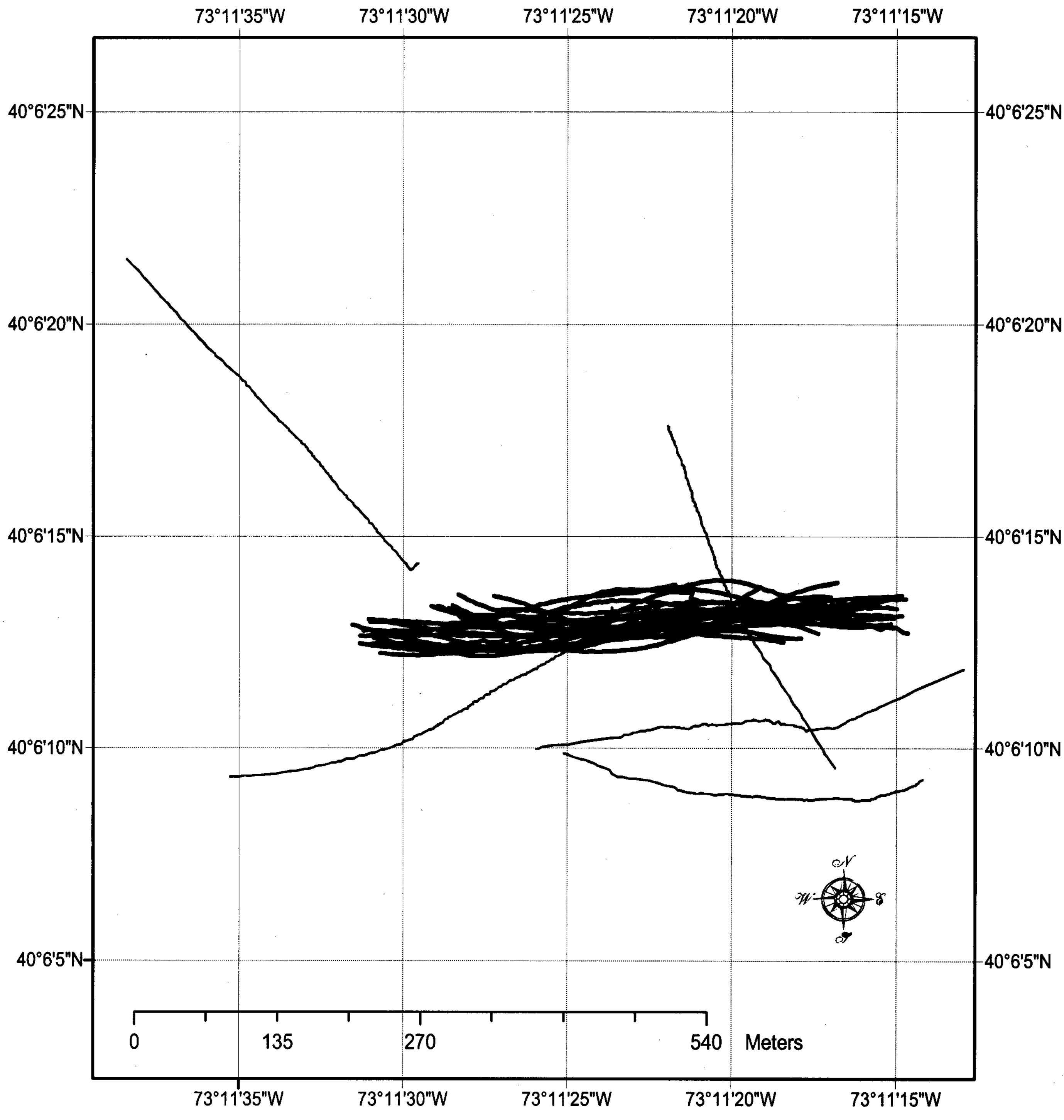


Fig. A28. Towpaths by the *R/V Delaware-II* setup tows (lighter lines) and the *F/V Lisa Kim* (darker lines), 2002, off LI (W) at site: oq02-2.

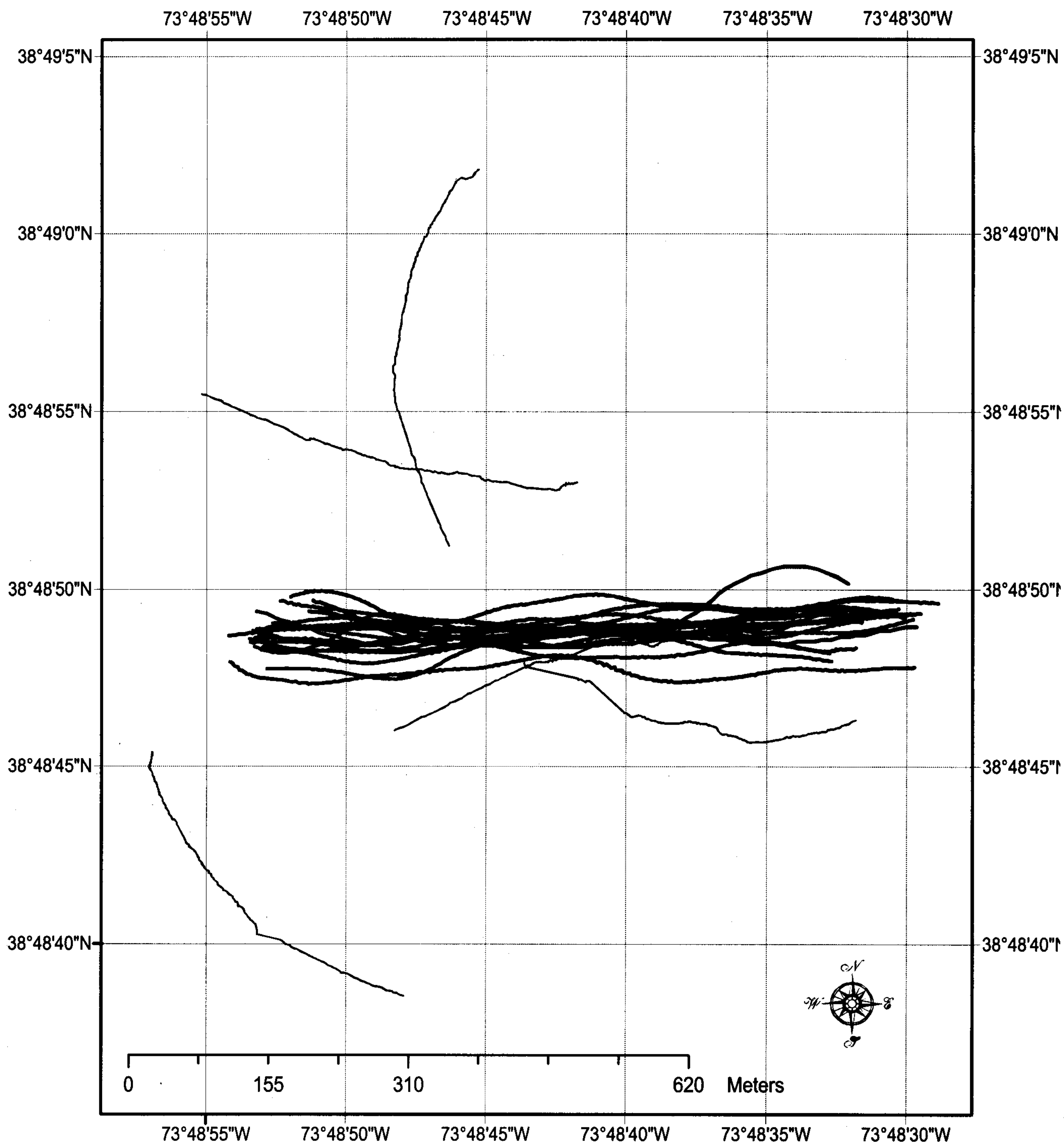


Fig. A29. Towpaths by the *R/V Delaware-II* setup tows (lighter lines) and the *F/V Lisa Kim* (darker lines), 2002, off SNJ at site: oq02-3.

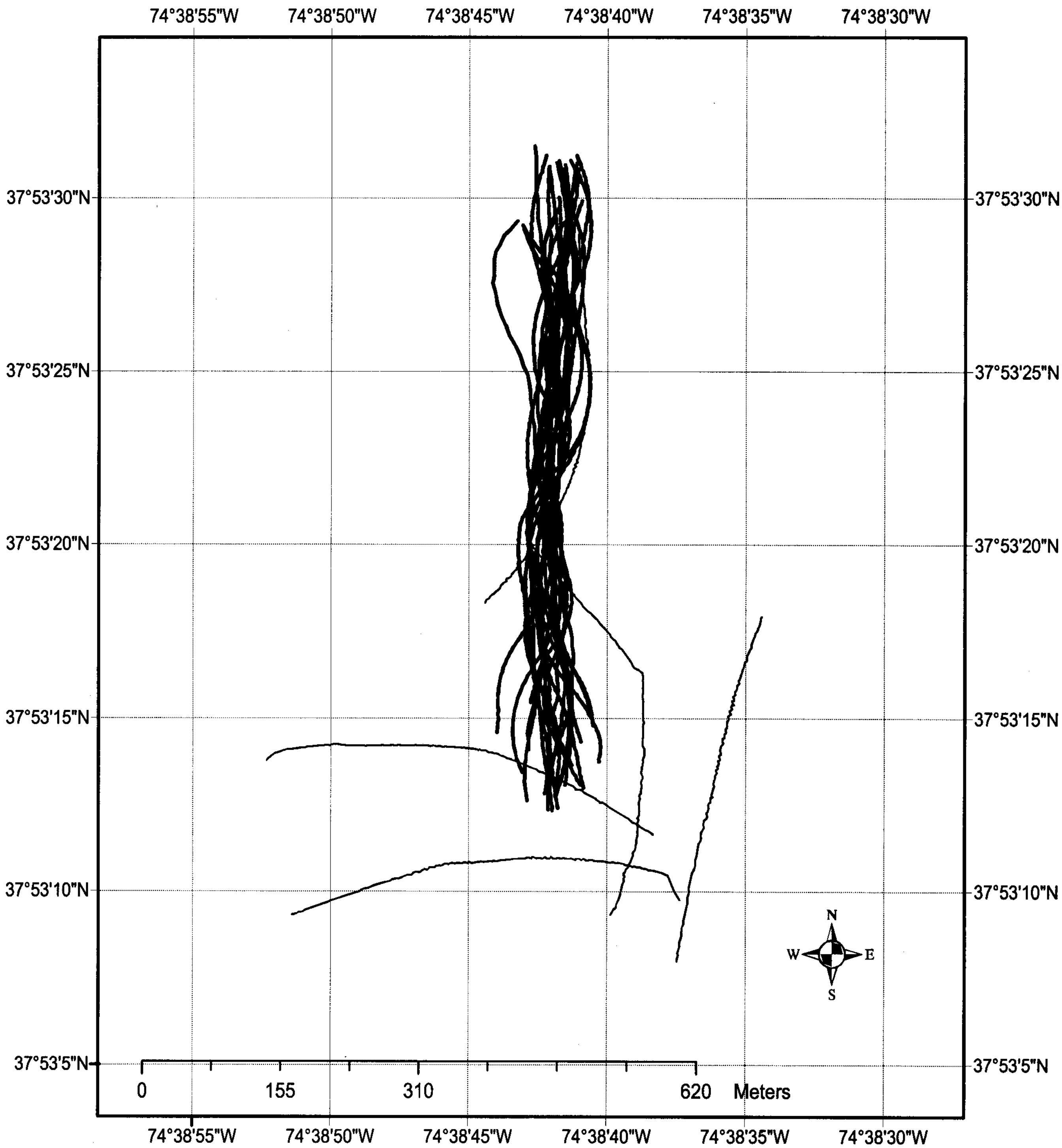
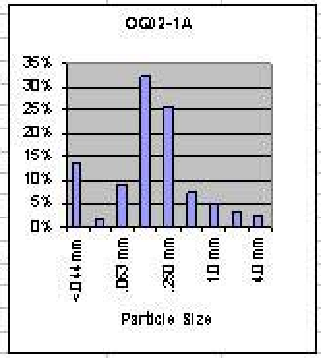
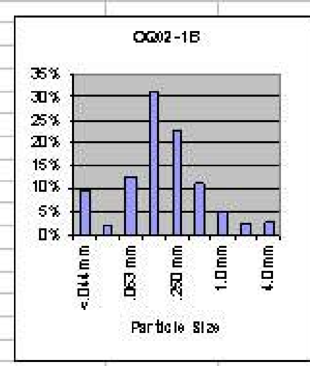


Fig. A30. Towpaths by the *R/V Delaware-II* setup tows (lighter lines) and the *F/V Lisa Kim* (darker lines), 2002, off Delmarva at site: oq02-4.

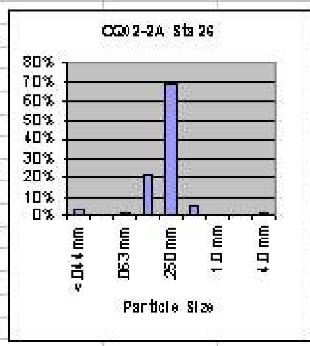
	Q02-1A	
Particle Size	Mass	Percent
<.044 mm	64.123	13.6%
.044 mm	7.746	1.6%
.063 mm	42.113	8.9%
.125 mm	150.437	31.9%
.250 mm	120.824	25.6%
.500 mm	34.695	7.4%
1.0 mm	24.424	5.2%
2.0 mm	15.303	3.2%
4.0 mm	12.066	2.6%
Total Mass	471.731	100.0%



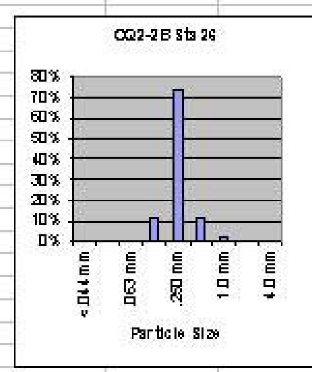
	Q02-1B	
Particle Size	Mass	Percent
<.044 mm	51.890	9.8%
.044 mm	10.479	2.0%
.063 mm	67.260	12.6%
.125 mm	164.839	31.0%
.250 mm	120.946	22.7%
.500 mm	60.455	11.4%
1.0 mm	28.353	5.3%
2.0 mm	12.508	2.4%
4.0 mm	15.311	2.9%
Total Mass	532.041	100.0%



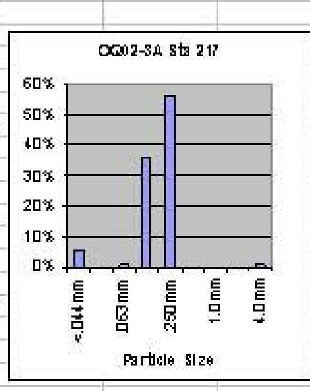
	Q02-2A Sta 26	
Particle Size	Mass	Percent
<.044 mm	11.135	2.8%
.044 mm	0.311	0.1%
.063 mm	6.677	1.7%
.125 mm	83.066	20.7%
.250 mm	275.183	68.5%
.500 mm	21.239	5.3%
1.0 mm	1.010	0.3%
2.0 mm	0.963	0.2%
4.0 mm	1.901	0.5%
Total Mass	401.485	100.0%



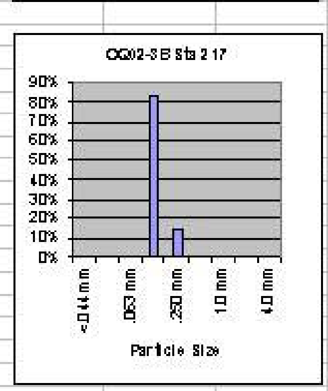
	Q02-2B Sta 26	
Particle Size	Mass	Percent
<.044 mm	4.812	1.0%
.044 mm	0.538	0.1%
.063 mm	3.873	0.8%
.125 mm	53.236	10.8%
.250 mm	359.471	73.2%
.500 mm	58.116	11.8%
1.0 mm	6.018	1.2%
2.0 mm	3.728	0.8%
4.0 mm	1.016	0.2%
Total Mass	490.808	100.0%



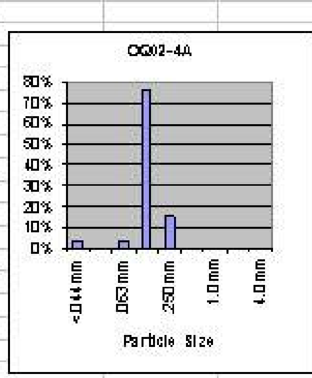
	Q02-3A Sta 217	
Particle Size	Mass	Percent
<.044 mm	19.272	5.4%
.044 mm	0.126	0.0%
.063 mm	2.810	0.8%
.125 mm	127.733	35.9%
.250 mm	201.327	56.5%
.500 mm	0.638	0.2%
1.0 mm	0.121	0.0%
2.0 mm	0.450	0.1%
4.0 mm	3.670	1.0%
Total Mass	356.147	100.0%



	OQ02-3B Sta 217	
Particle Size	Mass	Percent
<.044 mm	2.902	0.9%
.044 mm	0.200	0.1%
.063 mm	3.107	1.0%
.125 mm	260.436	83.5%
.250 mm	44.546	14.3%
.500 mm	0.377	0.1%
1.0 mm	0.152	0.0%
2.0 mm	0.100	0.0%
4.0 mm	0.108	0.0%
Total Mass	311.928	100.0%



	OQ02-4A	
Particle Size	Mass	Percent
<.044 mm	24.093	4.0%
.044 mm	0.911	0.2%
.063 mm	23.894	4.0%
.125 mm	451.165	75.7%
.250 mm	94.877	15.9%
.500 mm	0.557	0.1%
1.0 mm	0.299	0.1%
2.0 mm	0.345	0.1%
4.0 mm	0.051	0.0%
Total Mass	596.192	100.0%



	OQ02-4B	
Particle Size	Mass	Percent
<.044 mm	3.976	0.9%
.044 mm	0.468	0.1%
.063 mm	18.515	4.1%
.125 mm	426.709	93.4%
.250 mm	6.662	1.5%
.500 mm	0.566	0.1%
1.0 mm	0.052	0.0%
2.0 mm	0.103	0.0%
4.0 mm	0.000	0.0%
Total Mass	457.051	100.0%

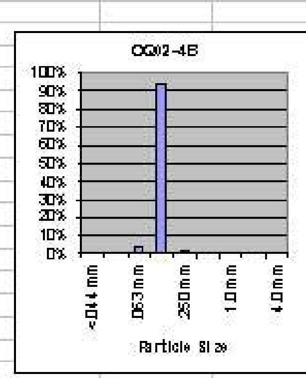


Fig. A31. Grain size analysis for the 4 sites where ocean quahog depletion experiments were carried out in 2002.

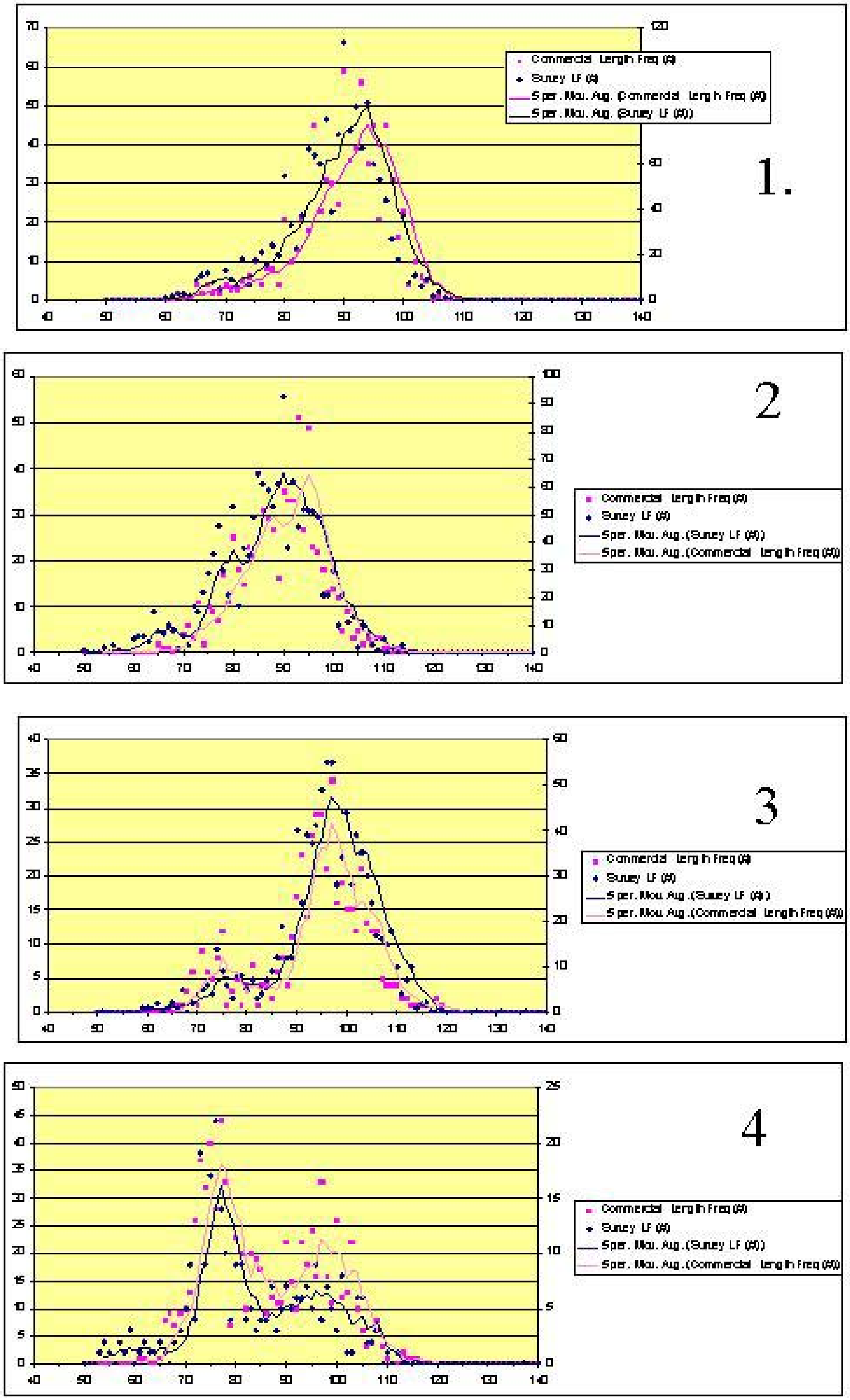


Fig. A32. Comparison of Raw Catch Length Freq. By the DE-II and FV Lisa Kim in 4 depletion exps in 2002.

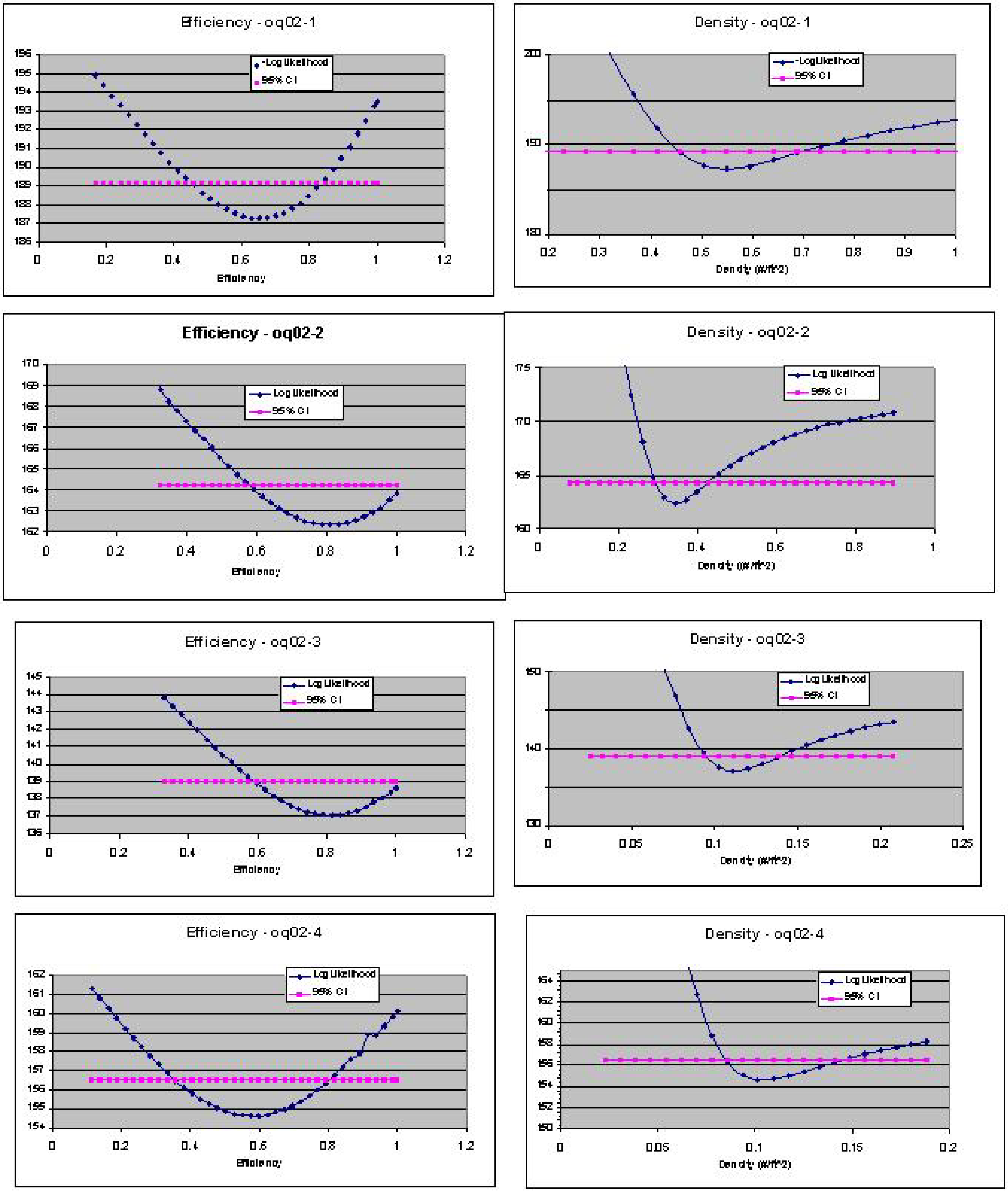


Fig. A33. 95% CI's for Efficiency and Density estimates for the FV Lisa Kim catching ocean quahogs in 4 depletion exps in 2002.

OQ02 Site	Density (#/ft^2) (Patch Model)	DE-II Efficiency
1	0.55	0.053
2	0.345	0.128
3	0.111	0.225
4	0.101	0.284

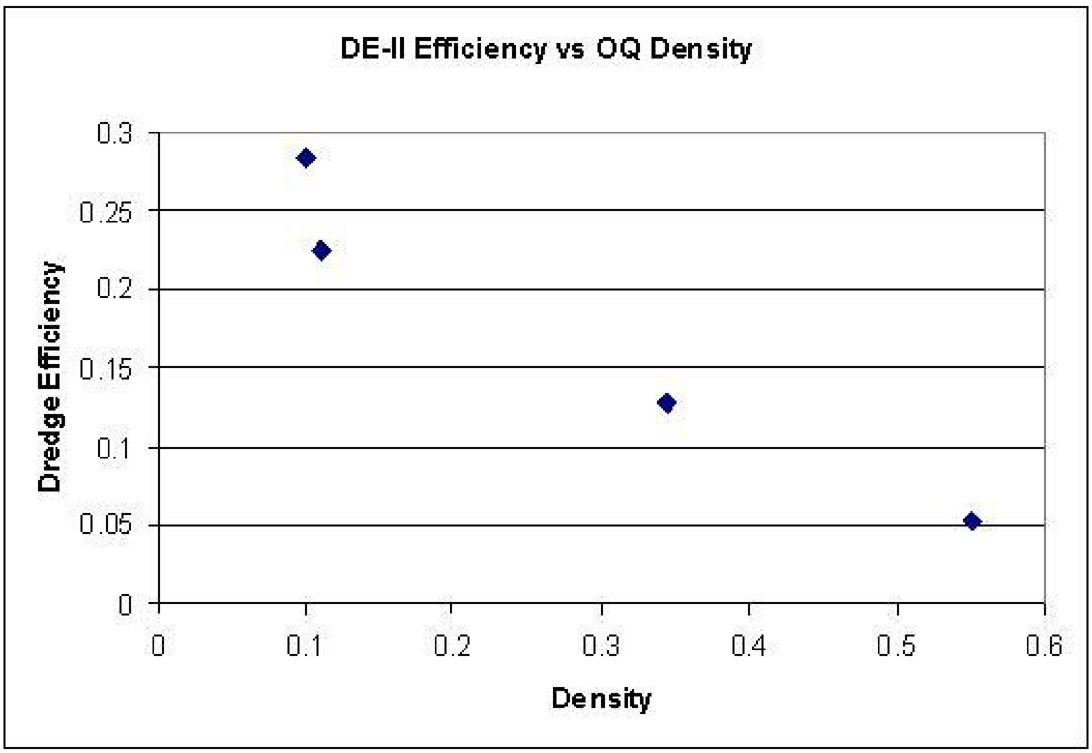
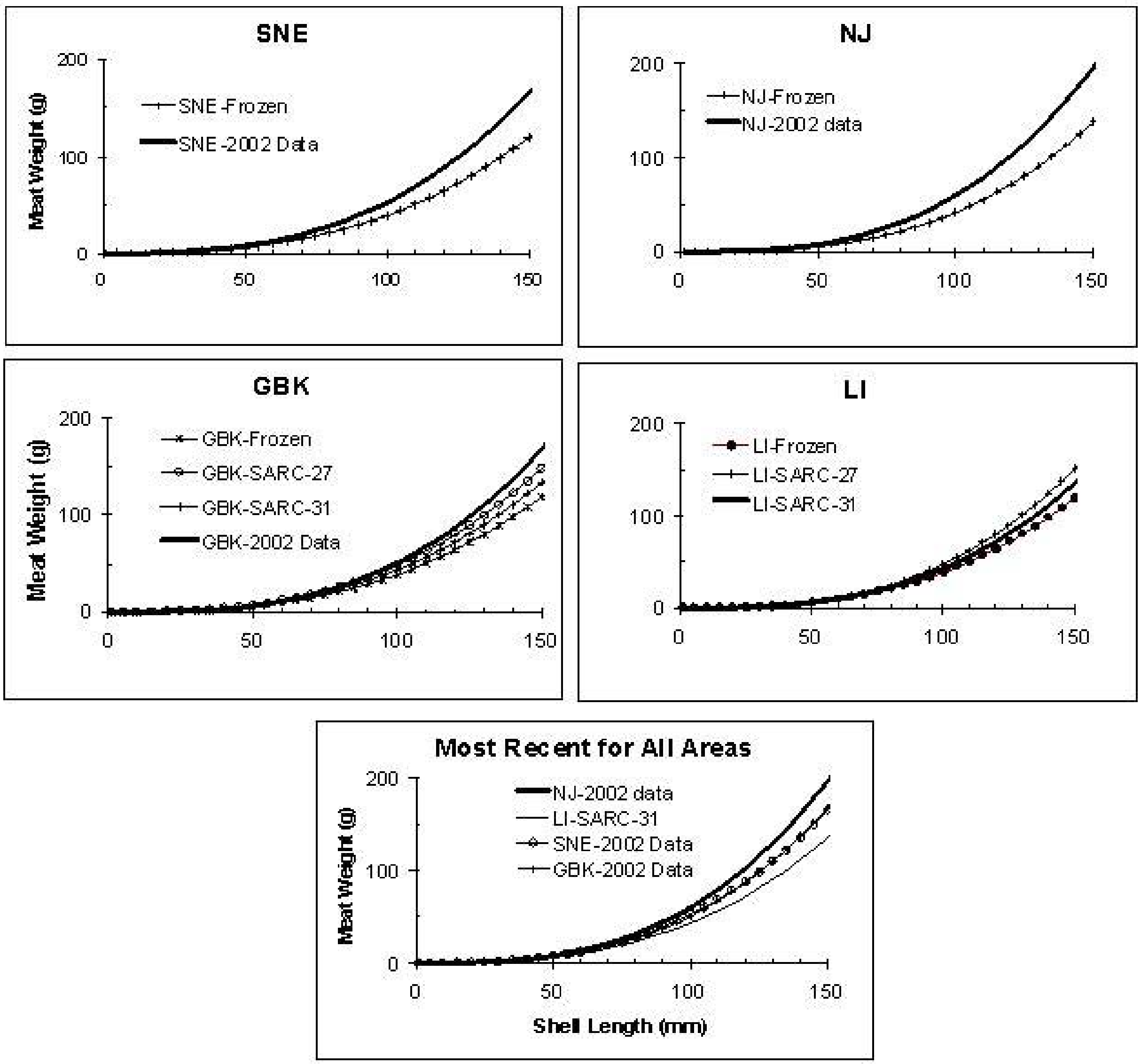


Figure A34.

Data from 2002 relating ocean quahog density to DE-II dredge efficiency.

Fig. A35.

Shell length-tissue weight relationships for ocean quahog from NEFSC clam surveys. "Frozen" weights were based on frozen samples (Murawski and Serchuk, 1979). All other relationships based on fresh samples collected during NEFSC clam surveys in 1997 and 2002 (NEFSC 1998; 2000). Data from frozen samples are not directly comparable to data from fresh samples. "NJ-2002 data" is the relationship for quahogs in the NJ area based on samples from the 2002 clam survey. "GBK-SARC-27" is the relationship for GBK used at SARC-27 (NEFSC 1998) and "GBK-SARC-31" is the relationship used at SARC-31 (NEFSC 2000).



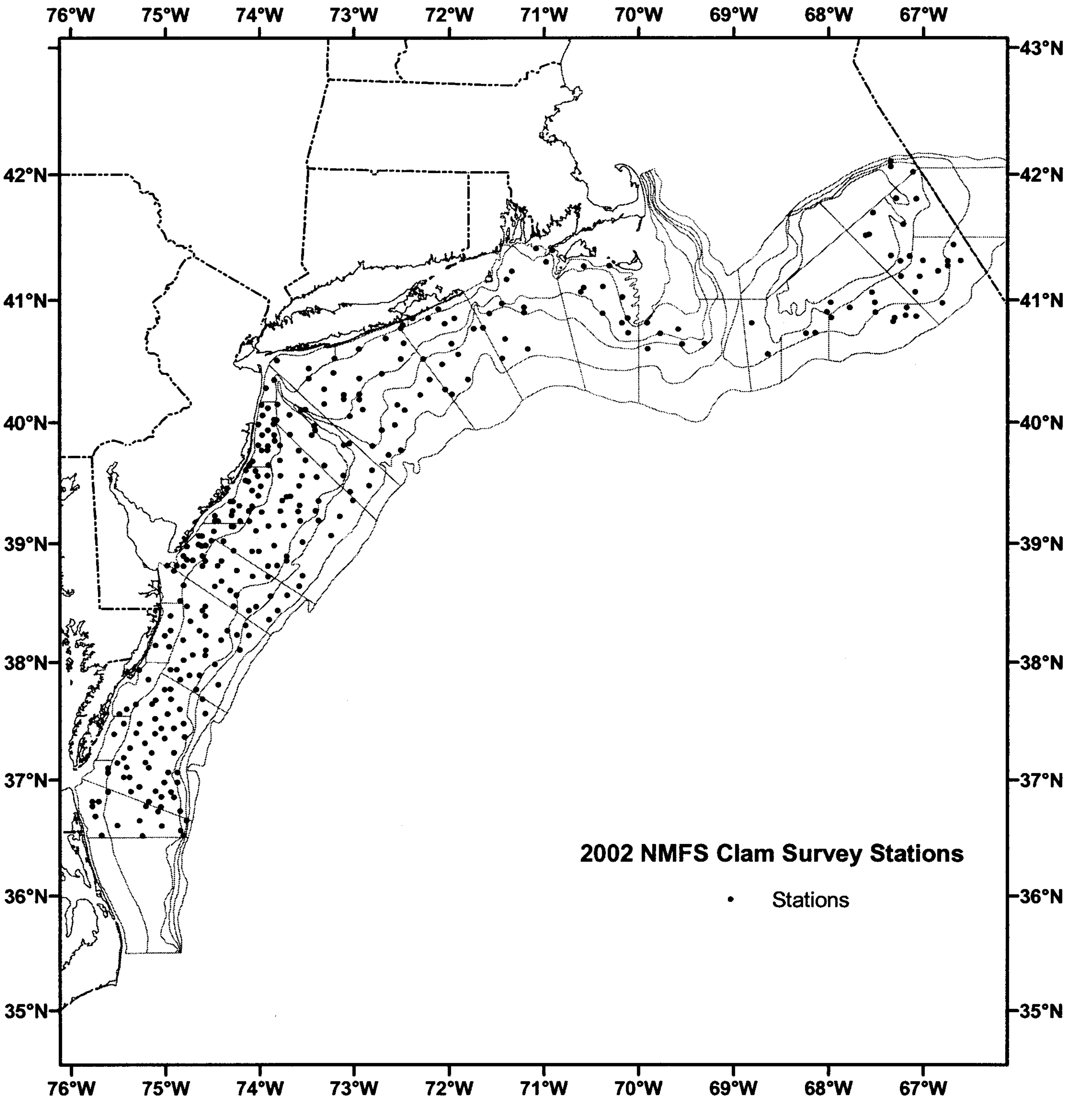


Fig. A36. NMFS clam survey station locations in 2002.

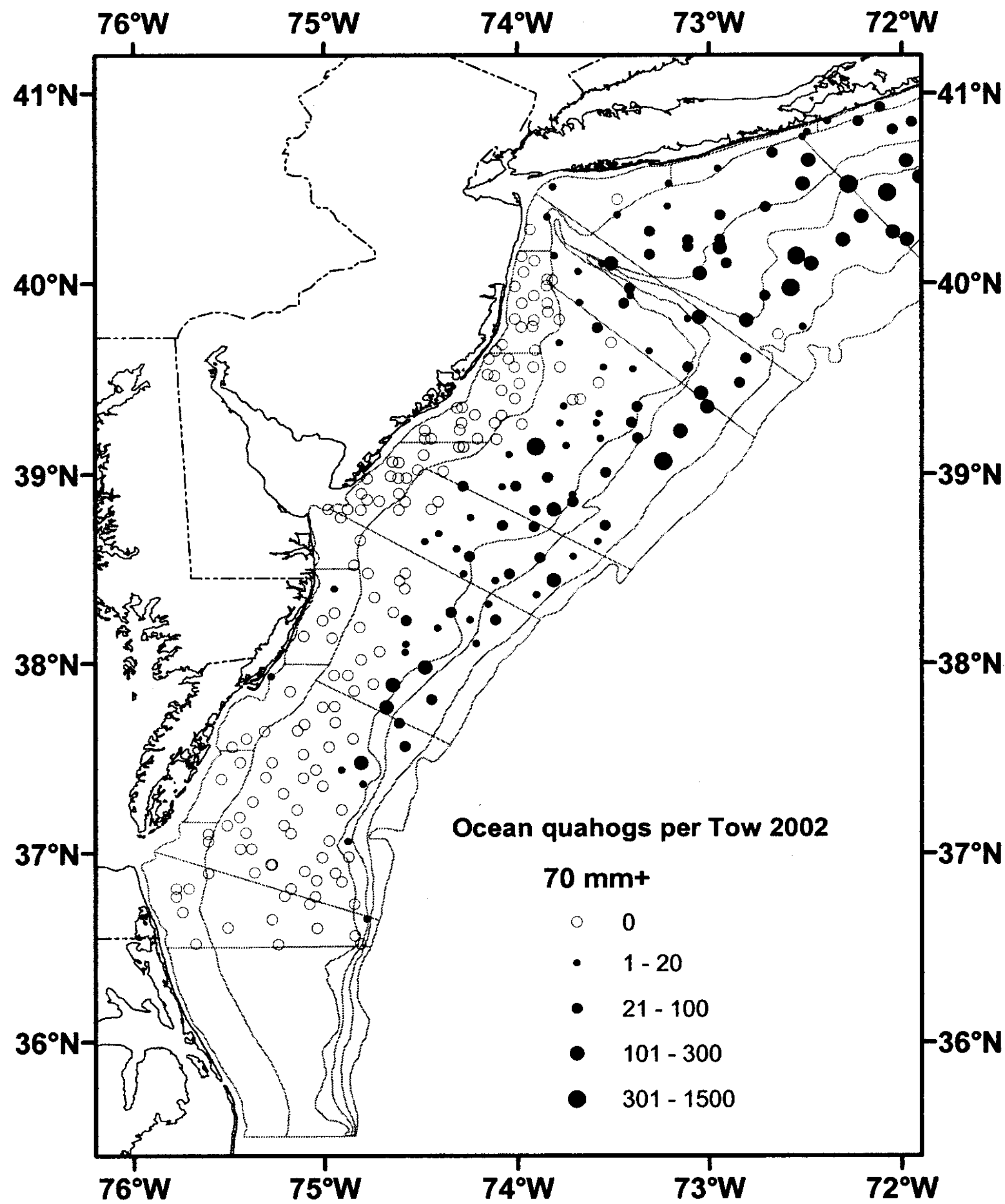


Fig. A37. Distribution of ocean quahog abundance per tow (>=70 mm), during the 2002 NEFSC survey, adjusted to 0.15nmi tow distance with sensor data. Clam strata boundaries are 10-31m,31-50m, 51-60m,61-80m and 81-120m.

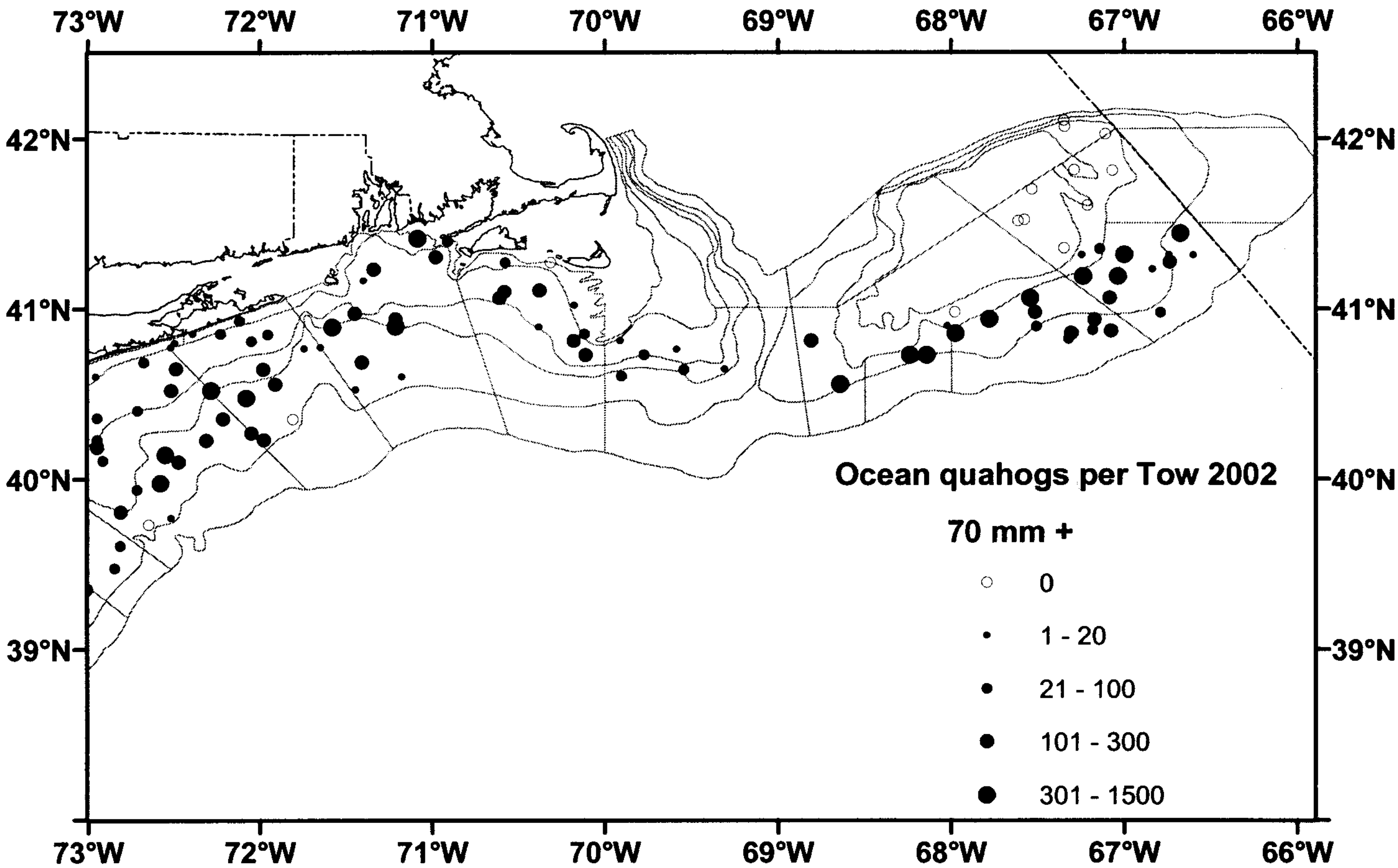


Fig. A38. Distribution of ocean quahog abundance per tow (>=70 mm), during the 2002 NEFSC survey, adjusted to 0.15nmi tow distance with sensor data. Clam strata boundaries are 10-31m,31-50m, 51-60m,61-80m and 81-120m.

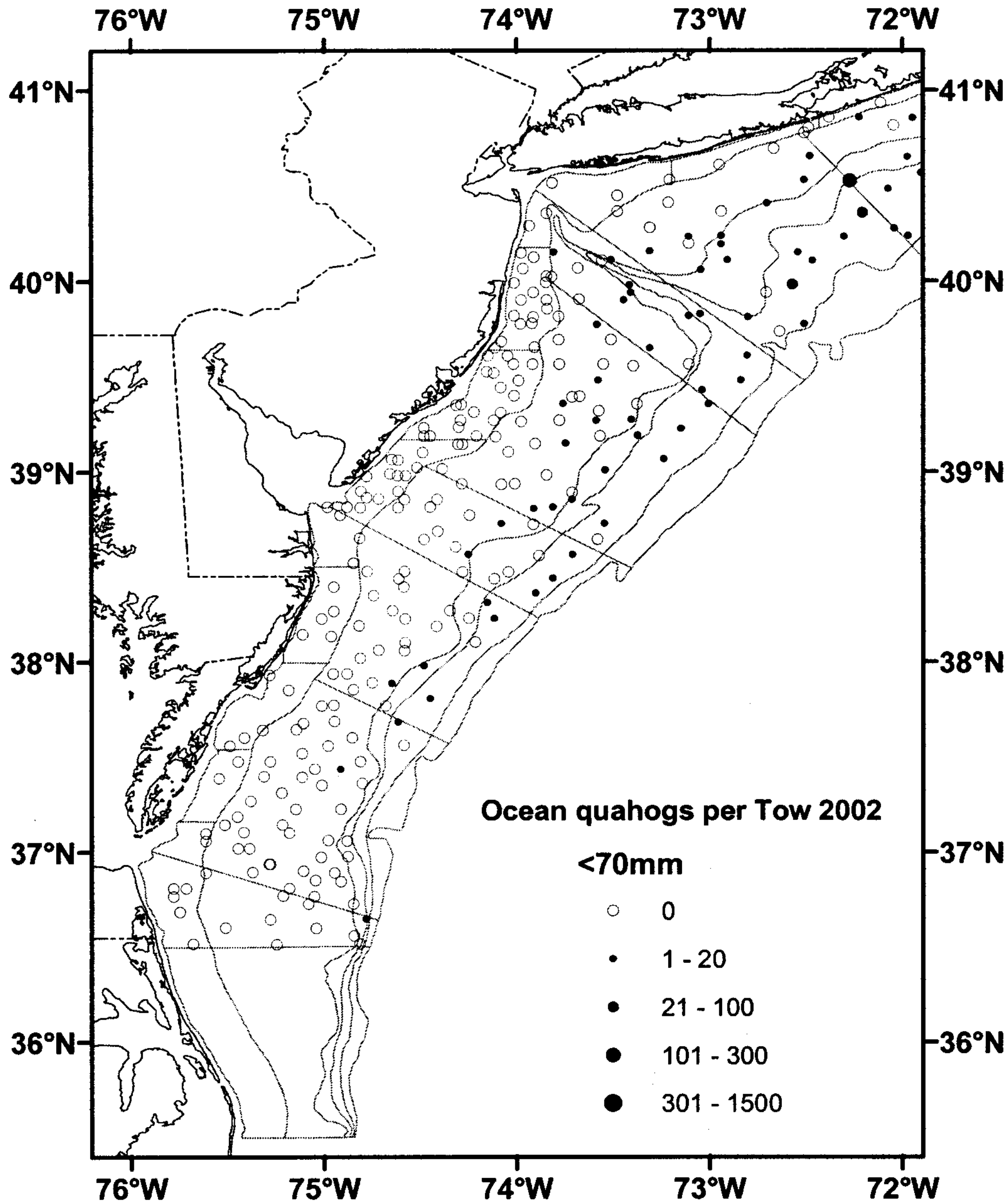


Fig. A39. Distribution of ocean quahog abundance per tow (<70 mm), during the 2002 NEFSC survey, adjusted to 0.15nmi tow distance with sensor data. Clam strata boundaries are 10-31m,31-50m, 51-60m,61-80m and 81-120m.

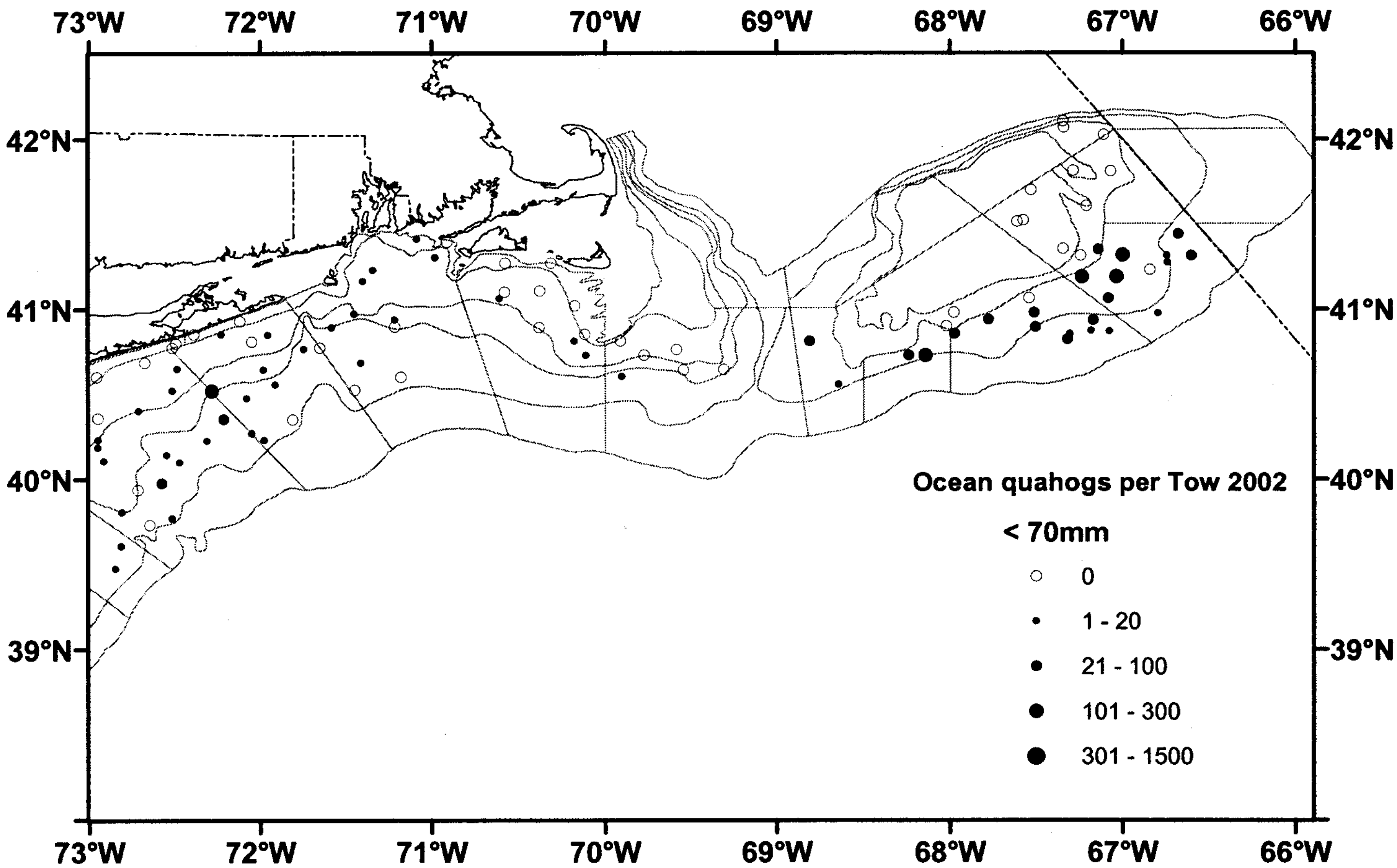


Fig. A40. Distribution of ocean quahog abundance per tow (<70 mm), during the 2002 NEFSC survey, adjusted to 0.15nmi tow distance with sensor data. Clam strata boundaries are 10-31m,31-50m, 51-60m,61-80m and 81-120m.

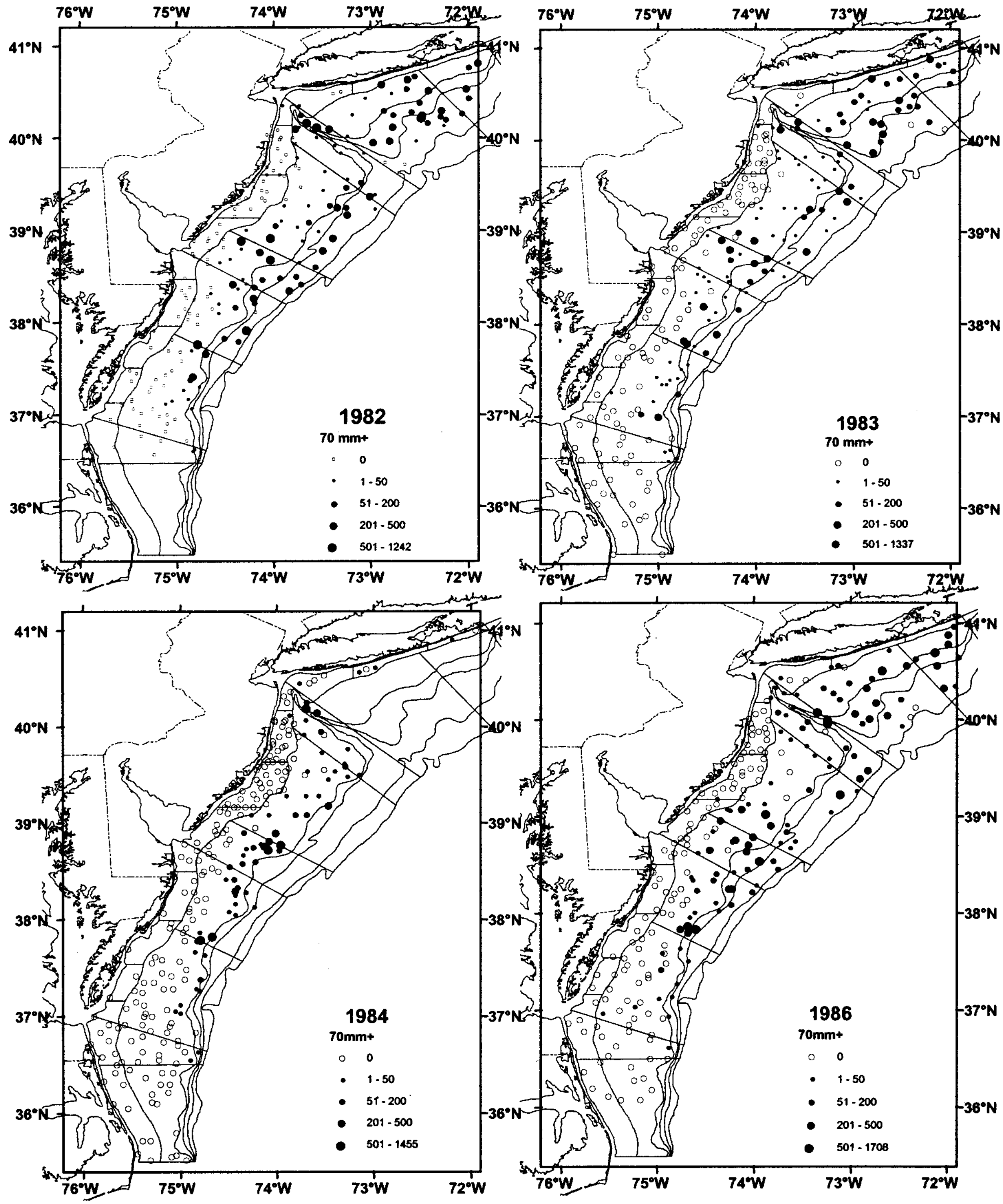


Fig. A41. Catch per tow of ocean quahogs (70mm+) in NMFS clam surveys. 1982 – 1986.

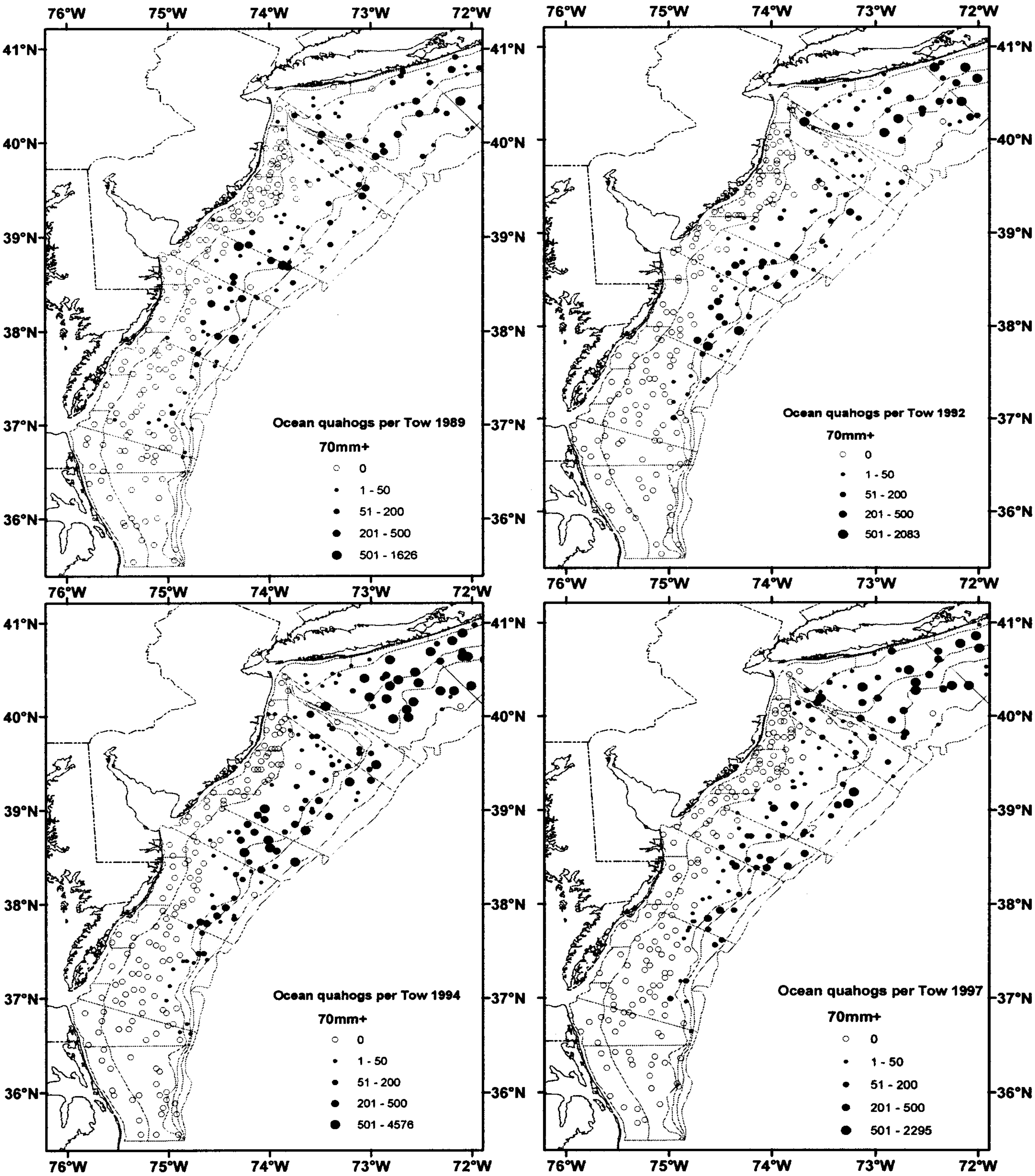


Fig. A42. Catch per tow of ocean quahogs (70mm+) in NMFS clam surveys. 1989 – 1997.

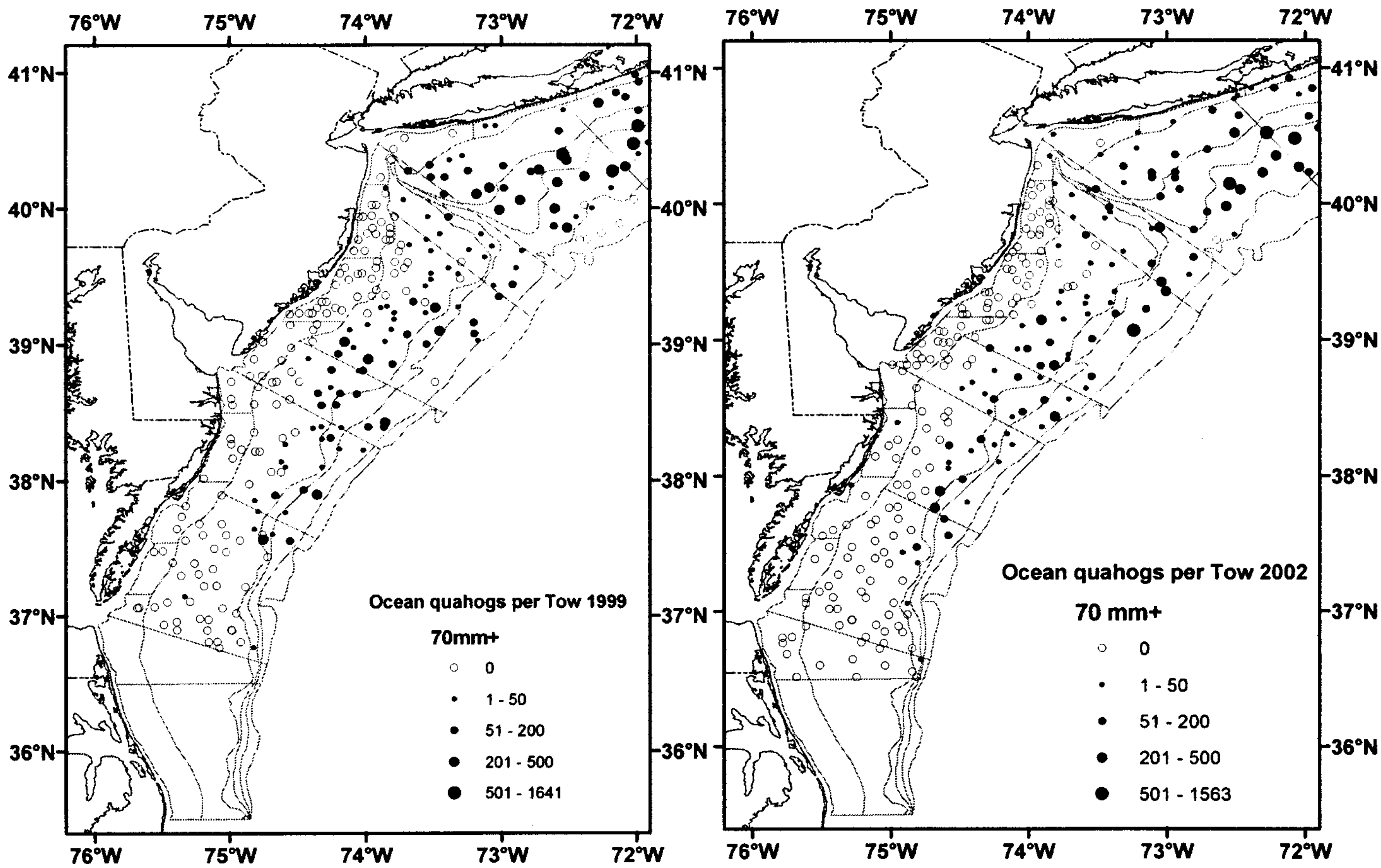


Fig. A43. Catch per tow of ocean quahogs (70mm+) in NMFS clam surveys. 1999 and 2002.

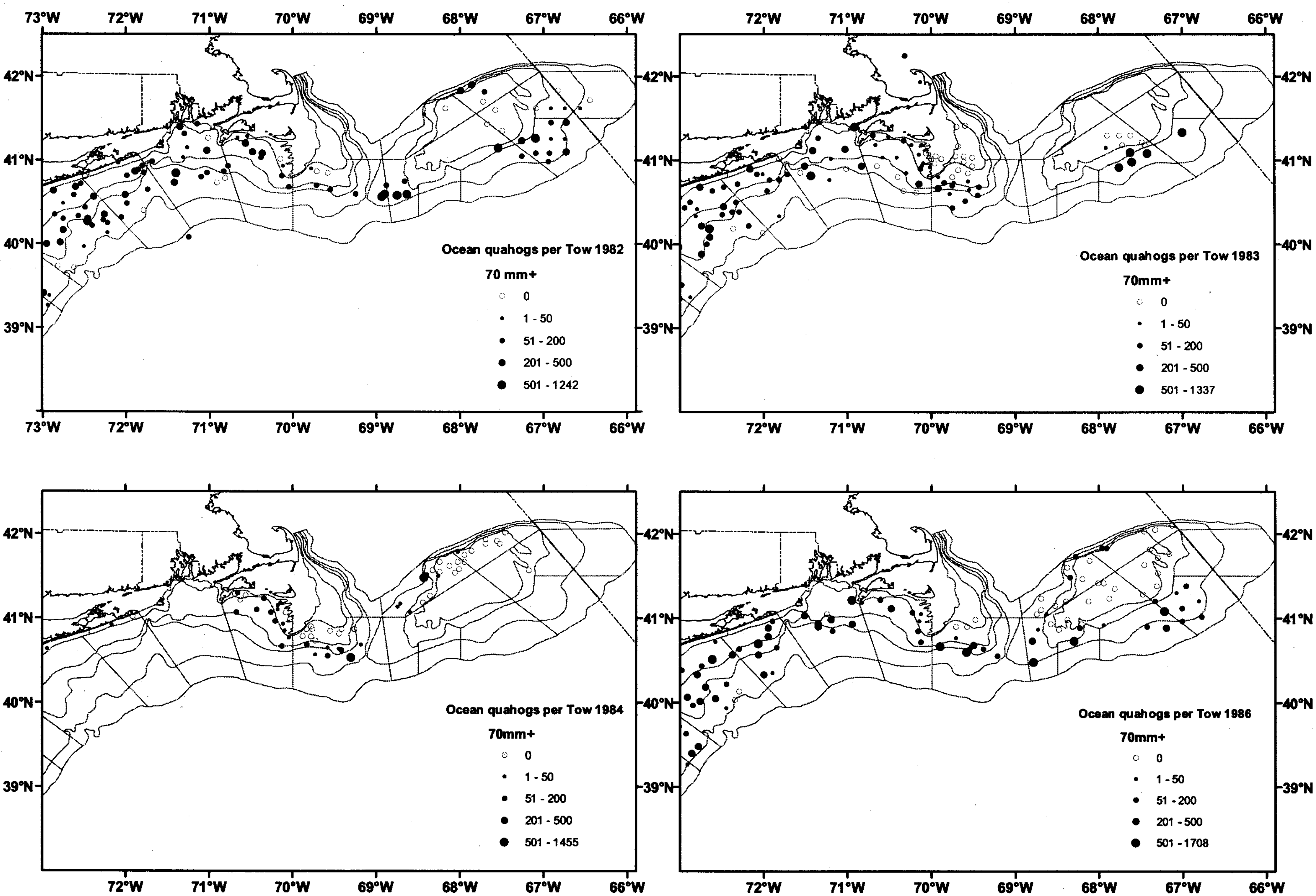


Fig. A44. Catch per tow of ocean quahogs. 1982 – 1986.

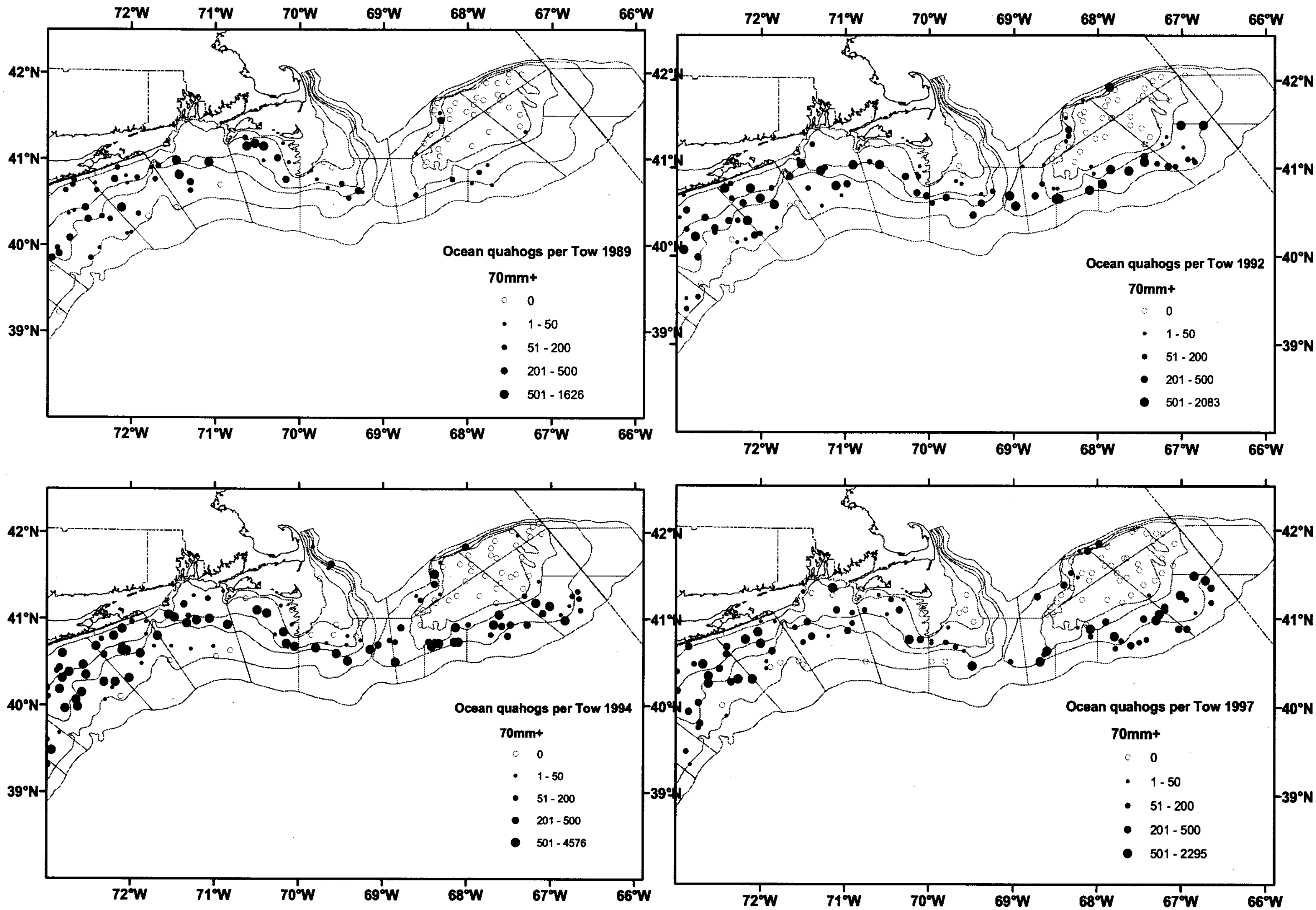


Fig. A45. Catch per tow of ocean quahogs, 1989-1997.

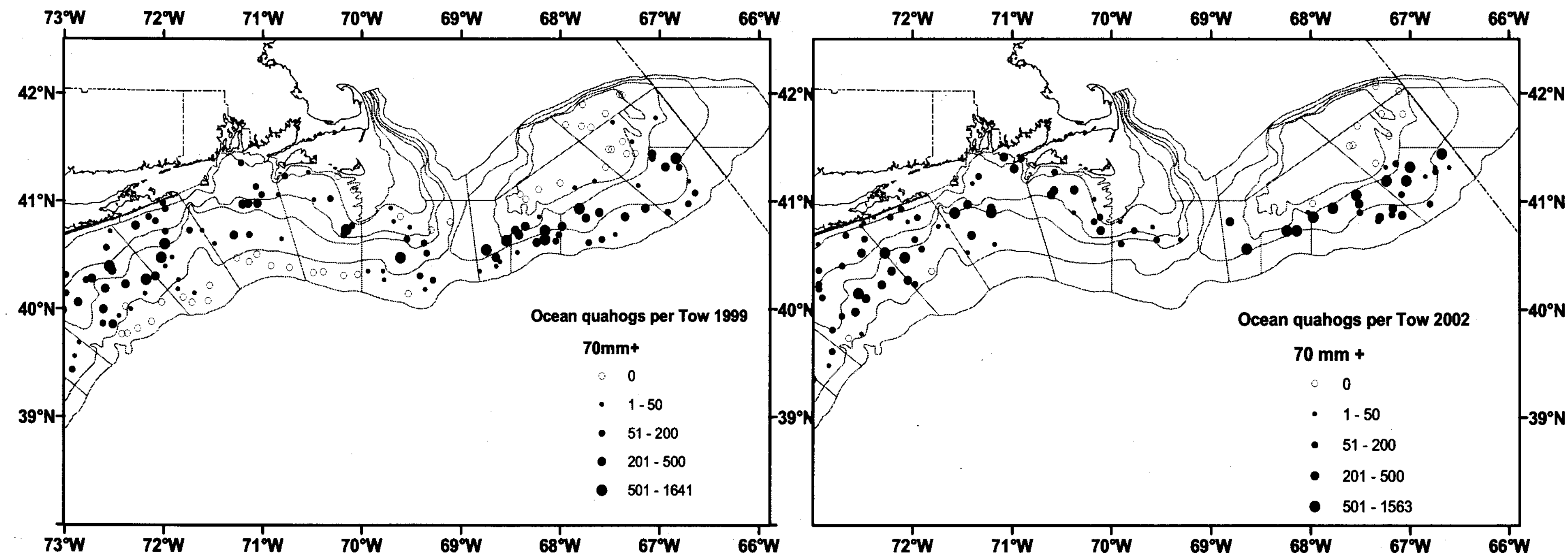


Fig. A46. Catch per tow of ocean quahogs, 1999-2002.

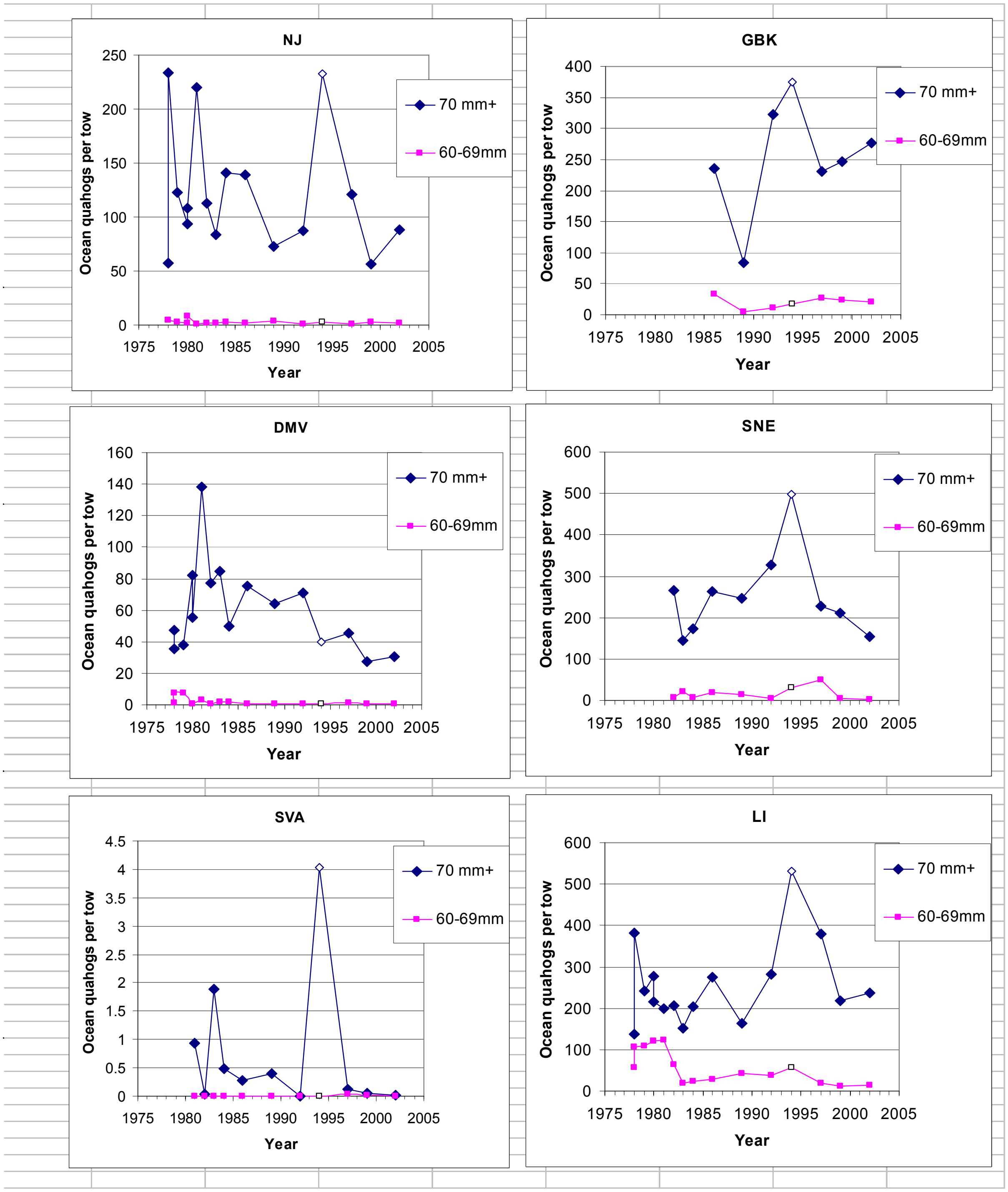


Fig. A47.

Stratified mean number of ocean quahogs per tow over time, by region, based on the NMFS survey.
Data were not adjusted for gear efficiency.
Catch was standardized to a 0.15nmi tow distance, based on doppler distance.
The 1994 survey was done with a voltage > the standard operating procedure, and catch was often high.

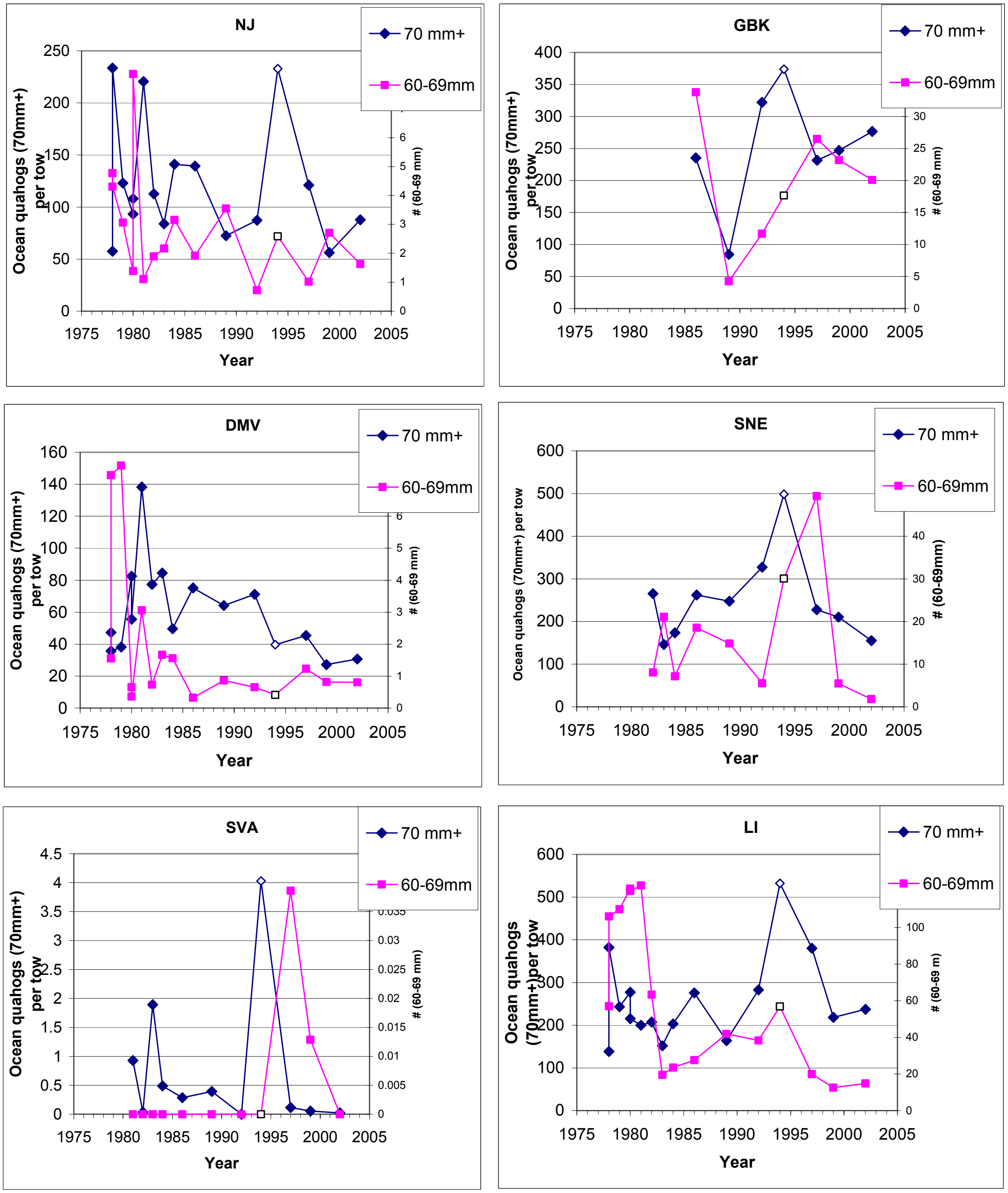
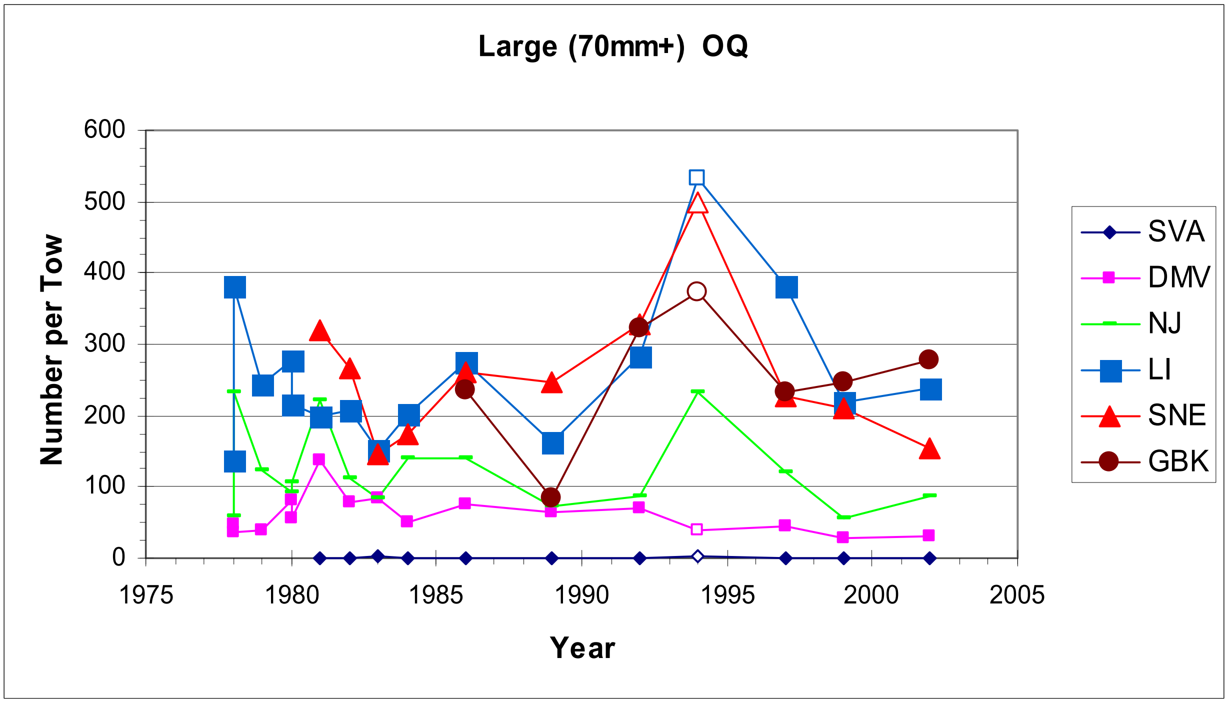


Fig. A48.

Stratified mean number of ocean quahogs per tow over time, by region, based on the NMFS survey.
Data were not adjusted for gear efficiency.
Catch was standardized to a 0.15nmi tow distance, based on doppler distance.
The 1994 survey was done with a voltage > the standard operating procedure, and catch was often high.
(same as previous Fig., but with 2 y-axes).



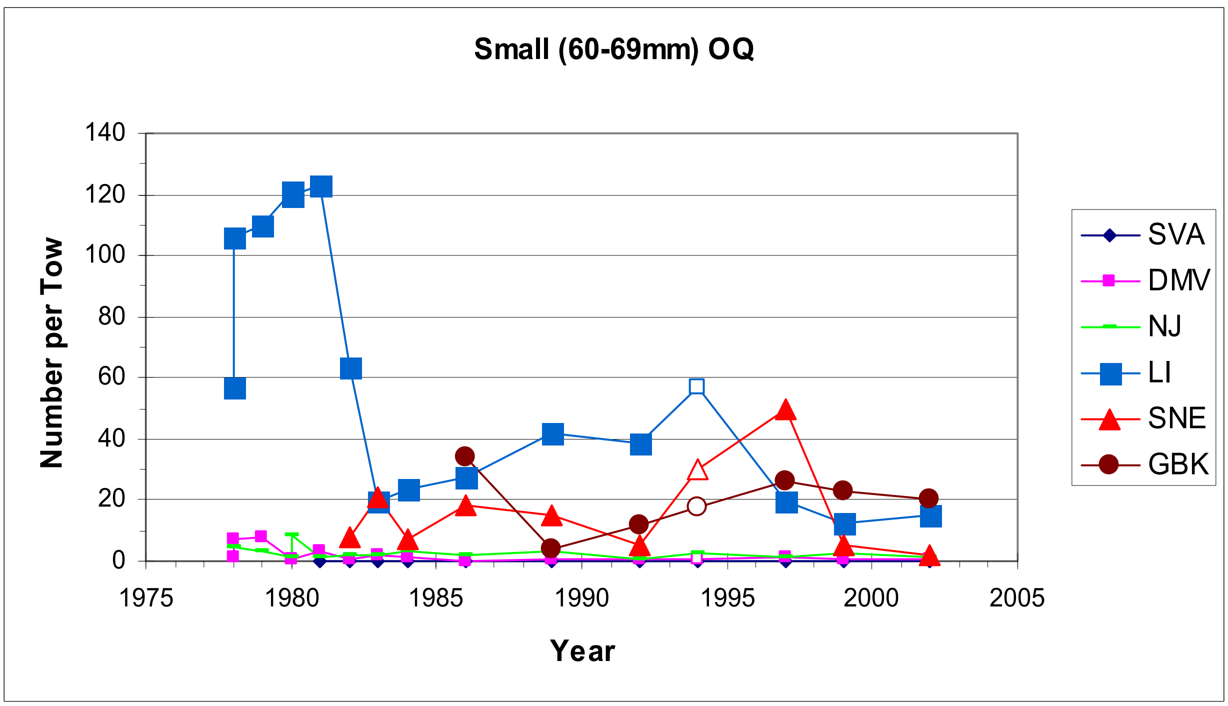


Fig. A49.

Comparison of NMFS survey ocean quahog catches across regions.
Shown are the stratified mean number per tow over time.
Data were not adjusted for gear efficiency.
Catch was standardized to a 0.15nmi tow distance, based on doppler distance.
The 1994 survey was done with a voltage > the standard operating procedure, and catch was often high.

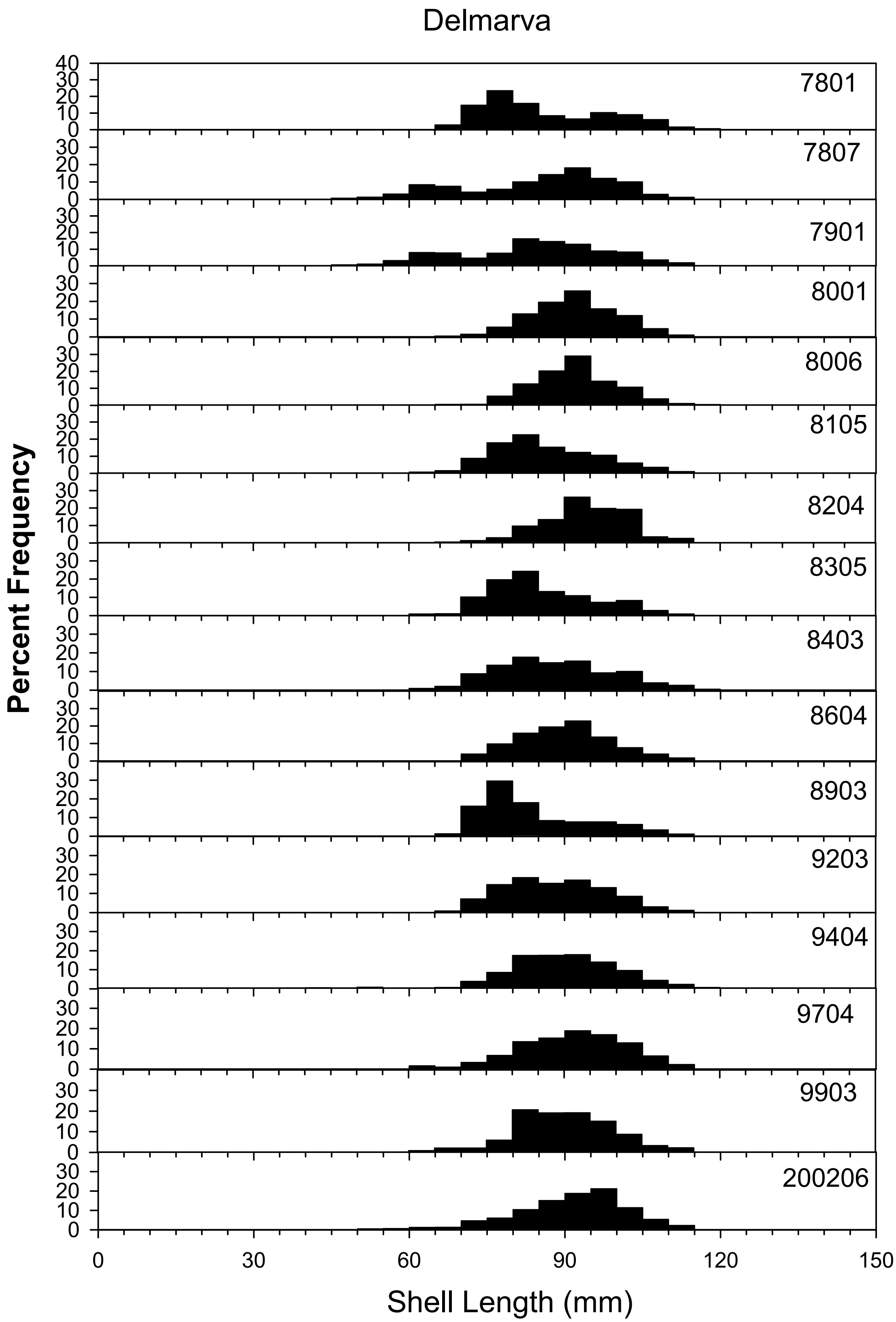


Fig. A50. Ocean quahog length frequency distributions over time, based on NMFS survey data. Region: DMV

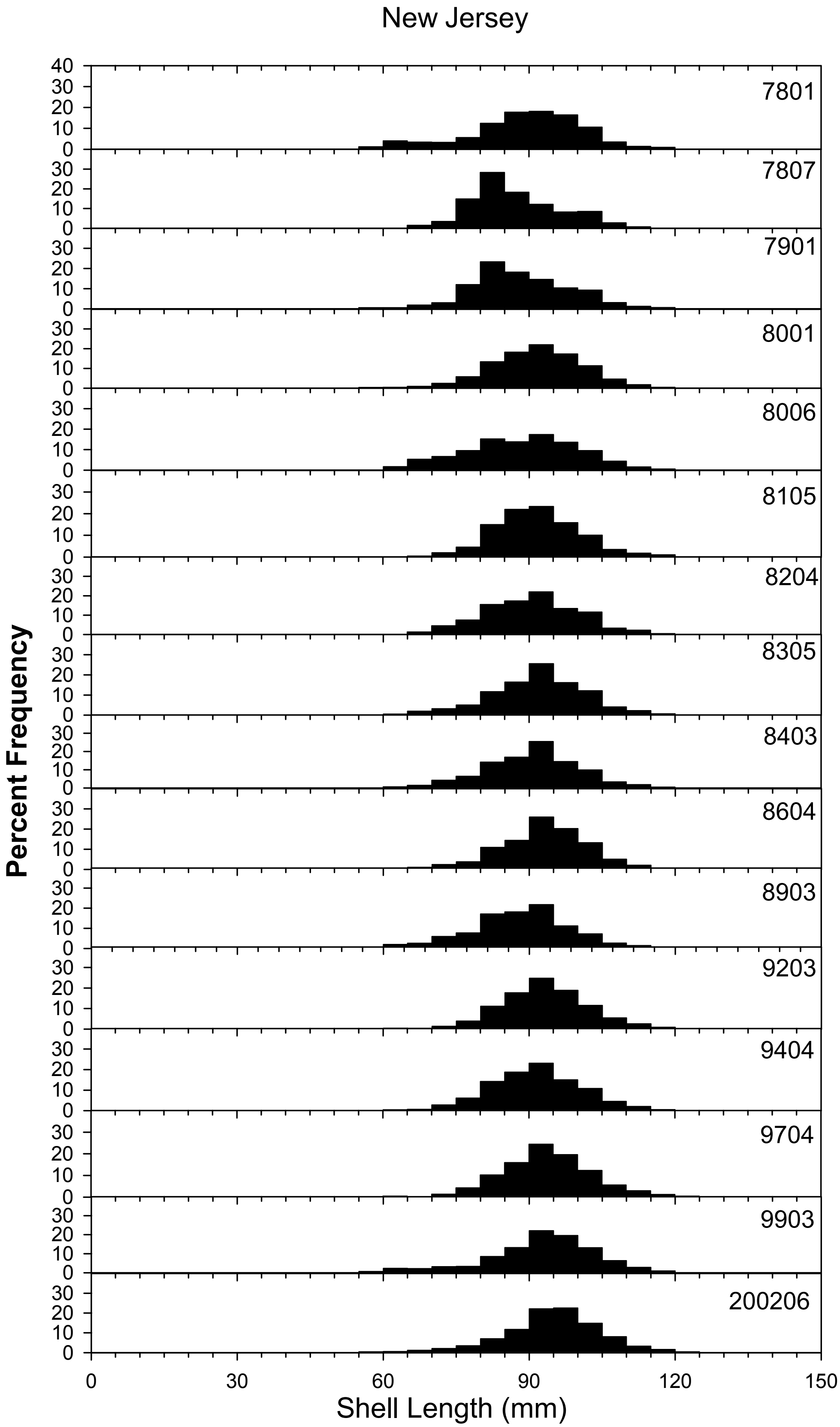


Fig. A51. Ocean quahog length frequency distributions over time, based on NMFS survey data. Region: NJ .

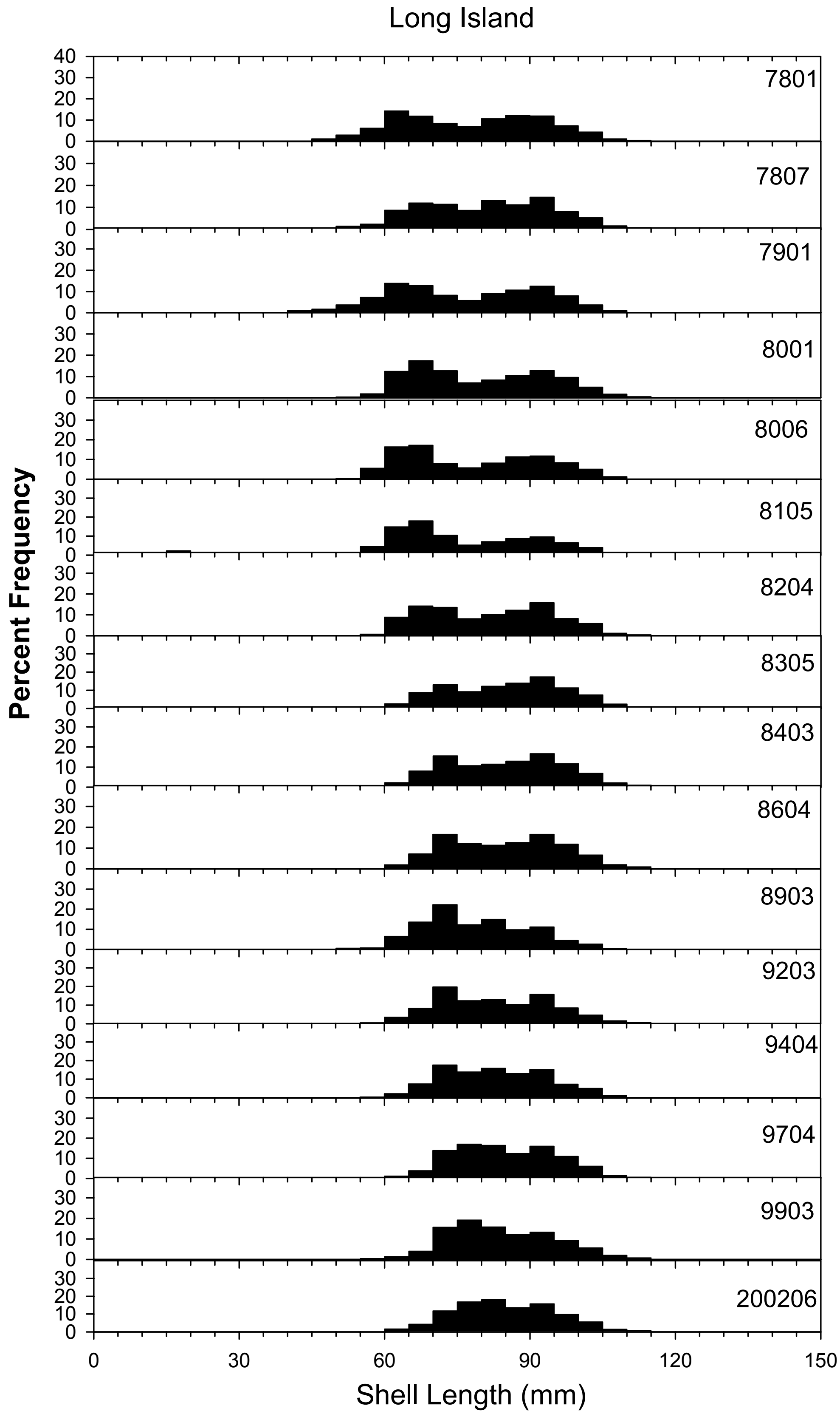


Fig. A52. Ocean quahog length frequency distributions over time, based on NMFS survey data. Region: LI .

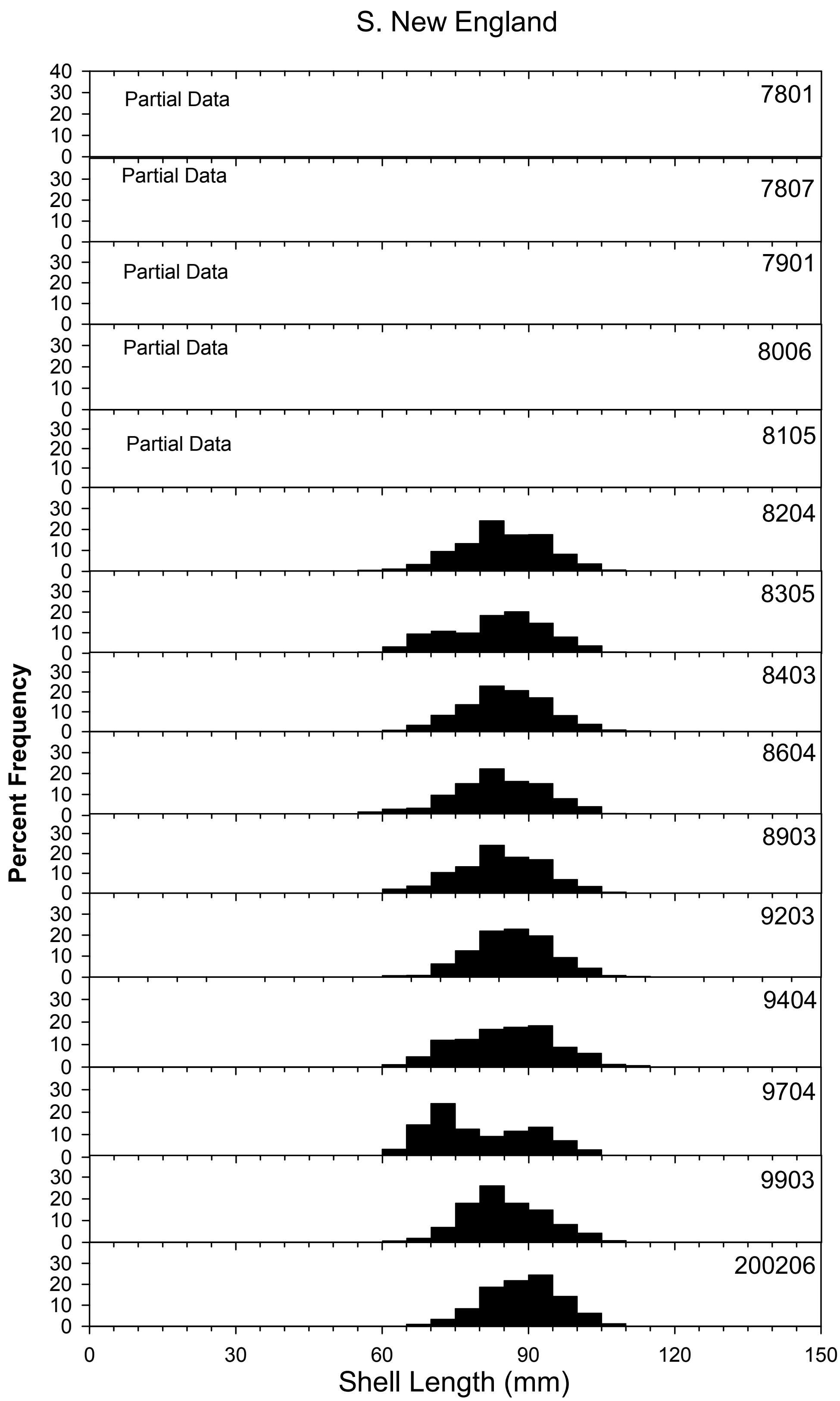


Fig. A53. Ocean quahog length frequency distributions over time, based on NMFS survey data. Region: SNE .

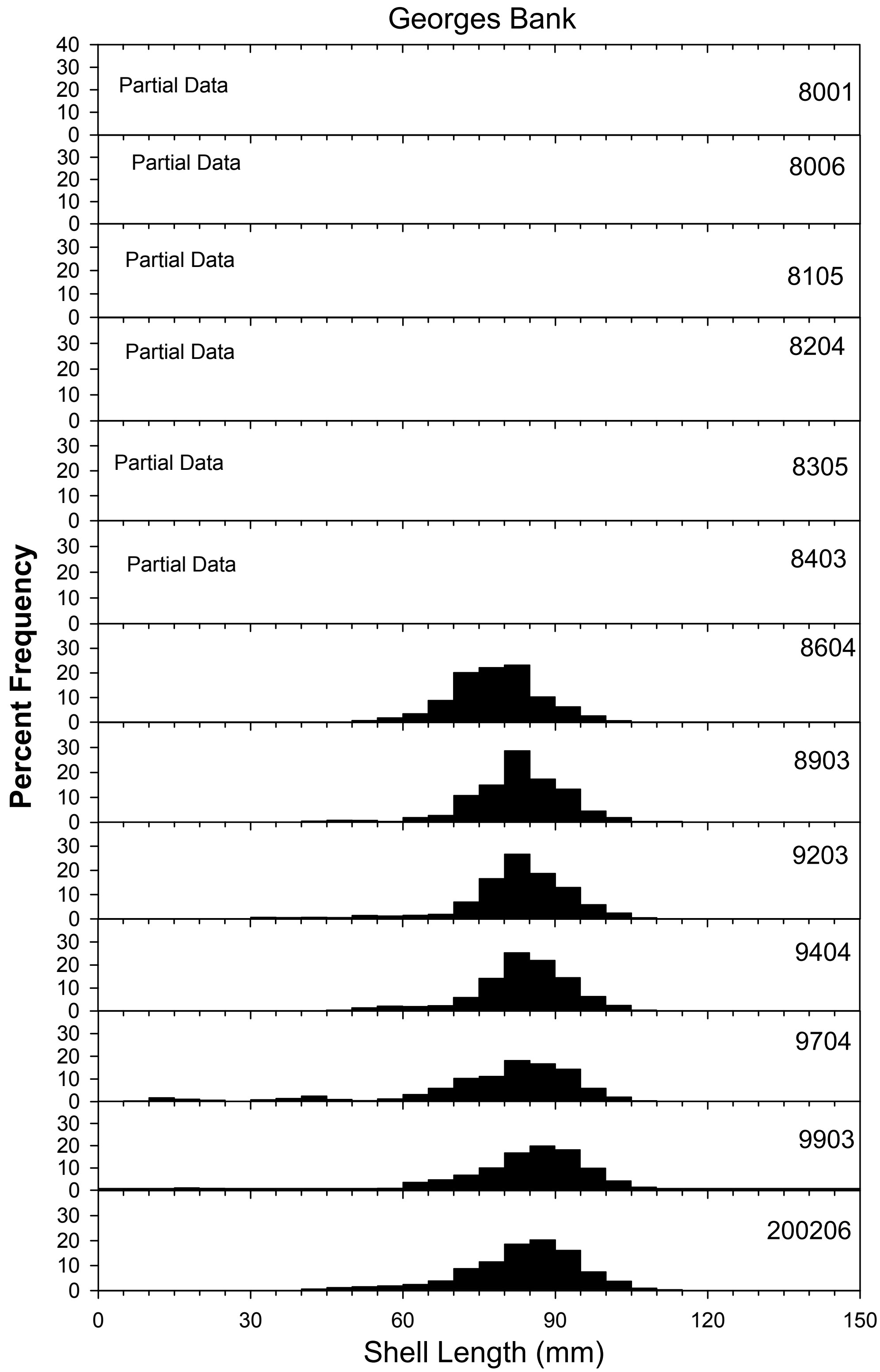


Fig. A54. Ocean quahog length frequency distributions over time, based on NMFS survey data. Region: GBK .

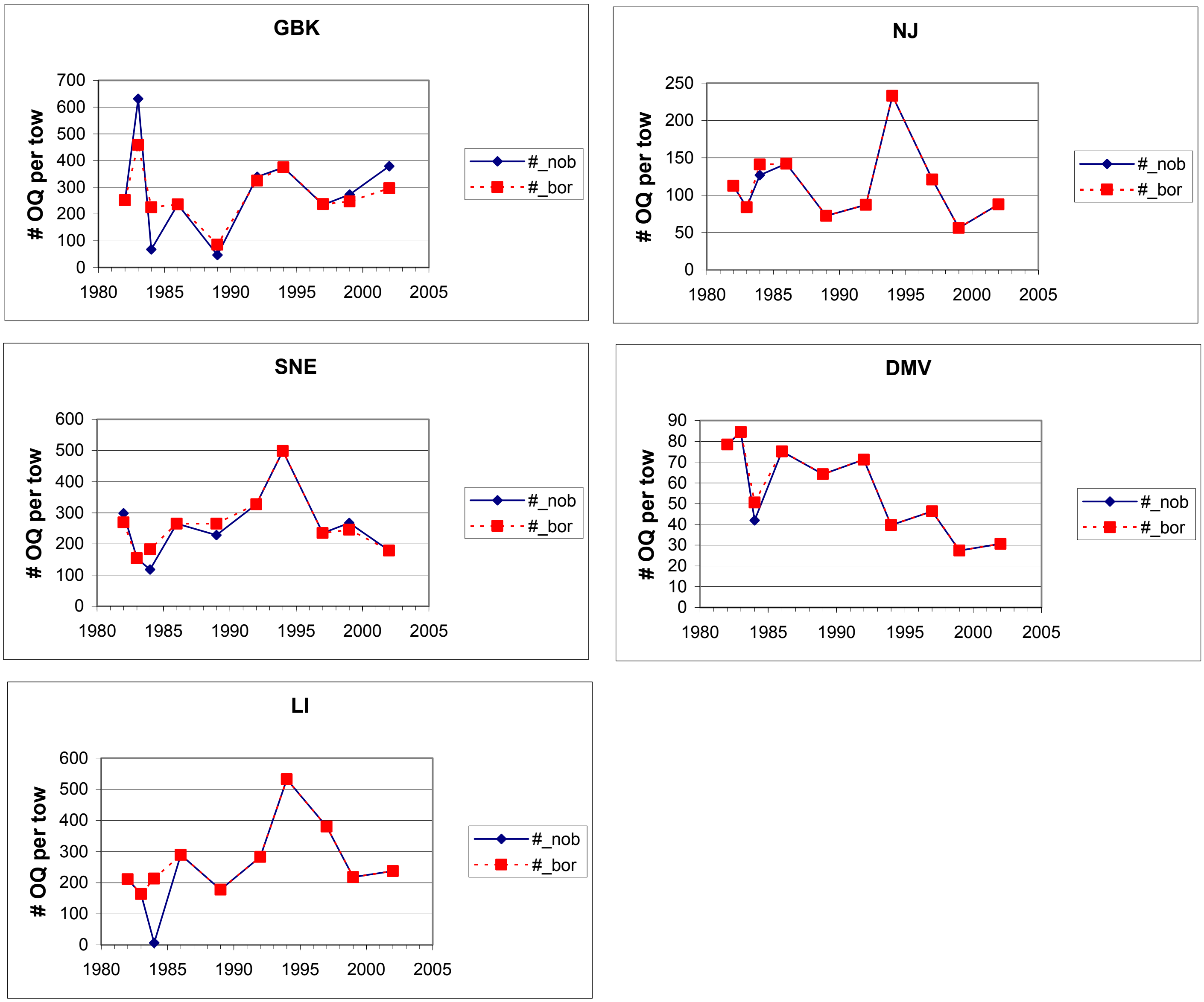
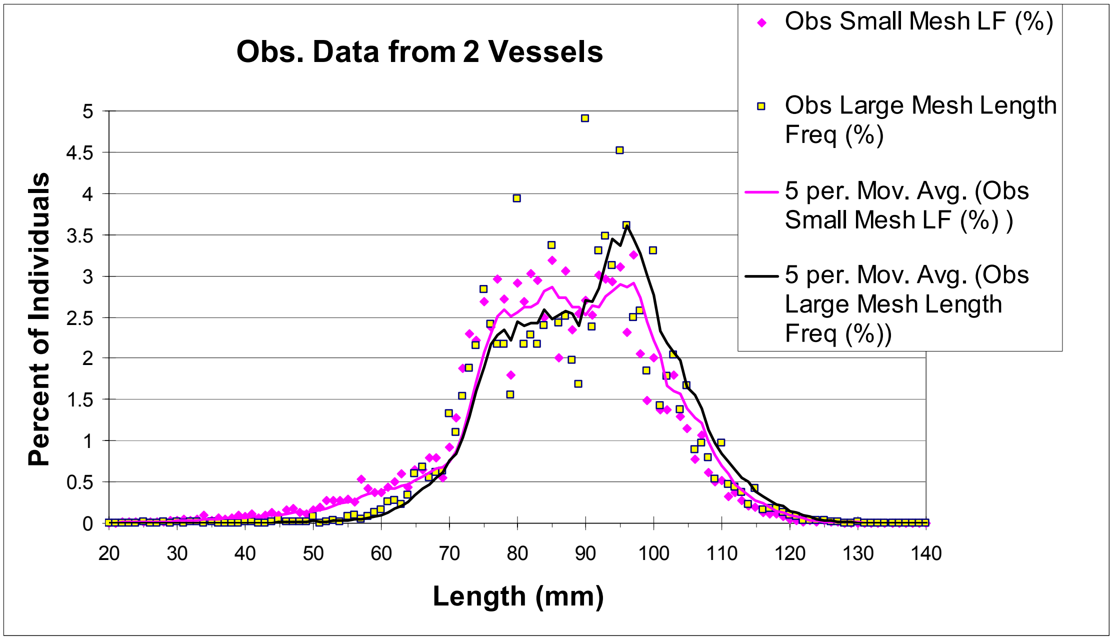


Figure A55.
Sensitivity analysis about "borrowing" to fill survey holes (results from Table A16).



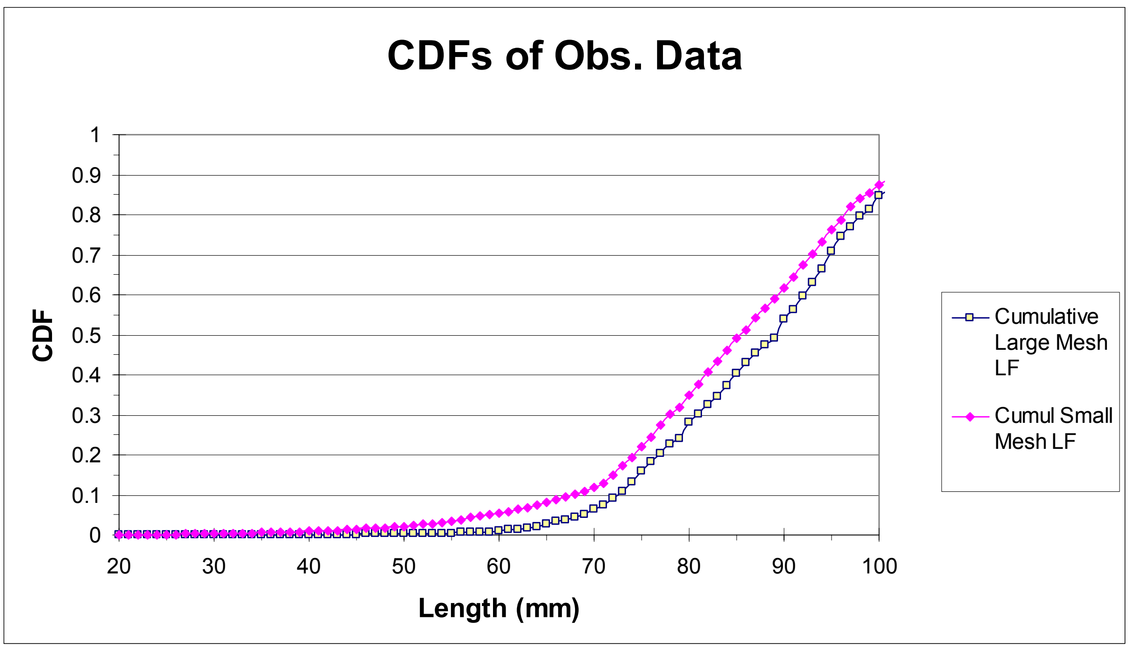


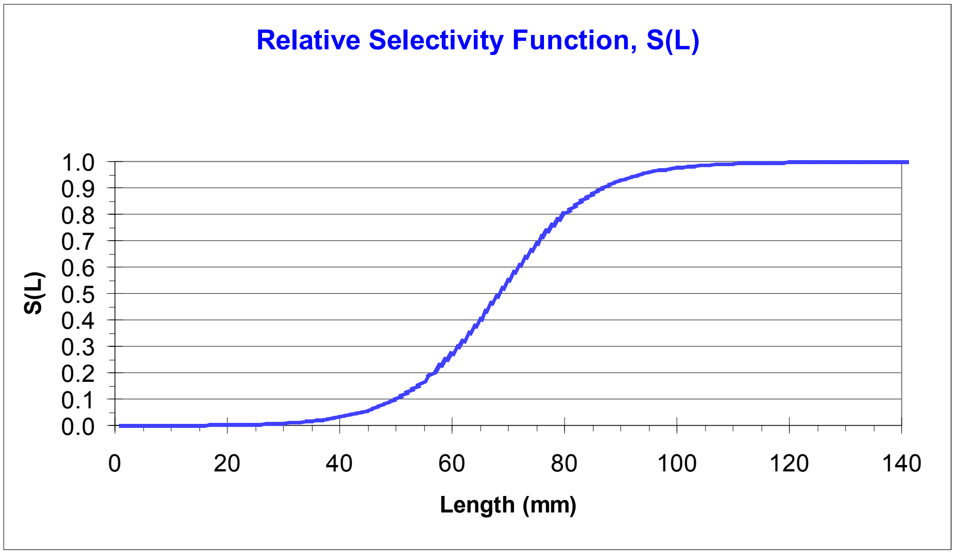
Fig. A56.

Ocean quahog recruit survey:

Observed ocean quahog length frequencies and cumulative distribution functions (CDF) from the NMFS dredge (2" mesh) and the commercial dredge (1" mesh).

Data were collected at approximately 100 stations, sampled by both the *RV Delaware II* in June-July and the *FV Christie* in Sept. 2002. All tows from each vessel were pooled.

A.



B.

alpha	beta	L50%ile	Konst.
8.122	-0.119	68.368	5E-06

C.

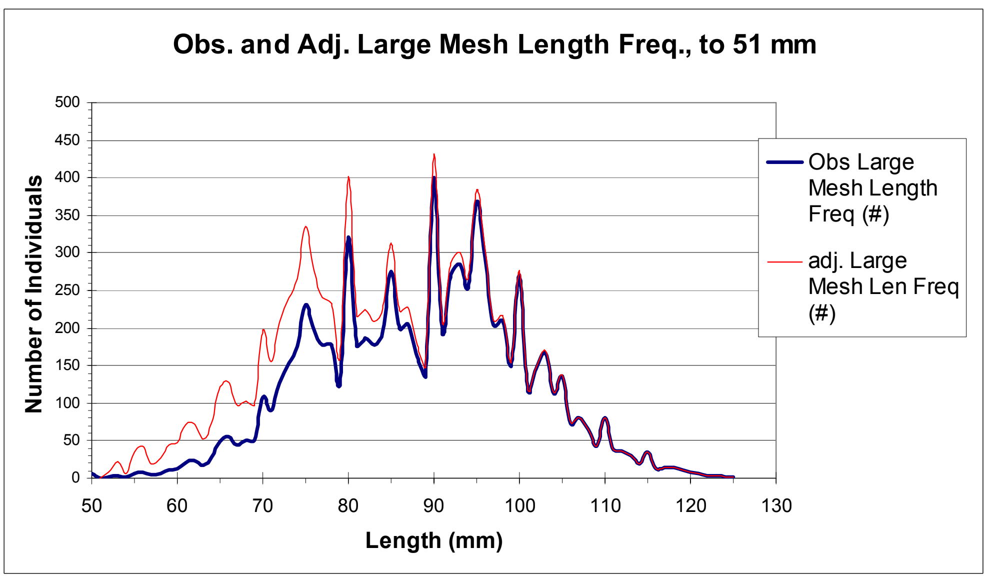


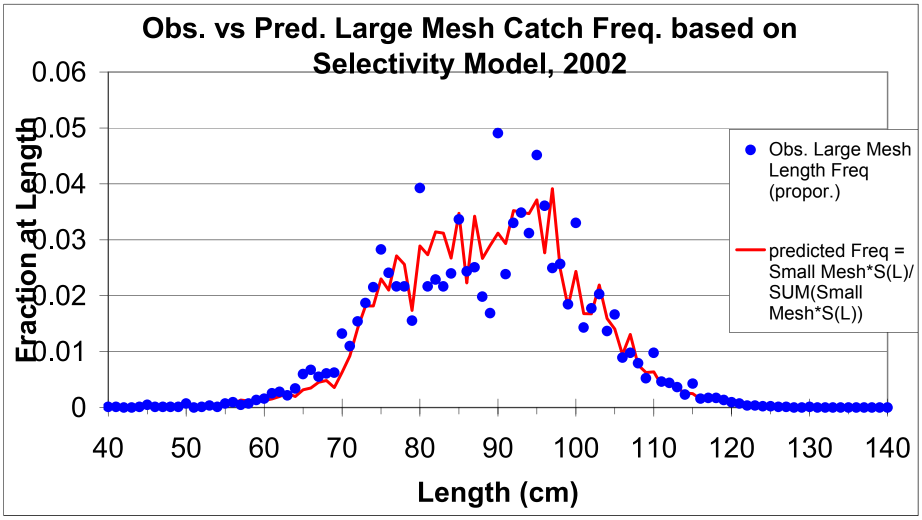
Fig. A57.

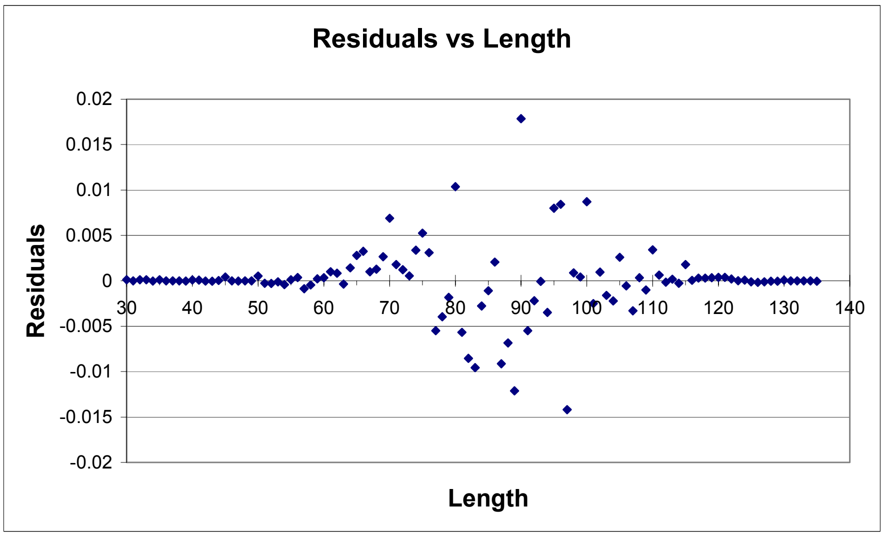
Model results and adjusted DE-II length frequency.

A. Relative size selectivity of the *RV DE-II* to the *FV Christie* catching ocean quahogs in summer 2002.

B. Parameter estimates for Model: S(L) = 1/(1+exp(alpha+ (beta * L))) .

C. Observed DE-II length frequency and the same data (upper red line) after adjustment for relative size selectivity, down to 51 mm shell length.





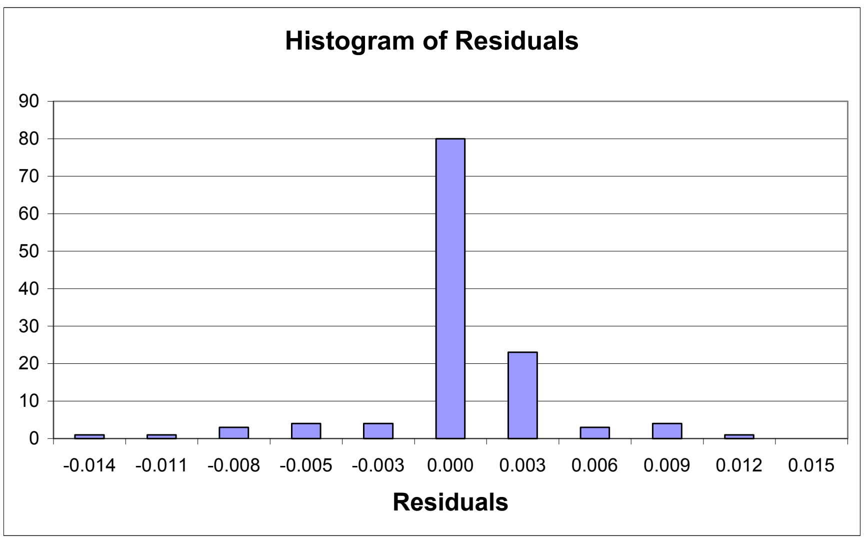


Fig. A58. Fit of the relative selectivity model using data from the paired stations.

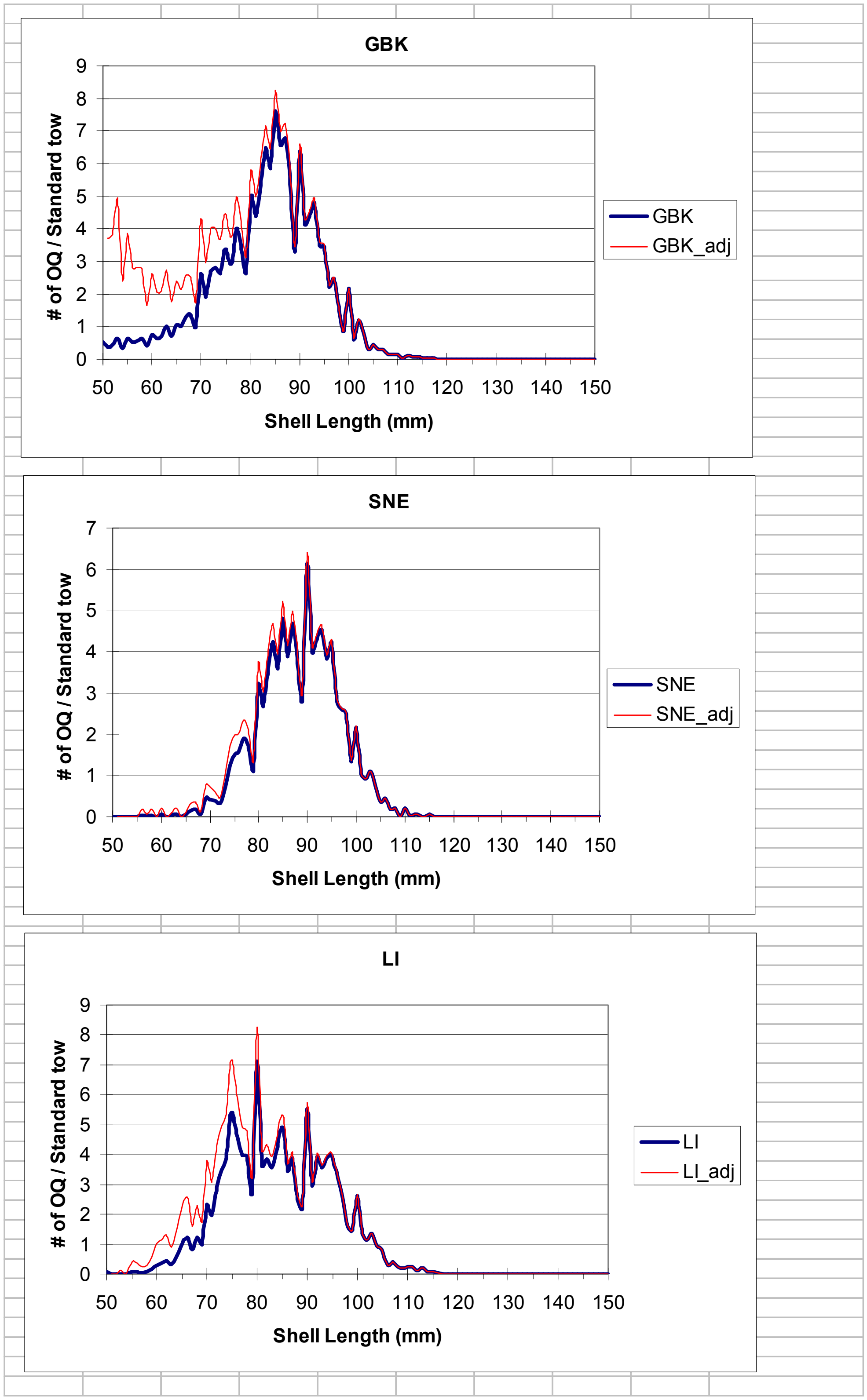
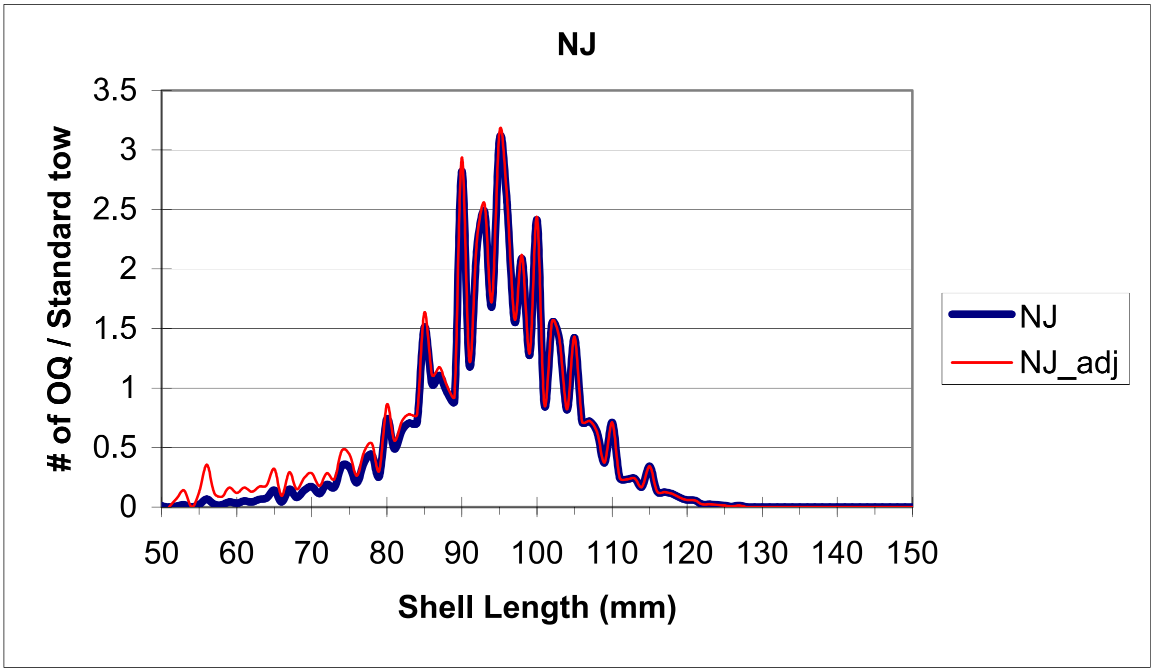


Fig. A59.

Ocean quahog length frequency distributions in 2002; **Northern Regions**. The thick blue line is based only on *RV Delaware-II* data. The thin red line is adjusted for dredge selectivity, down to a shell length of 51 mm, using data from the *FV Christie* 2002 "recruit" survey.
Data were standardized to a common distance of 0.15 nmi based on sensors.
The catches have not been adjusted for dredge efficiency.



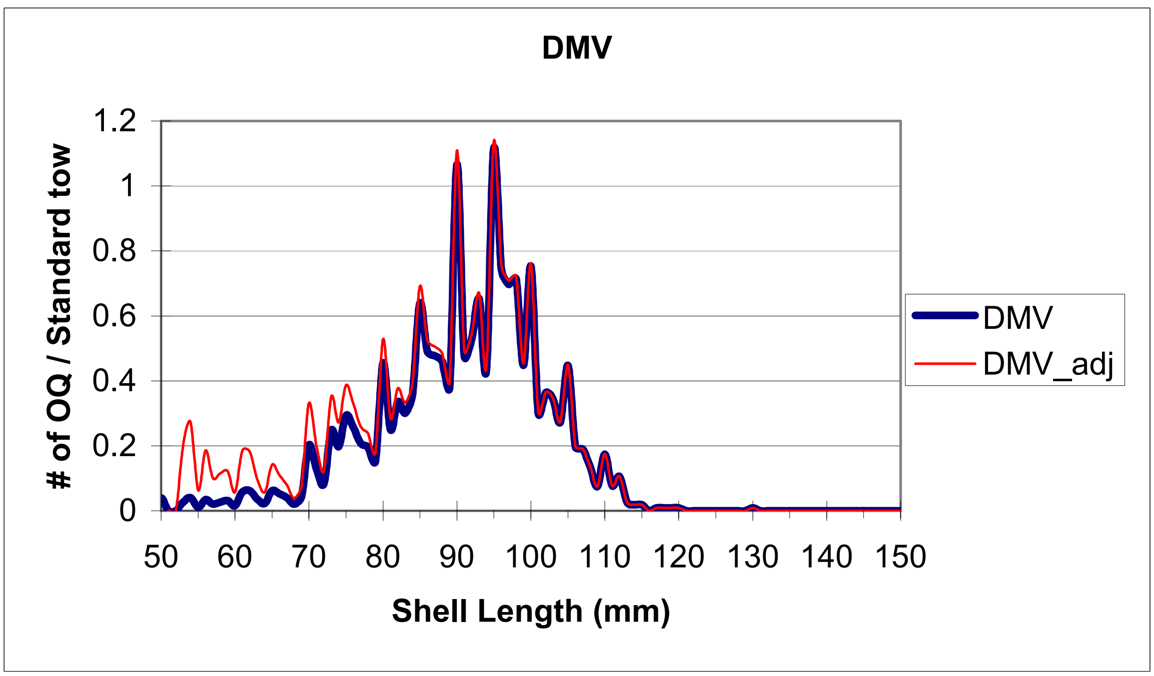


Fig. A60.

Ocean quahog length frequency distributions in 2002; **Southern Regions**.
The thick blue line is based only on *RV Delaware-II* data. The thin red line is adjusted for dredge selectivity, down to a shell length of 51 mm, using data from the *FV Christie* 2002 "recruit" survey.
Data were standardized to a common distance of 0.15 nmi based on sensors.
The catches have not been adjusted for dredge efficiency.

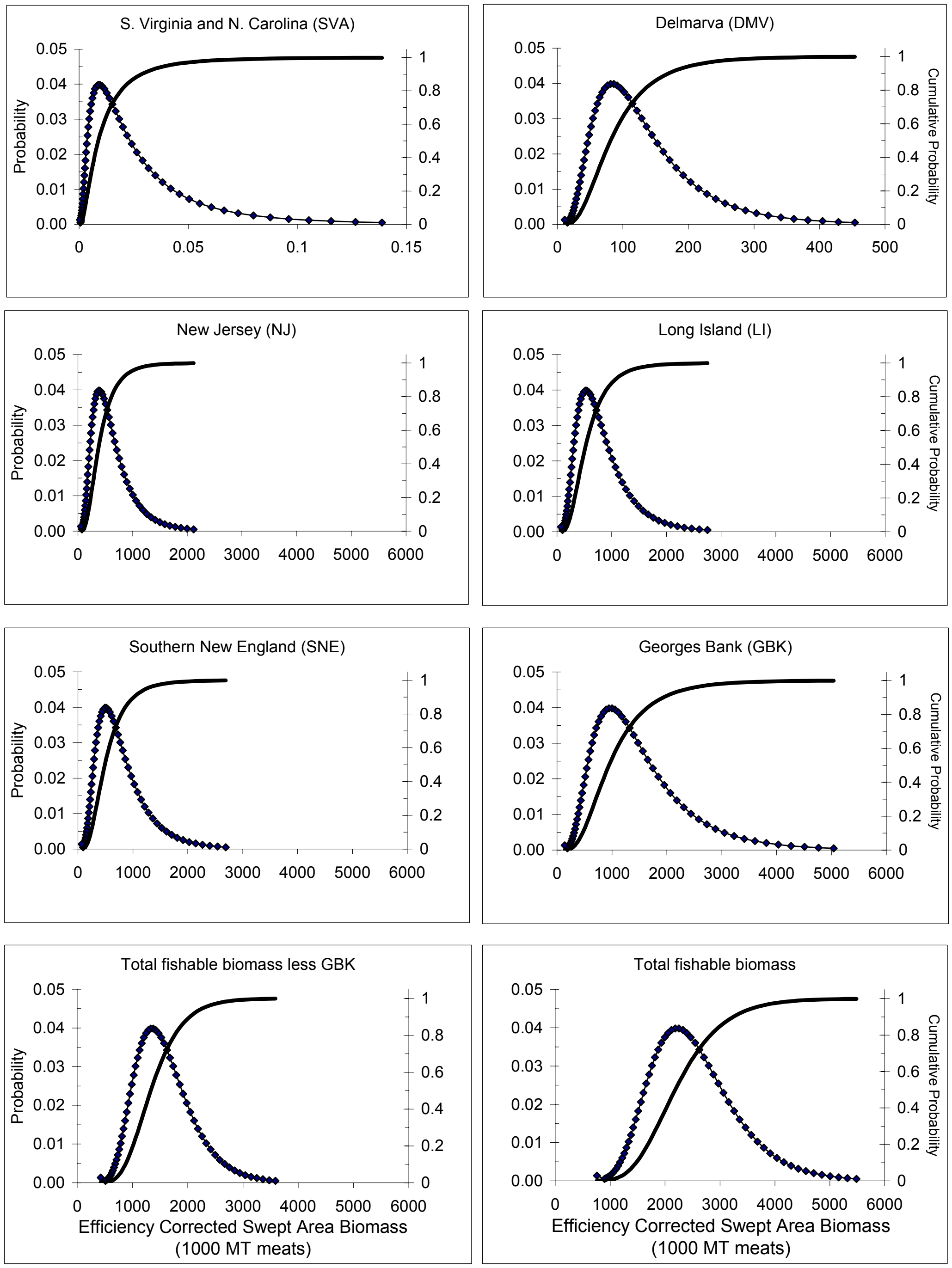


Fig. A61.

Uncertainty in ocean quahog (70+ mm) efficiency corrected swept area **biomass** estimates in 2002. Uncertainty distributions are based on analytical variance calculations assuming log normality, and include uncertainy in survey data, swept-area, amount of suitable habitat and survey dredge efficiency. The x-axis in most graphs scaled to the same maximum value to facilitate comparisons.

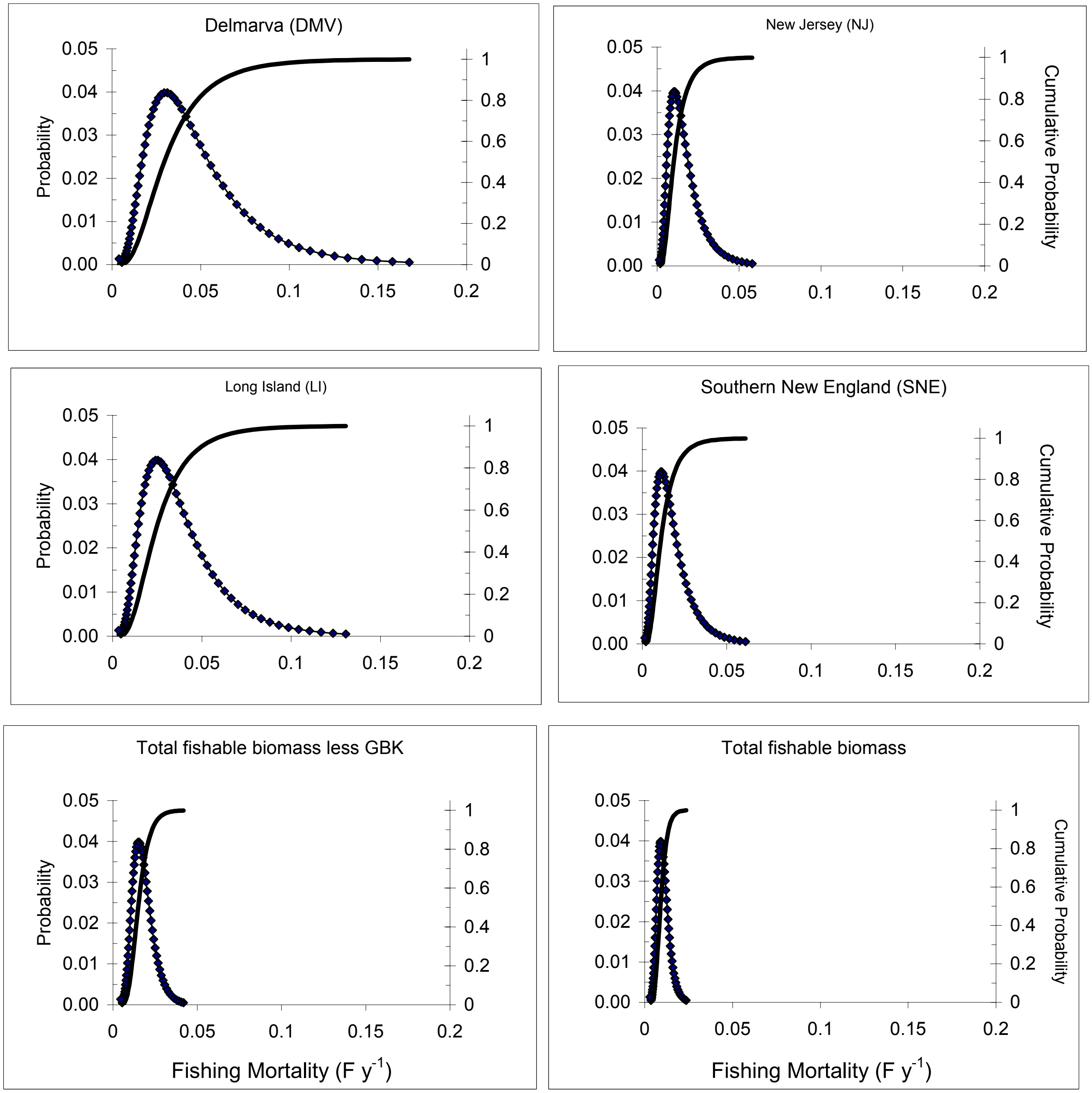


Fig. A62.

Uncertainty in ocean quahog (70+ mm) **fishing mortality** estimates for 2002 based on catch data and efficiency corrected swept-area biomass. Uncertainty calculations are based on analytical variance calculations that assume log normality, and include uncertainty in catch, survey data, swept-area, amount of suitable habitat, and survey dredge efficiency. X-axes are scaled to the same maximum to facilitate comparisons.

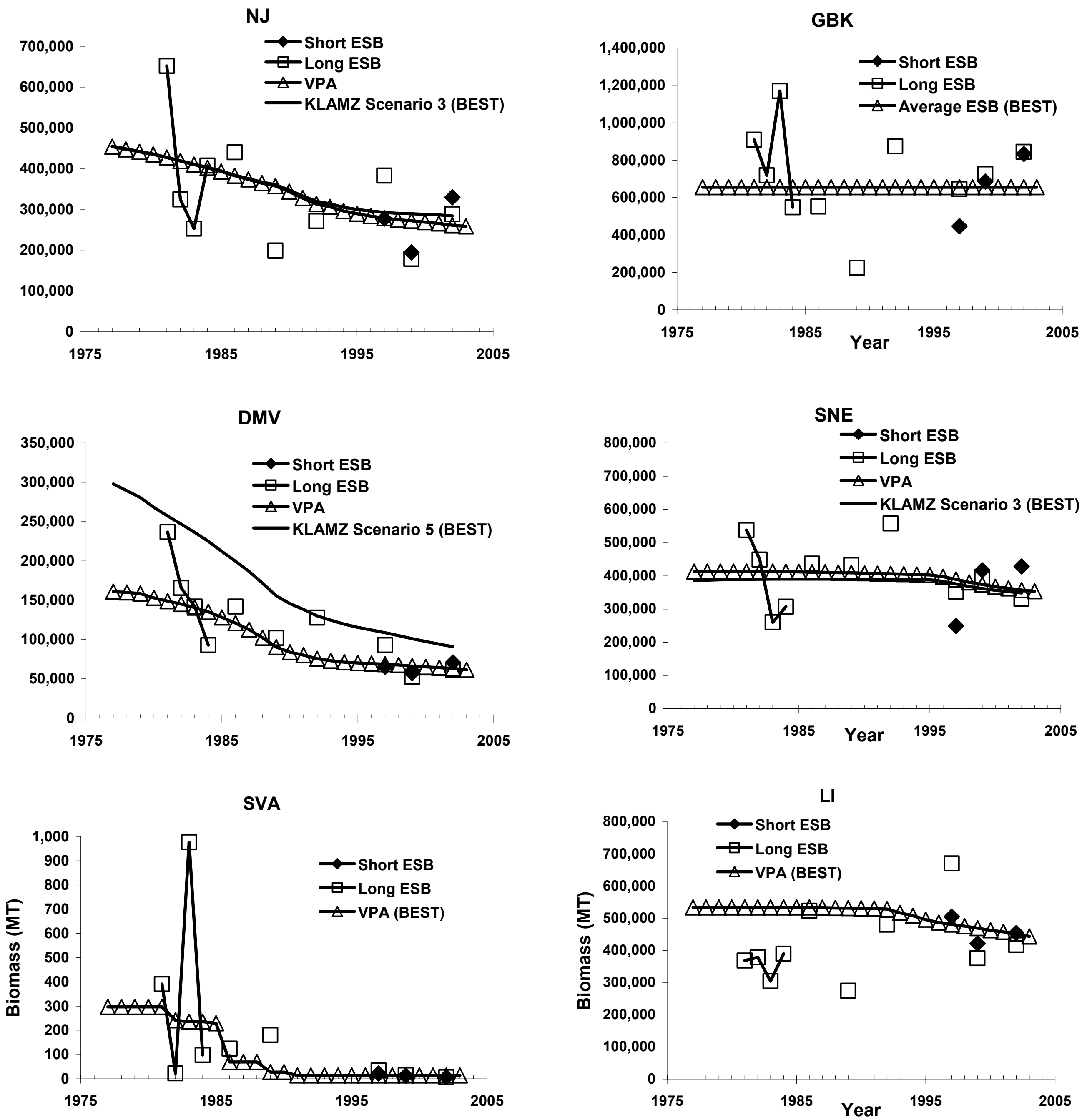


Figure A63. Results of models estimating ocean quahog biomass.

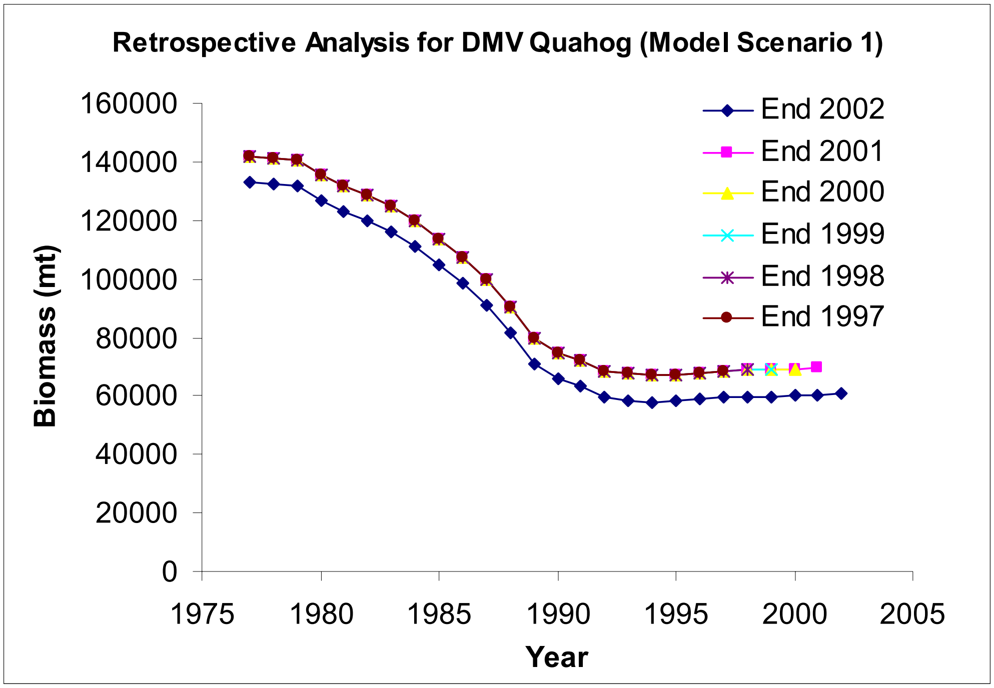


Figure A64. Delmarva region, retrospective analysis.

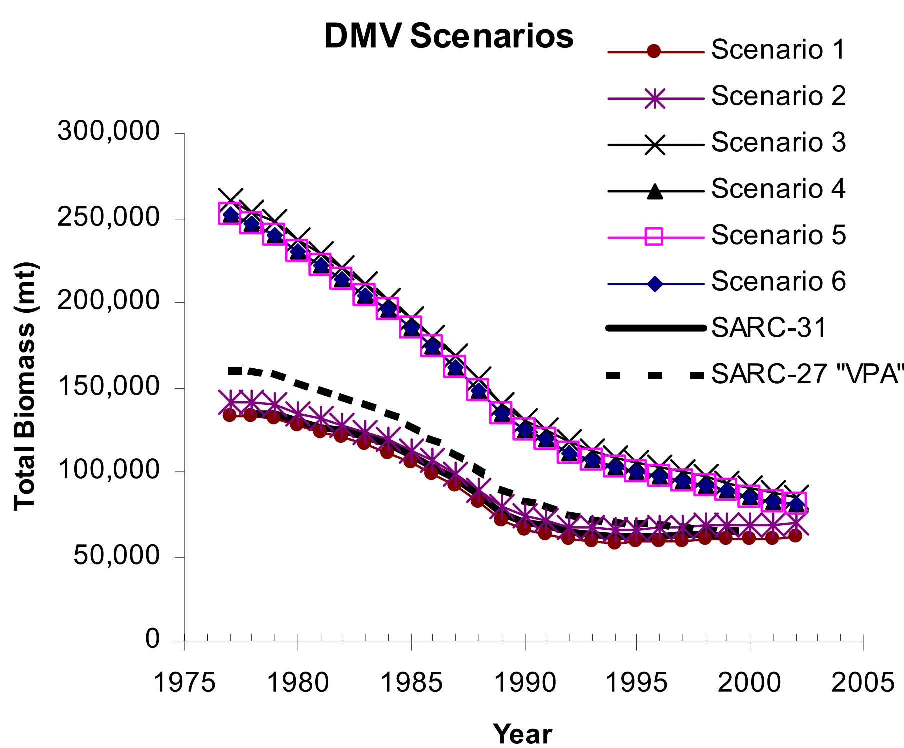


Figure A65. Delmarva region, biomass scenarios.

DMV - Scenario 5

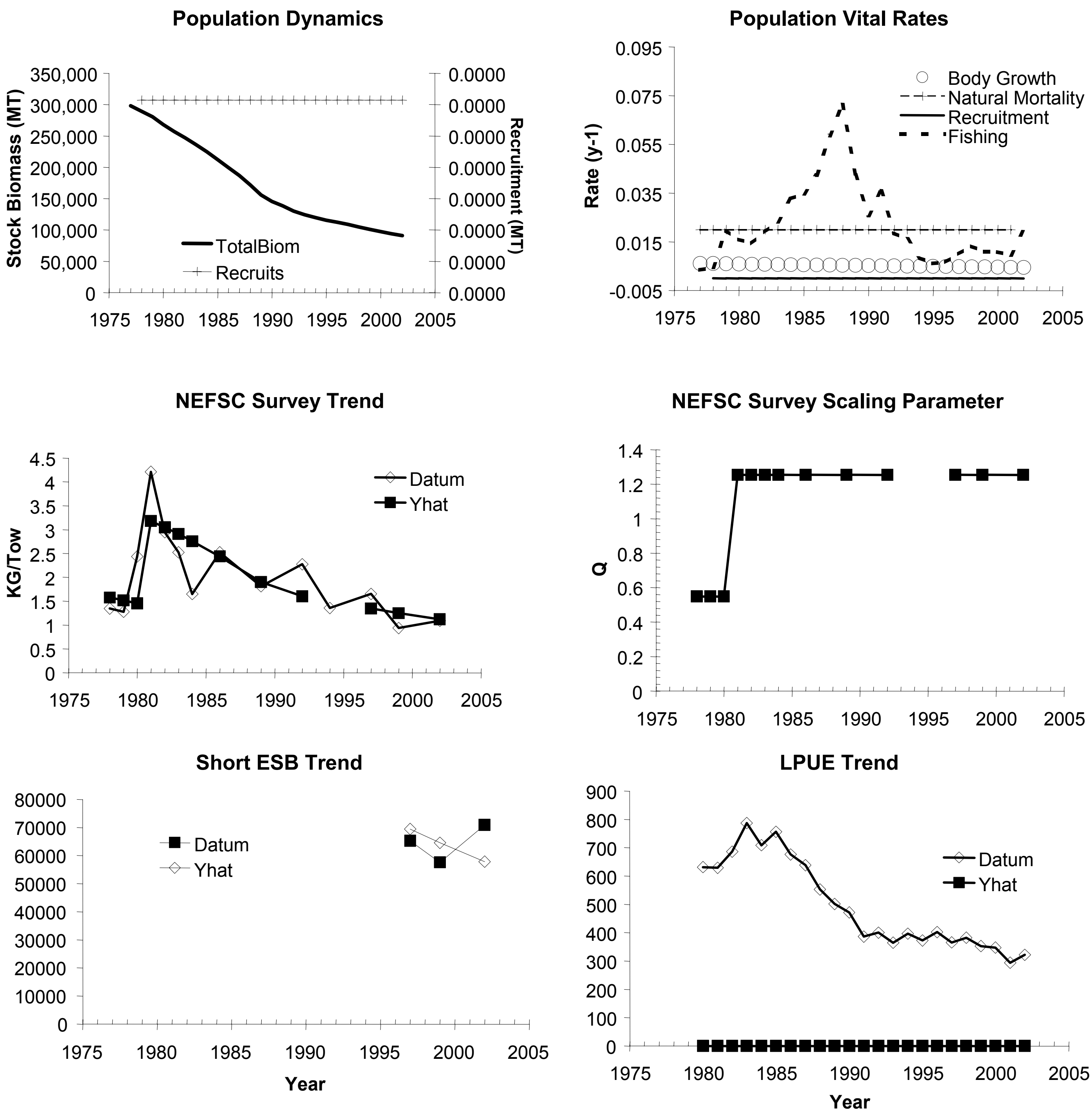


Figure A66. Delmarva region, Scenario 5.

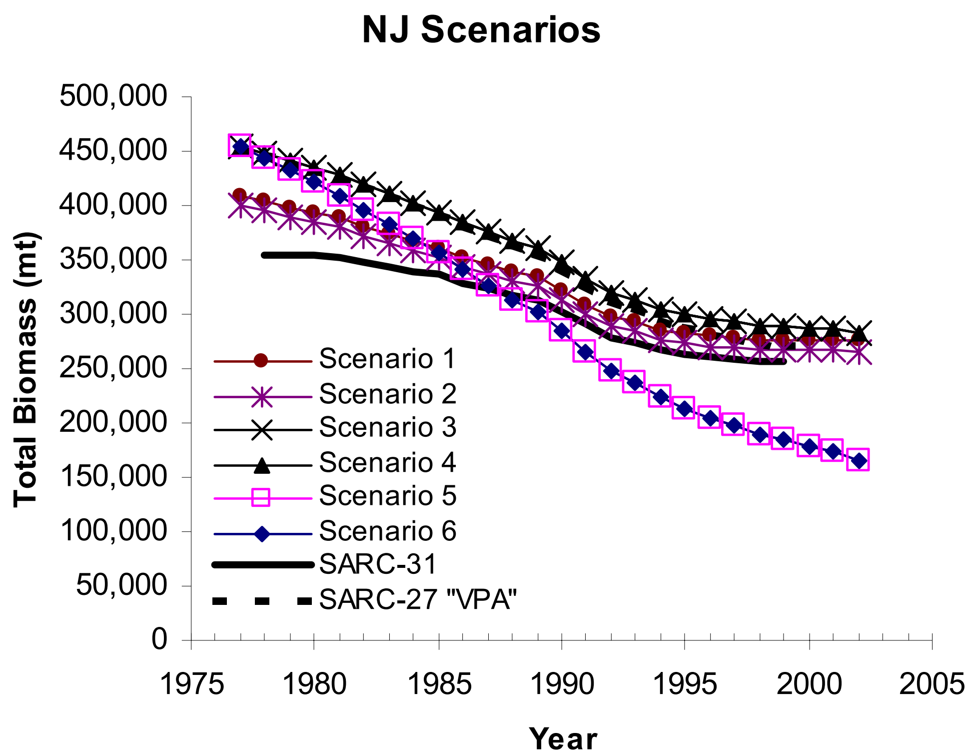


Figure A67. New Jersey region, biomass scenarios.

NJ - Scenario 3

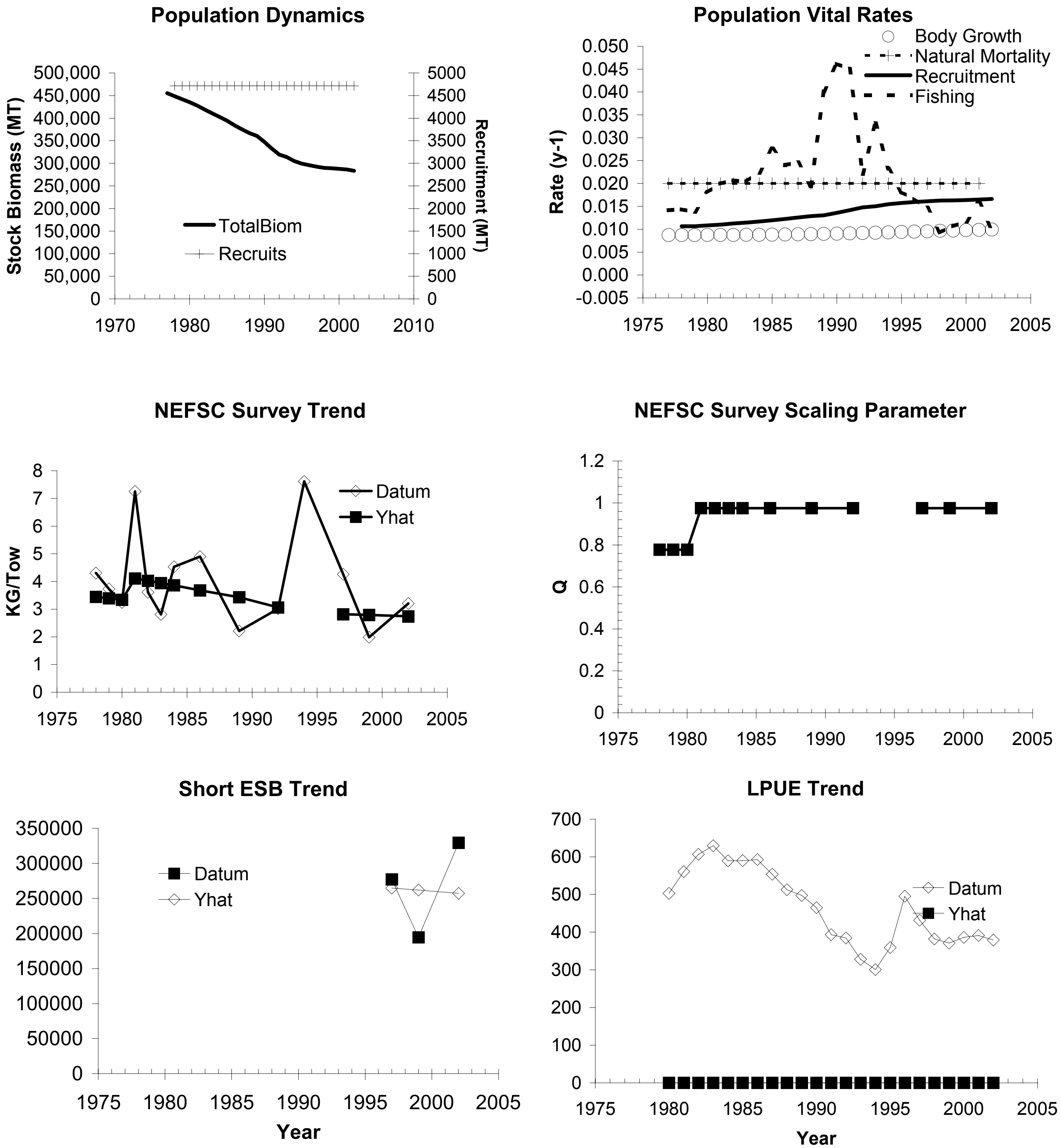


Figure A68. New Jersey region, Scenario 3.

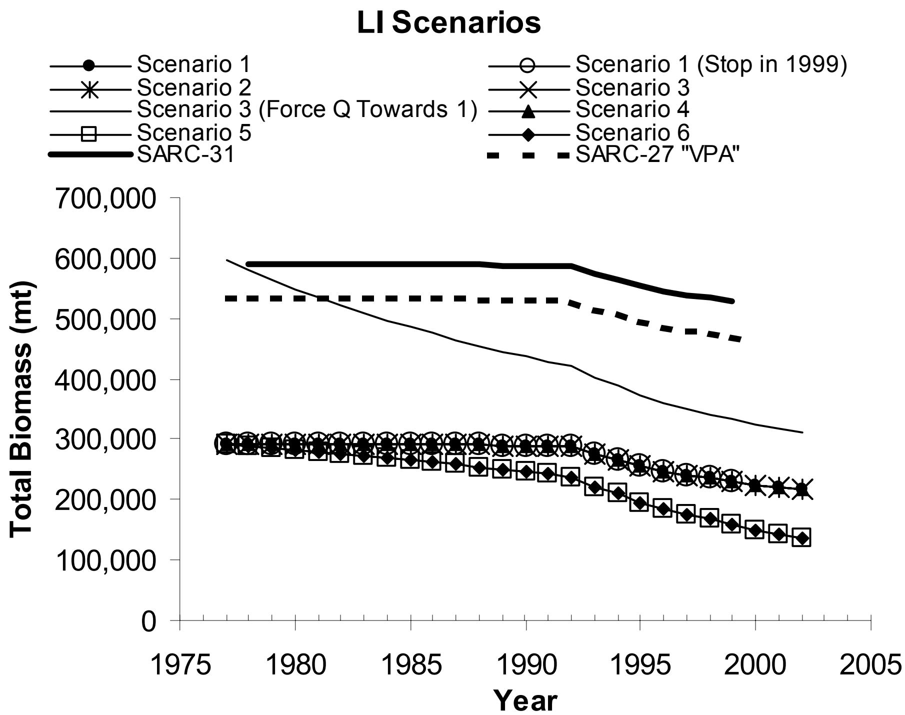


Figure A69. Long Island region, biomass scenarios.

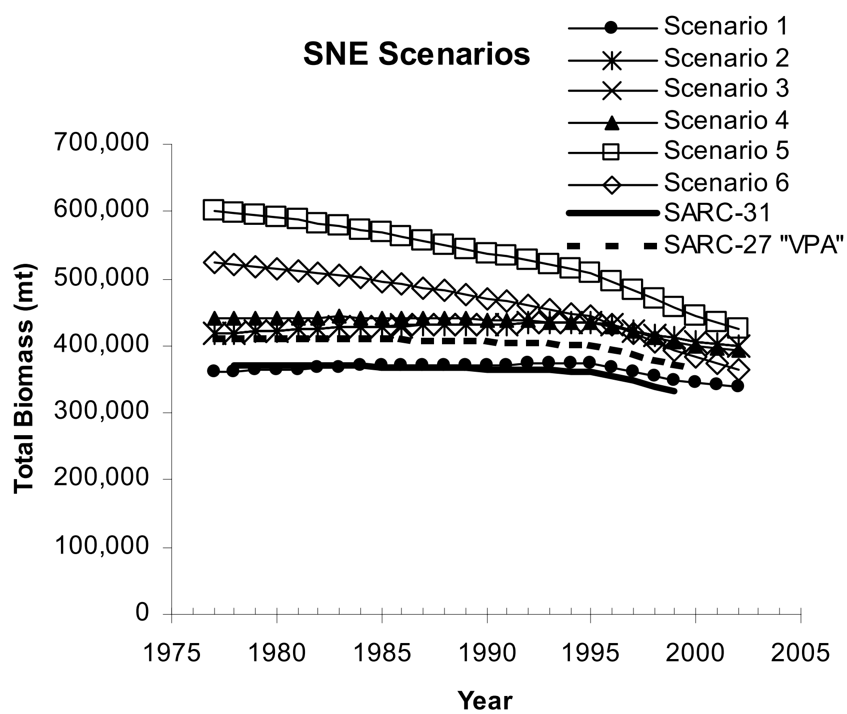


Figure A70. Southern New England region, biomass scenarios.

SNE - Scenario 3

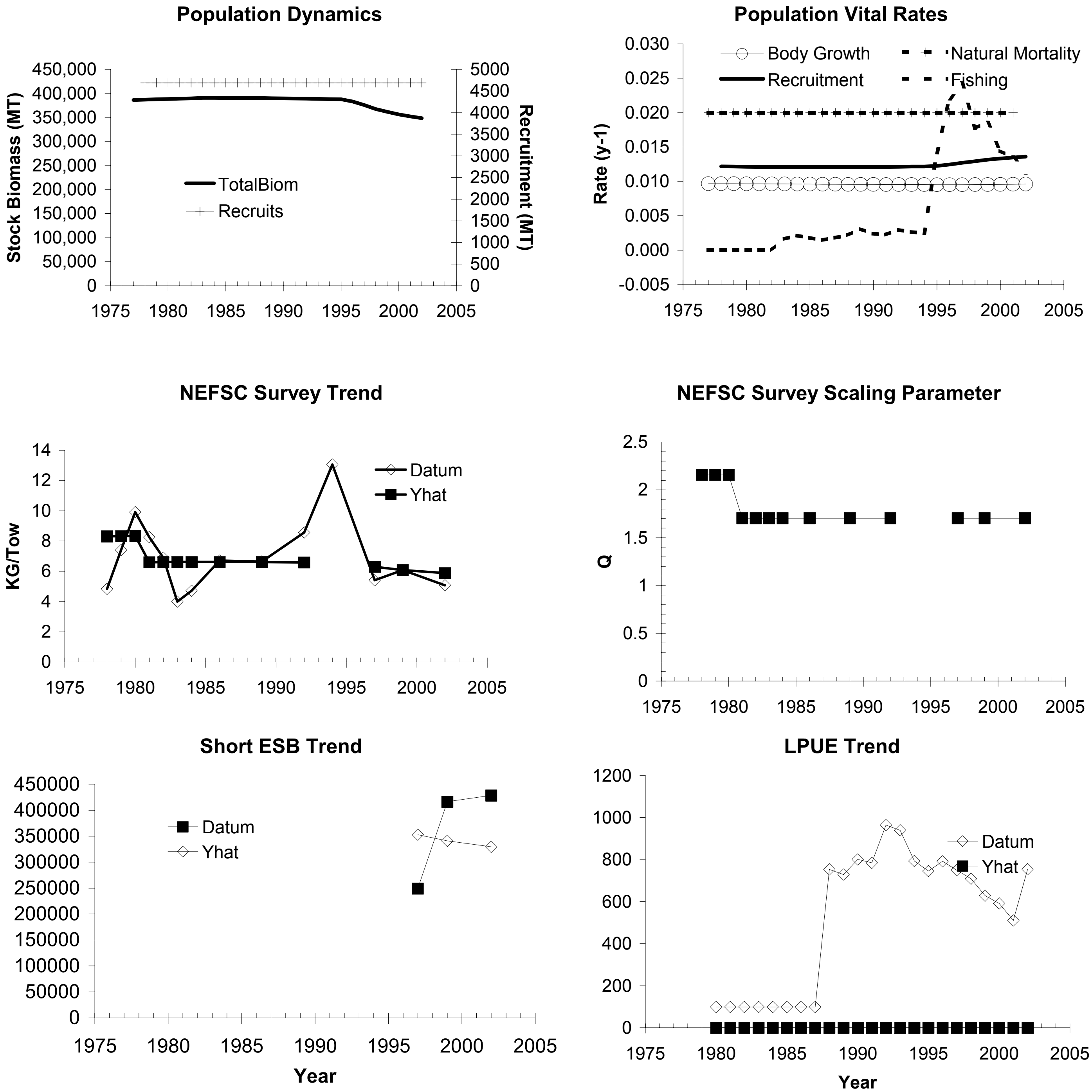


Figure A71. Southern New England region, Scenario 3.

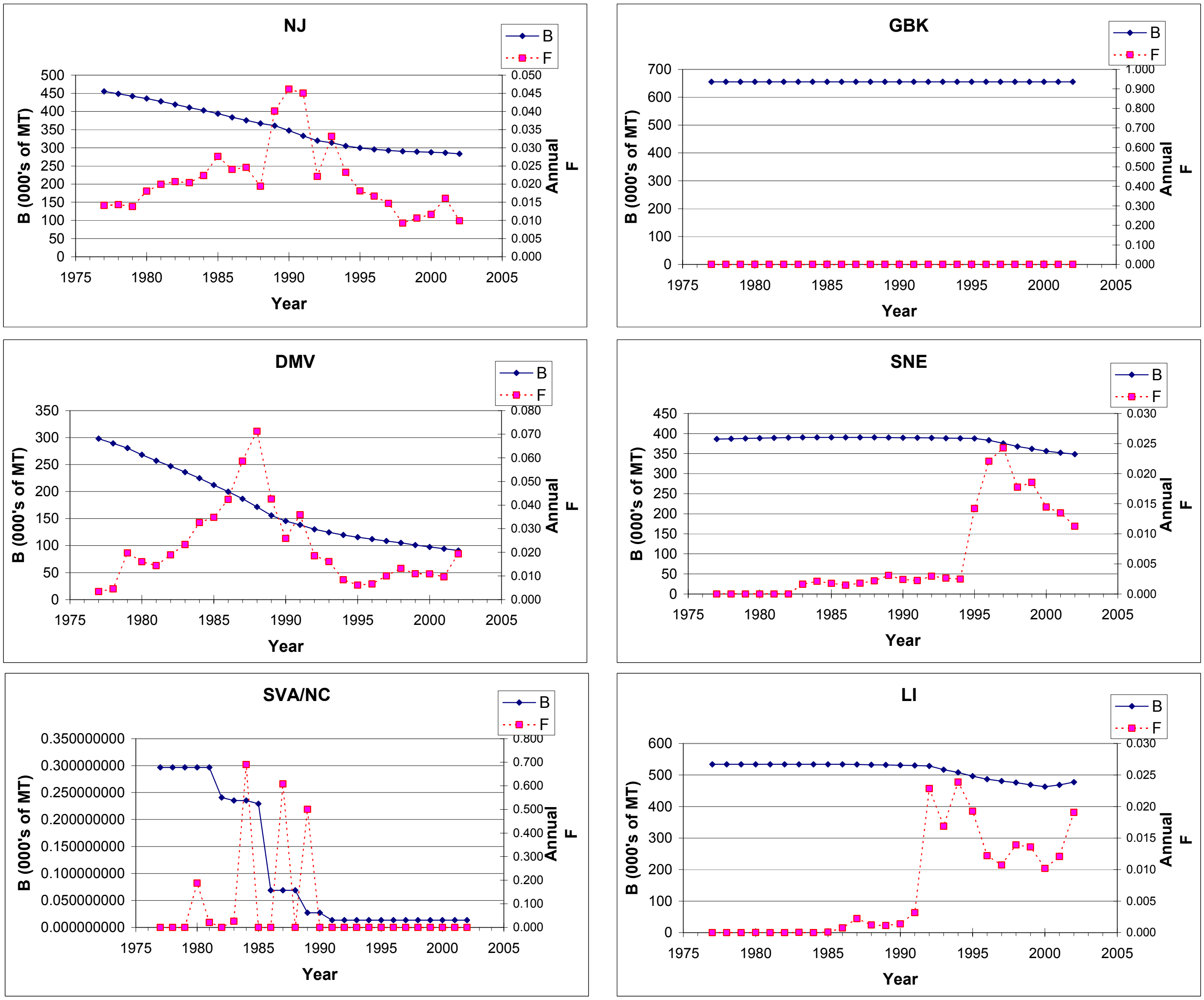
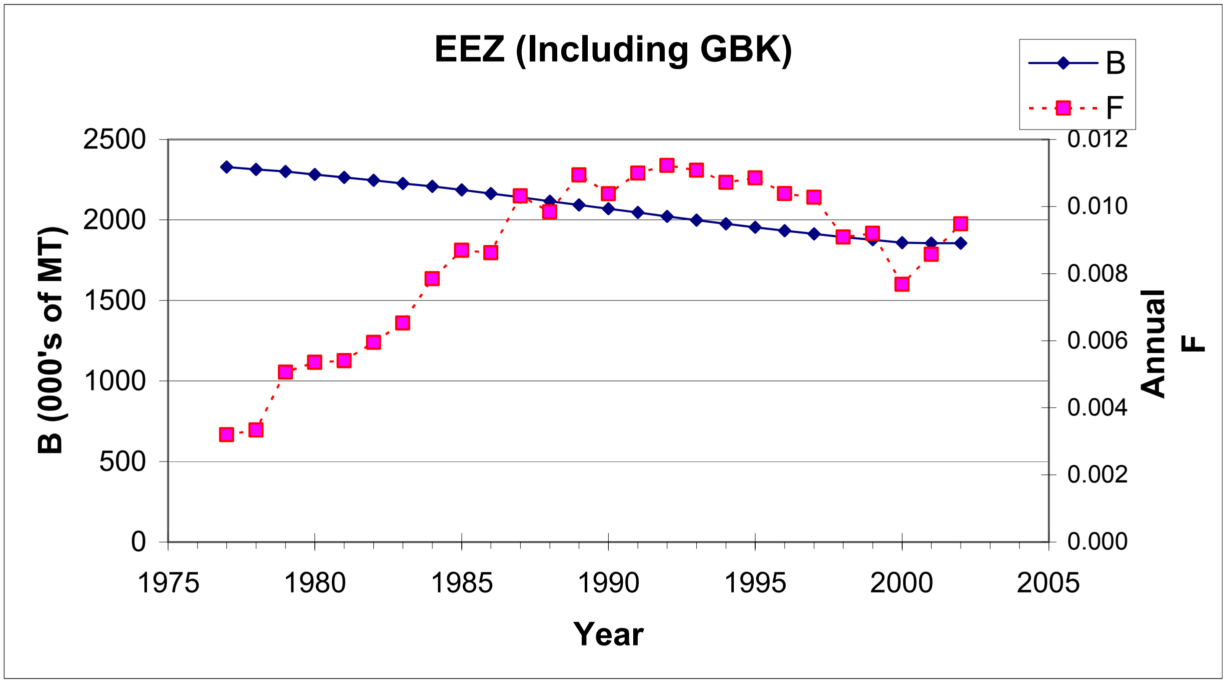


Figure A72. Regional biomass and annual fishing mortality rate over time based on KLAMZ and other models. Values are from Table A24.



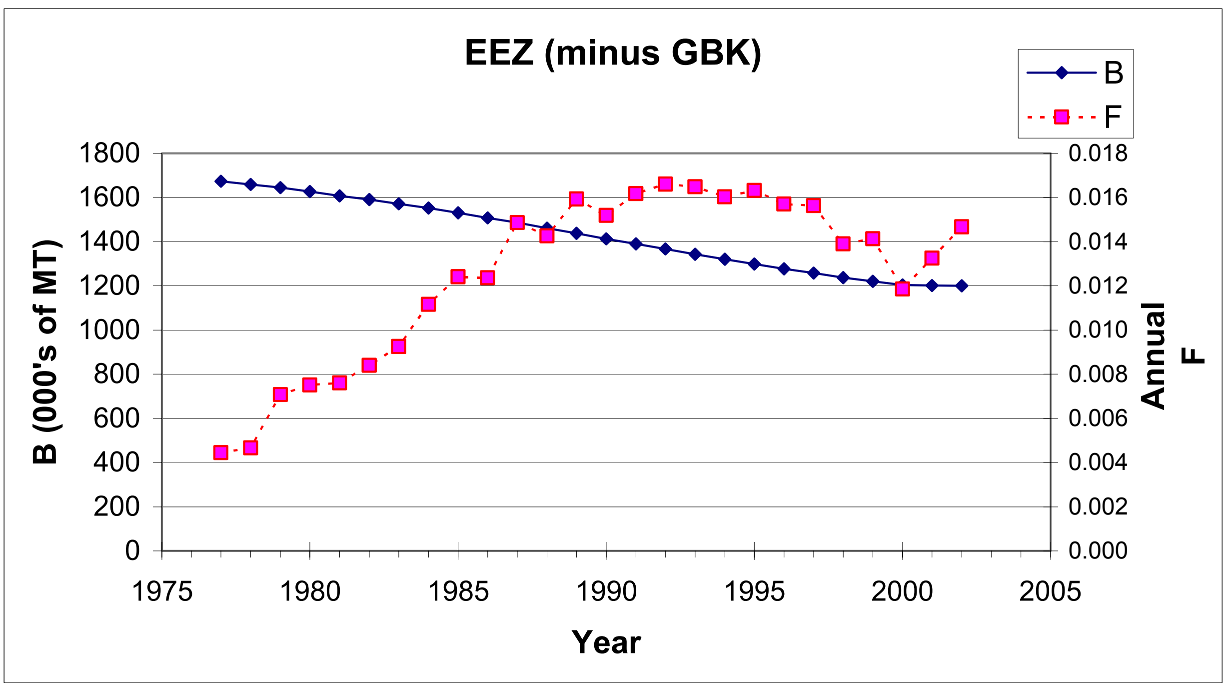


Figure A73. Biomass and annual fishing mortality rate over time based on KLAMZ and other models, for the EEZ and the EEZ less GBK. Values are from Table A24.

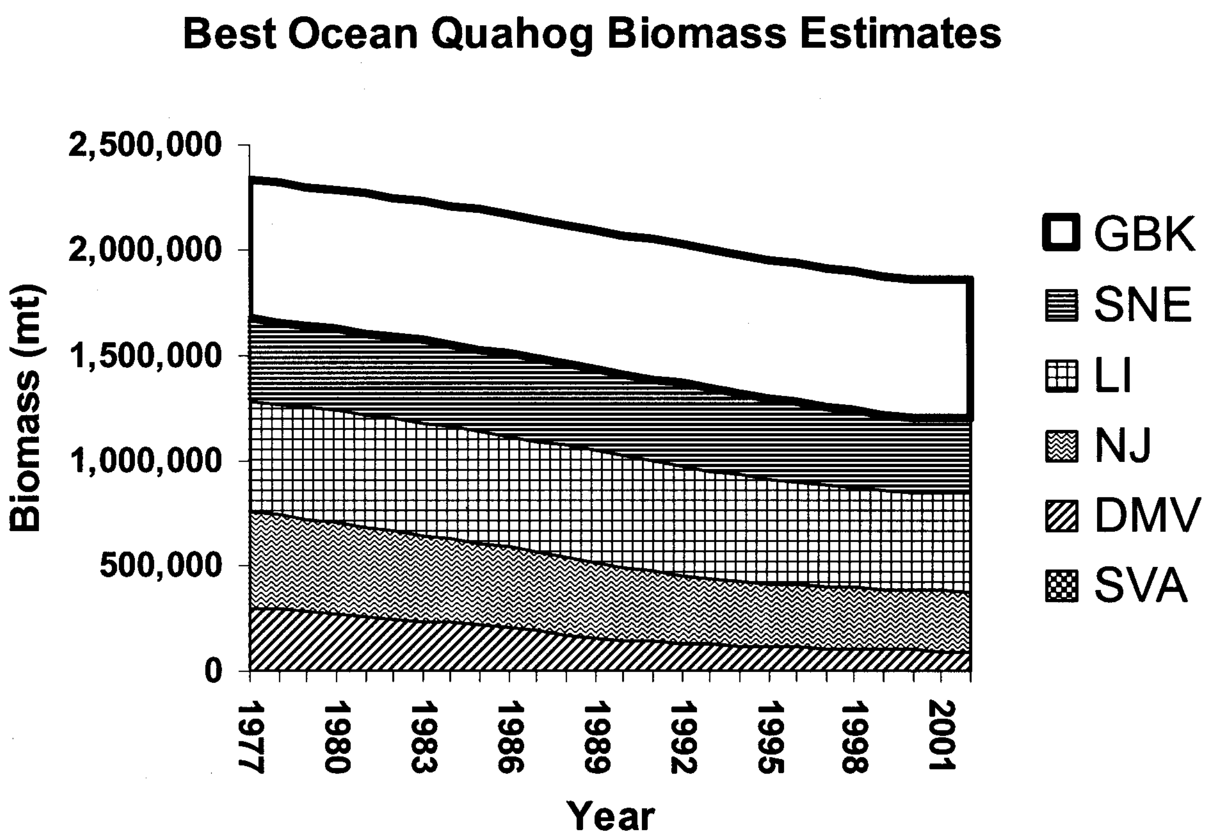
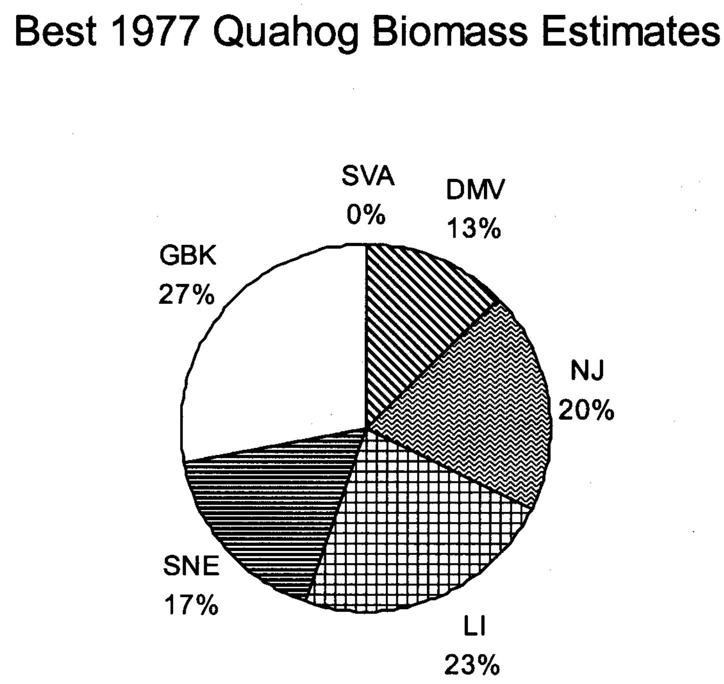


Figure A74. Temporal trends in ocean quahog biomass, Based on Table A24.



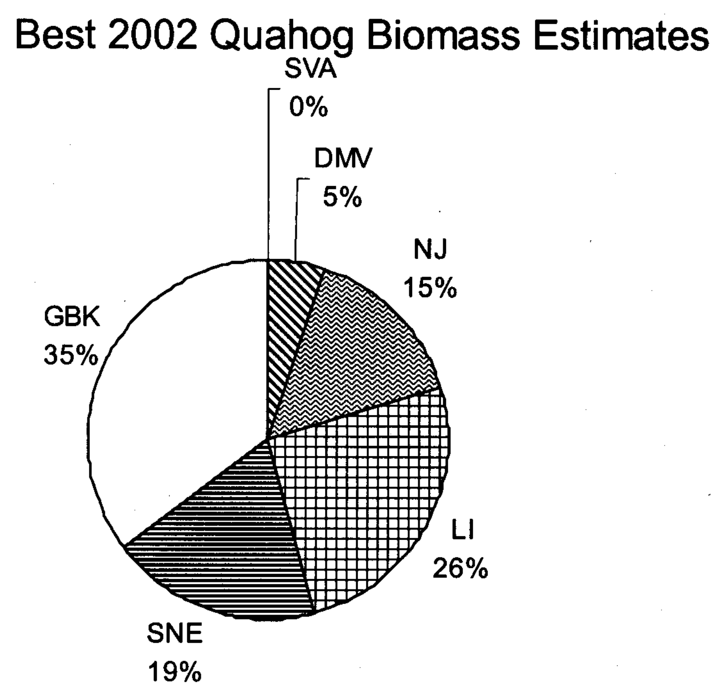
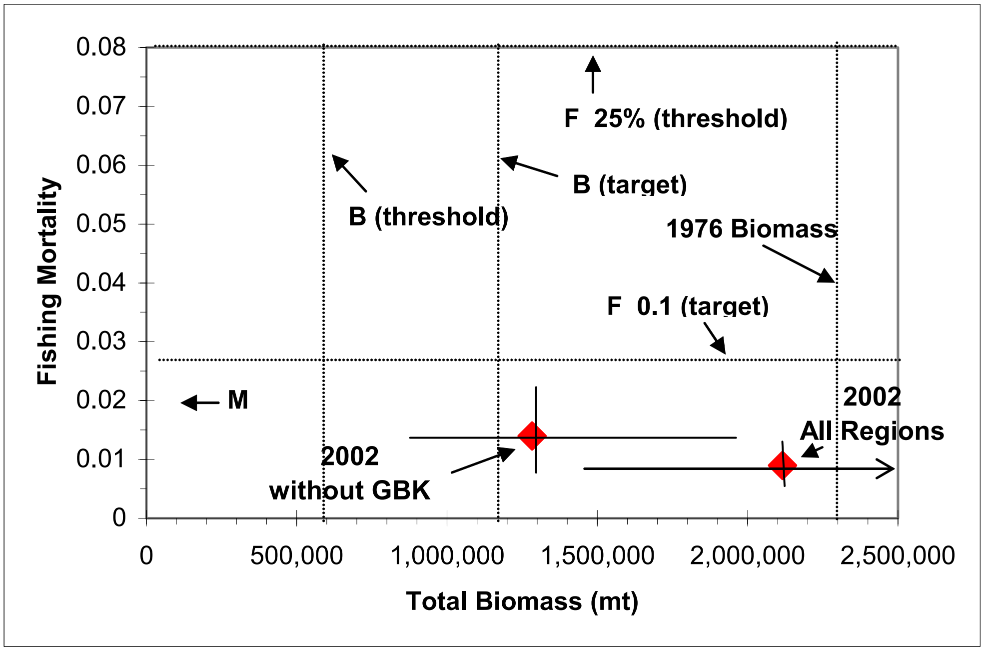


Figure A75. Percentage ocean quahog biomass by region, 1977 and 2002. Based on values in Table A24.

A.



B.

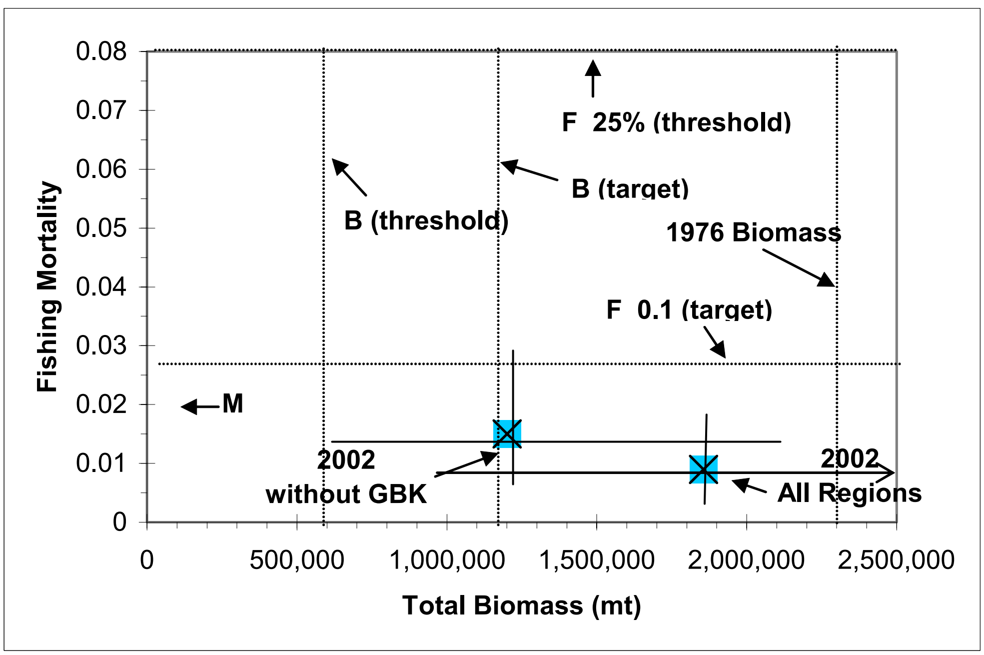


Figure A76. Ocean quahog biomass and fishing mortality rate in relation to updated Biological Reference Points. Biomass and F estimates for 2002, as well as the 80% CIs, are from the A. ESB model or B. KLAMZ model.