		Full-time	Part-time	Occasional			Georges Bank	Mid-Atlantic
1992-93	NA	NA	NA	NA	44,934	31.3	1.7	0.6
1993-94	NA	NA	NA	NA	40,490	16.1	0.5	0.8
1994-95[38]	1.69	204	91	18	36,747	16.9	0.5	1.1
1995-96	1.51	182	82	16	33,490	17.4	0.8	1.6
1996-97	1.51	182	82	16	34,404	17.5	1.5	0.8
1997-98	1.33	164	66	14	30,832	13.6	1.7	0.6
1998-99	1.15	142	57	12	27,208	12.2	4.2	1.3
1999-00[39]	0.83	120	48	10	24,772	26.9	2.9[40]	2.4[41]
2000-01[42]	0.34	120	48	10	25,065	34.2	3.7	3.6
2001-02	0.28	49	19	4	11,558	28.3	4.3	4.7[43]
2002-03	0.24[44]	46	18	4	12,009	27.3	5.6	5.2
2003-04	0.22	45	18	4	11,799	26.0	6.9	5.6
2004-05	0.15	34	14	3	9,374		8.2[45]	6.0
2005-06	0.15	35	14	3	9,585			
2006-07	0.15	38	15	3	10,245			
2007-08	0.15	36	17	4	9,824			
2008-09	0.20[46]	60	24	5	15,098		8.2[47]	3.9[48]

5.0 EFFECTS OF MANAGEMENT TARGETS IN FUTURE YEARS, INCLUDING THE NEXT FISHING YEAR

5.1 Biological Projections

(D. Hart)

5.1.1 Introduction

The present biological projection model is a slightly modified and updated version of the one described in the 1999 SAFE document. It is a size-structured model, with the population broken down into discrete 5 mm shell height classes, and the projected size-frequency distributions are tracked

[37] The landing estimates are from the "Amendment 7" status quo (no action) scenario, assuming a full-time day-at-sea allocation of 49 days. Other management options could increase the expected landings, but the biomass projections would of course be lower. Various scenarios and their results are described in Section 5.1???.
[38] Amendment 4 initiates day-at-sea regulations and was implemented on May 1, 1994. Day-at-sea allocations are later amended to coincide with the March to February fishing year.
[39] Amendment 7 revised the day-at-sea schedule and was implemented on March 1, 1999.
[40] Biomass based on 1999 survey (1998 survey for the Nantucket Lightship Area).
[41] Biomass based on 1999 survey.
[42] Framework Adjustment 12 increased the day-at-sea allocation to the same level as allocated in 1999.
[43] The biomass of Mid-Atlantic scallops would exceed the biomass target and the fishing mortality target would be 0.20.
[44] Fishing mortality is set at F_{max} and overfishing ceases.
[45] The biomass of Georges Bank scallops would exceed the biomass target and the fishing mortality target would be 0.20.
[46] Annual target set at 80 percent of F_{max}, after rebuilding is complete.
[47] Georges Bank scallop rebuilding objective is a B_{MSY}-proxy equal to 8.16 kg/tow (NEFSC 1999).
[48] Mid-Atlantic scallop rebuilding objective is a B_{MSY}-proxy equal to 3.90 kg/tow (NEFSC 1999).

separately for each area. Population growth follows a von Bertalanffy equation. Fishing mortality may be specified both temporally and spatially. This allows the model to simulate the effects of area closures/reopenings, as well as other spatial variations in fishing mortality.

The principle improvements of the current model over the model presented last year are: (1) The addition of an option for stochastic simulation of recruitment, together with the previous option of constant (e.g., median) recruitment; (2) subdivision of the fishing grounds into a finer spatial scale; (3) inclusion of a non-landed fishing mortality term; (4) updating of the initial conditions to reflect the more recent NMFS sea scallop surveys.

5.1.2 Methods

The model follows, for each area *i* and time *t*, population vectors $\mathbf{p}(i,t) = (p_1, p_2,\ldots, p_n)$, where p_j represents the density of scallops in the *j*th size class in area *i* at time *t*. The model uses a difference equation approach, where time is partitioned into discrete time steps $t_1, t_2,\ldots$, with a time step of length $\Delta t = t_{k+1} - t_k$. The landings vector $\mathbf{h}(i,t_k)$ represents the catch at each size class in the *i*th region and *k*th time step. It is calculated as:

$$h(i,t_k) = [I - \exp(\Delta t H(i,t_k))]\, p(i,t_k),$$

where *I* is the identity matrix and *H* is a diagonal matrix whose *j*th diagonal entry h_{jj} is given by:

$$h_{jj} = \begin{cases} 0 & \text{if} \quad s(j) \le s_{\min} \\ -F(i,t_k)[s(j) - s_{\min}]/(s_{full} - s_{\min}) & \text{if } s_{\min} < s(j) < s_{full} \\ -F(i,t_k) & \text{if} \quad s(j) \ge s_{full} \end{cases}$$

Here, $s_{\min}$ is the minimum size at which a scallop is vulnerable to the gear, s_{full} is the size at which a scallop is fully vulnerable to the gear, and $F(i,t_k)$ represents the fishing mortality rate suffered by a full recruit in area *i* at time t_k. Scallops of shell height less than a minimum size s_d are assumed to be discarded, and suffer a discard mortality rate of *d*. There is also evidence that some scallops not actually landed may suffer mortality due to incidental damage from the dredge. Caddy (1973) estimated that 15-20% of the scallops remaining on the bottom after one pass of an offshore dredge were killed by such incidental damage. Using an estimated dredge efficiency of 40% (Rago et al., 1999), this implies that (1-0.4)*(0.15 to 0.2) = 0.09 to 0.12 of the scallops originally on the bottom will suffer non-landed fishing mortality from one pass of the dredge. The PDT therefore estimated that 10% of the scallops in the path of the dredge will be killed by incidental contact with the gear. Using an estimated dredge efficiency of 40%, this implies that incidental mortality can be modeled as $0.25F_L$, where F_L is the landed fishing mortality rate of a fully recruited scallop. This incidental fishing mortality was applied equally to all size classes, including pre-recruits. Besides landed and incidental fishing mortality, scallops are also subject to natural mortality; this was taken to occur at a constant rate for all size classes and areas, though in principle, it could depend on both size and location if that was indicated.

The scallops grow according to a von Bertalanffy equation, so that their shell height $s(t)$ at age *t* (in years) is given by:

$$s(t) = L_\infty[1 - \exp(-k[t - t_0])]$$

The growth equation is used to construct a matrix *G*, which specifies the fractions of each size class that remains in that size class, or grows to other size classes, in a time ? t. Recruitment is modeled by assuming that new recruits enter the smallest size class (40-45 mm in these simulations) at a rate r_i depending on the location *i*. Recruitment in each subregion was modeled to be consistent with the median historical patterns in that subregion (based on the period 1982-1999). The recruitment in each subregion was then proportionally adjusted so that the area weighted average recruitment was for Georges Bank 66.1 and 47.5 for the Mid-Atlantic, consistent with the median 1982-1999 recruitment pattern for these areas. Area-specific recruitment rates are given in Table 173. Recruitment can either be chosen to be constant (e.g. median) with time, or stochastic, according to the model described below. For the present, no stock-recruitment relationship is assumed. However, the good recruitment events that have occurred in the past few years may be related to the high spawning stock biomass that has been built up in the groundfish closed areas. The model may include a stock/recruitment relationship in future work if the evidence indicates that such a relationship does indeed exist.

The population dynamics of the scallops in the present model can be summarized in the equation:

$$p(i,t_{k+1}) = r_i + G\exp(-M\Delta tH)\,p(i,t_k),$$

where $r_i = (r_i ? t,0,0,\ldots)$. The population and harvest vectors are converted into biomass by using the shell-height meat-weight relationship:

$$W = \exp[a + b\,\ln(s)],$$

where *W* is the meat weight of a scallop of shell height *s*. For calculating biomass, the shell height of a size class was taken as its midpoint, while for purposes of calculating harvest biomass, it was taken as the midpoint of the size class after it has grown for half a time step. The model also keeps track of egg production, based on the fecundity - shell-height relationship of MacDonald and Thompson (1985). A summary of model parameters is given in Table 162.

Table 161. Estimated age and meat yield by scallop size for Georges Bank and the Mid-Atlantic. The age assumes that Georges Bank scallops are two years old at 40 mm and Mid-Atlantic scallops are 1.6 years old at 40 mm.

Shell height (mm)	Georges Bank			Mid-Atlantic		
	Age (y)	Meat weight (g)	Meats per lb.	Age (y)	Meat weight (g)	Meats per lb.
40	2.0	0.9	503	1.6	0.9	503
45	2.1	1.3	350	1.8	1.3	350
50	2.3	1.8	253	1.9	1.8	253
55	2.4	2.4	189	2.0	2.4	189
60	2.5	3.1	145	2.2	3.1	145
65	2.7	4.0	113	2.3	4.0	113
70	2.8	5.0	90	2.5	5.0	90
75	3.0	6.2	73	2.6	6.2	73
80	3.2	7.6	60	2.8	7.6	60

Shell height (mm)	Georges Bank			Mid-Atlantic		
	Age (y)	Meat weight (g)	Meats per lb.	Age (y)	Meat weight (g)	Meats per lb.
85	3.4	9.1	50	3.0	9.1	50
90	3.6	10.9	42	3.2	10.9	42
95	3.8	12.9	35	3.4	12.9	35
100	4.0	15.1	30	3.6	15.1	30
105	4.3	17.5	26	3.9	17.5	26
110	4.5	20.2	22	4.2	20.2	22
115	4.8	23.2	20	4.5	23.2	20
120	5.2	26.4	17	4.8	26.4	17
125	5.5	29.9	15	5.2	29.9	15
130	6.0	33.8	13	5.6	33.8	13
135	6.5	37.9	12	6.1	37.9	12
140	7.1	42.4	11	6.7	42.4	11
145	7.8	47.2	10	7.5	47.2	10
150	8.9	52.4	9	8.5	52.4	9
155	10.5	58.0	8	10.1	58.0	8
160	14.2	63.9	7	13.8	63.9	7

Initial conditions for the population vector **p** *(i,t)* were generally estimated by using the mean catch per unit effort in each size class and area, as found in the 1999 NMFS research vessel sea scallop survey. However, only one tow (with zero catch) was performed in stratum 49, in the south channel region. To estimate the density in this stratum, we used the 1998 survey density in this stratum, projected forward one year. Also, the biomass estimate for the Nantucket Light Ship closed area was considerably higher than several other estimates of biomass in this region, including the projections of the 1998 survey, the joint NMFS/industry survey, and the CMAST video survey. Consequently, we initialized this area to the 1998 survey, projected forward one year. However, we also reported in the results the projections for this area initialized to the 1999 survey. Estimates for closed and open areas were obtained by post-stratification, which increases the uncertainty of the estimates. Catches were adjusted for survey catchability, as described in SARC 23 (1996). The mean initial biomass of each area is shown in the first rows of Table 164 to Table 171.

Table 162. Model parameters.

Parameter	Description	Value
Δt	Simulation time step	0.005 y
L_{∞}	Maximum shell height	162 mm
K	Growth parameter	0.3374 y^{-1} (GB), 0.23 y^{-1} (MA)
M	Natural mortality rate	0.1 y^{-1}
a	Shell height/meat wt parameter	-11.4403 (GB), -12.3405 (MA)
b	Shell height/meat wt parameter	3.0734 (GB), 3.2754 (MA)
s_0	Initial shell height of recruit	40 mm
s_{min}	Minimum size retained by gear	65 mm
s_{full}	Size for full retention by gear	88 mm
s_d	Maximum size discarded	75 mm
d	Mortality of discards	0.2
c	Incidental fishing mortality	$0.25F_L$
	Dredge efficiency	0.4

Table 173. Area and assumed recruitment for each management designation used in projections.

Management designation	Area (nm^2)	Recruitment (#/tow)
Georges Bank	**7435**	------
South Channel	1391	137.6
Southeast Part	1593	25.1
Northern Edge and Peak	972	44.7
Closed Area I	636	97.0
Closed Area II-N*	867	69.7
Closed Area II-S*	965	69.7
Nantucket Lightship Closed Area	1010	26.8
Mid-Atlantic	**8404**	------
New York Bight	5342	36.5
Delmarva	1403	60.9
Hudson Canyon Closed Area	1466	53.6
VA/NC Closed Area	193	36.4

* Closed Area II-N comprises that part of Closed Area II in survey strata 71,74,631,651, and 661, while Closed Area II-S is that part of Closed Area II in strata 59,61 and 621.

Stochastic Recruitment Sub-Model

Much of the uncertainty in the short-term projections given here stems from error in the initial conditions (i.e., the annual NMFS survey) rather than from variation in recruitment. The PDT therefore felt that for the purposes of this report, it was sufficient to assume median recruitment. Nonetheless, for future reference, a stochastic recruitment model based on the recruitment time series for Georges Bank is presented in this document.

Global recruitment

The sea scallop recruitment time series for Georges Bank in the years 1982-1998 has the following properties. Recruitment is roughly log normal.

(a) The lag 1 autocorrelation a_1 is 0.4, but there is no significant higher order lag autocorrelations.
(b) Mean and median recruitment are about 83 and 69, respectively, with a standard deviation of 60.

The recruitment time series can thus be modeled as a moving average process:

$$G_i = e^{Xi} + q\, e^{Xi-1}$$

where G_i represents the spatially averaged recruitment in year j, X_i are iid normal random variables with mean m and standard deviation s. It remains to estimate the three parameters of this model.

$$0.4 = a_1 = \frac{\mathrm{Cov}(G_i, G_{i-1})}{\sqrt{\mathrm{Var}(G_i)\mathrm{Var}(G_{i-1})}} = \frac{q\ \mathrm{Var}(e^{Xi})}{(1+q^2)\mathrm{Var}(e^{Xi})} = \frac{q}{1+q^2}$$

Solving this equation for θ gives θ = 0.5. To estimate the other two parameters, compute the expectation and variance of G_i.

$$E(G_i) = (1+q)E(e^{Xi}) = (1+q)\exp(m+s^2/2)$$

and

$$\mathrm{Var}(G_i) = (1+q^2)\mathrm{Var}(e^{Xi}) = (1+q^2)\exp(s^2+2m)[\exp(s^2)-1]$$

Solving these two equations for s^2 and m gives:

$$s^2 = \ln\left(1 + \frac{(1+q)^2 \mathrm{Var}(G_i)}{(1+q)^2 E(G_i)^2}\right)$$

$$m = \ln(\mathrm{E}(G_i)) - \ln(1+q) - s^2 / 2$$

Using the estimates q = 0.5, E(G_i) = 83, and Var(G_i) = 60^2 gives that s=0.81 and m=3.68.

Local Recruitment

The local recruitment R_i to a subarea of Georges Bank typically shows a good correlation to the global mean recruitment G_i (mean log transformed correlation about 0.5). Local recruitment can be modelled as:

$$R_i = L_i G_i$$

where L_i is a (random) log-normally distributed local multiplier for which ln L_i has mean m_L and standard deviation s_L. Taking logs of this equation gives:

$$\ln R_i = \ln L_i + \ln G_i.$$

It is assumed that for purposes of illustration that the mean of all the L_i is 1 so that E(R_i) = E(G_i); this assumption is not essential to the technique. The observed global mean recruitment is:

$$\overline{G_i} = \frac{1}{n}\sum_{j=1}^{n} L_{ij} G_i$$

It is desirable for G_j to have the same mean and standard deviation as the observed mean Georges Bank recruitment time series, and that corr(ln R_i, ln G_i) should be at the observed value of about 0.5. The parameters m = 3.8, q = 0.5, s = 0.55 for the global process, and μ_L = -0.47 and σ_L = 0.97 for the local process, fits these requirements.

Projection Scenarios

Four scenarios were considered in this set of projections. In each case, it is assumed that the Georges Bank groundfish closed areas will remain closed for the next three years. In the second ("Low F" scenario; (Table 166 and Table 167), it is assumed that each full time vessel will have 120 DAS, the

total number of DAS will remain about the same, and that the two Mid-Atlantic closed areas will be fished at a total fishing mortality of F = 0.2 (with a landed F = 0.16) for each of the fishing years 2001 - 2003. The third scenario ("High F scenario; Table 168 and Table 169) has the similar to the first except that the Mid-Atlantic closed areas will be fished at a total fishing mortality of F = 0.3 during 2001-2003.

In both of these simulations, it was assumed that there would be a tradeoff of one DAS for each 1400 lbs. harvested in the closed areas. In 1999 and 2000, a 1000 lbs/DAS tradeoff was chosen by the Council, roughly equivalent to 10,000 lbs. for a trip that was charged 10 days-at-sea. The increased tradeoff level was chosen to reflect the improved CPUE in the open areas, which should reach about 1400 lbs/day by next year. There was an intensive survey this year of the Hudson Canyon closed area by the Virginia Institute of Marine Science. Preliminary analysis of this survey indicates that the biomass in the Hudson Canyon closed area is about 34 percent less than projected from the 1999 Albatross survey. Preliminary analysis of the 2000 Albatross scallop survey also suggests that the biomass of the VA/NC Area is 27 percent above the projection, based on the 1999 Albatross survey data. For the purposes of calculating total DAS, the catch and estimated day-at-sea use were reduced by 34 percent for the Hudson Canyon Area and by 27 percent for the VA/NC Area from that predicted by the model because of this estimate. The New Closure scenario used the 2000 NMFS survey, where the catch and estimated day-at-sea use were reduced by 18 percent only in the Hudson Canyon Area for the same reason. This adjustment affects the estimated fishing effort and mortality in the open scallop fishing areas outside of the Hudson Canyon and VA/NC Areas.

In summary, the following procedures and adjustments were followed to calculate fishing mortality by area and calculate day-at-sea tradeoffs and catches that are consistent with the VIMS biomass estimates in the Hudson Canyon Area and with the 2000 Albatross survey biomass estimate in the VA/NC Area:

Apply the target fishing mortality (Low F: F = 0.2; High F: F = 0.3; New Closures: F = 0.2) for the Hudson Canyon and VA/NC Areas.

1. The projections estimate landings in 2001 – 2003 and biomass in 2002 – 2004.

2. Divide the estimated landings for the Hudson Canyon and VA/NC Areas by the assumed tradeoff equivalent (1,400 lbs.) to calculate the charged days-at-sea in these areas.

3. Reduce the charged days-at-sea and estimated landings by 34 percent for the Hudson Canyon Area and by 27 percent for the VA/NC Area from that predicted by the projections to agree with the 2000 VIMS and Albatross survey results, respectively. The New Closure scenario used the 2000 NMFS survey, where the catch and estimated day-at-sea use were reduced by 18 percent only in the Hudson Canyon Area.

4. Calculate the number of days-at-sea available for scallop fishing in other open areas by subtracting the total days-at-sea calculated above from 25,000 days. It was assumed that the fleet would use 25,000 days-at-sea for all scenarios, consistent with projections described in Section 5.1.2.

5. Solve for fishing mortality in the remaining open areas so that the total days-at-sea matches the amount calculated above. The total days-at-sea in the remaining open areas is derived from the asymptotic formula that relates survey biomass, the average exploitable scallop size, and commercial LPUE. Days-at-sea in the remaining open areas is calculated as catch divided by the estimated LPUE.

6. Landings for 2001 – 2003 and biomass for 2002 – 2004 are estimated with the projection model described above, based on the 1999 Albatross survey data. The New Closure scenario used the 2000 Albatross survey data in the Mid-Atlantic because of the influence of closed areas and new recruitment observed in the DelMarVa region.

The first scenario ("Amendment 7 status quo"; Table 164 and Table 165) is based on the Amendment 7 DAS schedule, which allocates 49 DAS for each full time vessel in 2001, and assumes that the Mid-Atlantic closed areas will be open to unrestricted access. In such a case, nearly all the available effort will be expended in these areas, where the CPUE is the greatest. The effort would spread out to some extent to other areas in succeeding years as the biomass of these areas increases. The fourth plan is similar to the first scenario, except that four new closures were postulated: South Channel between 41° 15' N and 41° 45' N, Southeast Part of Georges Bank east of 67° 20', Hudson Canyon North between 39° 30' N, 40° 30' N, 72° W and 74° W, and in the Delmarva region between 37°N and 38° N, and 74°W and 75° W.

In the first three sets of projections, the simulations were initialized with the 1999 NMFS survey data. The 2000 Mid-Atlantic survey is now available, and was post-stratified to reflect the proposed closed areas. It was used to initialize the Mid-Atlantic portion of the fourth set of projections ("New Closure" scenario (Table 170 and Table 171). The 1999 Georges Bank data initialized the model for Georges Bank, as the 2000 data are not yet available. In all cases, recruitment is taken to be at the 1982-1999 median levels for each region, as given in Table 173.

5.1.3 Results and discussion

Two options were evaluated by the PDT: the status quo equivalent to the Amendment 7 day-at-sea allocations (i.e. 49 full-time days-at-sea) and a continuation of the 2000 fishing year allocation (i.e. 120 full-time days-at-sea). Both are expected to prevent stock-wide mortality from exceeding the Amendment 7 target, but the latter option was also evaluated with a proportional day-at-sea tradeoff equivalent to the expected 1,400 pound per day-at-sea catch in the remaining open areas. The PDT did not estimate the fishing mortality rate for 2001 without this day-at-sea tradeoff for trips within the Hudson Canyon and VA/NC closed areas.

The status quo, allocating 49 days-at-sea to full-time limited access scallop vessels, would be expected to achieve the Amendment 7 fishing mortality targets, but the landings would be considerably lower than other options that are below the fishing mortality target for 2001. Landings would be 12,850 mt from the Mid-Atlantic stock and fishing mortality would be 0.19, while no effort and no fishing mortality would be expected on Georges Bank due to the large differences in LPUE for the open portions of Georges Bank vs. the Mid-Atlantic (especially in the Hudson Canyon and VA/NC closed areas).

In the Mid-Atlantic, the stock biomass is expected to be 33 percent higher than the rebuilding target but most of the biomass will be in the Hudson Canyon and VA/NC closed areas. Nearly all of the fishing effort would be in the Hudson Canyon and VA/NC closed areas due to the relatively high LPUE within these areas, compared with other fishing options. Stock biomass on Georges Bank would increase from 4.3 kg/tow in 2001 to 5.6 kg/tow in 2002, or 69 percent of the Amendment 7 rebuilding objective. According to this projection, the rebuilding target would be met in 2004 if the status quo were maintained in 2001-2003.

All of the scenarios associated with a 120 full-time day-at-sea allocation ("Low F", "High F", and "New Closures") are anticipated to prevent fishing mortality from exceeding the Amendment 7 target with a day-at-sea tradeoff in the Hudson Canyon and VA/NC closed areas equivalent to the ratio of LPUE

inside and outside of the closed areas. In the Mid-Atlantic, the composite total fishing mortality would fall between 0.15 and 0.28. Landings and mortality would be highest for the High F option and lowest for the New Closures option. Stock biomass would increase the quickest for the option with new closures, because the areas with smaller scallops and the greatest rebuilding potential would be closed.

Table 164 through Table 171 give summaries of the results of the four sets of simulations. Figure 31 through Figure 37 shows the projected biomasses and landings of the four plans. The simulations project a 50% rise in biomass between 1999 and 2001. Most of this increase is due to the rapid growth in the Hudson Canyon closed area, while most other areas show only modest improvement in biomass. Landings in 1999-2000 are projected at about 12000 MT, and will rise to about 15000 MT in 2000-2001.

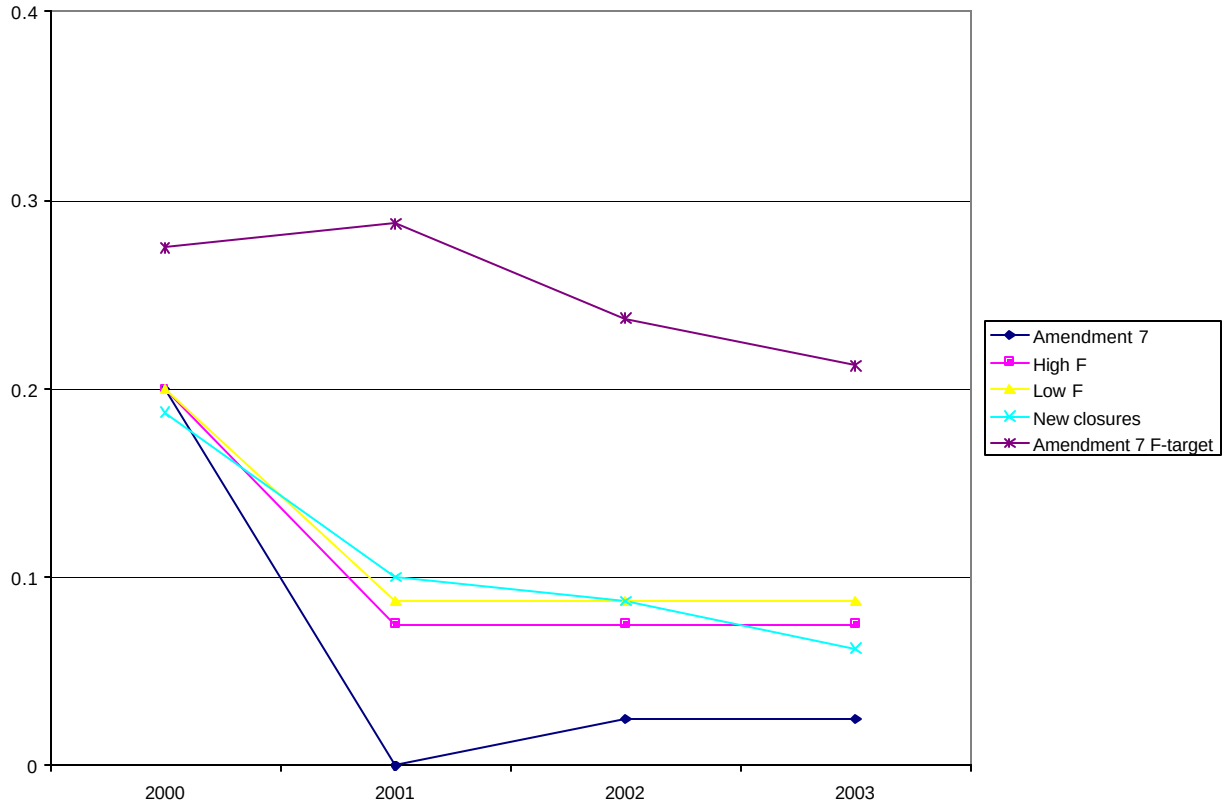

Figure 31. Composite total fishing mortality (biomass-weighted) for Georges Bank projection scenarios, 2000 – 2003.

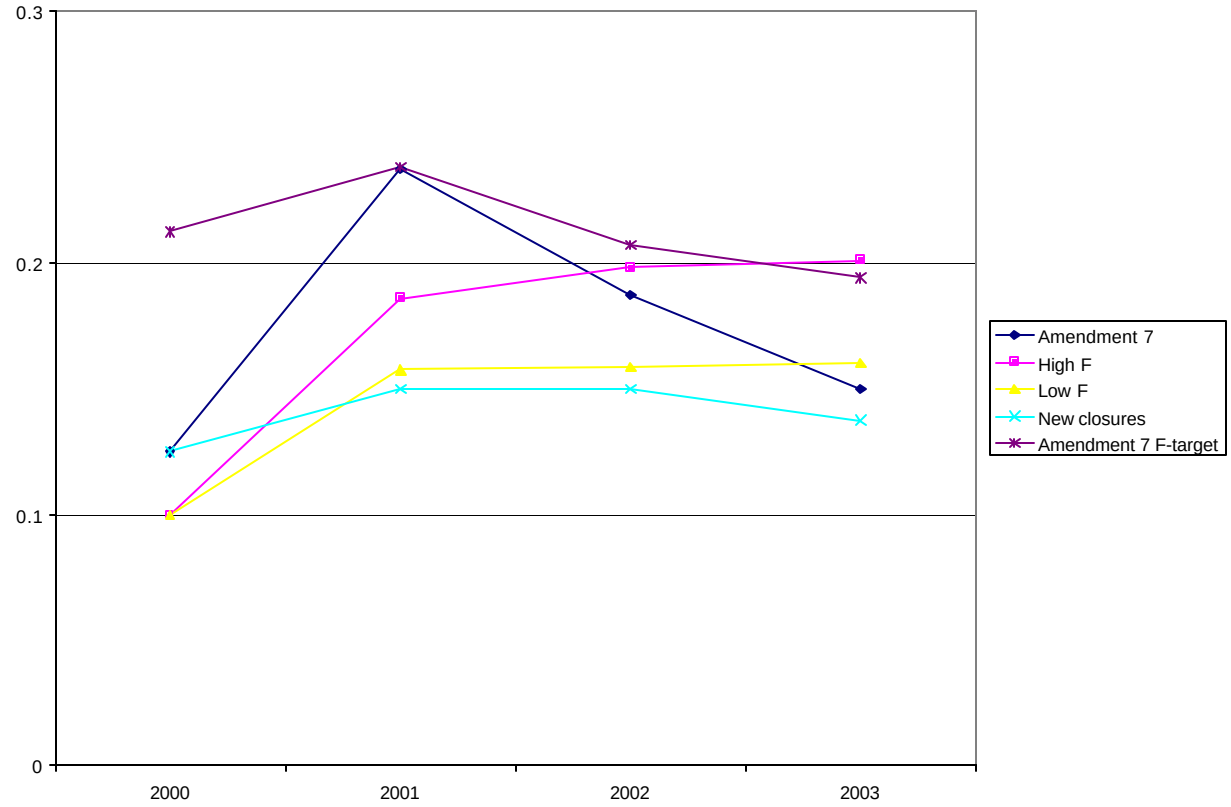

Figure 30. Composite total fishing mortality (biomass-weighted) for Mid-Atlantic projection scenarios, 2000 – 2003.

Figure 31. Estimated total day-at-sea use, after applying the biomass adjustments in the Hudson Canyon and VA/NC Areas and accounting for the prortional day-at-sea tradeoff with a 1,400 lbs. per day-at-sea equivalent.

Figure 32. Estimated total days-at-sea charged to vessels, including a proportional day-at-sea tradeoff with a 1,400 lbs. per day-at-sea equivalent, after accounting for the biomass adjustment in the Hudson Canyon and VA/NC Areas.

Figure 33. Estimated total scallop catch (mt), after applying the biomass adjustment in the Hudson Canyon and VA/NC Areas and accounting for a day-at-sea tradeoff with a 1,400 lbs. per day-at-sea equivalent.

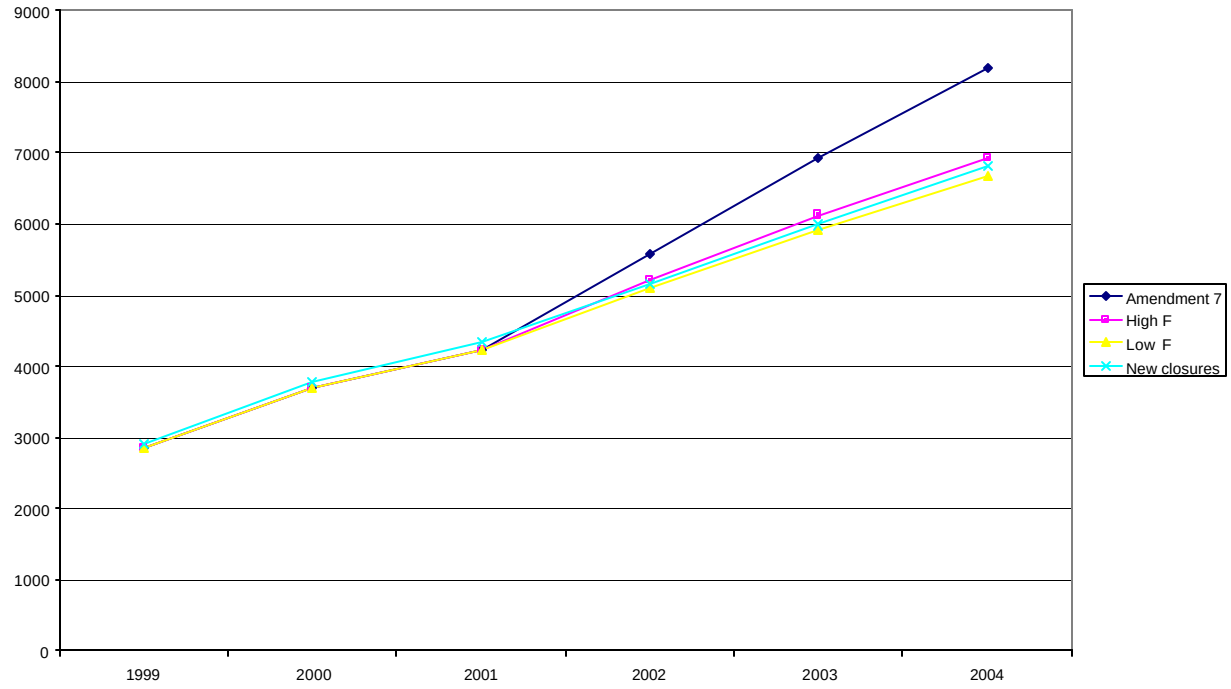

Figure 34. Projected scallop biomass (g/tow) for Georges Bank, 1999 – 2004.

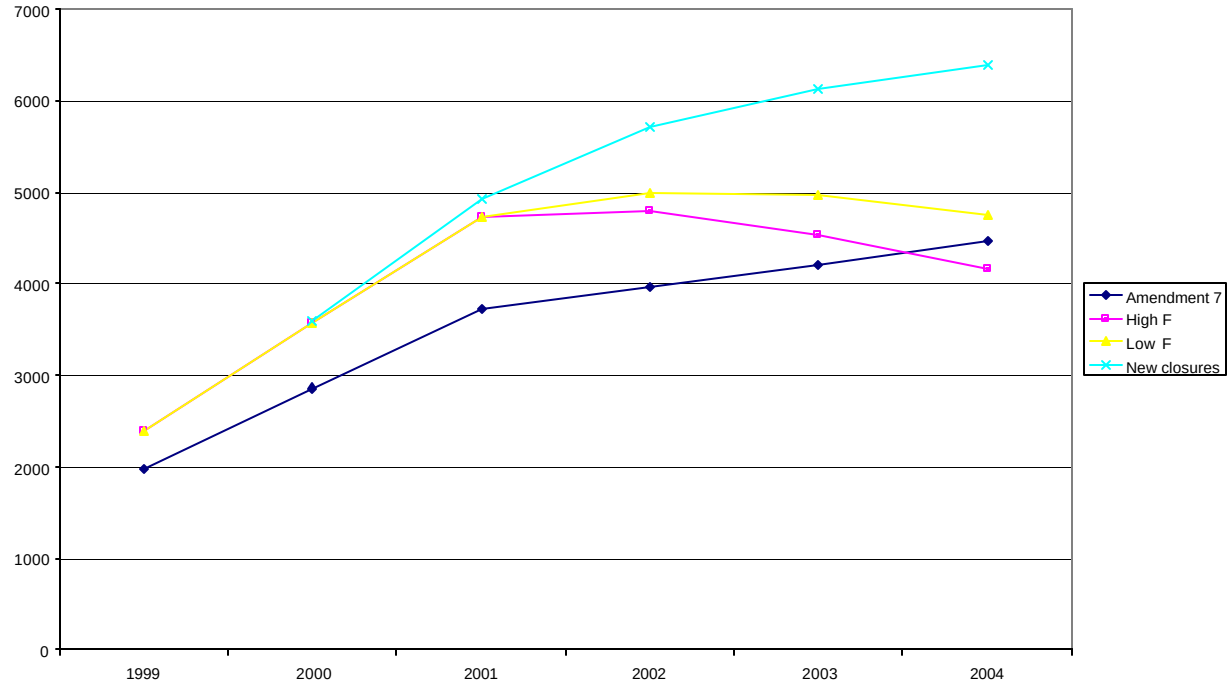

Figure 37. Projected scallop biomass (g/tow) for Mid-Atlantic, 1999 – 2004.

In the succeeding years, the "Low F" and "High F" scenarios project landings that would increase to 22,000 mt ("Low F") or 24,000 mt ("High F") by 2004. In the "Low F" scenario (Table 166 and Table 167), the biomass in the Mid-Atlantic would remain steady at about 4.7 kg/tow, slightly above B_{max} for the region of 3.9 kg/tow. This high biomass is a result of a combination of unusually good recruitment, closed area management, and effort reduction measures. Biomass in Georges Bank is forecast to rise to 6.7 kg/tow under the "Low F" scenario. This is somewhat below the regional B_{max} of 8.2 kg/tow, but nonetheless much higher than what has been seen historically.

In the "High F" scenario (Table 168 and Table 169) biomass in the Mid-Atlantic drops from 4.7 kg/tow in 2001 to 4.2 kg/tow in 2004, due to the higher effort exerted in Hudson Canyon. Biomass in Georges Bank is projected to rise 6.9 kg/tow. Under the Amendment 7 DAS schedule ("Amendment 7" scenario; Table 164 and Table 165), biomasses would increase to 6.0 kg/tow in the Mid-Atlantic and 8.2 kg/tow on Georges Bank in 2004. Landings would remain at about 12,000 mt/year.

The projections of the "New Closure" scenario (Table 170 and Table 171) is not exactly comparable to the others because it is initialized using the 2000 survey in the Mid-Atlantic. Nonetheless, these projections do demonstrate the effectiveness of closed area management. By 2004, the biomass in the Mid-Atlantic is projected to rise to 6.4 kg/tow, and to 6.8 kg/tow in Georges Bank. The combined biomasses of the two areas in 2004 are only 10% lower than in the Amendment 7 scenario, but allow for over 20% greater landings (about 16,000 mt/year) than does Amendment 7.

All the projections forecast an increase in the average size of an exploitable scallop, indicating improved yield-per-recruit. In the Mid-Atlantic, a substantial portion of this increase is due to the maturing of the large year class first observed as partial recruits in 1998. The typical size in this year class is projected to grow from about 90 mm in 2000 to about 137 mm in 2004. As this year class was

especially strong in Hudson Canyon, the fishing mortality in this region could be gradually raised to a higher level in 2002 and 2003 to exploit the larger average size of the scallops, provided fishing mortality begins relatively low. This additional effort in Hudson Canyon would reduce effort elsewhere, where the scallops are smaller, thereby increasing yield-per-recruit in these other areas. Similarly, allowing some limited access to Closed Area I and Nantucket Light Ship Area on Georges Bank could also benefit long-term yields.

Caution is needed regarding the projected biomasses and landings from the Hudson Canyon closed area. As already indicated, preliminary analysis of the 2000 VIMS survey of Hudson Canyon, done using commercial dredges, gives a biomass about 40% below that projected from the 1999 NMFS survey. The 2000 NMFS survey gives a somewhat higher biomass, but still about 15% less than projected from 1999. The disparities between these surveys may be due to sampling error, illegal fishing, emigration of scallops from the region, mis-estimation of growth or natural mortality in the model, reduced selectivity of the commercial dredge to ~90 mm scallops, or to some combination of the above. Nonetheless, since the closure of Hudson Canyon and Virginia Beach in 1998, there has been a rapid increase in biomass in the Mid-Atlantic, due in large part to these closures. The record 2000 Mid-Atlantic biomass of 3.6 kg/tow is well over twice the highest biomass observed in the Mid-Atlantic before these closures. Similar biomass increases were also seen in Georges Bank after three areas were closed there due to groundfish concerns in 1994.

Table 164. Amendment 7 status quo days-at-sea for Georges Bank: Projection of catch and biomass from 1999 Albatross survey.

Year	Stock component [49]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
1999	N. Edge	923.00	1,947	1,565	76.3%	1,314	1,314	0.31	532	34.1	40
	CA2-N	3188.70	5,999	5,776	34.8%	0	0	0.00	0	23.1	0
	CA2-S	3504.20	7,338	6,659	48.6%	3,819	3,819	0.63	3,238	25.8	184
	SE Part	1180.80	4,082	3,269	74.1%	2,320	2,320	0.31	1,112	35.2	86
	S. Channel	1161.20	3,505	2,564	87.5%	3,501	3,501	0.56	1,521	31.3	105
	CA1	8474.10	11,695	11,209	33.3%	0	0	0.00	0	21.7	0
	NLS-98	5263.30	11,536	11,071	24.6%	0	0	0.00	0	18.3	0
	Composite	2857.80	46,102	42,113		10,954	10,954	0.16	6,403	23.7	415
2000	N. Edge	1374.60	2,899	2,614	53.1%	1,068	1,068	0.25	610	25.9	35
	CA2-N	4536.70	8,535	8,200	26.6%	0	0	0.00	0	17.5	0
	CA2-S	3109.60	6,512	6,094	38.4%	0	0	0.00	0	21.4	0
	SE Part	1630.10	5,635	5,318	44.2%	1,848	1,848	0.25	1,179	24.9	65
	S. Channel	1796.50	5,423	4,235	79.3%	3,531	3,531	0.50	2,073	30.2	138
	CA1	11629.10	16,049	15,689	21.8%	2,496	2,496	0.25	3,105	16.8	115
	NLS-98	6650.00	14,575	14,354	16.1%	2,276	2,276	0.25	2,767	15.5	94
	Composite	3696.30	59,628	56,504		11,219	11,219	0.20	9,734	19.2	447
2001	N. Edge	1820.60	3,840	3,525	41.6%	0	0	0.00	0	21.7	0
	CA2-N	5980.50	11,252	10,795	21.7%	0	0	0.00	0	15.9	0
	CA2-S	4539.80	9,507	9,002	29.8%	0	0	0.00	0	18.5	0
	SE Part	1934.00	6,685	6,394	30.5%	0	0	0.00	0	19.2	0
	S. Channel	2562.10	7,734	6,408	67.4%	0	0	0.00	0	28.2	0
	CA1	11419.90	15,761	15,314	16.8%	0	0	0.00	0	14.7	0
	NLS-98	6125.60	13,425	13,226	11.2%	0	0	0.00	0	13.4	0
	Composite	4227.90	68,204	64,663		0	0	0.00	0	17.3	0
2002	N. Edge	2730.40	5,759	5,427	32.0%	0	0	0.00	0	19.2	0
	CA2-N	7514.00	14,137	13,672	18.0%	0	0	0.00	0	15.1	0
	CA2-S	6129.60	12,836	12,319	23.4%	0	0	0.00	0	16.8	0
	SE Part	2609.10	9,019	8,714	22.2%	0	0	0.00	0	16.5	0
	S. Channel	4756.40	14,357	12,903	49.4%	1,571	1,571	0.13	1,583	24.3	85
	CA1	13673.70	18,871	18,400	13.5%	0	0	0.00	0	13.7	0

[49] N. Edge = Northern Edge of Georges Bank; CA2-N = Closed Area II north of 41deg30' N; CA2-S = Closed Area II south of 41deg30' N; SE Part = Southeast Part of Georges Bank outside of Closed Area II; S. Channel = South Channel outside of Closed Area I and the Nantucket Lightship Area; CA1 = Closed Area I; NLS-98 = Nantucket Lightship Area based on 1998 Albatross survey; Composite = Sum or stratified mean for all Georges Bank stratum.

Year	Stock component [49]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
	NLS-98	6899.80	15,122	14,916	7.8%	0	0	0.00	0	12.2	0
	Composite	5585.30	90,101	86,349		1,571	1,571	0.03	1,583	16.3	85
2003	N. Edge	3757.30	7,925	7,590	24.9%	0	0	0.00	0	17.2	0
	CA2-N	9100.00	17,121	16,656	14.9%	0	0	0.00	0	14.2	0
	CA2-S	7803.60	16,341	15,824	18.6%	0	0	0.00	0	15.4	0
	SE Part	3272.40	11,312	11,004	16.8%	0	0	0.00	0	14.9	0
	S. Channel	6794.10	20,508	19,068	37.9%	2,343	2,343	0.15	2,604	21.0	121
	CA1	15852.40	21,878	21,404	11.1%	0	0	0.00	0	13.1	0
	NLS-98	7527.10	16,497	16,289	5.6%	0	0	0.00	0	11.5	0
	Composite	6916.90	111,582	107,834		2,343	2,343	0.03	2,604	15.2	121
2004	N. Edge	4844.80	10,219	9,884	19.6%					15.7	
	CA2-N	10692.00	20,116	19,651	12.3%					13.5	
	CA2-S	9494.70	19,882	19,365	15.0%					14.3	
	SE Part	3907.80	13,508	13,201	13.1%					13.7	
	S. Channel	8594.50	25,942	24,512	30.4%					18.7	
	CA1	17948.40	24,771	24,296	9.3%					12.6	
	NLS-98	8036.50	17,614	17,405	4.1%					11.1	
	Composite	8185.80	132,052	128,314						14.3	

Table 165. Amendment 7 status quo days-at-sea for Mid-Atlantic scallops: Projection of catch and biomass from 1999 Albatross survey.

Year	Stock component[50]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
1999	NYB	1374.30	16,002	12,648	61.5%	7,868	7,868	0.31	3,791	34.4	287
	HC	4328.80	13,769	8,907	73.5%	0	0	0.00	0	45.4	0
	Delmarva	1562.80	4,758	3,541	61.8%	4,325	4,325	0.63	1,990	38.1	167
	VB	3862.50	1,615	1,528	33.7%	0	0	0.00	0	26.2	0
	Composite	1976.40	36,144	26,624		12,193	12,193	0.20	5,781	38.1	454
2000	NYB	1796.10	20,914	17,727	44.8%	6,610	6,610	0.25	4,053	29.1	260
	HC	7636.90	24,291	22,107	42.4%	0	0	0.00	0	32.4	0
	Delmarva	1626.60	4,952	4,191	48.8%	3,251	3,251	0.50	1,714	31.1	117
	VB	5247.20	2,194	2,113	22.8%	0	0	0.00	0	20.3	0
	Composite	2862.70	52,351	46,138		9,861	9,861	0.13	5,767	30.4	377
2001	NYB	2168.40	25,249	23,023	34.0%	0	0	0.00	0	24.9	0
	HC	10998.00	34,982	33,975	26.5%	10,453	10,453	0.49	11,945	23.3	613
	Delmarva	1703.30	5,186	4,444	43.0%	0	0	0.00	0	26.5	0
	VB	6528.20	2,729	2,656	16.1%	733	733	0.49	890	16.9	33
	Composite	3726.40	68,146	64,098		11,187	11,187	0.24	12,835	23.9	646
2002	NYB	2989.60	34,812	32,791	25.6%	0	0	0.00	0	21.0	0
	HC	8774.90	27,910	27,169	18.7%	8,100	8,100	0.55	10,083	18.3	407
	Delmarva	2577.00	7,846	7,005	34.8%	0	0	0.00	0	23.7	0
	VB	4802.30	2,008	1,943	13.4%	633	633	0.55	705	15.2	24
	Composite	3968.60	72,576	68,907		8,733	8,733	0.19	10,788	20.1	430
2003	NYB	3839.90	44,712	42,702	19.8%	2,945	2,945	0.09	3,179	18.2	128
	HC	6226.00	19,803	19,105	15.3%	4,196	4,196	0.38	5,174	16.0	182
	Delmarva	3616.10	11,009	10,137	28.2%	459	459	0.05	460	21.4	22
	VB	3290.20	1,376	1,313	13.8%	91	91	0.09	95	14.8	3
	Composite	4205.10	76,900	73,256		7,691	7,691	0.15	8,908	18.0	335
2004	NYB	4316.20	50,259	48,283	16.1%					16.5	
	HC	5130.60	16,319	15,602	14.4%					15.1	
	Delmarva	4567.20	13,905	13,036	23.3%					19.4	
	VB	3527.60	1,475	1,407	13.5%					14.8	
	Composite	4478.90	81,907	78,279						16.7	

[50] NYB = New York Bight, outside of the Hudson Canyon Area; HC = Hudson Canyon Area; Delmarva = Delmarva Area; VB = VA/NC Area; Composite = Sum or stratified mean for all Georges Bank stratum.

Table 166. Low F scenario for Georges Bank: Projection of catch and biomass from 1999 Albatross survey.

Year	Stock component[51]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
1999	N. Edge	923.00	1,947	1,565	76.3%	1,314	1,314	0.31	532	34.1	40
	CA2-N	3188.70	5,999	5,776	34.8%	0	0	0.00	0	23.1	0
	CA2-S	3504.20	7,338	6,659	48.6%	3,819	3,819	0.63	3,238	25.8	184
	SE Part	1180.80	4,082	3,269	74.1%	2,320	2,320	0.31	1,112	35.2	86
	S. Channel	1161.20	3,505	2,564	87.5%	3,501	3,501	0.56	1,521	31.3	105
	CA1	8474.10	11,695	11,209	33.3%	0	0	0.00	0	21.7	0
	NLS-98	5263.30	11,536	11,071	24.6%	0	0	0.00	0	18.3	0
	Composite	2857.80	46,102	42,113		10,954	10,954	0.16	6,403	23.7	415
2000	N. Edge	1374.60	2,899	2,614	53.1%	1,068	1,068	0.25	610	25.9	35
	CA2-N	4536.70	8,535	8,200	26.6%	0	0	0.00	0	17.5	0
	CA2-S	3109.60	6,512	6,094	38.4%	0	0	0.00	0	21.4	0
	SE Part	1630.10	5,635	5,318	44.2%	1,848	1,848	0.25	1,179	24.9	65
	S. Channel	1796.50	5,423	4,235	79.3%	3,531	3,531	0.50	2,073	30.2	138
	CA1	11629.10	16,049	15,689	21.8%	2,496	2,496	0.25	3,105	16.8	115
	NLS-98	6650.00	14,575	14,354	16.1%	2,276	2,276	0.25	2,767	15.5	94
	Composite	3696.30	59,628	56,504		11,219	11,219	0.20	9,734	19.2	447
2001	N. Edge	1820.60	3,840	3,525	41.6%	1,131	1,131	0.25	779	21.7	37
	CA2-N	5980.50	11,252	10,795	21.7%	0	0	0.00	0	15.9	0
	CA2-S	4539.80	9,507	9,002	29.8%	0	0	0.00	0	18.5	0
	SE Part	1934.00	6,685	6,394	30.5%	1,850	1,850	0.25	1,327	19.2	56
	S. Channel	2562.10	7,734	6,408	67.4%	4,067	4,067	0.50	2,921	28.2	181
	CA1	11419.90	15,761	15,314	16.8%	0	0	0.00	0	14.7	0
	NLS-98	6125.60	13,425	13,226	11.2%	0	0	0.00	0	13.4	0
	Composite	4227.90	68,204	64,663		7,048	7,048	0.09	5,027	17.3	275
2002	N. Edge	2191.60	4,623	4,304	34.9%	1,199	1,199	0.25	919	19.7	40
	CA2-N	7514.00	14,137	13,672	18.0%	0	0	0.00	0	15.1	0
	CA2-S	6129.60	12,836	12,319	23.4%	0	0	0.00	0	16.8	0
	SE Part	2068.60	7,151	6,858	24.0%	1,843	1,843	0.25	1,382	16.8	51
	S. Channel	3219.80	9,719	8,383	57.9%	4,418	4,418	0.50	3,611	25.8	205

[51] N. Edge = Northern Edge of Georges Bank; CA2-N = Closed Area II north of 41deg30' N; CA2-S = Closed Area II south of 41deg30' N; SE Part = Southeast Part of Georges Bank outside of Closed Area II; S. Channel = South Channel outside of Closed Area I and the Nantucket Lightship Area; CA1 = Closed Area I; NLS-98 = Nantucket Lightship Area based on 1998 Albatross survey; Composite = Sum or stratified mean for all Georges Bank stratum.

Year	Stock component[51]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
	CA1	13673.70	18,871	18,400	13.5%	0	0	0.00	0	13.7	0
	NLS-98	6899.80	15,122	14,916	7.8%	0	0	0.00	0	12.2	0
	Composite	5111.60	82,458	78,852		7,459	7,459	0.09	5,912	16.0	296
2003	N. Edge	2486.40	5,244	4,926	30.6%	1,246	1,246	0.25	1,029	18.4	42
	CA2-N	9100.00	17,121	16,656	14.9%	0	0	0.00	0	14.2	0
	CA2-S	7803.60	16,341	15,824	18.6%	0	0	0.00	0	15.4	0
	SE Part	2101.30	7,264	6,971	21.0%	1,827	1,827	0.25	1,385	15.7	48
	S. Channel	3703.50	11,179	9,843	51.7%	4,618	4,618	0.50	4,095	24.0	217
	CA1	15852.40	21,878	21,404	11.1%	0	0	0.00	0	13.1	0
	NLS-98	7527.10	16,497	16,289	5.6%	0	0	0.00	0	11.5	0
	Composite	5921.50	95,524	91,912		7,691	7,691	0.09	6,509	15.1	307
2004	N. Edge	2713.00	5,722	5,404	27.8%					17.6	
	CA2-N	10692.00	20,116	19,651	12.3%					13.5	
	CA2-S	9494.70	19,882	19,365	15.0%					14.3	
	SE Part	2084.00	7,204	6,911	19.8%					15.3	
	S. Channel	4026.80	12,155	10,819	47.8%					22.8	
	CA1	17948.40	24,771	24,296	9.3%					12.6	
	NLS-98	8036.50	17,614	17,405	4.1%					11.1	
	Composite	6661.60	107,464	103,851						14.4	

Table 167. Low F scenario for Mid-Atlantic scallops: Projection of catch and biomass from 1999 Albatross survey.

Year	Stock component[52]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
1999	NYB	1374.30	16,002	12,648	61.5%	7,868	7,868	0.31	3,791	34.4	287
	HC	6558.80	20,862	13,495	73.5%	0	0	0.00	0	45.4	0
	Delmarva	1562.80	4,758	3,541	61.8%	4,325	4,325	0.63	1,990	38.1	167
	VB	5291.10	2,212	2,093	33.7%	0	0	0.00	0	26.2	0
	Composite	2396.90	43,834	31,777		12,193	12,193	0.16	5,781	38.8	454
2000	NYB	1796.10	20,914	17,727	44.8%	6,610	6,610	0.25	4,053	29.1	260
	HC	11506.80	36,600	33,469	41.7%	0	0	0.00	0	32.4	0
	Delmarva	1626.60	4,952	4,191	48.8%	3,251	3,251	0.50	1,714	31.1	117
	VB	7156.70	2,992	2,893	22.2%	0	0	0.00	0	20.2	0
	Composite	3579.40	65,459	58,280		9,861	9,861	0.10	5,767	30.6	377
2001	NYB	2168.40	25,249	23,023	34.0%	6,721	6,721	0.25	4,888	24.9	269
	HC	16432.70	52,268	51,101	25.6%	4,939	7,469	0.20	5,577	23.1	430
	Delmarva	1703.30	5,186	4,444	43.0%	2,404	2,404	0.38	1,396	26.5	82
	VB	8830.10	3,692	3,614	15.1%	340	464	0.20	415	16.7	21
	Composite	4724.20	86,395	82,183		14,403	17,057	0.23	12,276	23.5	801
2002	NYB	2387.90	27,805	25,891	27.4%	6,742	6,742	0.25	5,286	21.4	249
	HC	17074.50	54,309	53,506	16.5%	4,479	6,773	0.20	5,581	17.7	330
	Delmarva	1894.60	5,768	4,990	39.2%	2,444	2,444	0.38	1,540	24.8	84
	VB	8435.70	3,527	3,457	10.8%	304	415	0.20	389	14.5	17
	Composite	4998.50	91,410	87,844		13,969	16,374	0.23	12,795	19.1	680
2003	NYB	2491.20	29,008	27,133	23.6%	6,791	6,791	0.25	5,435	19.3	231
	HC	16454.80	52,338	51,573	11.0%	3,913	5,917	0.20	5,240	14.7	257
	Delmarva	2036.30	6,200	5,412	36.8%	2,479	2,479	0.38	1,650	23.7	86
	VB	7771.40	3,249	3,181	8.4%	272	371	0.20	353	13.2	14
	Composite	4964.80	90,795	87,298		13,454	15,558	0.23	12,679	16.7	589
2004	NYB	2520.00	29,343	27,470	21.6%					18.2	
	HC	15124.10	48,106	47,343	7.7%					13.0	
	Delmarva	2138.80	6,512	5,723	35.2%					23.1	
	VB	7011.40	2,931	2,863	7.1%					12.6	
	Composite	4751.40	86,892	83,400						15.4	

[52] NYB = New York Bight, outside of the Hudson Canyon Area; HC = Hudson Canyon Area; Delmarva = Delmarva Area; VB = VA/NC Area; Composite = Sum or stratified mean for all Georges Bank stratum.

Table 168 High F scenario for Georges Bank: Projection of catch and biomass from 1999 Albatross survey.

Year	Stock component[53]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
1999	N. Edge	923.00	1,947	1,565	76.3%	1,314	1,314	0.31	532	34.1	40
	CA2-N	3188.70	5,999	5,776	34.8%	0	0	0.00	0	23.1	0
	CA2-S	3504.20	7,338	6,659	48.6%	3,819	3,819	0.63	3,238	25.8	184
	SE Part	1180.80	4,082	3,269	74.1%	2,320	2,320	0.31	1,112	35.2	86
	S. Channel	1161.20	3,505	2,564	87.5%	3,501	3,501	0.56	1,521	31.3	105
	CA1	8474.10	11,695	11,209	33.3%	0	0	0.00	0	21.7	0
	NLS-98	5263.30	11,536	11,071	24.6%	0	0	0.00	0	18.3	0
	Composite	2857.80	46,102	42,113		10,954	10,954	0.16	6,403	23.7	415
2000	N. Edge	1374.60	2,899	2,614	53.1%	1,068	1,068	0.25	610	25.9	35
	CA2-N	4536.70	8,535	8,200	26.6%	0	0	0.00	0	17.5	0
	CA2-S	3109.60	6,512	6,094	38.4%	0	0	0.00	0	21.4	0
	SE Part	1630.10	5,635	5,318	44.2%	1,848	1,848	0.25	1,179	24.9	65
	S. Channel	1796.50	5,423	4,235	79.3%	3,531	3,531	0.50	2,073	30.2	138
	CA1	11629.10	16,049	15,689	21.8%	2,496	2,496	0.25	3,105	16.8	115
	NLS-98	6650.00	14,575	14,354	16.1%	2,276	2,276	0.25	2,767	15.5	94
	Composite	3696.30	59,628	56,504		11,219	11,219	0.20	9,734	19.2	447
2001	N. Edge	1820.60	3,840	3,525	41.6%	1,131	1,131	0.25	779	21.7	37
	CA2-N	5980.50	11,252	10,795	21.7%	0	0	0.00	0	15.9	0
	CA2-S	4539.80	9,507	9,002	29.8%	0	0	0.00	0	18.5	0
	SE Part	1934.00	6,685	6,394	30.5%	1,850	1,850	0.25	1,327	19.2	56
	S. Channel	2562.10	7,734	6,408	67.4%	2,678	2,678	0.31	1,996	28.2	124
	CA1	11419.90	15,761	15,314	16.8%	0	0	0.00	0	14.7	0
	NLS-98	6125.60	13,425	13,226	11.2%	0	0	0.00	0	13.4	0
	Composite	4227.90	68,204	64,663		5,659	5,659	0.08	4,102	17.3	217
2002	N. Edge	2191.60	4,623	4,304	34.9%	1,199	1,199	0.25	919	19.7	40
	CA2-N	7514.00	14,137	13,672	18.0%	0	0	0.00	0	15.1	0
	CA2-S	6129.60	12,836	12,319	23.4%	0	0	0.00	0	16.8	0
	SE Part	2068.60	7,151	6,858	24.0%	1,843	1,843	0.25	1,382	16.8	51
	S. Channel	3716.40	11,218	9,839	54.5%	3,157	3,157	0.31	2,837	25.2	158

[53] N. Edge = Northern Edge of Georges Bank; CA2-N = Closed Area II north of 41deg30' N; CA2-S = Closed Area II south of 41deg30' N; SE Part = Southeast Part of Georges Bank outside of Closed Area II; S. Channel = South Channel outside of Closed Area I and the Nantucket Lightship Area; CA1 = Closed Area I; NLS-98 = Nantucket Lightship Area based on 1998 Albatross survey; Composite = Sum or stratified mean for all Georges Bank stratum.

Year	Stock component[53]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
	CA1	13673.70	18,871	18,400	13.5%	0	0	0.00	0	13.7	0
	NLS-98	6899.80	15,122	14,916	7.8%	0	0	0.00	0	12.2	0
	Composite	5204.50	83,957	80,307		6,199	6,199	0.08	5,138	16.1	249
2003	N. Edge	2486.40	5,244	4,926	30.6%	1,246	1,246	0.25	1,029	18.4	42
	CA2-N	9100.00	17,121	16,656	14.9%	0	0	0.00	0	14.2	0
	CA2-S	7803.60	16,341	15,824	18.6%	0	0	0.00	0	15.4	0
	SE Part	2101.30	7,264	6,971	21.0%	1,827	1,827	0.25	1,385	15.7	48
	S. Channel	4783.10	14,438	13,053	45.3%	4,117	4,117	0.38	4,164	22.7	208
	CA1	15852.40	21,878	21,404	11.1%	0	0	0.00	0	13.1	0
	NLS-98	7527.10	16,497	16,289	5.6%	0	0	0.00	0	11.5	0
	Composite	6123.50	98,783	95,122		7,191	7,191	0.08	6,578	15.2	298
2004	N. Edge	2713.00	5,722	5,404	27.8%					17.6	
	CA2-N	10692.00	20,116	19,651	12.3%					13.5	
	CA2-S	9494.70	19,882	19,365	15.0%					14.3	
	SE Part	2084.00	7,204	6,911	19.8%					15.3	
	S. Channel	5374.90	16,224	14,854	40.0%					21.0	
	CA1	17948.40	24,771	24,296	9.3%					12.6	
	NLS-98	8036.50	17,614	17,405	4.1%					11.1	
	Composite	6913.90	111,533	107,886						14.4	

Table 169. High F scenario for Mid-Atlantic scallops: Projection of catch and biomass from 1999 Albatross survey.

Year	Stock component[54]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
1999	NYB	1374.30	16,002	12,648	61.5%	7,868	7,868	0.31	3,791	34.4	287
	HC	6558.80	20,862	13,495	73.5%	0	0	0.00	0	45.4	0
	Delmarva	1562.80	4,758	3,541	61.8%	4,325	4,325	0.63	1,990	38.1	167
	VB	5291.10	2,212	2,093	33.7%	0	0	0.00	0	26.2	0
	Composite	2396.90	43,834	31,777		12,193	12,193	0.16	5,781	38.8	454
2000	NYB	1796.10	20,914	17,727	44.8%	6,610	6,610	0.25	4,053	29.1	260
	HC	11506.80	36,600	33,469	41.7%	0	0	0.00	0	32.4	0
	Delmarva	1626.60	4,952	4,191	48.8%	3,251	3,251	0.50	1,714	31.1	117
	VB	7156.70	2,992	2,893	22.2%	0	0	0.00	0	20.2	0
	Composite	3579.40	65,459	58,280		9,861	9,861	0.10	5,767	30.6	377
2001	NYB	2168.40	25,249	23,023	34.0%	5,754	5,754	0.21	4,232	24.9	233
	HC	16432.70	52,268	51,101	25.6%	7,066	10,685	0.30	7,962	23.1	614
	Delmarva	1703.30	5,186	4,444	43.0%	1,635	1,635	0.25	988	26.5	58
	VB	8830.10	3,692	3,614	15.1%	488	667	0.30	593	16.7	30
	Composite	4724.20	86,395	82,183		14,944	18,742	0.28	13,775	23.5	934
2002	NYB	2469.20	28,752	26,823	27.1%	6,838	6,838	0.25	5,467	21.3	257
	HC	15489.20	49,267	48,481	16.7%	5,848	8,843	0.30	7,231	17.8	429
	Delmarva	2096.30	6,382	5,584	37.7%	2,131	2,131	0.31	1,466	24.4	79
	VB	7657.30	3,201	3,133	11.1%	404	553	0.30	504	14.6	22
	Composite	4790.30	87,602	84,021		15,222	18,366	0.29	14,668	19.2	786
2003	NYB	2566.70	29,887	28,007	23.2%	6,877	6,877	0.25	5,599	19.1	236
	HC	13577.10	43,185	42,440	11.5%	4,700	7,107	0.30	6,178	14.9	306
	Delmarva	2325.90	7,081	6,277	34.4%	2,180	2,180	0.31	1,619	23.1	83
	VB	6431.20	2,689	2,622	9.1%	339	463	0.30	418	13.4	17
	Composite	4530.00	82,842	79,347		14,095	16,626	0.29	13,814	17.0	642
2004	NYB	2585.40	30,105	28,232	21.2%					18.1	
	HC	11403.90	36,273	35,532	8.7%					13.3	
	Delmarva	2501.00	7,614	6,812	32.0%					22.1	
	VB	5327.10	2,227	2,161	8.6%					13.0	
	Composite	4167.80	76,220	72,737						16.0	

[54] NYB = New York Bight, outside of the Hudson Canyon Area; HC = Hudson Canyon Area; Delmarva = Delmarva Area; VB = VA/NC Area; Composite = Sum or stratified mean for all Georges Bank stratum.

Table 170. New Closure scenario for Georges Bank: Projection of catch and biomass from 1999 Albatross survey. See Section 5.4 for a description of the areas that could close for scallop fishing in 2001-2003.

Year	Stock component[55]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
1999	nep	488.60	798	689	69.1%	917	917	0.31	220	34.4	17
	CA2-N	3188.70	5,999	5,776	34.8%	0	0	0.00	0	23.1	0
	CA2-S	3504.20	7,338	6,659	48.6%	3,819	3,819	0.63	3,238	25.8	184
	sep-clo	1796.20	1,770	1,321	86.3%	819	819	0.31	487	36.9	40
	sep-op	1342.50	3,691	3,030	70.6%	1,945	1,945	0.31	1,016	36.6	82
	SC-cl	704.30	564	323	144.5%	286	286	0.19	95	31.3	7
	SC-op	1321.80	2,931	2,232	76.8%	2,670	2,670	0.56	1,275	31.3	88
	CA1	8474.10	11,695	11,209	33.3%	0	0	0.00	0	21.7	0
	NLS-98	5263.30	11,536	11,071	24.6%	0	0	0.00	0	18.3	0
	Composite	2907.10	46,323	42,310		10,457	10,457	0.16	6,331	24.0	417
2000	nep	762.50	1,246	1,059	62.4%	732	732	0.25	261	25.5	15
	CA2-N	4536.70	8,535	8,200	26.6%	0	0	0.00	0	17.5	0
	CA2-S	3109.60	6,512	6,094	38.4%	0	0	0.00	0	21.4	0
	sep-clo	2627.70	2,589	2,454	45.9%	670	670	0.25	550	26.7	32
	sep-op	1791.20	4,925	4,713	41.1%	1,491	1,491	0.25	1,023	24.0	54
	SC-cl	1974.30	1,581	1,145	91.6%	828	828	0.38	496	36.0	39
	SC-op	1857.50	4,119	3,338	73.1%	1,967	1,967	0.38	1,238	28.2	77
	CA1	11629.10	16,049	15,689	21.8%	2,422	2,422	0.25	3,105	16.8	115
	NLS-98	6650.00	14,575	14,354	16.1%	2,216	2,216	0.25	2,767	15.5	94
	Composite	3773.70	60,131	57,045		10,327	10,327	0.19	9,440	19.3	427
2001	nep	1143.50	1,868	1,626	54.0%	1,162	1,162	0.38	546	24.4	29
	CA2-N	5980.50	11,252	10,795	21.7%	0	0	0.00	0	15.9	0
	CA2-S	4539.80	9,507	9,002	29.8%	0	0	0.00	0	18.5	0
	sep-clo	3093.50	3,048	2,963	27.9%	0	0	0.00	0	19.1	0
	sep-op	2070.60	5,693	5,462	28.4%	3,505	3,505	0.63	2,348	18.5	96
	SC-cl	3215.60	2,575	2,206	64.5%	0	0	0.00	0	28.9	0

[55] nep = Northern Edge of Georges Bank; CA2-N = Closed Area II north of 41deg30' N; CA2-S = Closed Area II south of 41deg30' N; sep-clo = Southeast Part of Georges Bank outside of Closed Area II potentially closed to scallop fishing in 2001-2003; sep-op = Southeast Part of Georges Bank outside of Closed Area II potentially open to scallop fishing in 2001-2003; SC-cl= South Channel outside of Closed Area I and the Nantucket Lightship Area potentially closed to scallop fishing in 2001-2003; SC-op= South Channel outside of Closed Area I and the Nantucket Lightship Area potentially open to scallop fishing in 2001-2003; CA1 = Closed Area I; NLS-98 = Nantucket Lightship Area based on 1998 Albatross survey; Composite = Sum or stratified mean for all Georges Bank stratum.

Year	Stock component[55]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
	SC-op	2787.60	6,182	5,194	63.2%	4,310	4,310	0.75	3,094	26.8	183
	CA1	11419.90	15,761	15,314	16.8%	0	0	0.00	0	14.7	0
	NLS-98	6125.60	13,425	13,226	11.2%	0	0	0.00	0	13.4	0
	Composite	4349.80	69,311	65,787		8,977	8,977	0.10	5,988	17.3	308
2002	nep	1404.60	2,295	2,054	47.2%	1,576	1,576	0.50	833	22.9	42
	CA2-N	7514.00	14,137	13,672	18.0%	0	0	0.00	0	15.1	0
	CA2-S	6129.60	12,836	12,319	23.4%	0	0	0.00	0	16.8	0
	sep-clo	4043.10	3,983	3,896	18.2%	0	0	0.00	0	15.6	0
	sep-op	1540.50	4,235	4,017	25.9%	2,602	2,602	0.50	1,454	16.9	54
	SC-cl	5757.80	4,610	4,223	45.1%	0	0	0.00	0	23.4	0
	SC-op	2800.90	6,212	5,268	60.5%	4,649	4,649	0.84	3,316	25.9	189
	CA1	13673.70	18,871	18,400	13.5%	0	0	0.00	0	13.7	0
	NLS-98	6899.80	15,122	14,916	7.8%	0	0	0.00	0	12.2	0
	Composite	5165.10	82,302	78,763		8,827	8,827	0.09	5,603	16.0	286
2003	nep	1456.70	2,380	2,145	44.1%	1,572	1,572	0.50	856	21.9	41
	CA2-N	9100.00	17,121	16,656	14.9%	0	0	0.00	0	14.2	0
	CA2-S	7803.60	16,341	15,824	18.6%	0	0	0.00	0	15.4	0
	sep-clo	4865.40	4,793	4,706	12.6%	0	0	0.00	0	13.7	0
	sep-op	1289.20	3,544	3,323	27.5%	2,520	2,520	0.50	1,215	17.0	46
	SC-cl	8824.80	7,066	6,676	32.9%	0	0	0.00	0	19.7	0
	SC-op	2595.00	5,755	4,831	61.8%	4,640	4,640	0.88	3,156	25.9	180
	CA1	15852.40	21,878	21,404	11.1%	0	0	0.00	0	13.1	0
	NLS-98	7527.10	16,497	16,289	5.6%	0	0	0.00	0	11.5	0
	Composite	5985.60	95,377	91,852		8,732	8,732	0.06	5,227	15.0	267
2004	nep	1474.70	2,410	2,175	42.7%					21.4	
	CA2-N	10692.00	20,116	19,651	12.3%					13.5	
	CA2-S	9494.70	19,882	19,365	15.0%					14.3	
	sep-clo	5563.40	5,481	5,393	9.1%					12.6	
	sep-op	1109.50	3,051	2,829	30.8%					17.9	
	SC-cl	12194.00	9,764	9,373	24.7%					17.2	
	SC-op	2398.90	5,320	4,404	64.7%					26.5	
	CA1	17948.40	24,771	24,296	9.3%					12.6	
	NLS-98	8036.50	17,614	17,405	4.1%					11.1	
	Composite	6803.40	108,408	104,891						14.1	

Table 171. New Closure scenario for Mid-Atlantic scallops: Projection of catch and biomass from 2000 Albatross survey. See Section 5.4 for a description of the areas that could close for scallop fishing in 2001-2003.

Year	Stock component [56]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
2000	NYB-Op	2572.90	19,374	16,930	48.4%	6,344	6,344	0.28	4,348	35.7	342
	NYB	757.70	3,118	2,465	53.2%	979	979	0.13	331	34.1	25
	HC	9783.50	31,102	26,959	50.2%	0	0	0.00	0	35.4	0
	Del-Cl	2905.60	3,802	2,887	65.2%	1,243	1,243	0.28	810	36.6	65
	Del-Op	3491.60	6,061	4,678	58.3%	2,121	2,121	0.31	1,467	36.3	117
	VB	5054.40	2,117	2,072	27.5%	0	0	0.00	0	24.3	0
	Composite	3585.90	65,574	55,991		10,686	10,686	0.13	6,956	35.2	550
2001	NYB-Op	3034.40	22,849	21,676	32.3%	0	0	0.00	0	25.6	0
	NYB	1122.50	4,618	4,116	41.2%	1,974	1,974	0.25	899	27.7	55
	HC	14816.70	47,103	45,089	30.5%	5,903	7,191	0.20	6,301	25.5	431
	Del-Cl	3968.20	5,192	4,483	44.1%	0	0	0.00	0	30.2	0
	Del-Op	4359.10	7,567	6,836	39.4%	3,146	3,146	0.50	2,661	28.9	169
	VB	6529.70	2,735	2,689	17.9%	361	361	0.20	426	18.1	17
	Composite	4925.20	90,065	84,889		11,383	12,670	0.15	10,287	25.9	673
2002	NYB-Op	4100.10	30,874	29,651	22.8%	0	0	0.00	0	20.0	0
	NYB	1348.00	5,546	4,939	35.4%	2,947	2,947	0.38	1,485	23.5	77
	HC	16045.60	51,010	50,031	19.7%	5,348	6,515	0.20	6,588	19.6	346
	Del-Cl	5858.60	7,666	7,213	30.1%	0	0	0.00	0	24.1	0
	Del-Op	3963.40	6,880	6,406	30.4%	3,618	3,618	0.75	3,148	23.3	161
	VB	6412.00	2,685	2,623	12.9%	328	328	0.20	407	15.1	14
	Composite	5723.40	104,661	100,863		12,242	13,409	0.15	11,628	20.3	598
2003	NYB-Op	5118.60	38,543	37,253	16.8%	0	0	0.00	0	17.0	0
	NYB	1387.80	5,710	5,072	33.3%	2,938	2,938	0.38	1,515	22.3	75
	HC	15898.20	50,541	49,758	13.1%	4,737	5,771	0.20	6,342	15.9	270
	Del-Cl	7762.50	10,157	9,772	21.4%	0	0	0.00	0	19.6	0
	Del-Op	2709.80	4,704	4,288	29.1%	2,837	2,837	0.75	2,101	20.9	97
	VB	6039.30	2,529	2,462	10.2%	301	301	0.20	377	13.8	11
	Composite	6134.80	112,184	108,605		10,814	11,847	0.14	10,335	17.1	453

[56] NYB-Op = New York Bight, outside of the Hudson Canyon Area, potentially open to scallop fishing in 2001-2003; NYB = New York Bight, outside of the Hudson Canyon Area, potentially closed to scallop fishing in 2001-2003; HC = Hudson Canyon Area; Del-Cl = Delmarva Area, potentially closed to scallop fishing in 2001-2003; Del-Op = Delmarva Area, potentially open to scallop fishing in 2001-2003; VB = VA/NC Area; Composite = Sum or stratified mean for all Georges Bank stratum.

Year	Stock component [56]	Survey Biomass (g/tow)	Total Biomass (mt)	Exploitable Biomass (mt)	Maximum Annual Biomass Increase	Used DAS	Charged DAS	Total F (biomass weighted)	Catch (mt)	Average Meat Count	Number Caught, millions
2004	NYB-Op	6063.00	45,654	44,353	12.8%					15.2	
	NYB	1405.60	5,783	5,144	32.3%					21.9	
	HC	14894.60	47,351	46,588	9.1%					13.7	
	Del-Cl	9567.60	12,519	12,141	15.8%					16.7	
	Del-Op	1911.40	3,318	2,911	33.1%					21.3	
	VB	5566.30	2,331	2,263	9.1%					13.2	
	Composite	6395.70	116,956	113,399						15.2	