

C. ATLANTIC SURFCLAM ADVISORY REPORT

State of Stock: The surfclam stock in the EEZ is not overfished and overfishing is not occurring (Figure C6). Total biomass was estimated at 1.1 million mt in 1997, and 1.5 million mt in 1999 but declined in 2002 to 0.8 million mt ($B_{MSY} = 0.7$ mmt). Clam catch was not great enough to account for the apparent decline in biomass between 1999 and 2002. The majority of the catch is from Northern New Jersey (NNJ), which contains about 39% of the stock biomass. Annual fishing mortality rates (F) in 1999 and 2002 were 0.02 and 0.03 for the whole resource; 0.02 and 0.05 for the whole resource excluding Georges Bank; 0.03 and 0.05 for the NNJ region; and 0.04 and 0.08 for the southern New Jersey (SNJ) region ($F_{MSY} = 0.15$).

Management Advice: Although the stock is above B_{MSY} , uncertainty in the current level and future trend in biomass suggest that substantial increases in catch levels are not advised. In addition, because surfclams are sedentary and fishing is concentrated in relatively small areas, it may be advantageous to avoid localized depletion.

Forecasts: Projections assume a constant negative instantaneous rate of surplus production (0.051 y^{-1}) during 2002-2005, use reported catch in 2002 and predicted catch during 2003-2005 equal to the quota for 2003, all increased by + 12% (the maximum adjustment for incidental mortality), and prorated by region. Total biomass for 2002 is from a regression model used to smooth original efficiency-corrected swept area biomass (ESB) estimates. For the total stock, projections through 2006 suggest there will be a small increase in fishing mortality rate accompanied by a moderate decrease in biomass (approximately -8% per year).

Short term projections:

Year	2003	2004	2005
Biomass ¹	849	780	714
Catch ²	28.07	28.07	28.07
Fishing Mortality	0.034	0.038	0.041

¹. on 1 January, in 1,000s of mt

². Catch = landings + 12% discard, in 1000s of mt

Catch and Status Table (weights in '000 mt): Surfclams

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	¹ Min	¹ Avg	¹ Max	
<u>Quota:</u>													
EEZ	22.0	19.8	19.8	19.8	19.8	19.8	19.8	22.0	24.2	-	-	-	
<u>Landings:</u>													
EEZ	21.9	19.6	19.8	18.6	18.2	19.6	19.8	22.0	23.8	18.2	20.4	23.8	
NNJ	17.8	15.7	16.1	14.1	13.1	14.4	13.7	16.1	14.9	13.1	15.1	17.8	
SNJ	0.7	0.7	1.3	2.9	3.6	4.3	3.6	1.2	2.8	0.7	2.3	4.3	
DMV	3.5	2.8	2.2	1.5	0.4	0.7	2.0	3.2	4.5	0.4	12.5	25.2	
Other (EEZ)	0.1	0.4	0.1	0.1	1.1	0.2	0.5	1.5	1.6	0.1	3.4	11.6	
State	9.1	9.4	9.0	7.7	6.3	7.1	11.3	9.2	-	1.4	7.4	11.7	
Year					1997					1999			2002
<u>²Biomass:</u>													
EEZ					1,146					1,460			803
NNJ					485					487			315
SNJ					37					116			42
DMV					292					317			143
Other (EEZ)					332					540			303
<u>²Recruitment:</u>													
EEZ					163					174			60
NNJ					51					29			15
SNJ					4					40			3
DMV					46					53			10
Other (EEZ)					62					52			32
<u>³Fishing Mortality Rate (F):</u>													
EEZ					0.018					0.015			0.033
NNJ					0.032					0.033			0.053
SNJ					0.089					0.041			0.076
DMV					0.006					0.002			0.035
Other (EEZ)					0.000					0.000			0.006

¹Reported landings from the period 1978-2002. ²Biomass (of fully recruited clams) and recruitment for the last 3 surveys are based on efficiency-corrected swept-area survey data. "Recruitment" includes 120-129 mm in NNJ and SNJ and 100-112 mm in other areas. ³F is based on reported landings plus a 12% maximum adjustment for indirect mortality. Discards were near zero since 1992.

Stock Distribution and Identification: The Atlantic surfclam occurs from the subtidal zone to 50 m depth. Its range includes state waters and the US EEZ along the Atlantic seaboard from Maine through North Carolina. Surfclam larvae are planktonic for 2-3 weeks and may disperse sufficiently to cause gene flow throughout their geographical range.

Catches: Since 1978, total EEZ annual landings of surfclams have varied between 13,200 mt and 24,500 mt (meat weight) (Figure C1). The fishery is managed with an annual catch quota, which has constrained catches in most years. Since 1983, 90% -100% of the EEZ landings have been taken from the Mid-Atlantic region. During 1986-2002, 64% -91% of the Mid-Atlantic landings came from the Northern New Jersey region, 1%-19% came from the Delmarva region, and 0% -22% came from the Southern New Jersey region (SNJ). Catches in SNJ have increased since 1995. Catches in DMV increased after 1999. Discarding reached substantial levels (e.g., 33% by weight of the total catch in the NJ region) in the early 1980s because of minimum size limits, declined through the mid- to late-

1980s, and has been low in the 1990s when minimum size limits were absent. The most recent (2002) pattern of landings is shown in Figure C2.

Data and Assessment: Surfclams were last assessed in 1999 (SAW30). The present assessment used efficiency corrected swept area biomass estimates based on clam survey data from the EEZ in 1997, 1999 and 2002. Fishing mortality rates were computed by dividing annual catches by annual efficiency-adjusted swept area biomass estimates. A biomass dynamics model (KLAMZ) used discard, landings per unit effort (LPUE), region specific growth curves and shell length-meat weight relationships, and research survey data to estimate surfclam biomass, recruitment biomass and fishing mortality rates during 1978-2002. A maximum adjustment for indirect mortality was assumed equal to 12% of landings (by weight) in all analyses.

Biological Reference Points: Based on age and growth studies, SARC 30 adopted $M = 0.15$. The current best proxy for F_{MSY} is $F = M = 0.15 \text{ y}^{-1}$ (Figure C5). SARC 30, which reviewed data through 1999, stated "the current total biomass can be used as a lower bound estimate for the carrying capacity, and half the total current biomass can serve as a proxy for B_{MSY} ." The estimate of B_{1999} was 1,268,500 mt based on the KLAMZ model (SARC 30). The value of B_{1999} was re-estimated for the present assessment (SARC 37) as 1,460,500 mt, based on efficiency-corrected swept area biomass from the 1999 NMFS survey. Although these two point estimates of B_{1999} differ by about 15%, the difference is not statistically significant.

SFA Control Rule: Overfishing occurs whenever the fishing mortality rate on the entire stock is larger than $F_{THRESHOLD}$ (0.15). The stock will be declared overfished if total biomass falls below $B_{THRESHOLD}$ (estimated as $B_{MSY}/2$). The proxy for B_{MSY} is $B_{1999}/2$. When stock biomass is less than the biomass threshold, the fishing mortality rate threshold is reduced from F_{MSY} in a linear fashion to zero (Figure C6).

Fishing Mortality: Based on the catch-swept area model for the entire EEZ stock, $F_{2002} = 0.03$, with an 80% confidence interval of 0.02 - 0.05. For the entire EEZ stock excluding Georges Bank, $F_{2002} = 0.05$ (80% confidence interval 0.03 - 0.07). For the Northern New Jersey region, $F_{2002} = 0.05$; for Southern New Jersey $F_{2002} = 0.08$; for Delmarva, $F_{2002} = 0.04$. Other regions, which are largely unfished, had lower estimated recent F_s .

Recruitment: Survey data from 1978 – 2002 were used to track trends in abundance of recruits. In the NNJ and DMV regions, and in the stock as a whole, survey recruitment indices were low in 1999 and 2002 (Figure C4).

Stock Biomass: Biomass and 80% confidence intervals (CI) for 2002 were 315,000 mt (163,000-607,000) in the Northern New Jersey region, 143,000 mt (74,000-275,000) in the Delmarva region, 236,000 mt (107,000-521,000) on Georges Bank, 36,000 mt (18,000-72,000) in Southern New England, 42,000 mt (19,000-93,000) in Southern New Jersey, 12,000 mt (5,000-29,000) off Long Island, and 18,000 mt (8,000-43,000) off Southern Virginia - North Carolina. Clams included in the biomass estimates were 120 mm+ shell length for NNJ and SNJ, and 100 mm+ elsewhere. For the Delmarva region in 2002, the KLAMZ model biomass estimate was higher (272,000 mt) than that from the catch-swept area model.

Special Comments: Biomass is estimated using efficiency-adjusted swept area calculations from dredge surveys. Estimates of dredge efficiency were obtained using a variety of co-operative sampling studies and state-of-the-art dredge efficiency sensor equipment during a joint NMFS-industry research program conducted in 1997, 1999 and 2002. There appear to be differences in the dredge efficiency in these three years. However, the experimental data allow the uncertainty in the efficiency estimates to be properly incorporated into the uncertainty of the biomass estimates.

There is evidence of increased surfclam mortality recently in the inshore, southern regions of the research survey. This might be due to elevated sea temperature. The future impact on the population cannot be predicted.

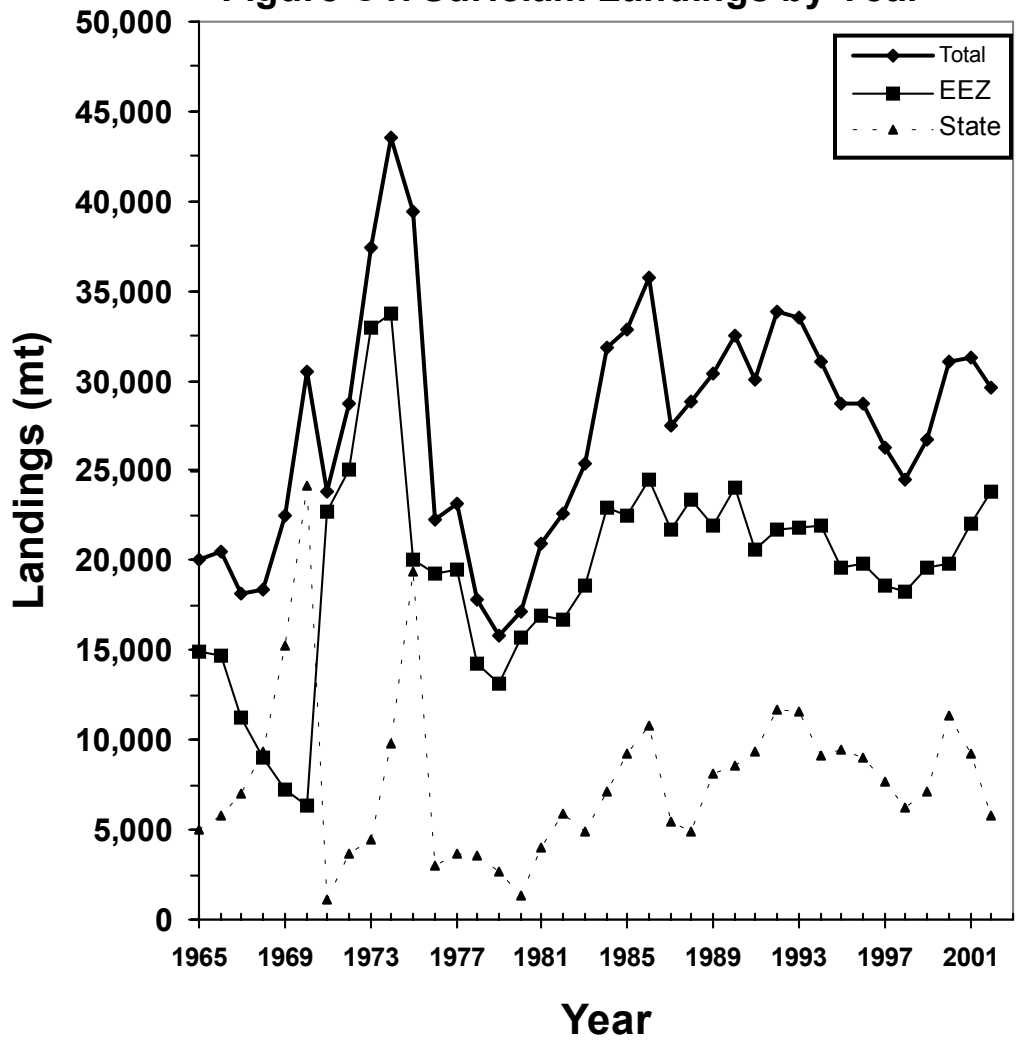
Commercial catch rates (LPUE) have declined in most of the harvested regions during the last 10 years. This is likely due to the "fishing down" of dense patches of clams (Figure C3).

Although the stock consists of at least 20 year classes, recruitment to the fishery is expected to be below average in the next 2 years.

The projection results do not incorporate information about age structure and thus should be considered only in general terms.

Sources of Information: 26th Northeast Regional Stock Assessment Workshop (26th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC Ref. Doc. 98-03; 30th Northeast Regional Stock Assessment Workshop (30th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC Ref. Doc. 00-03; 30th Northeast Regional Stock Assessment Workshop (30th SAW), Public Review Workshop, NEFSC Ref. Doc. 00-04; Weinberg, J.R. 1998. Density-dependent growth in the Atlantic Surfclam, *Spisula solidissima*, off the coast of the Delmarva Peninsula, USA. Mar. Biol. 130:621-630; Weinberg, J.R. 1999. Age-structure, recruitment, and adult mortality in populations of the Atlantic Surfclam, *Spisula solidissima*, from 1978 to 1997. Mar. Biol. 134:113-125; Weinberg, J. R., T.G. Dahlgren, and K. M. Halanych. 2002. Influence of rising sea temperature on commercial bivalve species of the U.S. Atlantic coast. Amer. Fish. Soc. Symp. 32:131-140; MAFMC, Amendment 13 to the Atlantic surfclam and ocean quahog fishery management plan. April 2003.

Figure C1. Surfclam Landings by Year



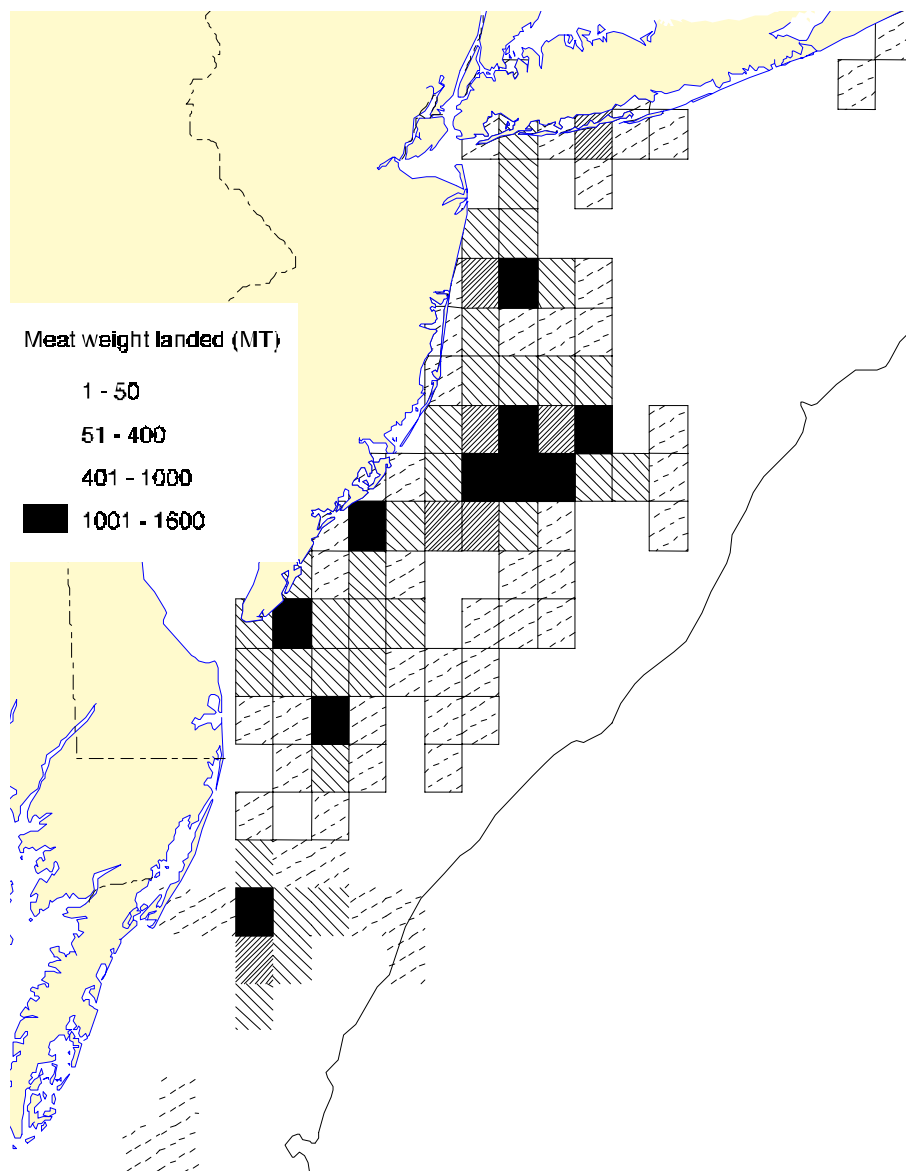


Figure C2. Distribution of surfclam landings during 2002 by ten-minute square

Figure C3. Surfclam Catch Rates for Medium and Large Vessels, by Region

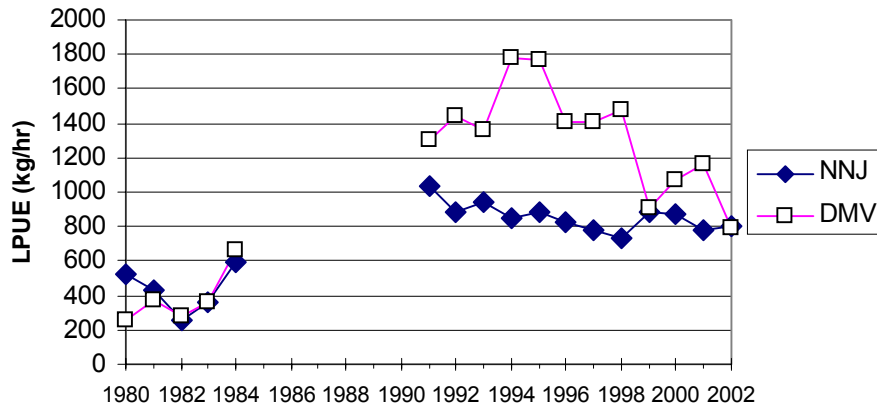


Figure C4. Surfclam Survey Recruit indices (88-119mm) by Region

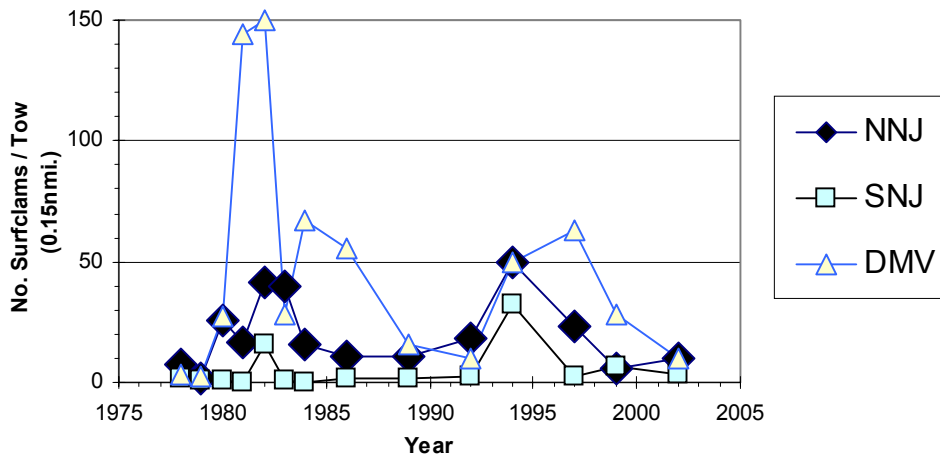


Figure C5. Yield per Recruit, NNJ (M=0.15, Recruit at 120 mm)

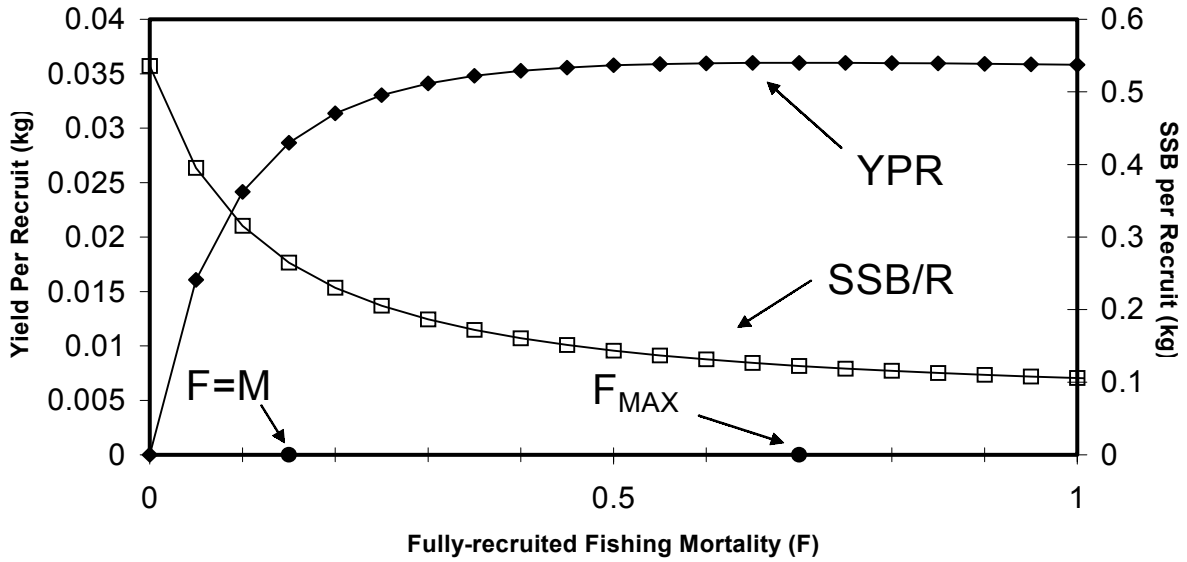


Figure C6. Surfclam Control Rule and Stock Status

