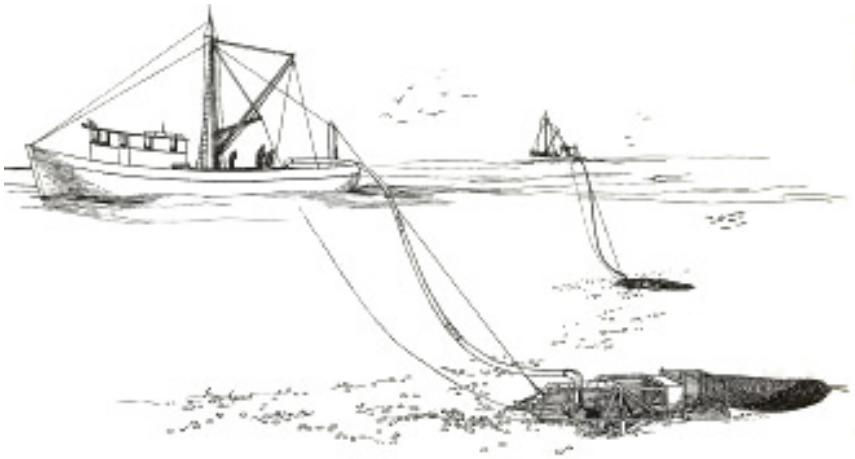
Review of the Atlantic Surfclam and Ocean Quahog Individual Transferable Quota Program



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Contents

Section		Page
Abbreviations		**vii**
Executive Summary		**ES-1**
1	**Introduction**	**1**
1.1	Overview	1
1.1.1	NMFS Catch Share Program Review Guidance Elements	2
1.1.2	Key Areas for Review	2
1.1.3	Net Benefits to the Nation	4
1.1.4	Other Considerations	4
1.2	Data Collection and Analysis	4
2	**Purpose and Need of the Review**	**6**
3	**Goals and Objectives**	**7**
3.1	Atlantic Surfclam and Ocean Quahog FMP	7
3.2	SCOQ ITQ Program	7
3.3	Magnuson-Stevens Act	7
3.3.1	National Standards	7
3.3.2	Limited Access Privilege Program Requirements	8
4	**History of Management**	**10**
4.1	FMP Before SCOQ ITQ Program Implementation	10
4.1.1	Amendment 1	11
4.1.2	Amendment 2	11
4.1.3	Amendment 3	12
4.1.4	Amendment 4	13
4.1.5	Amendment 5	13
4.1.6	Amendment 6	13
4.1.7	Amendment 7	14
4.2	SCOQ ITQ Program Implementation: FMP Amendment 8	14
4.2.1	Allocations	14
4.2.2	Landings, Permits, and Transfers of Allocations and Cage Tags	14
4.2.3	Optimum Yield and Annual Catch Limit Range	15
4.2.4	Enforcement, Monitoring, and Data Collection	15
4.3	FMP after SCOQ ITQ Program Implementation	15
4.3.1	Amendment 9	15
4.3.2	Amendment 10	15
4.3.3	Amendment 11	16
4.3.4	Amendment 12	16
4.3.5	Amendment 13	16
4.3.6	Amendment 14	17
4.3.7	Framework 1	17
4.3.8	Amendment 15	17

4.3.9 Amendment 16 17
4.3.10 Amendment 17 18
4.3.11 Amendment 18 18
4.3.12 Amendment 19 18
4.4 Current Issues Being Considered 18
5 Biological and Ecological/Environmental Context and Effects Analysis 20
5.1 Questions to be Answered 20
5.2 Methodological Approach 20
5.3 Environment Before and After Program Implementation 20
5.3.1 Management Units for the Surfclam and Ocean Quahog Fisheries 21
5.3.2 Stock Status 23
5.3.2.1 Surfclam Resource 23
5.3.2.2 Ocean Quahog Resource 29
5.3.3 Bycatch Reduction 32
5.3.4 Collection and Application of Scientific Information 35
5.4 Summary of the Effects of the Program 38
6 Economic Context and Effects Analysis 39
6.1 Questions to be Answered 39
6.2 Methodological Approach 40
6.3 Environment Before and After Program Implementation 42
6.3.1 Stabilizing Harvest Rates and Minimizing Short-Term Economic Dislocations 42
6.3.2 Harvest Capacity 45
6.3.3 Fishing Inputs, Output, and Productivity 52
6.3.3.1 Changes in Inputs 52
6.3.3.2 Changes in Output 54
6.3.3.3 Changes in Productivity 55
6.3.4 Industry Planning and Investment Needs 58
6.3.5 Full Utilization 60
6.3.6 Market Power 61
6.3.6.1 Concentration of ITQ Quota Share Ownership 61
6.3.6.2 Concentration of Harvest 63
6.3.6.3 Concentration of Buyers 68
6.3.7 Economic Effect of Cost Recovery Program 69
6.3.8 Duration of Catch Privileges 70
6.3.9 Costs of Entry 71
6.4 Summary of the Effects of the Program 72
7 Social Context and Effects Analysis 76
7.1 Questions to be Answered 76
7.2 Methodological Approach 76
7.3 Environment Before and After Program Implementation 77
7.3.1 Fair and Equitable Allocations 77
7.3.2 Effects on Fishery Participants 81
7.3.2.1 Vessel Owners 82
7.3.2.2 Crewmembers 82
7.3.2.3 Processors 84

7.3.2.4 Vessel Owners 86
7.3.2.5 Crewmembers 91
7.3.2.6 Processors 93
7.3.3 Transferability Rules and New Entrants 94
7.3.4 Equity/Distributional Impacts of Absence of Caps 95
7.3.5 New Entrants Set-Asides and Loan Programs 96
7.3.6 Sustained Participation of Fishing Communities 98
7.3.6.1 Fisheries Engagement 99
7.3.6.2 Social Vulnerability 116
7.3.7 Safety of Human Life at Sea 121
7.4 Summary of the Effects of the Program 126
8 Administrative Context and Effects Analysis 131
8.1 Questions to be Answered 131
8.2 Methodological Approach 132
8.3 Environment Before and After Program Implementation 132
8.3.1 Private and Public Management Costs 132
8.3.2 Flexibility and Adaptiveness of Management Approach 137
8.3.3 Eligibility Requirements to Participate in the Fisheries 140
8.3.4 Excessive Share of Fishing Privileges 141
8.3.5 Cost Recovery 143
8.3.6 Management System and Review of SCOQ ITQ Program Goals and Objectives 144
8.3.7 Reporting Burden 146
8.3.8 Electronic Technologies 150
8.3.9 Enforcement Provisions 151
8.4 Summary of the Effects of the Program 154
9 Net Benefits to the Nation 161
9.1 Efficiency of Harvesting and Processing Sectors 161
9.2 Communities 161
9.3 Management Costs 162
9.4 Conservation Benefits 163
10 Summary of Program Performance Evaluation 164
10.1 Conserve and Rebuild Resources 164
10.2 Simplify Regulatory Requirements and Minimize Management Costs 164
10.3 Provide Opportunities for Efficiency 165
10.4 Provide Management and Regulatory Framework that is Flexible and Adaptive and Consistent with Long-term Industry Planning and Investment Needs 166
11 Other Considerations 168
11.1 Summary of Unexpected Effects 168
11.2 Identification of Issues Associated with Program Structure or Function 169
11.2.1 Imbalance between Annual Catch Limits and Harvest 169
11.2.2 Barriers to New Entry 169
11.3 Potential Need for Additional Data Collection and/or Research 170
12 References 173
Appendix 1: NIOSH Assessment of Occupational Hazards in the Atlantic Surfclam and Ocean Quahog Fisheries 186

Table **Page**

Table ES-1. SCOQ ITQ Program Review Summary Findings by Program Goals and Objectives ES-3
Table ES-2. SCOQ ITQ Program Review Summary Findings by NMFS Catch Share Review Guidelines Key Area, National Standard, and Net Benefits to the Nation ES-4
Table 1. SCOQ ITQ Program Review Oversight Team 1
Table 2. Program Review Questions for the Biological and Ecological/Environmental Analysis 20
Table 3. Discards in the Surfclam Fishery, 1982-1993 33
Table 4. Program Review Questions and Summary of Biological and Ecological/Environmental Effects of the Program 38
Table 5. Program Review Questions for the Economic Analysis 39
Table 6. Average Number of Vessels per Owner in the Surfclam and Ocean Quahog Fisheries by Fleet Owner Type, 1983-1999[1] 47
Table 7. Percent of Surfclam and Ocean Quahog ITQ Quota Share Held by Top Owners, 1990 and 1999 63
Table 8. Concentration of Catch in the Surfclam and Ocean Quahog Fisheries, 1979–1987 64
Table 9. Average Number of Buyers per Vessel Owner in the Surfclam and Ocean Quahog Fisheries, 1983-1999 68
Table 10. Program Review Questions and Summary of Economic Effects of the Program 72
Table 11. Program Review Questions for the Social/Community Analysis 76
Table 12. Number of Plants Processing Surfclams and/or Ocean Quahogs by State, 1976-1986 85
Table 13. Surfclam/Ocean Quahog Processing Facilities, 2009 94
Table 14. Communities Highly Engaged in the Surfclam Fishery for One or More years, Baseline (1987-1989)–2013 101
Table 15. Communities Highly Engaged in the Ocean Quahog Fishery for One or More years, 1991–2013 105
Table 16. Gentrification Pressure Vulnerability Indices for Communities Highly Engaged in the Surfclam and/or Ocean Quahog Fishery for One or More Years, Baseline (1987-1989)–2013[1] 112
Table 17. Social Vulnerability Indices for Communities Highly Engaged in the Surfclam and/or Ocean Quahog Fisheries for One or More years, Baseline (1987-1989)–2013[1] 117
Table 18. Number and Rate of Vessel Disasters and Fatalities in the Surfclam and Ocean Quahog Fisheries, 1990–2017 125
Table 19. Program Review Questions and Summary of Social Effects of the Program 126
Table 20. Program Review Questions for the Administrative Analysis 131
Table 21. Public and Private Management Costs Before and After SCOQ ITQ Program Implementation[1] 134
Table 22. Number of Cage Tags Used, Total Recoverable Costs, Cost Recovery Cage Tag Fee, and Total Amount Billed in the Surfclam and Ocean Quahog Fisheries, 2016–2018 144
Table 23. Program Review Questions and Summary of Administrative Effects of the Program 154
Table 24. Correspondence Between NMFS Catch Share Review Guidelines Key Area, National Standard, or Net National Benefit Analysis, Program Review Question Number, and Component Evaluation by Document Section Number 167

Figure **Page**

Figure 1. Surfclam Stock Assessment Regions and NEFSC Shell Fish Survey Strata[1] 21
Figure 2. Ocean Quahog Stock Assessment Regions and NEFSC Shell Fish Survey Strata[1] 22
Figure 3. Trends in Relative Spawning Stock Biomass ($SSB/SSB_{Threshold}$) for the Surfclam Stock, 1984–2016[1] 25
Figure 4. Trends in Relative Fishing Mortality $F/F_{Threshold}$ for the Surfclam Stock, 1984–2016[1] 25
Figure 5. Harvests in the Surfclam Fishery by Stock Assessment Region, 1980–2016 27
Figure 6. Trends in Relative Spawning Stock Biomass (SSB/SSBThreshold) for Ocean Quahogs, 1982–2016[1] 30
Figure 7. Trends in Relative Fishing Mortality $F/F_{Threshold}$ for the Ocean Quahog Stock, 1982–2016[1] 30
Figure 8. Harvests in the Ocean Quahog Fishery by Stock Assessment Region, 1980–2016 32
Figure 9. Annual Harvest in the Surfclam Fishery, 1965–2016 43
Figure 10. Annual Harvest in the Ocean Quahog Fishery, 1976–2016 44
Figure 11. Number of Active Atlantic Surfclam and Ocean Quahog Vessels, 1980–2016[1] 46
Figure 12. Landings per Unit of Effort in the Surfclam and Ocean Quahog Fisheries, 1980–2016[1] 49
Figure 13. Average Length, Horsepower, and Gross Tonnage of Active Vessels in the Surfclam and Ocean Quahog Fisheries, 1980–2016[1] 51
Figure 14. Mean Trip Length in the Surfclam and Ocean Quahog Fisheries, 1980–2016 52
Figure 15. Landings per Unit of Effort in the Surfclam Fishery by Stock Assessment Region, 1981–2016[1] 53
Figure 16. Landings per Unit of Effort in the Ocean Quahog Fishery by Stock Assessment Region, 1982–2016[1] 54
Figure 17. Annual Average Catch Per Vessel in the Surfclam and Ocean Quahog Fisheries, 1980–2016 . 54
Figure 18. Inflation-Adjusted Average Annual Ex-Vessel Prices for Surfclams and Ocean Quahogs, 1982-2016[1] 55
Figure 19. Unadjusted and Adjusted Productivity Indices in the Surfclam and Ocean Quahog Fisheries, 1990–2012[1] 57
Figure 20. Annual Landings and Catch Limits in the Surfclam Fishery, 1978–2016 60
Figure 21. Annual Landings and Catch Limits in the Ocean Quahog Fishery, 1980–2016 61
Figure 22. Herfindahl-Hirschman Index of Concentration in the Surfclam and Ocean Quahog Harvesting Sector, 1998–2008 65
Figure 23. Share of Harvest by Processor-Owned Vessels in the Surfclam and Ocean Quahog Fisheries, 1998–2008 66
Figure 24. Herfindahl-Hirschman Index of Concentration in the Surfclam and Ocean Quahog Processing Sector, 1998–2008 69
Figure 25. Number of Crew Positions in the Surfclam and Ocean Quahog Fisheries, 1980–2016 83
Figure 26. Average Crew Sizes of Active Vessels in the Surfclam and Ocean Quahog Fisheries, 1980–2016 84
Figure 27. Number of Active Vessel Owners in the Surfclam and Ocean Quahog Fisheries by Firm Type 87
Figure 28. Participation of the Surfclam and Ocean Quahog Fisheries Harvesting Sector by Firm Type, 1983-1999 88
Figure 29. Share of Surfclam Harvest by Vessel Owner Firm Type, Selected Periods 89
Figure 30. Annual Harvest in the New York Surfclam Fishery, 1990-2008 91

Figure 31. Average Time at Sea per Crew Position on Active Vessels in the Surfclam and Ocean Quahog Fisheries, 1980–2016 92
Figure 32. Communities Highly Engaged in the Surfclam and/or Ocean Quahog Fisheries for One or More Years, Baseline (1987-1989)–2013 100
Figure 33. Fishing Engagement Index Scores of Communities Highly Engaged in the Surfclam Fishery for at Least 10 Years, Baseline (1987-1989)–2013[1] 102
Figure 34. Fishing Engagement Index Scores of Communities Highly Engaged in the Surfclam Fishery for Fewer Than 10 Years, Baseline (1987-1989)–2013[1] 103
Figure 35. Percentage of Total Surfclams Landed within Communities Highly Engaged in the Surfclam Fishery for at Least 10 Years, Baseline (1987-1989)–2013 104
Figure 36. Fishing Engagement Index Scores of Communities Highly Engaged in the Ocean Quahog Fishery in Any Year, 1991–2013[1] 106
Figure 37. Percentage of Total Ocean Quahogs Landed within Communities Highly Engaged in the Ocean Quahog Fishery for at Least 10 Years, 1991–2013 107
Figure 38. Age Distribution of Active Vessels in the Surfclam and Ocean Quahog Fisheries, Selected Years[1] 123

Abbreviations

ABC	acceptable biological catch
ACL	annual catch limit
ACT	annual catch target
BLS	U.S. Bureau of Labor Statistics
CPUE	catch per unit of effort
EEZ	exclusive economic zone
EFH	essential fish habitat
FAO	Food and Agricultural Organization of the United Nations
FMP	fishery management plan
G&O	goals and objectives
GARFO	Greater Atlantic Regional Fisheries Office
HHI	Herfindahl-Hirschman Index
IFQ	individual fishing quota
ITQ	individual transferable quota
KA	key areas
LAPP	limited access privilege program
LASAF	Limited Access System Administrative Fund
LPUE	landings per unit effort
MAFMC	Mid-Atlantic Fishery Management Council
MSA	Magnuson-Stevens Fishery Conservation Act
MSY	maximum sustainable yield
NBN	net benefits to the Nation
NEFSC	Northeast Fisheries Science Center
NIOSH	National Institute of Occupational Health and Safety
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NS	national standard
NSSP	National Shellfish Sanitation Program
OST	Office of Science and Technology
OY	optimum yield
PSP	paralytic shellfish poisoning
QCEW	Quarterly Census of Earnings and Wages
QP	quota pounds
QS	quota share
SCOQ	surfclam and ocean quahog
SSC	Scientific and Statistical Committee
TAC	total allowable catch
VMS	vessel monitoring system

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Executive Summary

The Review of the Atlantic Surfclam and Ocean Quahog Individual Transferable Quota Program (SCOQ ITQ Program Review) is structured around National Marine Fisheries Service (NMFS) Procedural Instruction 01-121-01, *Guidance for Conducting Review of Catch Share Programs* (NMFS Catch Share Review Guidelines). The SCOQ ITQ program is a specific type of catch share program called a Limited Access Privilege Program (LAPP), which involves the issuance of a federal permit to harvest a quantity of fish expressed by a unit or units representing a portion of the total allowable catch of the fishery that may be received or held for exclusive use by a person (16 USC § 1853a).

The NMFS Catch Share Review Guidelines lists eight elements that a review of a LAPP and other catch share programs should contain. These elements, together with the corresponding section of this document addressing the element, are as follows:

1. Purpose and need of the review (discuss legal/policy requirements) (Section 2).
2. Goals and objectives of the program, the Fishery Management Plan (FMP), and the Magnuson-Stevens Fishery Conservation Act (Magnuson-Stevens Act or MSA) (Section 3).
3. History of management, including a description of management before the program's implementation, a description of the program at the time of implementation (including enforcement, data collection, and monitoring), and any changes made since the program's implementation or the previous review (including an explanation of why those changes were made) (Section 4).
4. A description of the biological and ecological/environmental (Section 5), economic (Section 6), social (Section 7), and administrative (Section 8) environments before and after the program's implementation.
5. A summary of the program's biological and ecological/environmental (Section 5.4), economic (Section 6.4), social (Section 7.4), and administrative (Section 8.4) effects.
6. An evaluation of those effects with respect to meeting the goals and objectives of the program (i.e., program performance), including a summary of the conclusions arising from the evaluation (Section 10).
7. A summary of any unexpected effects (positive or negative) which do not fall under the program's goals and objectives (Section 11.1).
8. Identification of issues associated with the program's structure or function (Section 11.2) and the potential need for additional data collection and/or research (Section 11.3).

In addition, the NMFS Catch Share Review Guidelines requires an evaluation of the net benefits to the Nation of the program (Section 9).

Among the requirements of a LAPP is the regular monitoring and review by the Council and the Secretary of the operations of the program, including determining progress in meeting the goals of the program and the MSA, and any necessary modification of the program to meet those goals. According to the NMFS Catch Share Review Guidelines, to properly describe and analyze the performance of a LAPP and other catch share programs in terms of meeting its goals and the goals of the MSA, a review must address the components identified in the program's goals and objectives and the following key areas:

A) Goals and objectives
B) Allocations
C) Eligibility
D) Transferability
E) Catch and sustainability
F) Accumulation limits/caps
G) Cost recovery
H) Data collection/reporting, monitoring, and enforcement
I) Duration
J) New entrants
K) Auctions and royalties

Table ES-1 provides a summary of program review findings organized by program review goals and objectives. Table ES-2 provides a summary of program review findings by NMFS Catch Share Review Guidelines key area and MSA national standard (if not already addressed by a key area), along with a summary of the net benefits to the Nation analysis. Cross-references are provided to document sections containing detailed analyses.

Table ES-1. SCOQ ITQ Program Review Summary Findings by Program Goals and Objectives

Goal/Objective	Program Review Summary Finding
1) Conserve and rebuild Atlantic surfclam and ocean quahog resources by stabilizing annual harvest rates throughout the management unit.	Stock surveys and assessments indicate that neither the surfclam stock nor the ocean quahog stock has been overfished and overfishing has not occurred. Surfclam stock size has declined slightly since the program implementation, but there is evidence of a substantial decline in some regions due to environmental factors and fishing pressure. Surfclam landings have been relatively stable since program implementation except for a recent downturn in landings, which may be due to market constraints. There has been no substantial decline in the ocean quahog stock as a whole since program implementation, but there is evidence of substantial biomass decline in heavily fished regions. Ocean quahog landings have shown a decreasing trend and are likely constrained by market limitations (Sections 5.3.2 and 6.3.1).
2) Simplify the regulatory requirement of clam and quahog management to minimize government and private costs of administering and complying with requirements of management	Ongoing NMFS administrative and enforcement costs were reduced. Issuance and subsequent tracking of ITQ allocation permits created new costs, but those have decreased over time. Industry experienced cost reductions as vessel owners and operators have more flexibility in their day-to-day operations, there are no limits on the amount of ITQ quota share a person can hold, restrictions on ITQ quota share transfers are minimal, and vessel replacement regulations have been eliminated (Section 8.3.1).
3) Provide opportunity for industry to operate efficiently, consistent with the conservation of clam and quahog resources, balancing harvesting capacity with processing and biological capacity and allow efficient utilization of capital resources.	With few restraints on ownership or transfer of ITQ quota share, economically excessive capacity was rapidly eliminated. A major decrease in fleet size has occurred, catch per vessel has increased, and output mix can be optimized. Efficient use of capital and labor has also been achieved to a considerable extent. In the surfclam fishery, productivity adjusted for changes in biomass remained above that of the pre-SCOQ ITQ program base time period (1987-1989) in every year between 1990 and 2012. Unadjusted productivity for the surfclam fishery was above the pre-program base from 1990 to 2007 before dropping below the base during 2009–2012. Similar trends were evident, if not as pronounced, in the ocean quahog fishery. From 1990 through 1995, unadjusted productivity was nearly identical to that of biomass-adjusted productivity. Since 1995, biomass has been declining and the divergence between unadjusted and biomass-adjusted productivity has increased. After adjusting the productivity index by the biomass index, there were only four years during the entire time period where productivity was less than the base (1990-1994) (Sections 6.3.2 and 6.3.3).
4) Provide a management regime and regulatory framework that is flexible and adaptive to unanticipated short-term events or circumstances, and consistent with overall plan objectives and long-term industry planning and investment needs	Industry has repeatedly been able to generate both collective action and financing to address problems and opportunities. Following program implementation, industry was at the forefront of a surge in cooperative or joint research efforts, contributing money, vessel and crew time, and expertise to at-sea research to improve the accuracy of the NMFS stock assessment survey. In turn, the flexible and adaptive management approach has helped promote long-term industry planning and investment. Vessel owners have more flexibility in operating their businesses. ITQ quota shareholders have the ability to harvest their quota when conditions are favorable or generate revenue by leasing or selling their quota. Processors are able to work with ITQ quota shareholders to schedule fishing effort when needed to better control inventory and match market demand (Sections 6.3.4, 8.3.1, and 8.3.2).

Table ES-2. SCOQ ITQ Program Review Summary Findings by NMFS Catch Share Review Guidelines Key Area, National Standard, and Net Benefits to the Nation

KA/NS/ NBN	Topic	Program Review Summary Findings
KA-A	Program Goals and Objectives Clear, Measurable, and Still Appropriate	The management system for the surfclam and ocean quahog fisheries is regularly reviewed and amended, if necessary, through the Council process to ensure that the program goals and objectives are being achieved and still appropriate. In 2017, the Council incorporated the goal of reviewing and revising the goals and objectives of the FMP into its 2014–2018 Strategic Plan (Section 8.3.6).
KA-B	Allocations	For vessels with permits to fish for surfclams in the Mid-Atlantic Area, 80 percent of the surfclam initial allocation was based on a vessel's reported historic catch, using data from as far back as 1979. Average reported catch was modified to make allowance for vessel breakdowns, loss of markets, and recent entry into the fishery—the last four years were counted twice, and the two worst years were excluded. The resulting values were summed and divided by the total catch of all harvesters for the period. The remaining 20 percent of the allocation was based on a vessel's capacity (length x width x depth) as a proxy for investment. This "cost factor" addressed concerns of newer participants with larger (replacement) vessels that did not have strong historical landings, and/or had large vessel mortgages. The allocation formula for the New England Area surfclam fishery and the ocean quahog fishery was based solely on average catch during the qualifying years, given the open access nature of the fisheries, the lack of effort restrictions, and the fact that both fisheries started years later than the Mid-Atlantic Area surfclam fishery. Following implementation of the SCOQ ITQ program, courts ruled that the SCOQ ITQ Program was consistent with the fair and equitable provisions of National Standard 4. In 2015, however, NMFS determined that the FMP is out of compliance with that national standard because it did not include an excessive share cap. Consequently, the Council is currently developing an FMP amendment to adopt an excessive share regulation (Section 7.3.1).
KA-C	Eligibility	Under the SCOQ ITQ program, two permits are needed to fish for and land surfclams and ocean quahogs. One permit is the same vessel permit required before program implementation and is required for any vessel that fishes for surfclams or ocean quahogs. The second permit is an ITQ allocation permit issued by NMFS. The ITQ allocation permit specifies the cage tag numbers the permit holder is required to use during the harvest of their allocation. Any person (i.e., individual, partnership, or corporation) who meets U.S. citizen requirements for ownership of a U.S. Coast Guard documented vessel is eligible to own an ITQ allocation permit. The initial allocation mechanism of the program specified that ITQ quota share would be distributed on a vessel basis, not directly to vessel owners. Thus, the fishing privilege asset was embedded in the vessel asset. However, at the point the program was implemented, the fishing privilege was disaggregated from the vessel. The program permits persons to retain ownership of their ITQ quota share even if they terminate harvesting and sell their vessel, thereby allowing them to lease their quota. Subject to the approval of NMFS, all or part of the ITQ quota share specified in a person's ITQ allocation permit may be transferred to any other person with an ITQ allocation permit. An ITQ allocation permit does not need to have associated ITQ quota share to be used for leasing ITQ quota share (Section 8.3.3).

KA/NS/ NBN	Topic	Program Review Summary Findings
KA-D	Transferability	There are few restrictions on the transfer of ownership of either ITQ allocation permits or the annual allocations of ITQ quota share (cage tags). The original owners of ITQ allocation permits and ITQ quota share were owners of permitted vessels in the surfclam and/or ocean quahog fisheries. Thereafter, any entity that meets requirements for owning a U.S. Coast Guard documented fishing vessel is eligible to own ITQ quota share. Initially, an allocation could not be transferred in amounts less than 160 bushels (i.e., 5 cages), but Amendment 13 to the FMP eliminated this restriction in 2004. There is no maximum amount that can be transferred, nor is there any limit on the percentage of the total ITQ quota share that can be held by one person. All transfers, whether permanent sales of ITQ quota share or temporary transfers of the annual allocations (i.e., leasing of ITQ quota share), must be approved by NMFS for monitoring and enforcement purposes. The ease of transferring ITQ quota share is evidenced by the large amount of ITQ quota share transferred each year. Council staff estimated that in 2016, 41 percent of the surfclam ITQ quota share and 26 percent of the ocean quahog ITQ quota share was temporarily transferred. These transactions included transfers 1) between industry entities through short- and long-term contracts; 2) between financial institutions holding ITQ quota share as collateral and industry entities; and 3) between related industry entities (e.g., transfers within a company or between different entities owned by the same company). However, transfers of ITQ quota share to new entrants appear to be limited. Initially, some industry participants tried to create a niche for brokers of allocations to facilitate ITQ quota share transfers, but a brokerage sector never fully developed, and transfers of ITQ quota share have been dominated by bilateral transactions. NMFS has recently started collecting price data for ITQ quota share transactions, but those data were not available for this review (Section 7.3.3).
KA-E	Catch and Sustainability	Since the SCOQ ITQ program was implemented, no significant annual catch limit overage in the surfclam and ocean quahog fisheries has occurred. With the allocation of ITQ quota share, vessels operators are no longer fishing under time pressure that would increase the probability of exceeding the catch limit. Furthermore, current market conditions in the surfclam and ocean quahog fisheries are such that there is little incentive to increase landings. A comparison of utilization of the surfclam and ocean quahog annual catch limits before and after SCOQ ITQ program implementation indicates that the program had little, if any, effect. The level of utilization in both fisheries is mainly constrained by market limitations. Under the program, the desire of vessel operators to maximize their revenue from a given ITQ quota share has led them to take additional measures to harvest the large-size, high-yield surfclams desired by buyers. Consequently, the surfclam discard rate has dropped to near zero. In addition, following implementation of the program there was a shift in gear usage in the surfclam and ocean quahog fisheries from side rig dredges to stern rig dredges, which significantly reduced incidental mortality. Data collected by the NMFS Northeast Fisheries Observer Program has confirmed that there is minimal bycatch in these fisheries (Sections 5.3.2, 5.3.3, and 6.3.5).

KA/NS/ NBN	Topic	Program Review Summary Findings
KA-F	Accumulation Limits/Caps	An analysis conducted by NMFS in 2009 found that while the ownership of ITQ quota share is mildly concentrated for surfclam ITQ quota share and unconcentrated for ocean quahog ITQ quota share, the use of quota is highly concentrated. The concentration of harvesting increased substantially after program implementation largely as the result of the backward integration of processors into harvesting and the proliferation of long-term contracts among ITQ quota share owners, vessel owners, and processing firms. Processors now have direct or indirect control over the use of the majority of ITQ quota share in both fisheries. NMFS examined the possibility that control over such a large amount of ITQ quota share is leading to lower prices paid to independent vessels for their harvest. However, the agency determined that there was insufficient information to definitively conclude that oligopsony power is being exercised. Moreover, although large holdings of ITQ quota share by processors raises the risk that processors can raise quota prices by withholding quota, there is insufficient information to definitively conclude that these barriers have led to market power being exercised and economic inefficiencies being created. In 2015, NMFS determined that the FMP is out of compliance with National Standard 4 because it did not include an excessive share cap, and the Council is currently developing an FMP amendment to adopt an excessive share regulation (Sections 6.3.2, 6.3.6, 7.3.4, and 8.3.4).
KA-G	Cost Recovery	Amendment 17 to the FMP added measures for collecting fees and recovering costs associated with the management of the program to ensure that the FMP complied with requirements of the MSA. The cost recovery provisions for the program became effective July 15, 2016. Under the cost recovery program, any ITQ allocation permit holder who has surfclam or ocean quahog ITQ quota share is responsible for paying a fee at the end of the year. The fee percentage is based on the total recoverable costs from the prior fiscal year, adjusted for any prior over- or under-collection, divided by the total ex-vessel value of the fishery. NMFS calculates a per-cage tag fee based on the total number of cage tags used to land surfclams or ocean quahogs in the previous year. If NMFS collects more or less money than is necessary to recover its costs, the agency applies any over- or under-collection to its calculation of recoverable costs and per-tag fees in the following year. The total amount billed to industry for 2017 management, data collection, and enforcement costs was $21,942 in the surfclam fishery and $19,397 in the ocean quahog fishery, which represented less than one-tenth of one percent of the gross revenue in each fishery. The cost recovery program has been certified to not have a significant economic impact on a substantial number of small entities (Sections 6.3.7 and 8.3.5).

KA/NS/ NBN	Topic	Program Review Summary Findings
KA-H	Data Collection/Reporting, Monitoring, and Enforcement	The majority of current reporting and recordkeeping requirements in the surfclam and ocean quahog fisheries predate SCOQ ITQ program implementation. New requirements have included the reporting of ITQ quota share/cage tag transfers and the submittal of annual ITQ allocation permit renewal applications that require detailed ownership information. The two fisheries became the first federally-managed fisheries engaging in electronic reporting on a per vessel and trip basis ("e-Clams"), and this voluntary program is currently being used by nearly all vessels. In 2004, all federally-permitted surfclam and ocean quahog processors as well dealers were required to have the capability to transmit report data via the Internet. This has improved monitoring of commercial landings, enhanced enforceability of the existing regulations, promoted compliance with existing regulations, and ensured consistency in reporting requirements among fisheries. The enactment of a mandatory VMS in 2008 allowed the discontinuation of the telephone-based vessel call-in system. Vessels are required to declare their intended fishing activity via VMS before leaving port, and the transponder provides the location of fishing. The automatic data collection provides more accurate fishing location data than are being collected through vessel logbooks. Additionally, the desire of vessel operators to maximize their revenue from a given ITQ quota share led them to take additional measures to harvest the large-size, high-yield surfclams, which has allowed the Council to suspend the minimum size limit. Enforcement under the program can be accomplished through monitoring of the cage tag requirements at processing plants and auditing of vessel logbooks and processor/dealer reports and is further facilitated by vessel consolidation and a reduction in regulatory complexity. The Council included accountability measures in the surfclam and ocean quahog fisheries in Amendment 16 to the FMP. If the annual catch limit for the surfclam or ocean quahog fishery is exceeded, and that overage can be attributed to one or more holders of ITQ quota share, then accountability for that overage occurs at the individual level. Any amount of an annual catch limit overage that cannot be otherwise attributed to an ITQ quota share holder is deducted from the appropriate annual catch limit in the following fishing year (Sections 8.3.6, 8.3.7, 8.3.8, and 8.3.9).
KA-I	Duration	At the time the SCOQ ITQ program was implemented, the Council and NMFS were careful to make clear that the limited property right created by the program existed not to grant exclusive control over the resource to the industry participants who had been using it, but instead to promote economic efficiency in the industry and to make it easier for the government to control the harvest of the resource in a way that ensures its conservation. Until January 1, 2016, an ITQ allocation permit never expired. After that date, ITQ allocation permits became subject to an annual renewal requirement. In addition, ITQ allocation permits may be suspended, revoked, or modified by NMFS for violations of the FMP. From the early years of the program, financial institutions demonstrated a willingness to hold ITQ quota share as collateral on a loan to purchase quota and other harvesting and processing assets over a long term. In this arrangement, an agreement establishes to whom the financial institution can transfer the ITQ quota share each year. The financial institution retains ownership of the ITQ quota share until the loan has been paid. This arrangement is possible because ITQ quota share ownership is not restricted to individuals who actually do the fishing (Section 6.3.8).

KA/NS/ NBN	Topic	Program Review Summary Findings
KA-J	New Entrants	The implementation of the SCOQ ITQ program ended the moratorium on new vessel entries in the surfclam fishery. However, some vessel owners had to lease or purchase ITQ quota share from others to harvest enough surfclams or ocean quahogs to be profitable. While this approach was possible if financing was available, small fishing operations without adequate funding often sold out. Moreover, the high cost of ITQ quota share created an obstacle for prospective new entrants, thereby decreasing opportunities for young people, crew, and hired captains to enter the surfclam and ocean quahog fisheries. The industrial scale of the fisheries has also long posed an economic barrier to entry for new entrants. Vessels and fishing gear are expensive, and it can be difficult to find buyers. In recent years, an effort was made to facilitate the entry of individuals who lack the assets to purchase quota in the open market. However, that effort was implemented by the private sector and was limited in scope and duration. The number of new processors entering the surfclam and ocean quahog fisheries since the program began has also been limited. While the barriers for new entrants into the harvesting and processing sectors of the surfclam and ocean quahog fisheries are substantial, there is insufficient information to definitively conclude that these barriers have led to market power being exercised and economic inefficiencies being created (Sections 6.3.9, 7.3.3, and 7.3.5).
KA-K	Auctions and Royalties	For LAPPs implemented after January 12, 2007, section 303A(d) of the MSA requires Councils and NMFS to consider the use of auctions or royalties for the initial or any subsequent distribution of limited access privileges. Because the SCOQ ITQ program was implemented before that date, this key area for review is not applicable to the program.
NS-2	Contribute to Conservation and Management Measures with Best Scientific Information Available	Reporting and recordkeeping requirements in the surfclam and ocean quahog fisheries before and after SCOQ ITQ program implementation were essentially the same. Reporting and recordkeeping violations decreased after the program eliminated fishing time restrictions, and both landings and effort data from vessel logbooks are considered accurate by NMFS. Management measures implemented since program began, including VMS and onboard observers, have facilitated enforcement and monitoring in the two fisheries. In addition, the program has increased the propensity of industry to actively engage in the management process, including becoming proactive advocates of measures that will help ensure the long-term sustainability of the resource and supporting cooperative or joint research efforts in order to improve the accuracy of NMFS stock assessment surveys (Section 5.3.4).
NS-3	Manage Stocks as a Unit	Since the implementation of the FMP, the surfclam and ocean quahog stocks in the EEZ have been managed as single units throughout their range. Because the surfclam and ocean quahog fisheries are highly localized, surfclam and ocean quahog stock conditions are often described for smaller stock assessment regions rather than for the whole stock area, but these designated regions have no legal meaning. During the pre-SCOQ ITQ program period, Amendment 2 divided the surfclam fishery into the Mid-Atlantic and New England management areas, with separate annual catch limits and no moratorium on new entry in the New England Area. Under the SCOQ ITQ program, this division was discontinued and surfclam fishery regulations were applied uniformly across the range of the management unit (Section 5.3.1).

KA/NS/ NBN	Topic	Program Review Summary Findings
NS-8	Sustained Participation of Fishing Communities	The level of engagement in the surfclam and ocean quahog fisheries of many communities changed after the SCOQ ITQ program was implemented. While the available literature suggests that the socioeconomic effects of the program account for at least some of these community-level changes, it is difficult to disentangle the effects of the program from the effects of co-occurring factors. These other factors include changes in resource availability, wastewater discharge regulations, demographics and economic development, markets for surfclam and ocean quahog products, and economic conditions in other fisheries. The social and economic impacts of each of these factors may have exacerbated or mitigated the negative effects of the program on fishing communities over both the short- and long-terms. One major social effect of the program was loss of crew employment due to fleet consolidation, although the crewmembers who retained their jobs were more fully employed. Another major social effect of the program was changes in the share system of returns to vessel captains and crew, as vessel owners came to commonly deduct the cost of leasing ITQ quota share from the amount that would be shared out. After the program began, the number of processors of surfclams and ocean quahogs also declined. Some small, independently-owned processors that did not receive substantial initial allocations of ITQ quota share (because they had few or no vessels) had difficulty getting financing to purchase additional quota and left the industry (Sections 7.3.2 and 7.3.6).
NS-10	Safety of Human Life at Sea	Improved safety was a much-anticipated positive impact the SCOQ ITQ program, but the surfclam and ocean quahog fisheries continued to experience relatively high vessel disaster and fatality rates after program implementation. It is only recently that a combination of factors, most of which were external to the program, have contributed to lowering these rates in the fisheries, including new U.S. Coast Guard regulations, reestablishment of the onboard observer program, and the inclusion of various safety features in new vessel design. However, recent crewmember fatality rates continue to be substantially higher than in most other U.S. fisheries. Moreover, less serious accident injury rates have not shown a declining trend. It is likely that myriad factors, including market conditions, the offshore environment, weather conditions, and hazardous gear and equipment, contribute to the ongoing incidence of safety-related incidents in the surfclam and ocean quahog fisheries (Section 7.3.7).
NBN	Net Benefits to the Nation	The net benefits arising out of SCOQ ITQ program implementation accrued from several different sources, including increased economic efficiency in the harvesting and processing sectors of the two fisheries, reduced public and private management costs, and improved management of stocks. However, the program also led to costs to the Nation in the form of economic and social dislocations (Sections 9.1 through 9.4).

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1 Introduction

1.1 Overview

The Review of the Atlantic Surfclam and Ocean Quahog Individual Transferable Quota Program (hereafter, SCOQ ITQ Program Review) is structured around National Marine Fisheries Service (NMFS) Procedural Instruction 01-121-01, *Guidance for Conducting Review of Catch Share Programs* (hereafter, NMFS Catch Share Review Guidelines).[1] This guidance applies to all fisheries in the U.S. Exclusive Economic Zone (EEZ) managed under a catch share program, which is a generic term used to describe fishery management programs that allocate a specific percentage of the total allowable fishery catch or a specific fishing area to individuals, cooperatives, communities, or other entities (National Marine Fisheries Service 2010b). The SCOQ ITQ program is a specific type of catch share program called a Limited Access Privilege Program (LAPP), which involves the issuance of a federal permit to harvest a quantity of fish expressed by a unit or units representing a portion of the total allowable catch of the fishery that may be received or held for exclusive use by a person (16 USC § 1853a).[2]

The preparation of this document was overseen by the SCOQ ITQ Program Review Oversight Team (Table 1). The Oversight Team consisted of individuals from the staff of the Mid-Atlantic Fishery Management Council (MAFMC), the NMFS Northeast Fisheries Science Center (NEFSC), the NMFS Greater Atlantic Regional Fisheries Office (GARFO), and the NMFS Office of Science and Technology (OST).

Table 1. SCOQ ITQ Program Review Oversight Team

Team Member	Organization	Team Role/Area of Expertise
Jessica Coakley	MAFMC	Council staff lead for SCOQ ITQ Program Review
Lisa Colburn	NMFS NEFSC	Fisheries social scientist
Daniel Hennen	NMFS NEFSC	Lead stock assessment scientist
Douglas Lipton	NMFS OST	Fisheries economist; SSC member
Anna Macan	NMFS GARFO	Fisheries database expert
José Montañez	MAFMC	Council staff back-up lead for SCOQ ITQ Program Review
Douglas Potts	NMFS GARFO	GARFO lead for SCOQ ITQ Program Review

[1] In 1988, the American Malacological Union officially changed the common name of "surf clam" to the one-word name "surfclam." This nomenclature change was published in the American Fisheries Society Special Publication 16 entitled Common and Scientific Names of Aquatic Invertebrates from the United States and Canada: Mollusks (Turgeon et al. 1998), and MAFMC started using the new one-word name shortly thereafter. However, Amendment 8 to the Atlantic Surf Clam and Ocean Quahog FMP was completed or near completion when the change was made. For consistency and clarity, the one-word term "surfclam" is used throughout this document, except where "surf clam" is used in the title of the original FMP or the title of amendments to the FMP up to and including Amendment 8.

[2] The term "person" as defined in the Magnuson-Stevens Fishery Conservation Act means any individual (whether or not a citizen or national of the United States), any corporation, partnership, association, or other entity (whether or not organized or existing under the laws of any state), and any federal, state, local, or foreign government or any entity of any such government (16 USC § 1802(36)).

1.1.1 NMFS Catch Share Program Review Guidance Elements

The NMFS Catch Share Review Guidelines lists eight elements that a review of a LAPP and other catch share programs should contain. These elements, together with the corresponding section of this document addressing the element, are as follows:

1. Purpose and need of the review (discuss legal/policy requirements) (Section 2).
2. Goals and objectives of the program, the Fishery Management Plan (FMP), and the Magnuson-Stevens Fishery Conservation Act (Magnuson-Stevens Act or MSA) (Section 3).
3. History of management, including a description of management before the program's implementation, a description of the program at the time of implementation (including enforcement, data collection, and monitoring), and any changes made since the program's implementation or the previous review (including an explanation of why those changes were made) (Section 4).
4. A description of the biological and ecological/environmental (Section 5), economic (Section 6), social (Section 7), and administrative (Section 8) environments before and after the program's implementation.
5. A summary of the program's biological and ecological/environmental (Section 5.4), economic (Section 6.4), social (Section 7.4), and administrative (Section 8.4) effects.
6. An evaluation of those effects with respect to meeting the goals and objectives of the program (i.e., program performance), including a summary of the conclusions arising from the evaluation (Section 10).
7. A summary of any unexpected effects (positive or negative) which do not fall under the program's goals and objectives (Section 11.1).
8. Identification of issues associated with the program's structure or function (Section 11.2) and the potential need for additional data collection and/or research (Section 11.3).

In addition, the NMFS Catch Share Review Guidelines requires an evaluation of the net benefits to the Nation of the program (Section 9).

1.1.2 Key Areas for Review

Section 303A(c)(1) of the MSA describes the requirements of a LAPP. Among these requirements is the regular monitoring and review by the Council and the Secretary of the operations of the program, including determining progress in meeting the goals of the program and the MSA, and any necessary modification of the program to meet those goals. According to the NMFS Catch Share Review Guidelines, to properly describe and analyze the performance of a LAPP and other catch share programs in terms of meeting its

goals and the goals of the MSA, a review must address the components identified in the program's goals and objectives and the following key areas:

A) Goals and objectives
B) Allocations
C) Eligibility
D) Transferability
E) Catch and sustainability
F) Accumulation limits/caps
G) Cost recovery
H) Data collection/reporting, monitoring, and enforcement
I) Duration
J) New entrants
K) Auctions and royalties

The current review addresses each of these key areas, or documents why a key area is not applicable to the SCOQ ITQ program (e.g., key area "K" [auctions and royalties]).

The evaluation of the SCOQ ITQ program with respect to the key areas is undertaken in various "resource" sections of the document, as some, for example, are economic in nature while others focus on biological topics. For ease of use, however, the "summary of program performance evaluation conclusions" appearing in Section 10 is structured as a matrix organized around the A–K list of key areas (along with net benefits to the Nation [abbreviated as "NBN" when listed in tables/matrices] component, see Section 1.1.3, and those MSA national standards not already addressed by a key area), and cross-references to those document sections where the detailed analyses for each of the key areas are provided.

The four resource sections included in the evaluation are as follows:

- Biological and Ecological/Environmental Context and Effects Analysis (Section 5)
- Economic Context and Effects Analysis (Section 5.1)
- Social Context and Effects Analysis (Section 6.1)
- Administrative Context and Effects Analysis (Section 7.1)

Each of these resource sections has four main subsections:

1. **Questions to be Answered.** To ensure that the analysis of the SCOQ ITQ program's biological, ecological/environmental, economic, social, and administrative effects can be used to evaluate the program's performance, a series of analytical questions for each resource area have been developed based on (1) the goals and objectives of the Atlantic Surfclam and Ocean Quahog FMP (Section 3.1) and the SCOQ ITQ program (Section 3.2) (the goals and objectives of the FMP/SCOQ ITQ program are abbreviated as "G&O" when listed in tables/matrices); (2) the catch share program key areas described in the NMFS Catch Share Review Guidelines and listed above (and abbreviated as "KA" when listed in tables/matrices); and (3) the MSA goals and objectives as detailed in the national standards (Section 3.3.1) (abbreviated as "NS" when listed in tables/matrices) and are included in the questions to be answered only in those limited instances where it is not apparent that they are already captured by a key area listed in the NMFS Catch Share Review Guidelines. The MSA also provides program requirements for a LAPP (Section 3.3.2) that could be used as the basis for a program review, but these are already generally captured in the key areas defined in the NMFS Catch Share Review Guidelines and are not called out separately in the review of the SCOQ ITQ program.
2. **Methodological Approach.** This section lays out how the analysis of resource-specific effects will be conducted, including the type of data to be utilized and the analytic tools to be employed to answer the questions posed in the first section.

3. **Environment Before and After Program Implementation.** This section houses the main content of the resource analyses, including the tracking of key indicators across the pre- and post-program implementation periods. Tracking quantitative indicators in one place facilitates an at-a-glance review of changes in common indicators pre- and post-program implementation and results in a more readable document rather than having two different sets of tables and graphics for the pre- and post-implementation periods in the two different document sections. To facilitate the subsequent effects analysis, a summary of the environment before and after program implementation is provided for each key indicator and the contribution of the indicator to answering questions posed in the first section is noted.
4. **Effects of the Program.** This section summarizes the resource-specific evaluation of the effects of the program, using a matrix to specifically answer each of the questions posed.

1.1.3 Net Benefits to the Nation

In addition to requiring that a catch share program review contain the nine elements listed in Section 1.1.1, the NMFS Catch Share Review Guidelines state that a review must contain an assessment of a program's effects on net benefits to the Nation, keeping in mind that net benefits are not exclusively economic in nature. According to the NMFS Catch Share Review Guidelines, this assessment should be consistent with Guidelines for Economic Review of National Marine Fisheries Service Regulatory Actions (Guidelines for Economic Review) (National Marine Fisheries Service 2007). However, one exception is the baseline considered for analyses of catch share programs should be an appropriate number of years before the implementation of the program, and not what would have been likely to occur in the absence of the program, which is how a baseline is defined in the Guidelines for Economic Review.

In Section 9 of this document, net benefits to the Nation are assessed using information presented in the key area evaluations. Quantitative information is used to conduct the assessment to the extent data allows. When quantitative data are unavailable, net benefits to the Nation are described qualitatively.

1.1.4 Other Considerations

In addition to the other topical areas described in the preceding sections, the NMFS Catch Share Review Guidelines specifies that program reviews should contain the following elements: a summary of any unexpected effects (positive or negative) which do not fall under the program's goals and objectives, and identification of issues associated with the program's structure or function and the potential need for additional data collection and/or research. These considerations are discussed in Section 11.

1.2 Data Collection and Analysis

To the extent practicable, the questions to be answered for each resource area are addressed using standardized performance indicators or metrics developed at the national level, as described in the NMFS Catch Share Review Guidelines. Primary and secondary data for these indicators were obtained from several sources. If quantitative estimates of particular indicators were not available, a qualitative assessment was included in the review.

- Because this is the initial review for the SCOQ ITQ program, it compares and analyzes the Atlantic surfclam and ocean quahog fisheries before and after the program's implementation, to the extent data before the program's implementation are available. If possible, the baseline period is at least 3 years for most performance variables. Information for the two fisheries are presented separately

the resource/topical-specific analyses when appropriate, but otherwise a single discussion is presented.

- If a detailed analysis of a particular component of the SCOQ ITQ program already exists, the analysis is incorporated by reference and a summary of the findings and their implications with respect to evaluating the program's performance is included in the review.
- If a particular component of a program is the subject of a current management action, a summary containing a description of, rationale for, and current status of the management action is included in the review.
- A fieldwork component was used to complement the data and analysis of existing quantitative fishery data and synthesis of other studies. The specific data collection needs for fieldwork/key person interviews were refined following the compilation of a first internal iteration of the Draft Review.

2 Purpose and Need of the Review

As stated in the NMFS Catch Share Review Guidelines, the MSA requires the Councils and Secretary to include provisions for the regular monitoring and review of the operations of LAPPs implemented January 12, 2007 and later, including determining progress in meeting the goals of the LAPP and the MSA, and any necessary modification of the LAPP to meet those goals. A formal and detailed review is required five years after the implementation of the LAPP and thereafter to coincide with scheduled Council review of the relevant FMP; but no less frequently than once every seven years.

While this MSA requirement would not directly apply to the SCOQ ITQ program, since it was established before January 12, 2007, the NOAA Catch Share Policy prepared in 2010 indicates that periodic reviews are expected of all LAPPs, regardless of when they were put in place (National Marine Fisheries Service 2010b). According to the NMFS Catch Share Review Guidelines, reviews of LAPPs established before January 12, 2007, should be initiated no later than seven years after the NOAA Catch Share Policy went into effect in 2010 (i.e., no later than the end of calendar year 2017), consistent with MSA's requirement for subsequent LAPP reviews. The current document is intended to fulfill the LAPP review requirements as described in the NMFS Catch Share Review Guidelines.

3 Goals and Objectives

3.1 Atlantic Surfclam and Ocean Quahog FMP

The Atlantic Surfclam and Ocean Quahog FMP and its amendments are described in detail in Section 4. The reader is referred to that section for information on the original FMP goals and objectives and their evolution over time.

3.2 SCOQ ITQ Program

The goals and objectives of the FMP, as revised by Amendment 8 (Mid-Atlantic Fishery Management Council 1988), coincide with the goals and objectives of the SCOQ ITQ program listed below.

1. Conserve and rebuild Atlantic surfclam and ocean quahog resources by stabilizing annual harvest rates throughout the management unit in a way that minimizes short-term economic dislocations.
2. Simplify to the maximum extent the regulatory requirement of clam and quahog management to minimize the government and private cost of administering and complying with regulatory, reporting, enforcement, and research requirements of clam and quahog management.
3. Provide the opportunity for industry to operate efficiently, consistent with the conservation of clam and quahog resources, which will bring harvesting capacity in balance with processing and biological capacity and allow industry participants to achieve economic efficiency including efficient utilization of capital resources by the industry.
4. Provide a management regime and regulatory framework which is flexible and adaptive to unanticipated short-term events or circumstances, and consistent with overall plan objectives and long-term industry planning and investment needs (Mid-Atlantic Fishery Management Council 1988).

3.3 Magnuson-Stevens Act

The goals and objectives of the MSA are implicitly detailed in the national standards. The MSA also sets forth the requirements of a LAPP.

3.3.1 National Standards

The MSA at Section 301(a) requires that any FMP be consistent with national standards for fishery conservation and management. These national standards are generally captured in the key areas for review specified in the NFMS review guidance report, and they are called out separately in the review of the SCOQ ITQ program only in those limited instances where it is not apparent that they are already captured by a key area.

The national standards are as follows:

1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
2. Conservation and management measures shall be based on the best scientific information available.

3. To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.
4. Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.
5. Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.
6. Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
7. Conservation and management measures shall, where practicable, minimize cost and avoid unnecessary duplication.
8. Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts in such communities.
9. Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. [Added in 1996]
10. Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

3.3.2 Limited Access Privilege Program Requirements

Section 303A(c)(1) of the MSA describes the requirements of a LAPP. These requirements are captured in the key areas for review specified in the NFMS review guidance report, and they are not called out separately in the review of the SCOQ ITQ program.

According to the MSA, any LAPP must:

1. if established in a fishery that is overfished or subject to a rebuilding plan, assist in its rebuilding;
2. if established in a fishery that is determined by the Secretary or the Council to have over-capacity, contribute to reducing capacity;
3. promote fishing safety, fishery conservation and management, and social and economic benefits;
4. prohibit any person other than a United States citizen, a corporation, partnership, or other entity established under the laws of the United States or any State, or a permanent resident alien, that meets the eligibility and participation requirements established in the program from acquiring a privilege to harvest fish, including any person that acquires a limited access privilege solely for the purpose of perfecting or realizing on a security interest in such privilege;
5. require that all fish harvested under a limited access privilege program be processed on vessels of the United States or on United States soil;
6. specify the goals of the program;

7. include provisions for the regular monitoring and review by the Council and the Secretary of the operations of the program, including determining progress in meeting the goals of the program and this Act, and any necessary modification of the program to meet those goals, with a formal and detailed review 5 years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequently than once every 7 years);
8. include an effective system for enforcement, monitoring, and management of the program, including the use of observers or electronic monitoring systems;
9. include an appeals process for administrative review of the Secretary's decisions regarding initial allocation of limited access privileges;
10. provide for the establishment by the Secretary, in consultation with appropriate Federal agencies, for an information collection and review process to provide any additional information needed to determine whether any illegal acts of anti-competition, anti-trust, price collusion, or price fixing have occurred among regional fishery associations or persons receiving limited access privileges under the program; and
11. provide for the revocation by the Secretary of limited access privileges held by any person found to have violated the antitrust laws of the United States.

4 History of Management

This section provides background information on the management of the Atlantic surfclam and ocean quahog fisheries during three time periods. The first period covers management of the fisheries before implementation of the SCOQ ITQ program. The second period describes management at the time the program was implemented (including enforcement, data collection, and monitoring). Finally, the third period reviews management of the fisheries after the program was implemented.

4.1 FMP Before SCOQ ITQ Program Implementation

The FMP for the Atlantic surfclam (*Spisula solidissima*) and ocean quahog (*Arctica islandica*) fisheries was adopted by the Council in November 1977 (Mid-Atlantic Fishery Management Council 1977). The FMP applied to domestic fishermen who harvested surfclams and/or ocean quahogs in the U.S. EEZ portion of the Atlantic Ocean between the U.S./Canadian border and the southern limit of the range of surfclams. Because surfclams were the preferred species and ocean quahogs were secondary at the time the FMP was first developed, management measures differed for each species.

The FMP was prepared at a time when signs of overfishing were apparent in the surfclam fishery. Harvests were significantly lower than historical levels, and the industry was economically unstable. The Council recognized that a long-term stock rebuilding program needed to be instituted and that such a program would require significant cutbacks in the allowable harvest levels of surfclams (Mid-Atlantic Fishery Management Council 1977). Based on this recognition, the FMP defined three goals and objectives for the surfclam and ocean quahog fisheries:

1. Rebuild the declining surfclam populations to allow eventual harvest approaching the 50 million-pound level, which was the best estimate of the maximum sustainable yield (MSY).
2. Minimize short-term economic dislocations to the extent possible consistent with program objective 1 and promote economic efficiency.
3. Prevent the harvest of the ocean quahog from exceeding biologically sound sustainable yield levels and direct the fishery toward maintaining optimum yield.

The FMP established annual catch limits on surfclams and ocean quahogs, with the surfclam catch limit of 1.8 million bushels to be allocated on a quarterly basis.[3] These limits were based on the optimum yield, which was determined by applying social, economic, and ecological factors "in a somewhat subjective manner" to the maximum sustainable yield.

Quarterly catch limits were established for surfclams from October 1977 through September 1979. The catch limit was set at 350,000 bushels per quarter from October through March. The catch limit was increased to 550,000 bushels per quarter from April through September. Provisions were also included that allowed the unharvested portion of the catch limit to roll-over to the next quarter when 5,000 bushels or more remained unharvested. Fishing was only allowed Monday through Thursday each week, and those days could be modified after 50 percent of the quarterly limit was projected to be taken. The plan provided a maximum surfclam fishing week of 96 hours, and the hours of fishing could be adjusted by NMFS to help spread the catch evenly throughout the quarter and to minimize the chances of a fishery closure. Fishing areas could be closed if the clams harvested did not meet specific size thresholds.

[3] For simplicity, this program review consistently uses the term "annual catch limit" when referring to the maximum amount of surfclams and ocean quahogs that can be caught in a given year. A number of similar terms are used in the FMP and amendments to refer to this amount, including annual quota and total allowable catch.

The annual catch limit on ocean quahogs was set at 3 million bushels. Fishing was allowed seven days per week. As was the case for surfclams, NMFS was granted the authority to adjust the fishing days based on projections of whether the catch limit would be taken.

All surfclam and ocean quahog buyers were required to submit a weekly report to NMFS that identified the date of the purchase, number of bushels purchased, who sold the product, the price, and address of the plant. Vessel operators harvesting these species were required to obtain a license and report information on the vessel, its capacity, and effort for the year before submitting the application. All vessel operators that were issued a license were also required to maintain an accurate log of fishing operations and to immediately comply with instructions and requests from authorized enforcement officers.

The FMP also implemented a moratorium on new entry into the surfclam fishery for one year after plan implementation. This moratorium on new entry did not extend to the ocean quahog fishery. The moratorium on new entry limited the number of permits for vessels to 184, but some permits were dropped later because of inactivity, leaving 142 (Mid-Atlantic Fishery Management Council 1988). With the moratorium in place, vessel operators were required to gain access to the surfclam fishery by owning one of the original boats or its replacement. There were no restrictions on sale or purchase of these vessels.

4.1.1 Amendment 1

The original FMP was set to expire on September 30, 1979. Amendment 1 extended the FMP until December 31, 1979 (Mid-Atlantic Fishery Management Council 1979a). The short duration of this amendment was to allow sufficient time to prepare a more substantial amendment to the FMP. In addition to maintaining the moratorium, Amendment 1 included three primary provisions:

1. Set a fourth quarter surfclam catch limit for 1979 (October 1, 1979 to December 31, 1979) that was equal to the 1978 fourth quarter limit (350,000 bushels).
2. Establish processor reporting requirements.
3. Remove the requirement that each quarter begin with a four-day fishing week for surfclams and replace that provision with a provision that allowed the number of fishing days for the beginning of each quarter to be set by NMFS in consultation with the Council.

4.1.2 Amendment 2

In addition to extending the FMP through the end of 1981, Amendment 2 imposed several changes to the plan (Mid-Atlantic Fishery Management Council 1979b). Prepared in 1979, the amendment established separate New England and the Mid-Atlantic management areas for the surfclam fishery, with the dividing line between the areas coinciding with the boundary separating the management authority areas of the Mid-Atlantic Fishery Management Council and New England Fishery Management Council. Annual catch limits for surfclams in the two management areas were established for 1980 and 1981: 1.8 million bushels in the Mid-Atlantic Area, and 0.025 million bushels in the New England Area. The annual catch limit in the Mid-Atlantic Area was allocated on a quarterly basis: 400,000 bushels for October through December and January through March, and 500,000 bushels for April through June and July through September. An annual catch limit was also established for the ocean quahog fishery: 3.5 million bushels in 1980, and 4.0 million bushels in 1981.

Fishing for surfclams in the Mid-Atlantic Area continued to be restricted to no more than four days each week, Monday through Thursday, with each vessel being limited to 96 hours of fishing per week. During the months of December, January, February, and March, a make-up day for bad weather was permitted on the fishing day following the fishing day during which the bad weather condition existed. The prohibition

on additional vessels entering the surfclam fishery was applied to the Mid-Atlantic Area, but the amendment lifted the moratorium in the New England Area.

The amendment implemented a 4.5″ minimum size limit for surfclams. Surfclam beds where closed to fishing where over 60 percent of the clams are under 4.5″ in length and less than 15 percent are over 5.5″ in length. The action also recommended special management measures for reopened areas to ensure that such openings do not result in premature closures and prevent overfishing of the newly reopened beds.

Amendment 2 continued the licensing provisions of the original FMP and revised the reporting requirements. All persons who bought surfclams and ocean quahogs from vessels were required to provide NMFS the following weekly information:

1. The dates and number of bushels purchased.
2. The name and permit number of the vessel from which surfclams or ocean quahogs are landed or received.
3. The price per bushel, by species.
4. The mailing address of dealer or processing plant.
5. The meat yield per bushel by species.

Buyers were also required to submit the annual reports to NMFS with the following information:

1. The number of dealer or processing plant employees, by month.
2. The number of employees processing surfclam and ocean quahog, by species, by month.
3. The total payroll for surfclam and ocean quahog processors by month.
4. The capacity to process surfclams and ocean quahogs, by species; and the projected capacity to process surfclams and ocean quahogs, by species, for the following year.

Owners or operators of any vessel with a permit in the surfclam or ocean quahog fisheries were required to maintain an accurate NMFS logbook for each fishing trip. The logbook forms included:

1. The name and permit number of the vessel.
2. The total amount (in bushels) of each species caught.
3. The date(s) the surfclam or ocean quahog were caught.
4. The time spent at sea and duration of fishing.
5. The location(s) that were fished.
6. The crew size and crew shares paid.
7. The landing port, date the fish were sold, and the price per bushel.
8. The buyer and the size distribution of surfclams and ocean quahogs sold, by species, on a percentage basis.

4.1.3 Amendment 3

Amendment 3, prepared in 1981, extended the FMP without including a sunset date; allowed for an surfclam annual catch limit of 25,000 to 100,000 bushels the New England Area; imposed a 5.5" surfclam minimum size limit in the Mid-Atlantic Area; expanded the surfclam fishing week in the Mid-Atlantic Area by one day by adding Sunday to the open days (from Sunday through Thursday); and established a framework basis for catch limit setting (Mid-Atlantic Fishery Management Council 1981).

The Council also recommended a permit limitation system to replace the moratorium, but this provision was disapproved by NMFS. However, NMFS implemented a Secretarial Amendment to extend the moratorium to prevent the fishery from reverting back to open access.

4.1.4 Amendment 4

Implemented in 1984, the purpose of Amendment 4 was to increase the New England Area surfclam annual catch limit from 100,000 bushels to 200,000 bushels and to control the harvest rate to extend the fishery to traditional length and avoid repeating the extended closure that occurred in 1983 (Mid-Atlantic Fishery Management Council 1984b). In 1983, the harvest of surfclams from the New England Area was estimated to have reached 114,000 bushels by June 1, and the area was closed to fishing on July 1 for the remainder of the year. A new stock assessment was used as justification for increasing the New England Area surfclam annual catch limit. Based in part on the new assessment, Amendment 4 was implemented on an emergency basis for 180 days beginning July 1, 1984. However, NMFS subsequently determined that the Amendment 4 document was not structurally complete and additional analysis would be required. Ultimately, components of Amendment 4 were included in Amendment 6.

4.1.5 Amendment 5

In 1985, Amendment 5 implemented three primary changes to the FMP (Mid-Atlantic Fishery Management Council 1984a). First, it retained the 5.5" minimum size limit for surfclams as a target but allowed the size limit to be reduced if the clam size distribution suggested that excessive discards would result from the limit. The size could be reduced as necessary to keep the discard level around 30 percent while still maintaining the number of clams an agent must count to determine whether a violation occurred. The number of smaller clams that would result in a violation set the tolerance percentage to float from about 10 percent (240 clams at 5.5") to about 1 percent (50 clams at 4.75"). The size limit could not be adjusted smaller than 4.75". Amendment 5 also applied the size limit to the surfclam fisheries in both state and federal waters. This was intended to aid enforcement, as the size limits of states were not uniform or did not exist.

In addition, the amendment implemented a cage tag requirement. The tag was intended to facilitate enforcement of the size limit provision. Without tagging the cage, it was difficult to track landings from the vessel to the processing plant.

4.1.6 Amendment 6

Amendment 6, prepared in 1986, divided the New England Area into two areas (Mid-Atlantic Fishery Management Council 1986a). The Nantucket Shoals Area was defined as the portion of the New England Area west of 69° N Longitude, while the Georges Bank Area was defined as the portion of the New England Area east of 69° N Longitude. Dividing the areas allowed the Georges Bank Area annual catch limit to be set at 25,000 bushels to 300,000 bushels. The Nantucket Shoals Area limit was estimated at 25,000 bushels to 200,000 bushels. If the areas were not divided, an increase in the Georges Bank Area limit could result in excessive harvest from the Nantucket Shoals Area.

The Georges Bank annual catch limit was divided by quarter, with the first and last quarters each allocated 10 percent of the annual catch limit and the second and third quarters each allocated 40 percent. Regulatory changes also allowed for a catch limit overage in a quarter to be deducted from the following quarter and a catch limit underage to be added to the following quarter, within specified guidelines. Those guidelines included a 5,000-bushel threshold for transfer of the unharvested portion of the catch limit between quarters and a cap of 10 percent if the quarterly catch limit was being transferred inter-year. The Nantucket

Shoals Area limit was also divided by quarter, with 20 percent allocated to the first and last quarters and 30 percent allocated to the second and third quarters.

Weekly catch limits for the Nantucket Shoals Area were eliminated until 50 percent of the quarterly catch limit was landed. After 50 percent of the quarterly catch limit was taken, NMFS would consult with the Council to determine what effort control measures should be implemented to help ensure the fishery would remain open for the balance of the quarter.

Amendment 6 also established a limit of one landing per authorized fishing period. An authorized fishing period was defined as a trip.

4.1.7 Amendment 7

Amendment 7, prepared in 1987, set the Georges Bank quarterly catch limits to 25 percent for each quarter and clarified that rollover provisions would include inter-year rollovers to provide greater flexibility to stakeholders (Mid-Atlantic Fishery Management Council 1987). The amendment also removed the 5,000-bushel threshold for transfer of the unharvested portion of the catch limit from one quarter to the next and added a provision that any unharvested portion would be distributed proportionally among the remaining quarters in the year rather than being added to the next quarter for the Nantucket Shoals and Georges Bank Areas. In addition, Amendment 7 removed the 10 percent cap on carry over of the unharvested portion from one year to the next.

4.2 SCOQ ITQ Program Implementation: FMP Amendment 8

Amendment 8 developed the SCOQ ITQ program (Mid-Atlantic Fishery Management Council 1988), which went into effect on October 1, 1990. The amendment revised the goals and objectives of the FMP to coincide with the goals and objectives of the SCOQ ITQ program, as listed in Section 3.2.

4.2.1 Allocations

Allocations of ITQ quota share were made to owners of all permitted vessels that harvested surfclams and/or ocean quahogs in the Atlantic EEZ from January 1, 1979 through December 31, 1988. The formula for allocating surfclams in the Mid-Atlantic Area was:

1. 80 percent of allocation was based on the vessel's average annual historical catch over the time period, with the worst two years dropped and the best four years counted twice.
2. 20 percent of the allocation was based on the vessel's capacity (length x width x depth).

The initial allocation for vessels fishing ocean quahog and New England Area surfclams was the average annual catch in the years actually fished during the qualifying period, with the lowest year of catch dropped. The average surfclam catch from the New England Area was combined with the Mid-Atlantic Area catch to calculate vessel allocations for the combined stock.

4.2.2 Landings, Permits, and Transfers of Allocations and Cage Tags

Under the SCOQ ITQ program, surfclams and ocean quahogs must be landed pursuant to an ITQ allocation permit. This permit takes the form of 1) an individual allocation certificate specifying the share of the annual surfclam and/or ocean quahog catch limit the allocation is worth; 2) surfclam and/or ocean quahog cage tags equivalent to the cages resulting from applying the individual allocation to the annual catch limit; and 3) any documentation issued by NMFS concerning the transfer of individual allocations and cage tags. ITQ quota share is issued in the form of cage tags that must be attached to the cages used to transport the catch.

The number of cage tags issued to an ITQ allocation permit holder is equal to the annual catch limit in bushels divided by 32.

ITQ quota share may be transferred in amounts not less than 160 bushels (i.e., 5 cages) to any person eligible to own a U.S. fishing vessel. A written application must be submitted to NMFS specifying the number of bushels to be transferred and the new owner at least 10 days before the applicant desires the transfer to be effective. Transfers may not be made between 15 October and 31 December of each year. The transfer is not effective until the new owner receives an ITQ allocation permit from NMFS. Amendment 8 places no limits on the amount of ITQ quota share a person can hold.

4.2.3 Optimum Yield and Annual Catch Limit Range

Amendment 8 also provided an optimum yield/annual catch limit range for each fishery. These were set at between 1.85 million and 3.4 million bushels in the surfclam fishery and between 4.0 million and 6.0 million bushels in the ocean quahog fishery.

4.2.4 Enforcement, Monitoring, and Data Collection

Enforcement in the SCOQ ITQ program relies heavily on shoreside surveillance, and the program requires vessel owners or operators to notify NMFS before the vessel reaches the dock from a trip on which surf clams or ocean quahogs were caught. To establish a chain of evidence adequate for enforcement of the SCOQ ITQ program from the vessel to the processor, all surf clam and ocean quahog cages must be tagged before the cable is removed from the cage on the dock, and tags must not be removed until cages are emptied at the processing plant. Cross-checking logbooks between vessels and processors also provides a system to double check the information reported. ITQ allocation permits may be suspended, revoked, or modified by NMFS for violations of the FMP.

Under the SCOQ ITQ program, previous reporting requirements continued with three changes: 1) dealers must file reports similar to those that processors must file; 2) dealers and processors must make their reports available for inspection by authorized officers or designated NMFS employees (the same requirement that was in effect for vessel logbooks); and 3) the ITQ allocation permit number must be reported on both the vessel logbook reports and the dealer/processor reports.

4.3 FMP after SCOQ ITQ Program Implementation

4.3.1 Amendment 9

Amendment 9, prepared in 1996, brought the overfishing definitions for surfclams and ocean quahogs into compliance with the guidelines at 50 CFR 602 (Mid-Atlantic Fishery Management Council 1996). For surfclams, the overfishing definition was set at $F_{20\%}$ which equated to an exploitation rate of 15.3 percent; the ocean quahog overfishing definition was set at $F_{25\%}$, or an exploitation rate of 4.3 percent.

4.3.2 Amendment 10

Amendment 10, prepared in 1997, established management measures for the small artisanal fishery for mahogany quahogs in the EEZ off the northeast coast of Maine. It was determined that after the SCOQ ITQ program was implemented, the fishery was being increasingly prosecuted. However, the small-scale Maine fishery did not fit well within the SCOQ ITQ program, as it differed from the large-scale, industrial ocean quahog fishery. As a result, Amendment 10 established conservation and management measures that are appropriate for the eastern Maine ocean quahog fishery.

4.3.3 Amendment 11

Amendment 11, prepared in 1998, was developed to achieve consistency among Mid-Atlantic Region and New England Region FMPs with respect to vessel replacement and upgrade provisions, permit history transfer and splitting, and renewal regulations for fishing vessels issued Northeast Limited Access Federal Fishery permits (National Marine Fisheries Service 1998).

4.3.4 Amendment 12

Amendment 12, prepared in 1998, brought the FMP into compliance with the revised national standards and provisions of the 1996 Sustainable Fisheries Act (Mid-Atlantic Fishery Management Council 1998). NMFS approved Amendment 12 with the exceptions of the proposed surfclam overfishing definition and the fishing gear impacts to essential fish habitat (EFH) section. The surfclam overfishing definition was disapproved because it was based on the sustainability of the Northern New Jersey Area, where greater than 80 percent of the fishery had occurred according to the most recent 10-years of data. NMFS determined that this proxy was too conservative and did not represent global values over the entire range of the surfclam resource.

The overfishing "target" for ocean quahogs was defined as one-half the virgin biomass and the $F_{0.1}$ level of fishing mortality for the exploited region. The overfishing definition "threshold" would be one-half B_{MSY} or one-quarter of the virgin biomass with an $F_{25\%}$ MSY level of fishing mortality that should never be exceeded.

A framework adjustment process was implemented in addition to the annual review and modifications to management measures associated with the annual catch limit setting process. The framework process was structured to allow the Council to be able to add or modify management measures through a streamlined public review process. Management measures identified in the FMP could be implemented or adjusted at any time during the year (with the exception of the annual catch limits). The specific management measures included the overfishing definition (both the threshold and target levels), description and identification of EFH (and fishing gear management measures that impact EFH), habitat areas of particular concern, set aside a portion of the catch limit for scientific research, vessel tracking system, and the optimum yield/annual catch limit range.

Amendment 12 also implemented a Vessel Operator Permit requirement for surfclam or ocean quahog fishermen who did not already have this permit for another fishery. Vessel's fishing commercially for surfclams or ocean quahogs were required to have on board at least one operator holding a permit.

4.3.5 Amendment 13

Amendment 13, prepared in 2003, addressed sections of Amendment 12 that were disapproved by NMFS (Mid-Atlantic Fishery Management Council 2003). Amendment 13 developed a new surfclam overfishing definition that was more global rather than being focused only on the Northern New Jersey area. Annual catch limits for surfclams were set between 1,850,000 and 3,400,000 bushels (31.5 to 57.8 million pounds of meats). The amendment also determined that the optimum yield/annual catch limit range would remain at "status quo" based upon the new overfishing definition and would use a planned stock assessment to determine any need to change the range.

Amendment 13 concluded that there was sufficient information that clam dredges could have an effect on EFH if the gear is fished improperly or in the wrong sediment type. However, the surfclam and ocean quahog resources are concentrated in high-energy, sandy sediment, and the fishing gear has evolved to fish efficiently in this type of environment. As a result, the adverse effect on EFH was expected to be minimal and temporary in nature.

Amendment 13 also addressed the implementation of multi-year catch limits, which were assumed to result in a more efficient regulatory process because time and effort could be saved in the monitoring cycle, alternatives development, notice, comment, and final regulation cycles.

In addition, Amendment 13 addressed the need for NMFS to annually conduct a review and publish a regulatory action to suspend the minimum surfclam size limit if the Council recommended this course of action. A minimum size limit had not been imposed since implementation of the SCOQ ITQ program. The amendment added the suspension of the surfclam minimum size limit and adjustment of the minimum size to the Amendment 12 framework list.

4.3.6 Amendment 14

Amendment 14, prepared in 2007, began the process of developing a standardized bycatch reporting methodology for all fisheries under the authority of the Mid-Atlantic and New England Fishery Management Councils (Mid-Atlantic Fishery Management Council et al. 2007).

4.3.7 Framework 1

Framework 1 to the FMP was drafted in 2007 to address issues related to a vessel monitoring system (VMS) (Mid-Atlantic Fishery Management Council 2007). The purpose of implementing a mandatory VMS requirement was to replace the call-in requirement and facilitate the enforcement of management regimes between state and federal waters, as well as area closures in federal waters. VMS was also anticipated to facilitate reporting harvest data electronically in the future, eliminating the need for paper forms and reducing stakeholders reporting time and effort.

4.3.8 Amendment 15

Amendment 15, implemented in 2015, addressed standardized bycatch reporting methodology issues (Mid-Atlantic Fishery Management Council et al. 2015). The amendment responded to a remand by the U.S. District of Columbia Court of Appeals decision concerning observer coverage levels specified by the methodology and to add various measures to improve and expand on the methodology that was defined in Amendment 14. Amendment 15 clarified bycatch reporting and monitoring mechanisms, analytical techniques, and allocation of at-sea fisheries observers, and it defined a precision-based performance standard for discard estimates.

In addition, Amendment 15 established consistent observer service provider approval and certification procedures, and it established measures to enable the Council to implement either a requirement for industry-funded observers and/or an observer set-aside program through a framework adjustment.

4.3.9 Amendment 16

Amendment 16 is part of an omnibus amendment developed in 2011 to established required annual catch limits and accountability measures for various Northeastern fisheries, including the surfclam and ocean quahog fisheries (Mid-Atlantic Fishery Management Council 2011). The annual catch limits for surfclams and ocean quahogs were set equal to the acceptable biological catch (ABC). The annual catch target (ACT) was set as a proactive accountability measure. Because the amendment set the annual catch limit equal to ABC, the ACT was determined to be a necessary component of a catch limit system to address management uncertainty.

4.3.10 Amendment 17

Amendment 17, implemented in 2016, established a cost recovery program for the SCOQ ITQ program (Mid-Atlantic Fishery Management Council 2016b). The MSA requires a cost recovery fee of up to 3 percent of ex-vessel value to cover "actual costs directly related to the management, data collection, and enforcement" of a LAPP. Amendment 17 established cost recovery provisions that were similar in structure (permit holder pays the fee) to the cost recovery provisions for the golden tilefish ITQ program.

Amendment 17 also changed how biological reference points are incorporated into the FMP. This was an administrative action to improve management efficiency and the incorporation of the best available scientific information by automatically incorporating new peer-reviewed status determination criteria instead of requiring a separate management action to adopt them within the FMP.

In addition, the amendment removed the optimum yield/annual catch limit ranges from the FMP, which was consistent with the other FMPs the Council manages. Surfclam and ocean quahog stocks were the only stocks before the amendment with optimum yield/annual catch limit ranges specified in the FMP. The Council may not exceed the ABC recommendations of the Scientific and Statistical Committee (SSC), but it continues to specify annual catch limits as described in the FMP.

4.3.11 Amendment 18

Amendment 18, prepared in 2015, is part of an omnibus amendment that eliminated the one-time limit on vessel upgrades and removed gross and net tonnages from the vessel baseline specifications that NMFS considers when reviewing vessel replacement applications (National Marine Fisheries Service 2015a). In addition, Amendment 18 removed the requirement for vessel operators to send in fishing reports during months or weeks when their vessels were inactive (i.e., "did not fish reports"). NMFS no longer needed those reports because vessel inactivity could be verified using other data sources.

4.3.12 Amendment 19

Amendment 19 is part of an omnibus amendment related to unmanaged forage fish that was implemented in 2017 (Mid-Atlantic Fishery Management Council 2017a). The amendment implemented management measures to prevent the development of new, and the expansion of existing, commercial fisheries on certain forage species in the Mid-Atlantic Region. These measures will remain in place until the Council has adequate opportunity and information to evaluate the potential impacts of forage fish harvest on existing fisheries, fishing communities, and the marine ecosystem.

4.4 Current Issues Being Considered

National Standard 4 of the MSA mandates that when fishing privileges are allocated among various fishermen, such allocation must be "carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges." The MSA does not define when a holding of fishing privileges constitutes an excessive share. It is left to the regional fishery management councils to determine what is considered excessive consolidation of shares on a fishery-by-fishery basis.

As described in Sections 8.3.4, NMFS recently determined that the Atlantic Surfclam and Ocean Quahog FMP is out of compliance with National Standard 4 because it does not currently include an excessive share cap expressed as a percentage of the total ITQ quota share. In 2016, a new ITQ allocation permit application process was implemented by NMFS that allows managers to assess ITQ quota share ownership and concentration levels (Sections 8.3.4 and 8.3.7). The Council will use this information to inform the development of an FMP amendment that defines what constitutes an excessive share in the SCOQ ITQ

program. The Council incorporated the goal of preparing an excessive share amendment into its 2014–2018 Strategic Plan, and it has been actively developing the amendment since then.

In addition, in 2017, the Council incorporated the goal of reviewing and revising the goals and objectives of the FMP into its 2014–2018 Strategic Plan. This initiative will allow the Council to revisit and possibly "refresh" FMP goals and objectives to ensure that they are consistent with today's fishery and management issues.

5 Biological and Ecological/Environmental Context and Effects Analysis

5.1 Questions to be Answered

Table 2 provides a summary of program review questions used to guide the biological and ecological/environmental context and effects analysis. These questions are based on the SCOQ ITQ program goals and objectives, the NMFS Catch Share Review Guidelines, and, where not already encompassed by the provisions of the NMFS Catch Share Review Guidelines, the MSA national standards. The methodological approach used to answer these questions is presented in Section 5.2.

Table 2. Program Review Questions for the Biological and Ecological/Environmental Analysis

Question Number	Element Number	Question to be Answered	Section Number
Questions that derive from program goals and objectives (G&Os)			
BE/E-1	G&O: 1	Has the program conserved and rebuilt Atlantic surfclam and ocean quahog resources by stabilizing annual harvest rates throughout the management unit?	5.3.2
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
BE/E-2	KA: E	Has the program helped to keep harvests/landings within the available annual catch limit?	5.3.2
BE/E-3	KA: E	Does the program minimize bycatch and bycatch mortality to the extent practicable (consistent with NS 9)?	5.3.3
Questions that derive from national standards (NSs) not encompassed by KA questions			
BE/E-4	NS: 2	Contributed to conservation and management measures that are based upon the best scientific information available, including high quality and timely biological and ecological scientific information?	5.3.4
BE/E-5	NS: 3	Does the program manage stocks as a unit?	5.3.1

5.2 Methodological Approach

The biological and environmental /ecological analysis relies generally on quantitative data and focuses on surfclam and ocean quahog harvests, stock status, bycatch and discard issues, and the collection and application of scientific information. Primary sources of information on biological and ecological impacts were the surfclam and quahog stock assessment reports prepared by the NMFS Northeast Fisheries Science Center. Published data were supplemented with information obtained from personal communications with Northeast Fisheries Science Center staff. In general, the methodological approach for the biological and environmental/ecological analysis section was to summarize the appropriate fishery information for the pre- and post-implementation periods, and then to use those summaries to develop answers to the program review questions.

5.3 Environment Before and After Program Implementation

Four issue categories and, where available, associated annual time series data spanning the pre- and post-SCOQ ITQ program periods were used to organize and summarize the information needed to address the

five biological and ecological/environmental analytic questions to be answered as listed in Table 2. These issue categories, each addressed in separate subsections below, are:

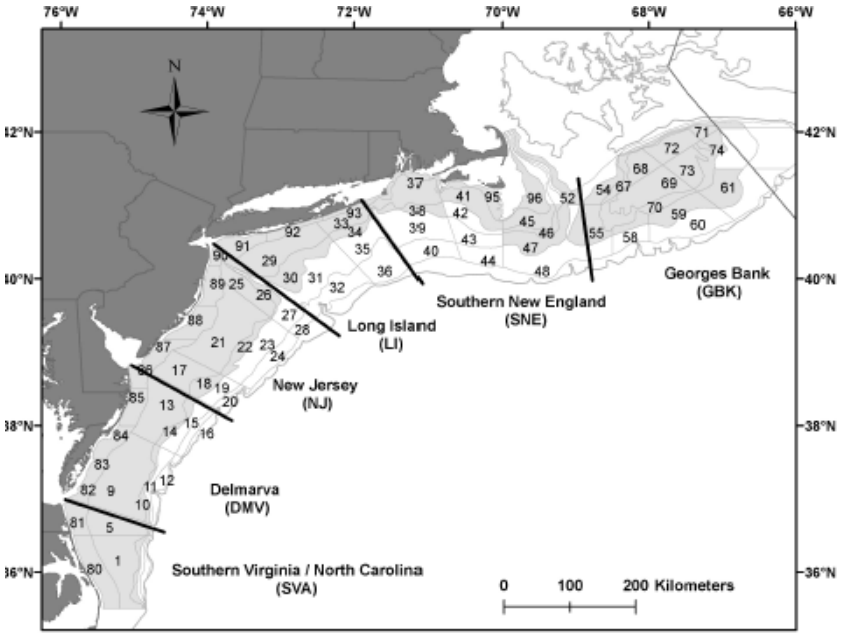
- Management Units
- Stock Status
- Bycatch Reduction
- Collection and Application of Scientific Information

5.3.1 Management Units for the Surfclam and Ocean Quahog Fisheries

The FMP established the management units for the surfclam fishery and ocean quahog fishery as the entire surfclam stock and ocean quahog stock, respectively, in the U.S. Atlantic EEZ (Mid-Atlantic Fishery Management Council 1977). NMFS stock assessments divide the surfclam and ocean quahog stocks into a northern (Georges Bank or GBK) and a southern (south of GBK to Cape Hatteras) area for modelling purposes. The southern area for both stocks is divided into five regions: Southern New England, Long Island, New Jersey, Delmarva, and Southern Virginia/North Carolina. However, surfclam and ocean quahog resources are managed as single stocks, and stock estimates for the north and south are combined for status determination (National Marine Fisheries Service 2017b; National Marine Fisheries Service 2017a).

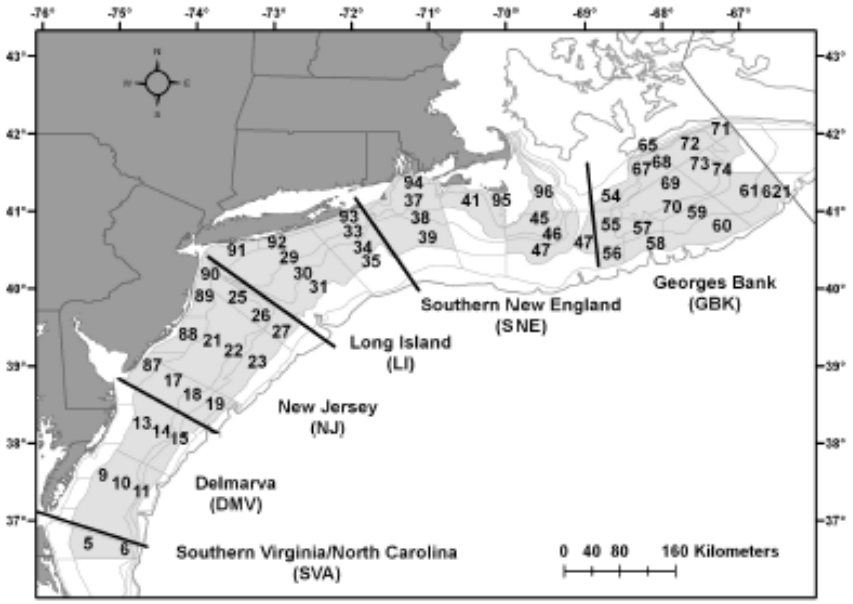
Because the surfclam and ocean quahog fisheries are highly localized, surfclam and ocean quahog stock conditions are often described for smaller stock assessment regions rather than for the whole stock area. These designated regions are important in understanding the fishery but have no legal meaning. Figure 1 shows the stock assessment regions for the surfclam resource, while Figure 2 shows the stock assessment regions for the ocean quahog resource.

Figure 1. Surfclam Stock Assessment Regions and NEFSC Shell Fish Survey Strata[1]



Source: National Marine Fisheries Service (2017b)
[1]NEFSC shellfish strata with potential surfclam habitat are shown in grey and identified by stratum ID numbers.

Figure 2. Ocean Quahog Stock Assessment Regions and NEFSC Shell Fish Survey Strata[1]



Source: National Marine Fisheries Service (2017a)
[1]NEFSC shellfish strata with potential ocean quahog habitat are shown in grey and identified by stratum ID numbers

Pre-SCOQ ITQ Program Period

The surfclam stock in the EEZ has been managed as a unit throughout its range since the FMP was first prepared and implemented. The NMFS Northeast Fisheries Science Center's stock surveys and assessments have been conducted as if there was one management unit, although, as noted above, surfclam stock conditions are often described for smaller stock assessment regions.

During the pre-SCOQ ITQ program period, Amendment 2 divided the surfclam fishery into the Mid-Atlantic and New England management areas, with separate annual catch limits and no moratorium on new entry into the surfclam fishery in the New England Area. The dividing line between the two areas coincided with the boundary separating the management authority regions of the MAFMC and New England Fishery Management Council. The latter council recommended the establishment of separate surfclam management areas in order to ensure that vessels operating in the surfclam fishery off New England would not be negatively affected by measures directed at managing the surfclam fishery occurring elsewhere in the EEZ (Mid-Atlantic Fishery Management Council 1979b; Mid-Atlantic Fishery Management Council 1981). The overall intent was to minimize restrictions in New England Area, and thereby encourage the development of a New England-based surfclam fishery. Amendment 6 divided the New England Area into the Nantucket Shoals Area and Georges Bank Area, with separate annual catch limits (Mid-Atlantic Fishery Management Council 1986a).

National Standard 3 of the MSA requires an FMP to manage an individual stock of fish as a unit throughout its range, to the extent practicable (Sec. 301(a)(3)). However, the management measures need not be identical for geographic areas within the management unit, if the FMP justifies the differences (50 CFR 600.320(d)(2)). With respect to the division of the surfclam fishery into the Mid-Atlantic and New England management areas and the division of the New England Area into the Nantucket Shoals Area and Georges Bank Area, National Standard 3 guidelines clearly allowed the surfclam unit stock to be managed differently by geographic area if the FMP justified this and incorporated mechanisms to coordinate management between areas. However, while there is a surfclam resource of some magnitude in the EEZ off the New England states, a significant New England-based EEZ surfclam fishery was never established during the pre-

SCOQ ITQ program period, and the fishery in the New England Area was largely prosecuted by vessels based in Mid-Atlantic states (Mid-Atlantic Fishery Management Council 1988).

Post-SCOQ ITQ Program Period

Under the SCOQ ITQ program, the division of the surfclam fishery into separate management areas was discontinued, and surfclam fishery regulations were applied uniformly across the range of the management unit. Given that available information showed that there was no "New England" surfclam fishery separate from the general fishery, this single management system was more consistent with the preference under National Standard 3.

5.3.2 Stock Status

5.3.2.1 Surfclam Resource

Pre-SCOQ ITQ Program Period

The surfclam has supported a major fishery, primarily off New Jersey and the Delmarva Peninsula, since the 1950s (Parker 1971). In 1977, the surfclam fishery was brought under federal management at a time when portions of the stock were severely depleted because of overexploitation and nature disaster. The surfclam stock biomass had declined to a historic low after a period of high exploitation in the early 1970s. By the mid-1970s, the fishery was experiencing a rapid decline in landings. The offshore New Jersey surfclam resources had been heavily fished, and the last of the large, previously unfished surfclam beds off Virginia were depleted (Mid-Atlantic Fishery Management Council 1977). This over-exploitation condition was aggravated by an anoxic habitat condition caused by a large-scale algal bloom and an unusual combination of other factors that occurred throughout the New York Bight area. This anoxic condition ended most of the fishing in the New Jersey region by the end of 1976 (Wang 1995).

To help achieve the objective of rebuilding the declining surfclam populations, the FMP included a moratorium on new entry into the surfclam fishery, imposed fishing time restrictions, and set an annual catch limit, which was allocated on a quarterly basis, and Amendment 3 included a size limit provision. Amendment 1 and 2 specified the annual catch limits for each year, but Amendment 3 created a framework process whereby a FMP amendment was unnecessary each time the annual catch limit was changed (Marvin 1992).

The annual catch limit for surfclams as initially established was essentially a compromise between the minimum economic needs of industry and the advice of scientific advisors, who advocated for rebuilding of the resource as soon as possible (Mid-Atlantic Fishery Management Council 1977; Nicholls 1985). The annual catch limit selected by the Council and applied on an annual basis for the two years following plan implementation imposed some risk insofar as being able to meet the Council's rebuilding objective. However, the risk was alleviated by high levels of recruitment from the 1976 year class which settled in the New Jersey region that had been extensively depleted of both surfclams and their benthic invertebrate predators by the anoxic condition in 1976 and by high levels of recruitment from the 1977 year class that benefited the southern component of the resource in the Delmarva region (Nicholls 1985; Weinberg 1999).

Despite the moratorium on new entry into the surfclam fishery, harvesting capacity in the fishery increased after plan implementation, along with average landings. The response by NMFS was to decrease allowable fishing time per vessel in order to spread out the catch over each quarter, thereby evening out product input to processors and reducing the likelihood of a fishery closure (Mid-Atlantic Fishery Management Council 1977; Nicholls 1985). Despite these measures, however, there was an increasing incidence of surfclam fishery closures, with four weeks lost to closure in 1978, none in 1979 through 1983, five in 1984, four in

1985, and six in 1986 (Mid-Atlantic Fishery Management Council 1988). Even with these closures, the surfclam annual catch limit was exceeded in 1981 and 1984 by 22 percent and 21 percent, respectively, requiring subtraction of the overage from the following year's limit (Nicholls 1985). One possible reason for the overages is that vessels were compelled to catch as many surfclams as possible within the time constraints of the authorized fishing periods, and fishing under this time pressure increased the probability of exceeding the catch limit.

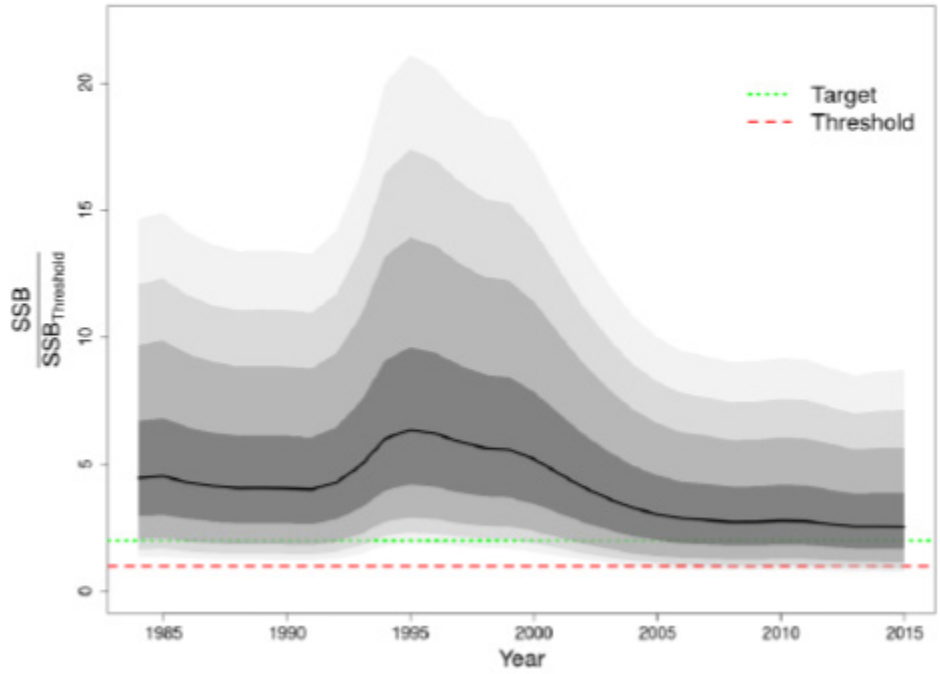
Overall, however, the pre-SCOQ ITQ program surfclam fishery management regime was successful in meeting its main objective of restoring the surfclam stock (McCay 1989). As noted by the Council in 1988 (Mid-Atlantic Fishery Management Council 1988), the surfclam fishery was one of the few U.S. fisheries during that period for which the effects of overfishing and stock decline were successfully reversed. While the recovery of surfclam populations during the 1980s may have been due, at least in part, to the strong recruitment from the 1976 and 1977 year classes of surfclams, the measures taken under the FMP served effectively to conserve the surfclam resource and to protect the significant recruitment (Nicholls 1985).

In addition, while everyone in industry suffered under the annual catch limits (Wallace 1994), the use of quarterly limits to spread harvests over the entire course of each fishing year, together with moratorium to prevent further growth in the number of vessels in the fishery, contributed to the success of the strict catch limit in the surfclam fishery. The quarterly limits helped to even out product input to processors and prevent closure of the fishery. The cap on the number of vessels involved in the surfclam fishery helped ensure that discussions of management alternatives could be considered in a forum where all fishery participants had achieved some understanding of the complexity of the issues and the consequences of actions taken (Nicholls 1985).

It should also be noted that the size selectivity of the fishing gear tends to buffer the resource from the effects of fishing to some degree. The dredges are designed to retain few undersized surfclams (Wallace and Hoff 2005). Surfclams are reproductive at very small sizes and thus are sexually mature for several years before becoming available to the fishery (Chintala and Grassle 1995). Moreover, the surfclam fishery exploits a limited part of the resource in terms of its geographical range, with the fleet operating in a relatively small area (Wallace and Hoff 2005; National Marine Fisheries Service 2017b).

Since 1965, surveys have been conducted by NMFS (or its predecessor, the U.S. Bureau of Commercial Fisheries) to estimate the relative abundance of surfclams in the Middle Atlantic Bight, although population assessment was not the primary objective of many of the early surveys (Mid-Atlantic Fishery Management Council 1977). A formal scientific peer-review process for evaluating and presenting stock assessment results to fishery managers began in 1985 (National Marine Fisheries Service 2018b). The available data from assessments conducted from 1984 to when the SCOQ ITQ program began in 1990 indicate that the surfclam stock was not overfished (Figure 3), and overfishing did not occur (Figure 4). Overfishing in both the surfclam and ocean quahog fisheries is currently defined to occur when the fishing mortality rate exceeds the threshold fishing mortality rate of F_{MSY}. Since F_{MSY} cannot be reliably estimated for surfclam and ocean quahog stocks, proxies are used. The stock surfclam assessment indicates that total biomass increased in the mid-1990s, and then declined.

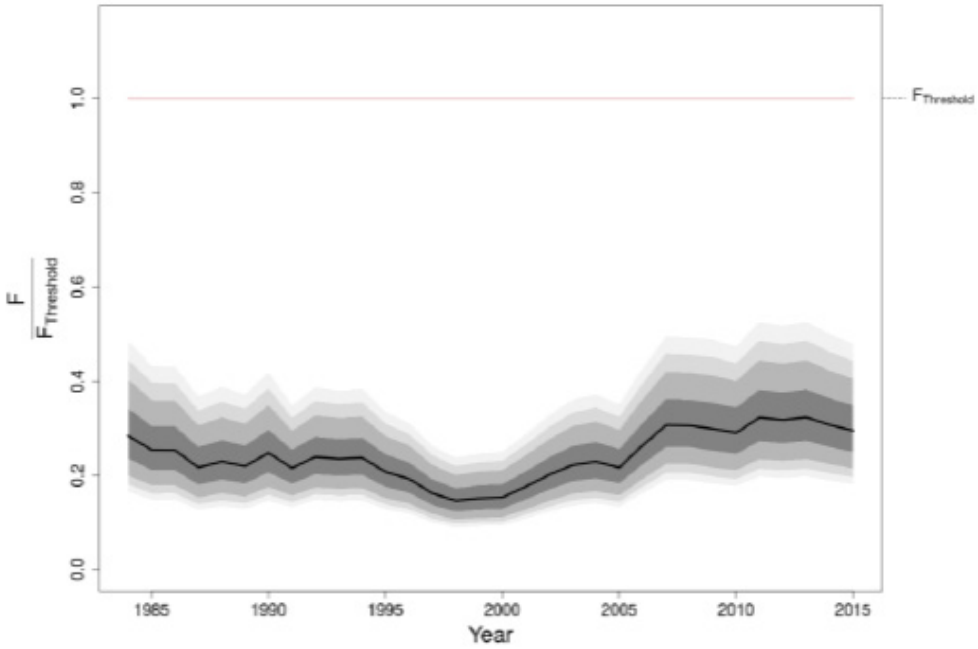
Figure 3. Trends in Relative Spawning Stock Biomass ($SSB/SSB_{Threshold}$) for the Surfclam Stock, 1984–2016[1]



Source: Mid-Atlantic Fishery Management Council (2017c)

[1]The solid line shows estimates from this assessment with approximate 50, 80, 90, and 95th percentile lognormal confidence intervals in shades of grey. The green short-dash line at $SB/SSB_{Threshold} = 2$ is the management target. The red long-dash line at $SSB/SSB_{Threshold} = 1$ is the level that defines an overfished stock.

Figure 4. Trends in Relative Fishing Mortality $F/F_{Threshold}$ for the Surfclam Stock, 1984–2016[1]



Source: Mid-Atlantic Fishery Management Council (2017c)

[1]The solid line shows estimates from this assessment with approximate 50, 80, 90, and 95th percentile lognormal confidence intervals in shades of grey. The solid line at $F/F_{Threshold} = 1$ is the fishing mortality threshold reference point.

Post-SCOQ ITQ Program Period

In addition to establishing the SCOQ ITQ program, Amendment 8 provided a range for the OY/annual catch limit in the surfclam fishery of between 1.85 million and 3.4 million bushels per year. In 1990, the surfclam annual catch limit was set at 2.85 million bushels where it remained until 1995 when it was lowered to 2.565 million bushels. In 2001, the annual catch limit was raised to 2.85 million bushels and then subsequently increased to 3.4 million bushels in 2004, where it has remained since.

Since SCOQ ITQ program implementation, no significant annual catch limit overage has occurred. With the allocation of ITQ quota share, vessels operators are no longer fishing under time pressure that would increase the probability of exceeding the catch limit. Furthermore, according to industry, market conditions are such that there is little incentive to increase surfclam landings (Mid-Atlantic Fishery Management Council 2016a). Both surfclam and ocean quahog products have global but limited markets, with strong competition, and the prices for these products is considered highly inelastic, i.e., if supply increases or decreases, the price remains about the same even if the costs of fuel, insurance, and other inputs increase.

Stock surveys and assessments performed since the SCOQ ITQ program was implemented indicate that the surfclam stock has not been overfished (Figure 3), and overfishing has not occurred (Figure 4). For the entire post-SCOQ ITQ program period, spawning stock biomass has been near unfished levels, and fishing mortality has been low. The stock is currently 2.54 times the recommended biomass threshold and 0.295 of the recommended fishing mortality threshold (National Marine Fisheries Service 2017b). The surfclam stock biomass declined from record-high levels during the mid-1990s toward lower levels similar to the early 1980s. High biomass during the late 1990s was due to relatively high recruitment and relatively fast growth rates in the southern region. The decline is surfclam stock biomass since the late 1990s can be explained by negative surplus production caused by lower recruitment and slower growth rates in the New Jersey and Delmarva regions. Fishing mortality contributed only modestly to the decline in the total biomass (Mid-Atlantic Fishery Management Council 2012).

The Council formally incorporated the precautionary approach into the surfclam and ocean quahog FMP through Amendment 16, adopted in 2011, which is applied by the Council's Scientific and Statistical Committee. A control rule/risk policy established a required procedure for ensuring that F is reduced as the threshold reference point is approached according to the following rules: for stocks with a ratio of B to Bmsy of 1.0 or higher (i.e., the stock is at Bmsy or higher), the maximum probability of overfishing may not exceed 35 percent. As the ratio of B/Bmsy becomes less than 1.0 and continues to decline, the allowable maximum probability of overfishing declines commensurately, in a linear fashion, until the probability of overfishing becomes zero at a B/Bmsy ratio of 0.10 (50 CFR §648.21). Therefore, in a scenario where the biomass is diminishing, falling below Bmsy and approaching the threshold, in order to conform with the allowable probability of overfishing, the annual catch limit must be commensurately reduced.

The current sustainability of both the surfclam and ocean quahog fisheries has received recent recognition by non-governmental organizations as well as government agencies. In a 2013 video produced by NMFS entitled "The Great American Surfclam" (National Marine Fisheries Service 2013a), the agency declared that "the surfclam fishery is a model of sustainable management." In 2015, Monterey Bay Aquarium's Seafood Watch program, which evaluates the sustainability of fisheries and aquaculture operations worldwide, rated the stock status of surfclams and ocean quahogs in the U.S. Atlantic EEZ to be of "very low concern" because of the strong evidence that the stocks are above target abundance levels (Hislop 2015). In 2016, the Marine Stewardship Council, which has one of the most recognizable ecolabeling programs in the world, certified both the surfclam and ocean quahog fisheries as "well managed and sustainable fisheries" (Marine Stewardship Council 2016).

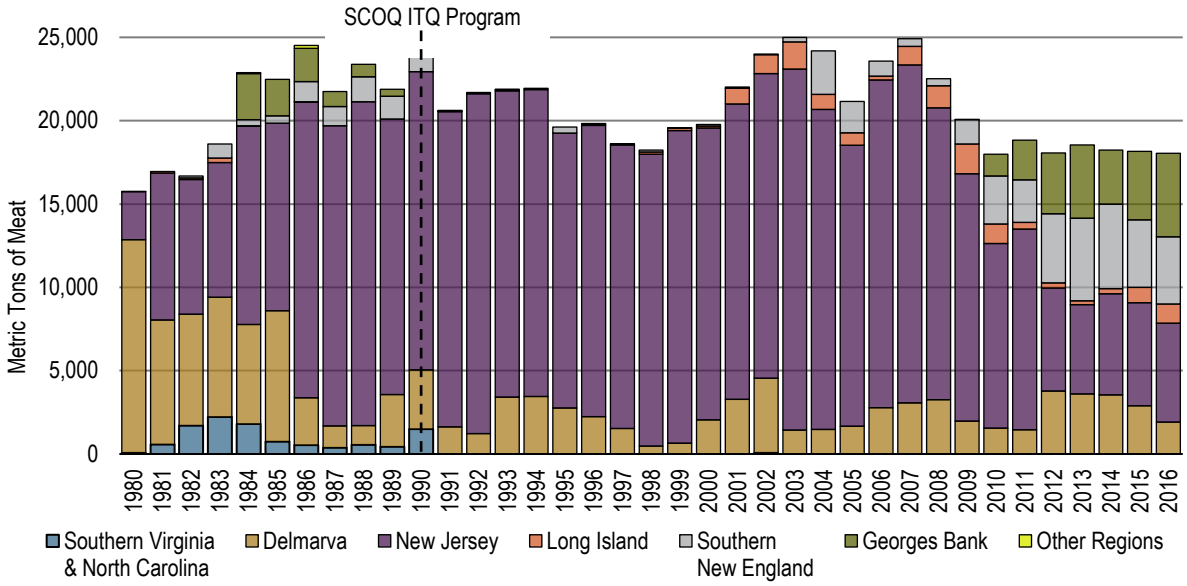
Although the overall surfclam stock size has declined only slightly since the SCOQ ITQ program was implemented, there is evidence that a substantial decline in surfclam biomass has occurred in some regions.

The decline has most notable in the southern portion of the fishery in the Delmarva region, which is also close to the southern limit of the species range.

In the 1960s and 1970s, and probably at earlier times, the range of the surfclam as documented by stock assessment surveys extended from Georges Bank almost to Cape Hatteras and encompassed the inner half of the continental shelf from the Chesapeake Bay mouth to Hudson Canyon at depths of 10 to 50 m, with nearshore populations along Long Island and Southern New England, extending onto the shallower portion of Georges Bank (Powell et al. 2017). Historically, high densities of surfclams occurred off the coast of the Delmarva Peninsula, which inludes coastal areas of Delaware, Maryland, and Virginia (Weinberg 2005). In 1978, 92 percent of the harvest of surfclams in the EEZ were from the Delmarva region (Murawski and Serchuk 1979).

Retrospective studies indicate that the inshore surfclam population in Virginia and Maryland state waters began to decline in the 1970s and 1980s, although early warning of climate change is poorly documented (Weinberg 2005; Munroe et al. 2013; Kuykendall et al. 2017; Hofmann et al. 2018). As shown in Figure 5, by the late 1980s, there was relatively little commercial harvesting of surfclams from regions off the Delmarva Peninsula. The small harvest was attributed to low tissue weights (Weinberg 2005). Estimates of surfclam biomass in these regions suggest that there was a substantial decline in resource abundance between the late 1990s and 2002. The decrease coincided with unusually warm bottom water temperatures over the Delmarva continental shelf during fall, when annual bottom temperature typically peaks (Weinberg 2005). This mortality event alerted the scientific community to a historic shift in range that had likely been ongoing well before the event and which initially generated concern about the resiliency of the stock to global climate change (Hofmann et al. 2018). The Delmarva Peninsula had 55 percent of the surfclam biomass in 1986, but by 2009, it accounted for only 5 percent (Mid-Atlantic Fishery Management Council 2010). An analysis of stock assessment survey data from more recent years also revealed a surfclam population decline in the inshore waters off the coast of New Jersey, where a state-waters fishery virtually ended by 2008 because of a severe depletion in the surfclam resource (McCay et al. 2011a; Mid-Atlantic Fishery Management Council 2012).

Figure 5. Harvests in the Surfclam Fishery by Stock Assessment Region, 1980–2016



Source: Developed using data from Mid-Atlantic Fishery Management Council (2018b)

At approximately the same time the southern areas experienced declines in surfclam biomass, population abundance rose along the offshore range boundary off New Jersey and along the inshore of Long Island. Surveys during the 2000s suggested progradation of the offshore boundary off New York and an expansion of the population on Georges Bank. Recent evidence suggests that surfclams also have expanded their range into deeper water on Georges Bank and east of Nantucket, west of the Great South Channel (Hofmann et al. 2018). Surfclams do not seem to be increasing in the southern New England parts of their range, possibly because the Hudson Canyon, a large submarine feature in the region, serves as an effective barrier to larval transport and successful recruitment despite high surfclam abundances on the Canyon's southern edge (National Marine Fisheries Service 2017b; Hofmann et al. 2018).

The surfclam population declines in the southern areas exceed fishing mortality rates, so it is likely that there are environmental factors contributing to the declines. Moreover, as noted above, the surfclam fishery is tightly managed by limits on allowable catches, which are set within a range that is generally far below the thresholds for overfishing (McCay et al. 2011a). The relative constancy of the fishing mortality rate limits the yearly influence on the stock, and thus variations in fishing pressure cannot explain the rapid population declines over a short period of years (Narváez et al. 2015).

Instead, the reduction in surfclam biomass in the southern areas and what appears as a northward and offshore progression of the boundary of the surfclam's range have been largely attributed to warming of Middle Atlantic Bight bottom waters (Weinberg 2005; Narváez et al. 2015; National Marine Fisheries Service 2017b). Evidence suggests that warm water conditions, likely accompanied by a reduction in food supply, led to poor recruitment, slow growth rates, and increased motality in the southern and inshore range boundary of the surfclam (Weinberg 2005; Munroe et al. 2013; Narváez et al. 2015; Powell et al. 2017).

Hofmann et al. (2018) tested surfclam vulnerability to rising bottom water temperatures by forcing the surfclam growth model with a 50-year (1958–2007) time series of simulated bottom water temperature obtained for the Middle Atlantic Bight from an implementation of the Regional Ocean Modeling System for the northwestern Atlantic. The growth model was implemented at sites along the Middle Atlantic Bight shelf where surfclams are found. Simulation results showed that warmer, relative to average conditions, bottom temperatures reduced surfclam assimilation rate because of thermal stress, leading to starvation mortality and a decline in biomass. However, these simulations showed that the long-term observed decline in surfclam populations is a response to episodic warm years rather than a gradual warming trend in bottom water temperature. Episodic warm events that occur at a frequency exceeding the ability of the surfclam population to recover fully during intervening periods, coupled with a long-term warming trend, reduced biomass and resulted in a recession of the southern and inshore boundary of the range.

As noted above, the surfclam population declines in the southern areas exceed fishing mortality rates. However, simulation modeling of surfclam population dynamics showed that reduced food supply and temperature-induced physiological stress alone were not sufficient to produce the observed decrease in surfclam size of 15–20 mm since the early 1980s. According to Hofmann et al. (2018), fishing pressure may also have contributed to the trend towards surfclam populations that consist of smaller animals.

A consequence of the shift in the surfclam stock's range is a contraction of the grounds supporting much of the fishery (Powell et al. 2016; Kuykendall et al. 2017). This contraction, in turn, may have major implications for the condition of the surfclam populations in certain regions. In particular, after the population decline in the Delmarva region, the surfclam fishery came to depend heavily on the New Jersey region, as shown in Figure 5. The reopening of a portion of the Georges Bank region for harvesting of surfclams in 2013—an area that was closed in 1990 owing to the risk of harvesting clams contaminated with paralytic shellfish poison (PSP)—allowed some relief from fishing pressure in the New Jersey region

(Kuykendall et al. 2017).[4] It is estimated that the Georges Bank region accounted for only around 5 percent of the total surfclam biomass in 1986, but by 2008, the region contained about 45 percent of the surfclam stock (Mid-Atlantic Fishery Management Council 2010). The New Jersey region has maintained its share of the biomass in that it had 32 percent in 1986 and currently it still has about 30 percent (Mid-Atlantic Fishery Management Council 2010). Nevertheless, a decline in landings per unit of effort (LPUE), coupled with rising fishing morality rates, has generated concern for the sustainability of the fishery off New Jersey (Kuykendall et al. 2017).

In conclusion, to date the warming of Middle Atlantic Bight bottom waters and the well documented shift in the surfclam stock's range have not threatened the surfclam stock as a whole. This outcome is in part due to the extensive range and biomass of the stock as it existed in the mid-1990s, but also because the decline in biomass at the southern and inshore portion of the range has been more or less balanced by an increase in abundance offshore of New Jersey, along Long Island, and on Georges Bank (Hofmann et al. 2018). However, the effects of climate change on the Middle Atlantic Bight are ongoing, which makes continued sustainability of the surfclam stock and survival of the surfclam fishery dependent on choices by both industry and fishery managers (Section 8.3.2).

5.3.2.2 Ocean Quahog Resource

Pre-SCOQ ITQ Program Period

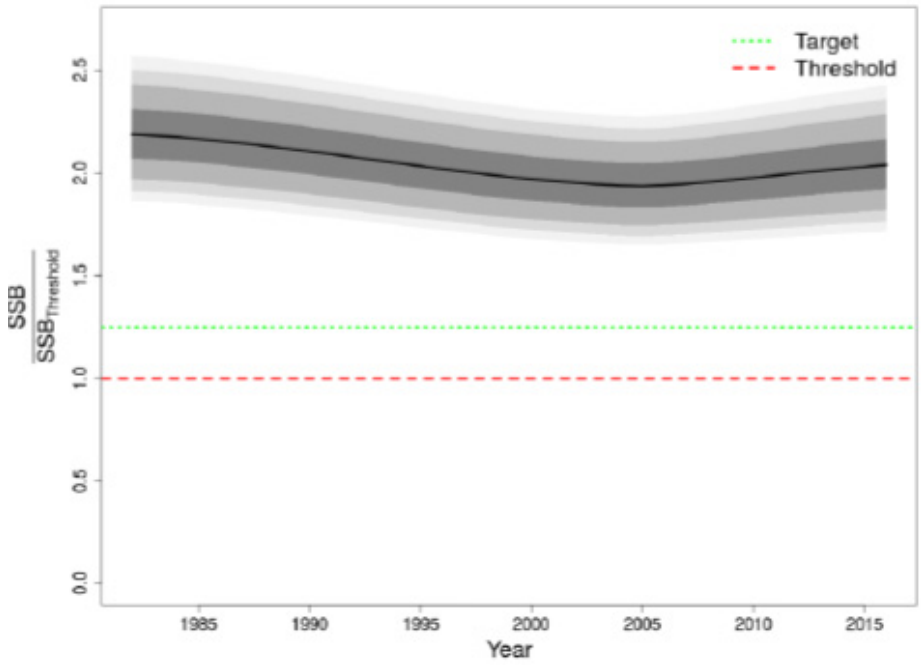
The FMP initially established the annual catch limit for the ocean quahog fishery at 3.0 million bushels. The catch limit was increased to 3.5 million bushels in 1980, and to 4.0 million bushels in 1981, where it remained for the remainder of the pre-SCOQ ITQ period. These catch limits were never exceeded.

Large-scale harvesting of ocean quahogs did not begin until the mid-1970s, and the abundance of the resource at that time was essentially unchanged from virgin stock conditions (Mid-Atlantic Fishery Management Council 1981). The ocean quahog stock has been periodically assessed by the NMFS Northeast Fisheries Science Center since the early 1980s. The available data from the stock assessment surveys indicate that from 1984 to when the SCOQ ITQ program began in 1990, the ocean quahog stock was not overfished (Figure 6), and overfishing did not occur (Figure 7).

[4] PSP is caused by saxitoxins, produced by the alga *Alexandrium fundyense* (red tide). The Georges Bank region closure was implemented based on advice from the U.S. Food and Drug Administration after samples tested positive for toxins that cause PSP. Shellfish contaminated with the toxin, if eaten in large enough quantity, can cause illness or death in humans (National Marine Fisheries Service 2010a).

Due, in part, to the inability to test and monitor this area for the presence of PSP-causing toxins, the Georges Bank region closure was made permanent through a technical change under Amendment 12 to the FMP in 1999. However, there was light fishing in the region in years 2009-2011 under an exempted fishing permit. NMFS reopened a portion of the region to the harvest of surfclam on January 1, 2013. Subsequently, NMFS reopened an additional portion on August 16, 2013 (Mid-Atlantic Fishery Management Council 2016b). The reopenings were based upon the adoption of a protocol developed by the U.S. Food and Drug Administration, the industry, and State Shellfish Control Authority that is designed to test and verify that clams harvested from the GBK region continue to be safe. The protocol was formally adopted into National Shellfish Sanitation Program in 2011. NMFS requires that the protocol be used on all fishing trips into the region.

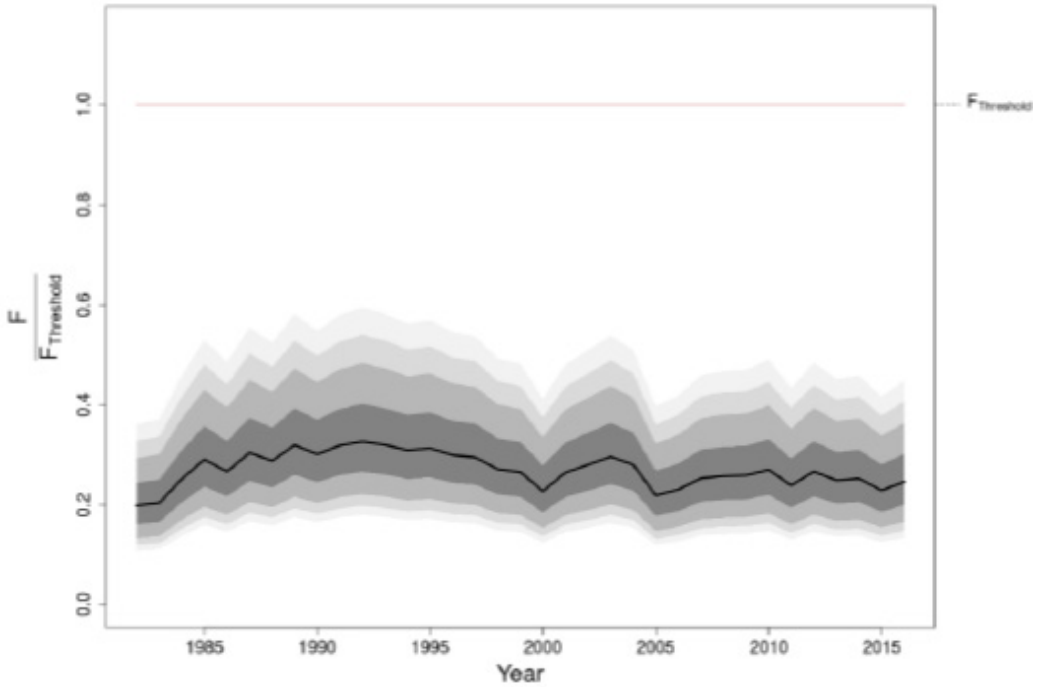
Figure 6. Trends in Relative Spawning Stock Biomass (SSB/SSBThreshold) for Ocean Quahogs, 1982–2016[1]



Source: Mid-Atlantic Fishery Management Council (2017b)

[1]The solid line shows estimates from this assessment with approximate 50, 80, 90, and 95th percentile lognormal confidence intervals in shades of grey. The green short-dash line at $SB/SSB_{Threshold}$ = 1.25 is the management target. The red long-dash line at $SSB/SSB_{Threshold}$ = 1 is the level that defines an overfished stock.

Figure 7. Trends in Relative Fishing Mortality $F/F_{Threshold}$ for the Ocean Quahog Stock, 1982–2016[1]



Source: Mid-Atlantic Fishery Management Council (2017b)

[1]The solid line shows estimates from this assessment with approximate 50, 80, 90, and 95th percentile lognormal confidence intervals in shades of grey. The solid line at $F/F_{Threshold}$ = 1 is the fishing mortality threshold reference point.

As mentioned above, both surfclam and ocean quahog catches may be constrained by market limitations. In addition, it is unlikely that the ocean quahog stock can be fished to levels that impair recruitment because product value is low and harvesting costs are high. With their lower ex-vessel price in comparison to surfclams, ocean quahogs have historically been a bulk, low-priced food item, and the ocean quahog fishery has only been viable when large quantities can be harvested quickly and efficiently. When catch rates fell below a certain point, vessels tend to shift their effort to higher-yielding areas. Consequently, fishing may become unprofitable even before the stock reaches the level that would produce the maximum sustainable physical yield (Mid-Atlantic Fishery Management Council 2010; SCS Global Services 2016).

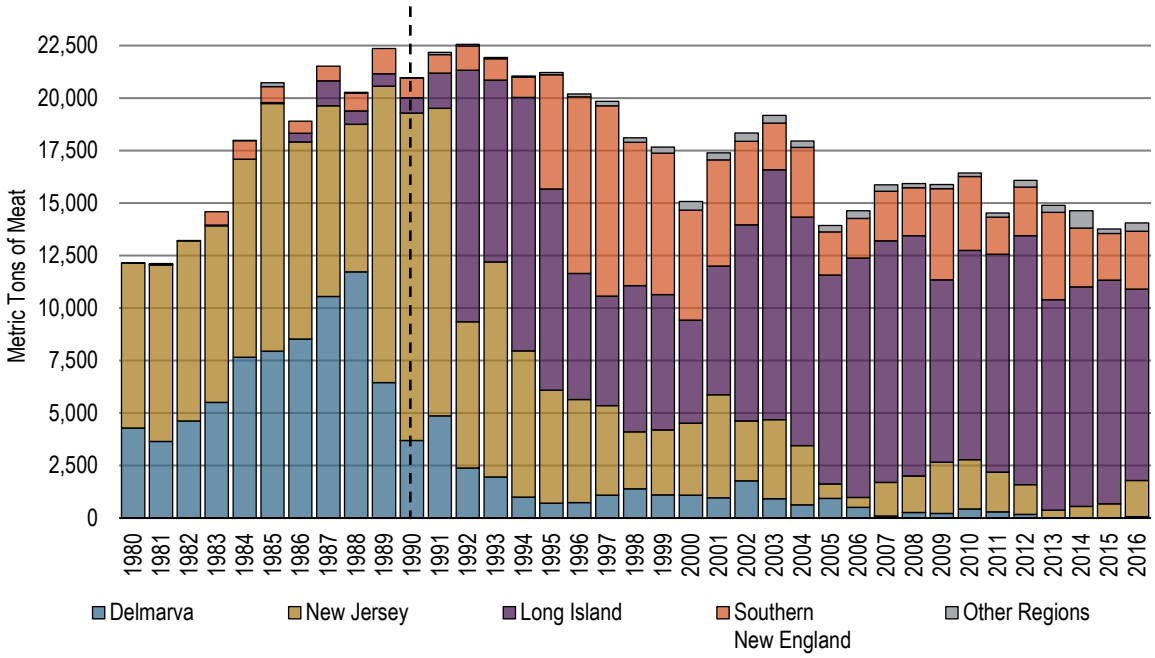
Post-SCOQ ITQ Program Period

Amendment 8 provided a range for the OY/annual catch limit in the ocean quahog fishery of between 4.0 million and 6.0 million bushels. The ocean quahog annual catch limit was set at 5.3 million bushels in 1990. It was lowered to 4.5 million bushels in 1999, and then was raised to 5.333 million bushels in 2005 where it has since remained. After SCOQ ITQ program implementation, no significant annual catch limit overage has occurred. Market conditions in the ocean quahog fishery, as they are in the surfclam fishery, are such that there is little incentive to increase landings (Mid-Atlantic Fishery Management Council 2016a).

Stock surveys and assessments performed since the SCOQ ITQ program was implemented indicate that the ocean quahog stock has not been overfished (Figure 6), and overfishing has not occurred (Figure 7), under either the previous or current reference point definitions and using either the previous or newly developed models. For the entire post-SCOQ ITQ program period, spawning stock biomass has been near unfished levels, and fishing mortality has been low. The ocean quahog stock is currently 2.04 times the recommended biomass threshold and 0.246 of the recommended fishing mortality threshold (National Marine Fisheries Service 2017a). As noted above, in 2011, the Council adopted Amendment 16 which established a harvest control rule/risk policy for the surfclam ocean quahog resources. The ocean quahog stock has been included among those stocks deemed "atypical" because their life history strategies and highly unusual lifespan result in greater vulnerability to exploitation. With a maximum life span exceeding 500 years, ocean quahogs are the longest-lived, non-colonial animal known today (Pace et al. 2017). The ocean quahog stock is considered to be relatively unproductive. Recruitment events appear to be regional, and larger events are thought to be infrequent, although survey length frequencies show that a low level of recruitment occurs on a continuous basis (Pace et al. 2017).

While there has been no substantial decline in the ocean quahog stock as a whole, there is evidence of substantial biomass decline in heavily fished regions. Over the last three decades, the ocean quahog fishery has shifted to more northern areas, including the Long Island and Southern New England regions, as catch rates decreased on the original fishing grounds in the southern regions of Delmarva and New Jersey (Figure 8). By 2011, fishable stock biomass in the Delmarva region was less than half of what it was in 1978, when the ocean quahog fishery began to develop (Chute et al. 2013). Biomass in the Long Island and Southern New England regions increased after 1978 due to a recruitment event and growth, but it began to decrease in the early 1990s, when recruitment declined, and the fishery gradually began to move north into these regions. As the majority of fishing effort shifted to the Long Island and Southern New England regions, estimated fishable biomass in the two regions declined by approximately 22 percent and 53 percent, respectively, between 1978 and 2011 (Chute et al. 2013).

Figure 8. Harvests in the Ocean Quahog Fishery by Stock Assessment Region, 1980–2016



Source: Developed using data from Mid-Atlantic Fishery Management Council (2018a)

In contrast to the change in the distributional range of the surfclam stock, there has been no apparent shift in the southern and inshore boundary for the ocean quahog stock. Biological characteristics buffers the ocean quahog against rising temperatures and stabilizes the range boundary. Whether ocean quahogs are expanding their range northward or offshore into deeper water remains unknown (Powell et al. 2017).

5.3.3 Bycatch Reduction

Pre-SCOQ ITQ Program Period

Since the surfclam and ocean quahog fisheries first developed, the primary tool employed to minimize bycatch and bycatch mortality has been the design of a highly selective gear. Surfclams and ocean quahogs are harvested using a steel hydraulic dredge that uses jets of water to fluidize the bottom sediment, thereby loosening the clams from their habitat. The dislodged clams are retained in the dredge. The spacing of the bars of the dredge is set to retain larger surfclams and quahogs of the desired size and let the smaller ones, along with unwanted invertebrates, fish and trash, fall through. After tows ranging from several minutes up to an hour the dredge is retrieved, the harvested clams are discharged into steel cages on the vessel, and the dredge is returned to the bottom. This process is repeated until the vessel is full or has reached time limits imposed by regulation or the harvester's processor. Selection of large surfclams and ocean quahogs with the highest meat weight is dictated by processors (Wallace and Hoff 2005; Interstate Shellfish Sanitation Conference 2018).

In addition, this size-selectivity of the hydraulic dredges is considered one manner in which the resource is protected from the effects of fishing for surfclams in particular, as they reproduce at small sizes and are sexually mature for several years before becoming available to the fishing gear (Chintala and Grassle 1995). The minimum size (shell length) regulation for the surfclam fishery first established by Amendment 2 was not implemented to secure sustainability of the resource as much as it was intended to assure a supply of

large surfclams for breaded fried clam products (Marvin 1992). As shown in Table 3, the minimum size limit led to high levels of discarded surfclams, the vast majority of which died since vessels used "sorting" machines which often damaged undersized clams as it routed them back overboard (Mid-Atlantic Fishery Management Council 2012).

Table 3. Discards in the Surfclam Fishery, 1982-1993

Year	Discards (mt)	Landings (mt)	Discard proportion (%)	Size limit (inches)
1982	6,194	16,688	37.1	5.5
1983	4,634	18,592	24.9	5.5
1984	4,739	22,889	20.7	5.2
1985	3,911	22,480	17.4	5.0
1986	2,800	24,521	11.4	5.0
1987	1,890	21,744	8.7	5.0
1988	1,436	23,378	6.1	5.0
1989	1,312	21,888	6.0	5.0
1990	1,269	24,018	5.3	5.0
1991	566	20,615	2.7	suspended
1992	1,024	21,686	4.7	suspended
1993	0	21,859	0.0	suspended

Source: National Marine Fisheries Service (2017b)

There also may be some incidental mortality of surfclams and ocean quahogs left on the bottom after passage of the dredge due to breakage or to predation if the animals do not re-burrow. This incidental mortality is accounted for in the respective stock assessment reports prepared by the NMFS Northeast Fisheries Science Center. Surfclam "catch" is defined as the sum of landings and discards, plus 12 percent of landings to account for incidental mortality of clams in the path of the dredge. Similarly, in ocean quahog stock assessments, catch is assumed to be 5 percent larger than landings to account for incidental mortality (National Marine Fisheries Service 2017a; National Marine Fisheries Service 2017b).

However, during the pre-SCOQ ITQ program period, the surfclam fishery was managed in part by controlling the number of hours a vessel could fish. Consequently, towing speeds were maximized to catch as many surfclams as possible regardless of the damage done to the surfclams or the habitat. Cutting and breakage of surfclams were estimated to be as high as 90 percent in some locations, and under some conditions decomposition of dead clams caused reduced oxygen concentrations in sediments to the point that surfclams were killed (Northeast Region Essential Fish Habitat Steering Committee 2002).

Post-SCOQ ITQ Program Period

Under the SCOQ ITQ program, the desire of vessel operators to maximize their revenue from a given ITQ quota share led them to take additional measures to harvest the large-size, high-yield surfclams that are desired by buyers and command a higher price. For example, with unlimited fishing time, vessels could search for and concentrate their fising effort on aggregations of the larger clams (Ross 1992). With the minimum size for surfclams no longer an issue, the Council has maintained an exemption from the size limit since implementation of the SCOQ ITQ program. Table 3 shows that within two years of the exemption (1993), the discard rate had dropped to near zero and has remained at this level since then (National Marine Fisheries Service 2017b).

In addition, following implementation of the SCOQ ITQ program there was a shift in gear usage in the surfclam and ocean quahog fisheries from side rig dredges to stern rig dredges, which significantly reduced incidental mortality. The chain bag on a side rig dredge drags behind the dredge and helps smooth out the trench created by the dredge. The chain bag can result in relatively high levels of damage to small surfclams. With the stern rig dredge, which is basically a giant sieve, small surfclams and other bycatch fall through the bottom of the cage into the trench and damage or injury is minimal. About 60 side-rig vessels pulling 80 dredges were taken out of the fishery after 1990 (Northeast Region Essential Fish Habitat Steering Committee 2002). After implementation of the SCOQ ITQ program, incidental mortality in the surfclam fishery has been estimated to be well under 10 percent (Northeast Region Essential Fish Habitat Steering Committee 2002).

The Northeast Fisheries Observer Program collected information on bycatch species in the surfclam and ocean quahog fisheries between 2004 and 2006. The data collection and evaluation confirmed that there is minimal bycatch in the two fisheries. In the ocean quahog fishery, the bulk of the bycatch is non-living (debris/shell), with a mean of 8 percent live bycatch (range 0-19 percent). The top live bycatch, ordered by declining contribution, are sea scallop, little skate, skate (unclassified), monkfish, clapper clam, clapper (unclassified), snail (unclassified), spiny dogfish, winter skate, rock crab, Jonah crab, sea star (unclassified), whelk (unclassified), mollusk (unclassified), summer flounder, ocean pout, crab (unclassified), and longfin sculpin (Mid-Atlantic Fishery Management Council 2016b). In the Atlantic surfclam fishery, the bulk of the bycatch is non-living (debris/shell), with a mean of 3 percent live bycatch (range 0-7 percent) for surfclam trips. The top live bycatch items include sea scallop, ocean quahog, little skate, clapper clam, stargazer (unclassified), monkfish, spiny dogfish, sea star (unclassified), moon snail (unclassified), clapper (unclassified), sponge (unclassified), horseshoe crab, sand dollar, snail (unclassified), winter skate, rock crab, skate (unclassified), and eggs (unclassified) (Mid-Atlantic Fishery Management Council 2016b).

Observer data show a small amount of bycatch of ocean quahogs occurs in the surfclam fishery. There is a strong incentive not to fish in areas where both species occur, as mixed loads of surfclams and ocean quahog are not allowed under current regulations (in addition to being undesired by processors), and it is not practical to sort catches at sea (Chute et al. 2013; National Marine Fisheries Service 2017a). Observers aboard surfclam trips between 2004 and 2006 reported discarded ocean quahogs averaged about 100 pounds per surfclam trip. No surfclam trips were observed between 2007 and 2014, but observers began accompanying surfclam trips again in 2015 after Amendment 15 reinstituted the onboard observer program. In 19 observed surfclam trips in 2015 and 2016, about 1,500 pounds of ocean quahogs were discarded per 100,000 lbs. of surfclams landed (National Marine Fisheries Service 2017a). In the Delmarva and Southern Virginia/North Carolina regions in the southern end of the ocean quahog's range, survey catches including both surfclam and ocean quahog have become more common in recent years, as surfclams have shifted towards deeper water (Section 5.3.2.1). The probability of catching both in the same tow has also clearly increased in the NJ region (Chute et al. 2013; Jacobson and Hennen 2018). This increasing range overlap may change discard patterns in the future (Chute et al. 2013).

With regard to the ecological/environmental impacts of the surfclam and ocean quahog fisheries, including impacts to essential fish habitat, the Council concluded in Amendment 13 that there may be some adverse effects of dredging (Mid-Atlantic Fishery Management Council 2003). However, the Council concurred with a panel of experts assembled at a fishing gear workshop in 2001 that the effects tend to be temporary and minimal because the fisheries occur in a small area compared to the total area of habitat, and they occur primarily in high-energy, sand habitats with no vegetation or benthic "structures" that could be damaged by the passing of a hydraulic dredge. Based on a combination of peer-reviewed scientific literature, gray literature, and professional judgment, the panel concluded that biological communities affected by the surfclam and ocean quahog fisheries recover within months to years, depending on the species affected, and recovery of physical structure can range from days in high-energy environments to months in low-energy environments. The panel concluded that hydraulic dredges have important habitat effects, but even

in a worse-case scenario, where there were known to be severe biological impacts, only a small area is affected and therefore this gear type is less destructive than other gear types, such as bottom trawls and scallop dredges, which affect much larger areas. It was also pointed out, however, that even though the effects of dredging are limited to a relatively small area, localized effects of dredging on essential fish habitat could be very significant if the dredged area is a productive habitat for one or more managed fish resources. For example, if hydraulic dredges are used in the in the wrong habitat type, such as a coral reef or a submerged aquatic vegetation bed. However, the fishing gear used in the surfclam and ocean quahog fisheries has evolved over the past five decades to fish most efficiently in the coarse-grained sandy bottom habitat where the target species are concentrated (Mid-Atlantic Fishery Management Council 2007).

In 2016, the New England Fishery Management Council prepared Omnibus Essential Fish Habitat Amendment 2, which includes measures intended to minimize the adverse effects of fishing on essential fish habitat (National Marine Fisheries Service 2018a). The amendment was partially approved by NMFS in January 2018 and implemented in April 2018. It included designation of the Great South Channel Habitat Management Area, an area closed to all mobile bottom-tending gears, including hydraulic dredges. The amendment granted a one-year exemption from the restriction for hydraulic dredges that will expire in April 2019. If the exemption is not extended, the closure would ban the use of hydraulic dredges in the northeast section of Nantucket Shoals, where the surfclam fishery is the only fishery being prosecuted. About a dozen surfclam vessels and three hand-shucking plants would be affected (Surfclam and Ocean Quahog Advisory Panel 2018). The New England Fishery Management Council is currently attempting to identify areas within the Great South Channel Habitat Management Area that are currently fished or contain high energy sand and gravel that could be suitable for a permanent hydraulic clam dredging exemption.

5.3.4 Collection and Application of Scientific Information

Pre-SCOQ ITQ Program Period

All vessels harvesting surfclams and ocean quahogs have been required to report their catches in detailed daily logbooks since 1978. Vessel owners and operators were required to submit the logbooks to NMFS within three days of the end of each reporting week. In addition, all surfclam and ocean quahog processors have been required to submit a weekly report to NMFS that identified the date of the purchase, number of bushels purchased, who sold the product, the price, and address of the plant (Mid-Atlantic Fishery Management Council 1977; Mid-Atlantic Fishery Management Council 1979a). This mandatory reporting program for harvesters and processors has been the primary source of landings, location, and effort data for the surfclam and ocean quahogs fisheries and has been used to monitor fishery progress and gain additional information about the distribution of fishing pressure on the resource and about the economic character of each fishery (Nicholls 1985; Chute et al. 2013).

However, effort data are not reliable for the 1981-1990 period due to difficulties in monitoring compliance with regulations that restricted the duration of fishing time (National Marine Fisheries Service 2017b). There were unchallenged allegations that everyone in industry was cheating at one time or another (Mid-Atlantic Fishery Management Council 1988). Cheating with respect to fishing effort took the form of fishing extra days or beyond the designated daily hours of 8 a.m. to 2 p.m. (Phillips 1985). There were also allegations of fraudulent reporting of a vessel's catch to be higher than it actually was in order to enhance one's position under an anticipated fishing history-based allocation scheme, or, alternatively, underreporting a vessel's catch to be less than it actually was in order to delay a closure (55 Fed. Reg. 24184 (June 14, 1990)). Additional forms of cheating were fishing in closed areas being held aside for later harvesting and harvesting surfclams under the legal minimum size (Phillips 1985).

With respect to information on the condition of the surfclam and ocean quahog resources, surveys to estimate the relative abundance of surfclams in the Middle Atlantic Bight have been conducted by federal

fishery scientists since 1965 (Mid-Atlantic Fishery Management Council 1977). Starting in the early 1980s, stock surveys and assessments for both surfclams and ocean quahogs have been performed by the NMFS Northeast Fisheries Science Center about every 3 years. A formal scientific peer-review process for evaluating and presenting stock assessment results to fishery managers began in 1985 with creation of the Northeast Regional Stock Assessment Workshop (SAW). The SAW protocol is used to prepare and review assessments for fish and invertebrate stocks in the U.S. EEZ off the northwest Atlantic coast. The surfclam and ocean quahog assessments are prepared by a SAW working group and peer reviewed by an independent panel of stock assessment experts called the Stock Assessment Review Committee (SARC). The SARC is asked to determine the adequacy of the assessments in providing a scientific basis for management. The SARC panel may accept or reject an assessment. Following the peer review meeting, each SARC panelist provides a written review and the panel provides an overall written summary of the proceedings. After the peer review takes place, final SAW assessment reports are published by the NMFS Northeast Fisheries Science Center (National Marine Fisheries Service 2018b). The early assessments of the surfclam and ocean quahog stocks were based on commercial vessel logbook data and catch sampling and results of research vessel surveys conducted by the Northeast Fisheries Science Center. The research vessel surveys used commercial-type hydraulic dredges modified to retain pre-recruit sizes, and indices of abundance were adjusted to reflect differences in the dimensions of gear and operational procedures employed.

Amendment 3, prepared in 1981, established a framework basis for catch limit setting (Mid-Atlantic Fishery Management Council 1981). NMFS, after consultation with the Council and opportunity for public comment, would set the annual catch limits for the surfclam and ocean quahog fisheries within the optimum yield ranges. In setting the catch limits NMFS was required to consider current stock assessments, catch reports, and other relevant information concerning exploitable and spawning biomass, fishing mortality rates, magnitude of incoming recruitment, projected effort and corresponding catches, and status of areas previously closed to surfclam fishing that would be reopened during the year.

Post-SCOQ ITQ Program Period

Reporting and recordkeeping requirements in the surfclam and ocean quahog fisheries after SCOQ ITQ program implementation were essentially the same as before the program. The only exceptions was that dealers must file reports similar to those that processors must file; dealers and processors must make their reports available for inspection by authorized officers or designated NMFS employees (the same requirement that was in effect for vessel logbooks); and the ITQ allocation permit number must be reported on both the vessel logbook reports and the dealer/processor reports (Mid-Atlantic Fishery Management Council 1988).

After the start of the SCOQ ITQ program, industry felt that reporting and recordkeeping violations still occurred in the surfclam and ocean quahog fisheries, but they had decreased from earlier times when fishing time restrictions were in place and potential catch histories were being established (Ross 1992). Among the alleged violations with respect to reported landings were deliberate increases in cage sizes to increase yield; improper tagging of cages; and use of state-issued clam tags to harvest surfclams in waters under federal jurisdiction (Ross 1992). However, after a few violators were caught and received high financial penalties, industry recognized that violations would not be tolerated under the SCOQ ITQ program (Wallace 1994). Additionally, the enhanced economic efficiency that resulted from the program improved the profitability of the fishing industry as a whole, thereby making it less likely that industry members feel compelled to break the law due to financial stress in their business operations (Mid-Atlantic Fishery Management Council 2012).

Currently, both landings and effort data from vessel logbooks in the surfclam and ocean quahog fisheries are considered accurate in comparison to other federally-managed fisheries (National Marine Fisheries

Service 2017b). There is a high level of correspondence between data from vessel logbooks, processor/dealer logbooks, and NMFS/state port agents (Hoff 2006).

Moreover, management measures have been implemented since the SCOQ ITQ program began that facilitate enforcement and monitoring in the surfclam and ocean quahog fisheries. Framework 1 to the FMP, which was drafted in 2007, requires any vessel issued an surfclam or ocean quahog permit to have an operational VMS that can verify their fishing area (Mid-Atlantic Fishery Management Council 2007). Amendment 15, implemented in 2015, required surfclam and ocean quahog vessels to carry onboard observers who document the catch composition.

The SCOQ ITQ program did not change the SAW/SARC process for assessing the surfclam and ocean quahog stocks. However, the stock assessment models have continually improved with more detailed data, improved scientific surveys, better analytical approaches, and more treatment of uncertainty. In addition, continuing research has led to a better understanding of the selectivity of the sampling gear (SCS Global Services 2016). A comprehensive range of information related to stock structure, stock productivity, fleet composition, stock abundance, landings and other information including environmental information and other data are described and used in stock assessments and therefore available to support the harvest strategy for surfclams and ocean quahogs. The combination of regular scientific surveys and complete fishery dependent landings data allows for the development of robust assessment models with fewer uncertainties (SCS Global Services 2016). As noted in a recent report prepared for Monterey Bay Aquarium's Seafood Watch (Hislop 2015), data collection on surfclam and ocean quahog stock biomass has been sufficient to ensure management goals are appropriate to maintain stocks, as evidenced by long-term maintenance of the surfclam and ocean quahog resources, warranting a score of "moderately effective" for scientific research and monitoring.

In addition to establishing the SCOQ ITQ program, Amendment 8 modified the mechanism for setting annual catch limits in the surfclam and ocean quahog fisheries. As discussed above, earlier amendments authorized NMFS to set the annual catch limits, taking into consideration several factors such as exploitable and spawning biomass, and effort and catch rates. Under Amendment 8, in addition to these factors, the Council considers "geographical distribution of the catch relative to the geographical distribution of the resource." The Council then makes an annual catch limit recommendation to NMFS. NMFS may then set a different annual catch limit only if the Council's recommendation violates the national standards of the MSA or the FMP's goals and objectives (Mid-Atlantic Fishery Management Council 1988).

Since the SCOQ ITQ program began, Amendment 16, which was part of an omnibus amendment developed in 2011, established required annual catch limits and accountability measures for various Northeastern fisheries, including the surfclam and ocean quahog fisheries (Mid-Atlantic Fishery Management Council 2011). Under the current catch limit setting process, the Council's Scientific and Statistical Committee annually develops recommendations for the allowable biological catch (ABC) for surfclams and for ocean quahogs. The annual catch limits for surfclams and ocean quahogs are set equal to the respective ABCs. An annual catch target (ACT) can be set as a proactive accountability measure. Because Amendment 16 set an annual catch limit equal to the ABC, the ACT was determined to be a necessary component of a catch limit system to address management uncertainty. An annual catch limit may be reduced by the Council if there is management uncertainty when it sets the limit.

5.4 Summary of the Effects of the Program

Table 4 provides a listing of the program review questions and summary of the biological and ecological/environmental effects of the program.

Table 4. Program Review Questions and Summary of Biological and Ecological/Environmental Effects of the Program

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
Questions that derive from program goals and objectives (G&Os)			
BE/E-1	G&O: 1	Has the program conserved and rebuilt Atlantic surfclam and ocean quahog resources by stabilizing annual harvest rates throughout the management unit?	Stock surveys and assessments performed by NMFS since the SCOQ ITQ program was implemented indicate that neither the surfclam stock nor the ocean quahog stock has been overfished and overfishing has not occurred. Although the overall surfclam stock size has declined only slightly since the program was implemented, there is evidence that a substantial decline in surfclam biomass has occurred in some regions due to environmental factors and fishing pressure. While there has been no substantial decline in the ocean quahog stock as a whole, there is evidence of substantial biomass decline in heavily fished regions.
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
BE/E-2	KA: E	Has the program helped to keep harvests/landings within the available annual catch limit?	Since the SCOQ ITQ program was implemented, no significant annual catch limit overage in the surfclam and ocean quahog fisheries has occurred. With the allocation of ITQ quota share, vessels operators are no longer fishing under time pressure that would increase the probability of exceeding the catch limit. Furthermore, market conditions in the surfclam and ocean quahog fisheries are such that there is little incentive to increase landings, which are substantially less than the annual catch limits.
BE/E-3	KA: E	Does the program minimize bycatch and bycatch mortality to the extent practicable (consistent with NS 9)?	Under the SCOQ ITQ program, the desire of vessel operators to maximize their revenue from a given ITQ quota share has led them to take additional measures to harvest the large-size, high-yield surfclams desired by buyers. Consequently, the surfclam discard rate has dropped to near zero. In addition, following implementation of the program there was a shift in gear usage in the surfclam and ocean quahog fisheries from side rig dredges to stern rig dredges, which significantly reduced incidental mortality. Data collected by the NMFS Northeast Fisheries Observer Program has confirmed that there is minimal bycatch in the surfclam and ocean quahog fisheries.
Questions that derive from national standards (NSs) not encompassed by KA questions			
BE/E-4	NS: 2	Contributed to conservation and management measures that are based upon the best scientific information available, including high quality and timely biological and ecological scientific information?	Reporting and recordkeeping requirements in the surfclam and ocean quahog fisheries after SCOQ ITQ program implementation were essentially the same as before the program. Reporting and recordkeeping violations decreased after the program eliminated fishing time restrictions, and both landings and effort data from vessel logbooks are considered by NMFS to be accurate. Management measures that have been implemented since the SCOQ ITQ program began, including VMS and onboard observers, have facilitated enforcement and monitoring in the two fisheries. In addition, the program has increased the propensity of industry to not only comply with management measures but to also actively engage in the management process, including becoming proactive advocates of measures that will help ensure the long-term sustainability of the resource and supporting cooperative or joint research efforts in order to improve the accuracy of NMFS stock assessment surveys.
BE/E-5	NS: 3	Does the program manage stocks as a unit?	The surfclam and ocean quahog stocks in the EEZ have been managed as units throughout their range since the FMP was first implemented.

6 Economic Context and Effects Analysis

6.1 Questions to be Answered

Table 5 provides a summary of program review questions used to guide the economic context and effects analysis. These questions are based on the SCOQ ITQ program goals and objectives and the key areas of the NMFS Catch Share Review Guidelines. The MSA national standards pertaining to this topic area are encompassed by the provisions of the NMFS Catch Share Review Guidelines. The methodological approach used to answer these questions is presented in Section 6.2.

Table 5. Program Review Questions for the Economic Analysis

Question Number	Element Number	Question to be Answered	Section Number
Questions that derive from program goals and objectives (G&Os)			
ECON-1	G&O: 1	Has the program conserved and rebuilt surfclam and ocean quahog resources by stabilizing annual harvest rates throughout the management unit in a way that minimizes short-term economic dislocations?	6.3.1
ECON-2	G&O: 3	Has the program promoted economic efficiency by bringing harvest capacity in line with processing and biological capacity?	6.3.2
ECON-3	G&O: 3	Has the program allowed industry participants to achieve economic efficiency, including efficient utilization of capital resources by the industry?	6.3.3
ECON-4	G&O: 4	Has the program created a management approach that is consistent with long-term industry planning and investment needs?	6.3.4
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
ECON-5	KA: D	How has the program as implemented (or as evolved over time) affected technical and economic efficiency for firms operating in the program?	6.3.3
ECON-6	KA: E	Has the program encouraged full utilization of the available ACL, total allowable catch, or quota?	6.3.5
ECON-7	KA: F	How has the program as implemented (or as evolved over time) affected market power in the markets for harvested fish and shellfish, product markets, input markets, and/or markets for limited access privileges?	6.3.6
ECON-8	KA: F	How has the program as implemented (or as evolved over time) affected consolidation?	6.3.2 and 6.3.6
ECON-9	KA: F	How has the program changed fleet capacity and overcapacity?	6.3.2
ECON-10	KA: G	What is the current economic effect of cost recovery program fees on fishery participants (e.g., what is the reduction in gross revenue, net revenue, or profits on average per participant?	6.3.7
ECON-11	KA: I	What are the economic effects of the current duration of catch privileges, given the program's goals and objectives and other factors (e.g., lending practices of financial institutions)?	6.3.8
ECON-12	KA: J	What are the costs of entry into the program? Have entry costs increased to the point where market power is being exercised and economic inefficiencies are being created?	6.3.9
Questions that derive from national standards (NSs) not encompassed by KA questions			
--	--	None applicable.	--

6.2 Methodological Approach

In general, the methodological approach for the economics section was to summarize the appropriate fishery data for the pre- and post-implementation periods, and then to use those summaries to develop answers to the program review questions. Throughout this section, time series data were used to track a range of variables in support of analyses relevant to the specific questions to be answered as listed in Table 5. These data have been derived from the literature, including published Council documents, and/or fisheries data provided in response to requests submitted to the NMFS Greater Atlantic Regional Fisheries Office for the purposes of the SCOQ ITQ Program Review.

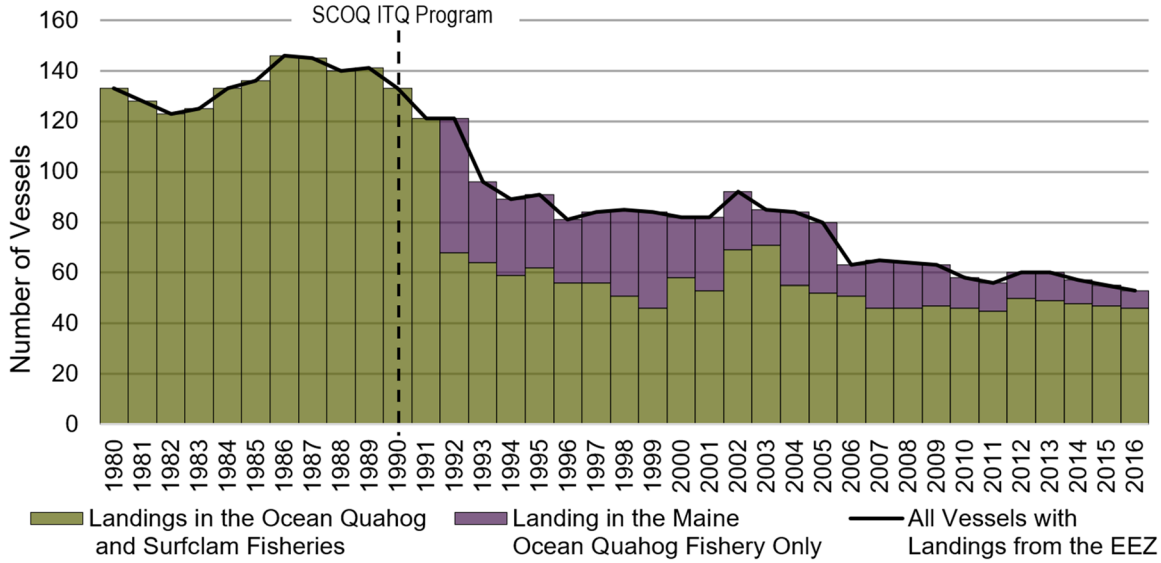
Chart values derived from the data request to NMFS may not necessarily match values appearing in previously published literature for a variety of reasons, the most notable being different assumptions about the inclusion or exclusion of vessels participating in the Maine ocean quahog fishery (Callout 1). A note has been added to those charts that include data that may be inconsistent with data in previously circulated charts describing the surfclam and ocean quahog fisheries due to these differing assumptions.

Callout 1. Maine Ocean Quahog Fishery

At the same time that the SCOQ ITQ program was being developed, the Council and NMFS became aware that the inshore fishery for ocean quahogs in Maine had been expanding into the EEZ. However, the small-scale Maine fishery did not fit well within the program, as it differed from the large-scale, industrial ocean quahog fishery. In 1990, NMFS granted experimental status to the Maine ocean quahog fishery in order to avoid the adverse impacts that could have resulted from the imposition of SCOQ ITQ program regulations that were not designed for a small artisanal fishery. Amendment 10, which was prepared in 1997, formalized a Maine ocean quahog fishery in a zone of both state and federal waters, with an annual quota of 100,000 Maine bushels managed outside of the program. Amendment 10 also established a criterion for continued participation in the Maine ocean quahog fishery—vessels must have landed at least one bushel from the zone while participating at least once in the experimental fishery. Vessels that did not meet this criterion can fish in State of Maine waters or use their ITQ quota share allocation. Harvests of vessels using ITQ quota share do not count against the 100,000-bushel limit.

Data presented in the SCOQ ITQ Program Review exclude vessels that participated exclusively in the Maine ocean quahog fishery. As shown in the figure below, an average of 25 vessels have participated exclusively in the fishery, although in recent years that number has been declining. However, after consultation with Council staff, it was determined that the review should include vessels that both participated in the Maine ocean quahog fishery and made harvests using ITQ quota share. Since 1992, the number of vessels in this group has averaged fewer than three. In the FMP amendment analyses prepared to date, vessels that participated in the Maine ocean quahog fishery, including those that made harvests using ITQ quota share, were excluded from the analyses. For this reason, chart values in the SCOQ ITQ Program Review may vary slightly from those appearing in FMP amendment analyses.

Vessels Participating in the Surfclam and Ocean Quahog Fisheries and Vessels Participating in the Maine Ocean Quahog Fishery within the EEZ, 1980–2016



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

6.3 Environment Before and After Program Implementation

Nine issue categories and, where available, associated annual time series data spanning the pre- and post-SCOQ ITQ program periods were used to organize and summarize the information needed to address the twelve economic program review questions listed in Table 5. These issue categories, each addressed in separate subsections below, are:

- Stabilizing Harvest Rates and Minimizing Short-Term Economic Dislocations
- Harvest Capacity
- Efficient Utilization of Capital
- Industry Planning and Investment Needs
- Full Utilization
- Market Power
- Economic Effect of Cost Recovery Program
- Duration of Catch Privileges
- Costs of Entry

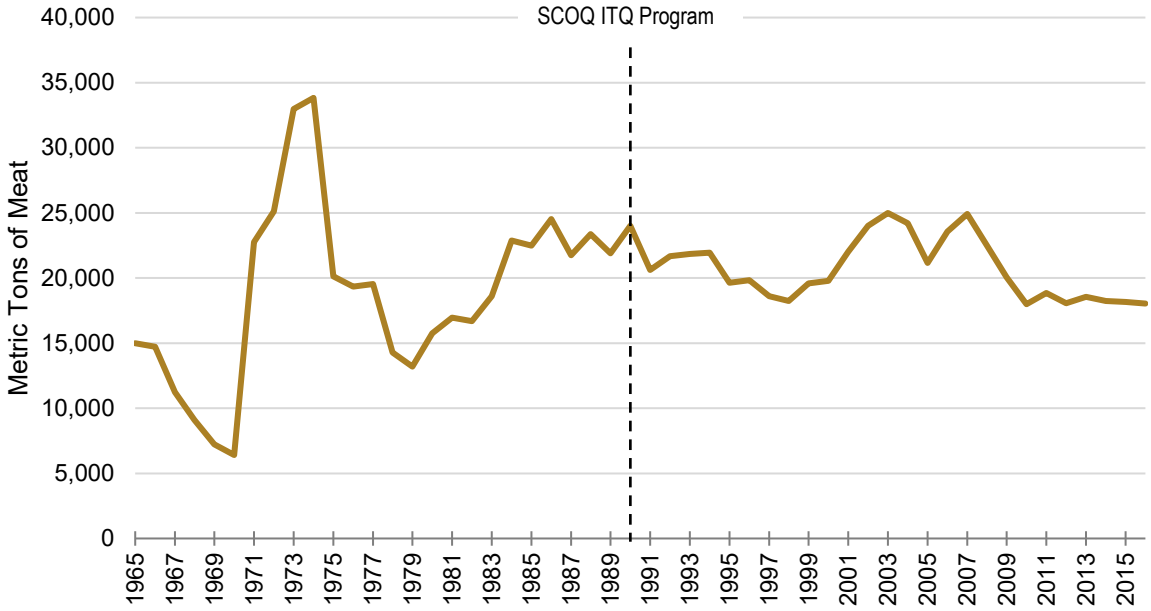
6.3.1 Stabilizing Harvest Rates and Minimizing Short-Term Economic Dislocations

Pre-SCOQ ITQ Program Period

In the early 1970s, a sharp increase in market demand for surfclam products, together with the introduction of mechanical shucking devices that greatly increased the capacity of processing plants, created a boom in the surfclam fishery (Mid-Atlantic Fishery Management Council 1988; Marvin 1992). Surfclams came to represent almost 75 percent of the U.S. clam market (Rountree 2016). The boom prompted the entry of more vessels into the fishery, and in 1974, surfclam landings peaked at 33,800 mt (Figure 9). However, surfclam vessels were harvesting well above the sustainable level of the resource, and by the mid-1970s, the abundance of surfclams in the beds off New Jersey, one of the principle fishing grounds, had decreased. This over-exploitation condition was aggravated by an anoxic habitat condition caused by a large-scale algal bloom and an unusual combination of other factors that occurred throughout the New York Bight area in 1976 (Mid-Atlantic Fishery Management Council 1977; Wang 1995). It was only the discovery of untapped surfclam beds off Virginia that allowed the high catch rates to continue. By the late 1970s, however, the last of the large beds off Virginia were depleted, and in spite of newer and larger vessels entering the fishery, landings decreased dramatically (Mid-Atlantic Fishery Management Council 1977; Marvin 1992). By 1979, surfclam landings had fallen to 13,200 mt (Figure 9).

The Council predicted that in the absence of controls on surfclam catches the industry would suffer immediate severe economic hardship, including large decreases in fleet revenue and processor employment (Mid-Atlantic Fishery Management Council 1977). To help achieve the objective of rebuilding the declining surfclam populations, the FMP prepared for the surfclam and ocean quahog fisheries in 1977 included a moratorium on new entry into the surfclam fishery and set an annual catch limit for the fishery. As shown in Figure 9, landings continued to fall through the early 1980s before stabilizing in about 1985.

Figure 9. Annual Harvest in the Surfclam Fishery, 1965–2016



Source: Developed using data from Murawski (1981); National Marine Fisheries Service (2017b); and a data request to Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service

From 1979 through 1989, the moratorium on new entrants and annual catch limit in the surfclam fishery were supported by a host of other measures, some of which were originally intended to be short-term attempts to stabilize the social and economic aspects of the fishery while the restrictive resource conservation program was carried out. The Council recognized that with the catch limit, it would have to offer present and future security and stability to the existing industry as compensation for the immediate reduction of fishing opportunity. In particular, to even out product input to processors the annual catch limit for the surfclam fishery was divided into unequal quarterly limits reflecting the expectation that greater fishing activity and harvest would occur from the late spring through early fall. In addition, NMFS could decrease allowable fishing time per vessel to spread out the catch over each quarter and reduce the likelihood of a fishery closure should a quarterly limit be exceeded. Closure of the fishery was judged a serious problem to be avoided because of the significant economic impact it would have on employees of processing plants, who received low wages and were only paid when work was available (Nicholls 1985).

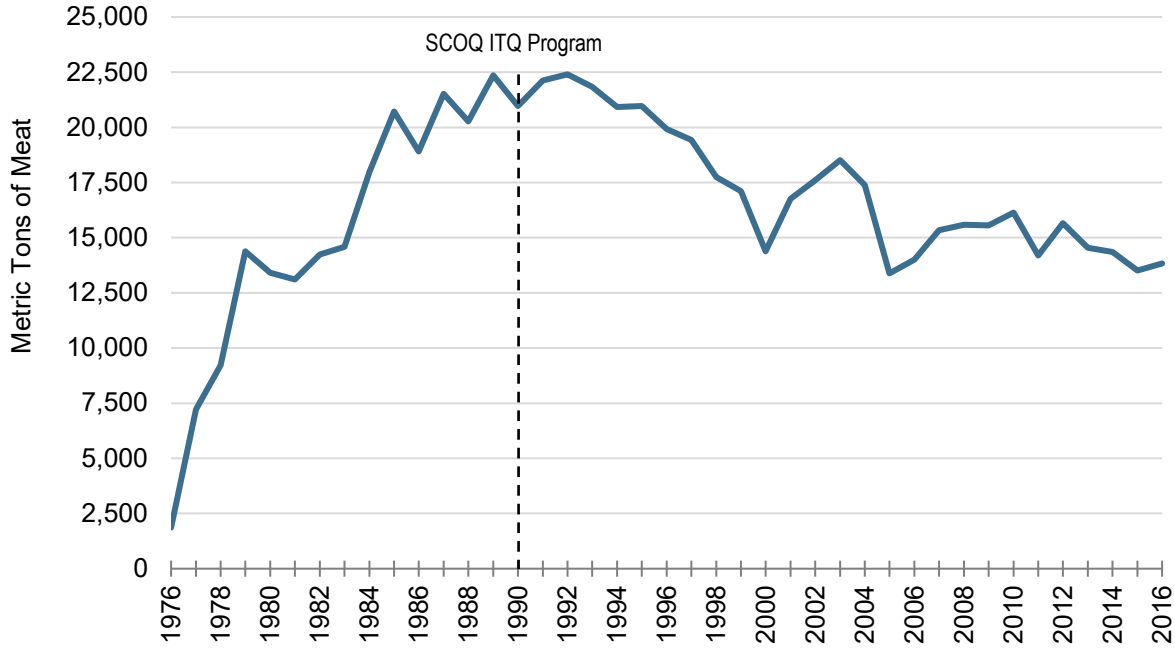
However, dislocation in employment through crew consolidation occurred under the effort limitation system. While fishing time restrictions helped avoid fishery closures, they caused vessels to be tied up for considerable periods of time. Typically, owners of more than one vessel would rotate a single crew among vessels if none were fishing simultaneously (Mid-Atlantic Fishery Management Council 1988). (Section 7.3.2.2).

Although overall crew recruitment in the surfclam fishery was negatively affected by the effort limitation system, the growth of the ocean quahog fishery served as an important source of alternative employment for many of the larger vessels in the surfclam fleet (Mid-Atlantic Fishery Management Council 1988). As shown in Figure 10, large-scale harvesting and processing of ocean quahogs began during the late 1970s. The increase was attributed to the declining availability and increasing cost of surfclams and to technological advances that resolved the flavor and meat color problems associated with ocean quahogs (Mid-Atlantic Fishery Management Council 1988; Marvin 1992). Ocean quahog landings increased during the mid- to late-1980s, as the idle capital in the surfclam fishery caused by fishing time restrictions shifted to the ocean

quahog fishery (Brandt 2005). The total harvest of ocean quahogs from 1985 to 1989 was 103,800 mt, an increase of 48 percent over the previous 5-year total (Figure 10).

Effort restrictions similar to those in the surfclam fishery were provided for the ocean quahog fishery in the event that the catch was likely to exceed the annual catch limit, or if overfishing required a closure before the end of the year. However, NMFS used these provisions only once, in the fall of 1985, when allowable fishing days were reduced from seven to five days per week (Marvin 1992).

Figure 10. Annual Harvest in the Ocean Quahog Fishery, 1976–2016



Source: Developed using data from National Marine Fisheries Service (2017a); Mid-Atlantic Fishery Management Council.(1981); and a data request to Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

Post-SCOQ ITQ Program Period

Surfclam landings have been relatively stable since SCOQ ITQ program implementation, varying between 18 thousand and 25 thousand mt from 1990 through 2016 (Figure 9). As described in Section 5.3.2, landings shifted northward after 2000 as fishery productivity and the sizes of landed surfclams in the south declined due to warming of Middle Atlantic Bight bottom waters. Declining stock abundance has led to the termination of the once thriving surfclam fishery in the most southerly regions. The shift in the surfclam stock's range and subsequent contraction of the fishing grounds was accompanied by a shift of vessels from southerly ports northward and by the movement of processing capacity northward. (Powell et al. 2016; Kuykendall et al. 2017).

After the population decline off the Delmarva Peninsula during the late 1990s, the surfclam fishery came to depend heavily on the New Jersey region. A decline in landings per unit of effort (LPUEs), coupled with rising fishing morality rates, has generated concern for the sustainability of the fishery off New Jersey (Kuykendall et al. 2017). The reopening of a portion of the Georges Bank region for harvesting of surfclams in 2013—an area that was closed in 1990 owing to the risk of harvesting clams contaminated with paralytic shellfish poison (PSP)—allowed some relief from fishing pressure in the New Jersey region (Kuykendall et al. 2017). while reopening of Georges Bank provided additional resources to the surfclam fishery, only a

small subset of vessels in the fleet have the steaming speed and fishing capacity to take advantage of that resource (Surfclam and Ocean Quahog Advisory Panel 2016; Hofmann et al. 2018). Harvests in the Southern New England region also increased starting in the late 2000s (National Marine Fisheries Service 2017b). The single largest reason given by industry for the downturn in surfclam catches in the past few years is likely market constraints.

As described in Section 5.3.2, while there has been no substantial decline in the ocean quahog stock as a whole, there is evidence of substantial biomass decline in heavily fished regions. During the last three decades, the ocean quahog fishery has shifted to more northern areas, including the Long Island and Southern New England regions, as catch rates decreased on the original fishing grounds in the southern regions of Delmarva and New Jersey. Overall, ocean quahog landings have declined since the peak of almost 22,500 mt in 1992 to a little more than 9,500 mt in 2016 (Figure 10). As with surfclams, catches of ocean quahogs are constrained by market limitations. In addition, as discussed in Section 5.3.2, with their lower ex-vessel price in comparison to surfclams, ocean quahogs have historically been a bulk, low-priced food item, and the ocean quahog fishery is only viable when large quantities can be harvested quickly and efficiently.

The shift in the range of surfclams could affect long-term harvest rates of both surfclams and ocean quahogs. The transition from surfclam to ocean quahog habitat generally starts at about 40 m, depending on location. With warming waters, however, the insulation of the ocean quahog and expansion of the surfclam has resulted in a range overlap. This overlap has become increasingly apparent in the Delmarva and Southern Virginia/North Carolina regions in the southern end of the ocean quahog's range, as surfclams have shifted towards deeper water (Section 5.3.3). There is a strong incentive not to fish in areas where both species occur because mixed loads of surfclams and ocean quahogs are not allowed under current regulations, which do not allow flexibility or a minimal tolerance for mixing, and it is not practical to sort catches at sea. Moreover, some vessels do not have permits to harvest both species (Hill 2017; Surfclam and Ocean Quahog Advisory Panel 2017).

6.3.2 Harvest Capacity

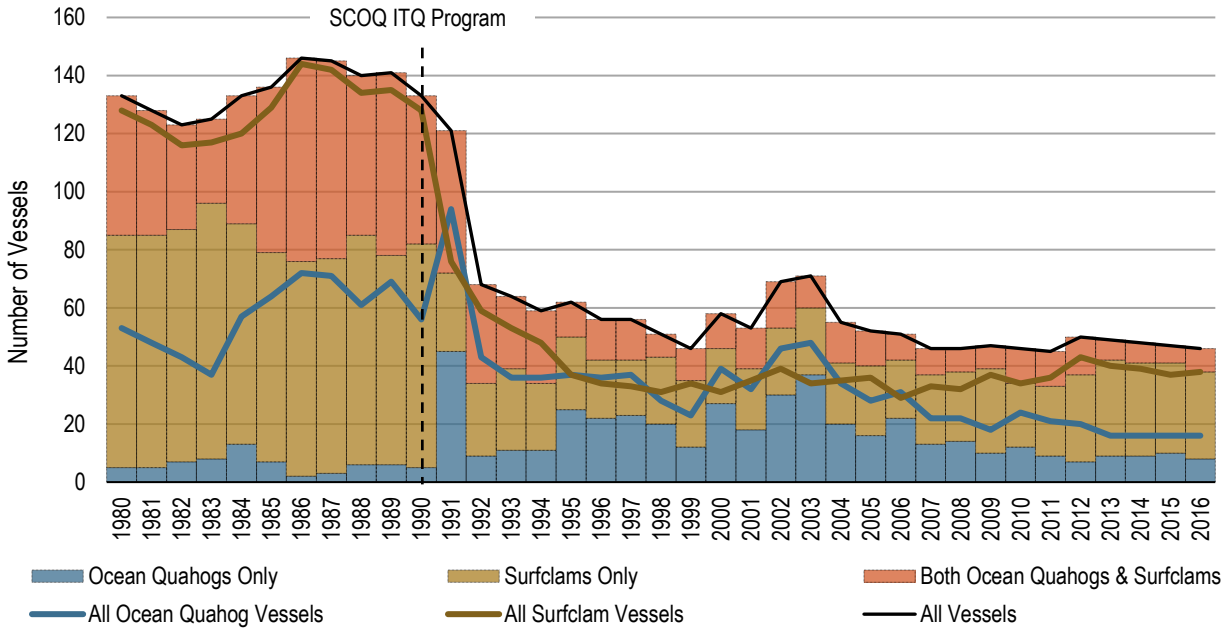
Pre-SCOQ ITQ Program Period

During the pre-SCOQ ITQ program period excess harvesting capacity in the surfclam fishery was a major problem. It was generated before the 1977 moratorium on new entrants into the fishery because the competition for the dwindling fishable stock of surfclams provided an incentive for harvesters to use larger vessels and more gear (National Research Council 1999). Moreover, when the wholesale price per bushel of surfclams rose from $3 in 1975 to $11 the next year because of shortages, increased demand, and a price war among surfclam buyers, many entrepreneurs with no background in the surfclam fishery but with an eye toward a good investment flocked to the industry. By 1978, there were about 160 surfclam vessels (Valente 1978). Subsequently, the size of the surfclam fleet began to drop, but the composition of the fleet shifted to a greater proportion of larger vessels. In 1980, 59 out of 127 vessels (46 percent) were over 100 tons, whereas in 1968 only 6 out of 86 vessels (7 percent) were that large (McCay 1989).

With the implementation of the moratorium in 1979, access to the surfclam fishery was contingent on owning one of the original boats that qualified for a moratorium permit or its replacement. However, the grandfathering provisions of the moratorium allowed more vessels than ever before into the surfclam fishery; 184 vessels applied for and received moratorium permits (Nicholls 1985; National Research Council 1999). During the 1980s, overcapacity in the surfclam fishery was further intensified by additional factors. For example, the Council was considering some form of individual allocation system based on a vessel's landing history as a substitute for the moratorium and effort limitation system from the time the FMP was first developed (Mid-Atlantic Fishery Management Council 1988). Consequently, vessel owners' expectation of

a future fishing privilege created the incentive to harvest with vessels that qualified for a moratorium permit but had previously been largely inactive. As a result, while the number of surfclam vessels with moratorium permits could not change, the number of active vessels increased (Figure 11). From 1980 to 1984, the average number of active vessels in the surfclam fishery was 121; from 1985 to 1989 the average number was 137.

Figure 11. Number of Active Atlantic Surfclam and Ocean Quahog Vessels, 1980–2016[1]



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

[1]Chart values may vary slightly from those appearing in previously published reports due to the inclusion of vessels that both participated in the Maine ocean quahog fishery and made harvests using ITQ quota share (Section 6.2).

In particular, vertically integrated processing firms assembled large fleets of vessels to bolster their claim to future allocations (Table 6). However, even some former deckhands and hired captains managed to put together sizeable fleets (McCay and Brandt 2001). The number of single vessel owner-operators declined though the 1980s; in 1979, 89 firms owned only one vessel, but by 1988, that number was down to 41 firms (Hall-Arber 1992; McCay and Brandt 2001).

Table 6. Average Number of Vessels per Owner in the Surfclam and Ocean Quahog Fisheries by Fleet Owner Type, 1983-1999[1]

	Species Fished (Average number of vessels)			Type of Fleet Owner (Average number of vessels)	
Year	Surfclam and Ocean Quahog	Surfclam Only	Ocean Quahog Only	Independent Owners	Processor Owners
1983	5.1	5.1	5.7	7.0	6.9
1984	5.0	6.4	5.3	7.1	6.6
1985	4.9	5.2	5.2	6.8	6.7
1986	4.6	4.6	4.9	5.6	7.1
1987	4.4	4.5	4.8	5.3	6.9
1988	4.5	4.5	4.7	5.2	7.0
1989	5.2	5.2	5.7	6.1	8.3
1990	5.0	5.0	5.4	6.0	7.8
1991	2.9	2.9	3.0	4.0	3.7
1992	2.8	3.0	2.9	4.2	3.2
1993	2.7	2.9	2.9	4.2	2.7
1994	3.0	3.1	3.2	5.0	2.8
1995	3.0	3.1	3.1	5.3	2.5
1996	2.8	2.8	2.9	5.0	2.3
1997	2.7	2.7	2.8	4.5	2.4
1998	2.6	2.5	2.5	4.0	2.4
1999	2.5	2.5	2.4	4.0	2.2

Source: McCay and Brandt (2001)

[1] An independent fleet owner is an independent owner- with three or more active vessels; a processor fleet owner is a vertically integrated owner with one or more active vessels.

In addition, overcapacity in the surfclam fishery was intensified by a management regime that engendered a "gold rush" mentality. Vessels (and their buyers) competed to harvest the surfclams they needed before the quarterly catch limit was reached and the fishery was closed (Mid-Atlantic Fishery Management Council 1988; National Research Council 1999). Moreover, NMFS restricted fishing time for all surfclam vessels to whatever number of hours per week or trips per quarter the agency determined would be needed for the entire fleet to harvest the quarterly allocation. The overall result of these management measures was to create an incentive for each vessel to apply an excessive level of operating inputs (e.g., labor, fuel, time) and capital inputs (e.g., vessel and gear improvements). Otherwise, the vessel might not be able to take full advantage of the limited fishing time it was allowed each quarter. In short, each vessel competed with the others and against time to catch as much as possible (McCay and Brandt 2001).

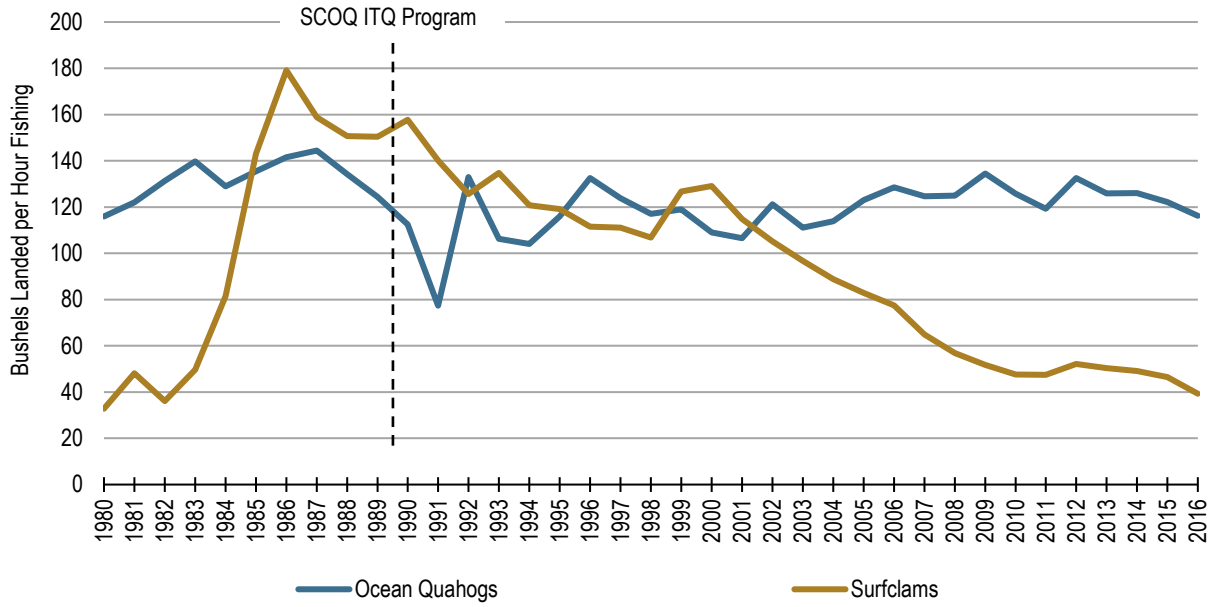
At the time the moratorium was imposed, the Council decided not to impose restrictions on vessel modifications (based on legal advice that such restrictions could not be placed into effect until the Secretary approved the FMP) except on vessels replacing those that sank, were destroyed by fire, or otherwise left the fishery involuntarily. These vessels had to have similar harvesting capacity to the vessel being replaced. However, the replacement policy during the moratorium was liberal (McCay and Brandt 2001). Moreover, an accurate determination of the relative fishing power of two hulls was very difficult to achieve. An unambiguous set of replacement rules were never agreed upon, leaving room for some uncertainty on the part of both vessel owners and government officials as to the merits of any particular replacement request (Mid-Atlantic Fishery Management Council 1988). As a result, replacements for vessels with moratorium

permits were typically larger. Between 1980 and 1987, the number of small surfclam vessels (Class 1: 0-50 gross registered tons (GRT)) decreased from 14 to 8, and the number of medium-size vessels (Class 2: 50-100 GRT) decreased from 54 to 50. In contrast, the number of large surfclam vessels (Class 3: 100+ GRT) increased from 59 to 75 (Nicholls 1985; McCay and Brandt 2001).

Moreover, once the replacement vessel had a moratorium permit issued to it, the owner could modify it without restriction (Mid-Atlantic Fishery Management Council 1988). There were many examples of vessel owners or operators investing in additional or re-designed equipment or changing their operating strategies to improve catching effectiveness. Dredge width was about 60 inches in the mid-1970s; by 1987, average dredge width was about 110 inches, with the largest dredge size being 240 inches (McCay 1989; McCay and Brandt 2001). The radius of the hydraulic hoses used to flush the surfclams out of the seabed mud also increased over time, allowing more water to be pumped (McCay and Brandt 2001). A significant number of vessels were fitted with a second dredge to increase their hourly harvesting capacity (Nicholls 1985). Some vessel owners substantially increased the width and length of their vessels or increased the size of their crews (Wang and Tang 1993). The end result of these changes to improve catching effectiveness was that the effects of the moratorium on controlling harvest capacity were largely negated.

The increase in the surfclam fleet's harvest capacity, together with increased surfclam stock abundance due to large recruitment events in 1976 (New Jersey region) and 1977 (Delmarva region), resulted in a surge in the fleet's landings per unit of effort, from 33 bushels of surfclams per hour in 1980 to 179 bushels per hour in 1986 (Figure 12). Initially, allowable fishing time was specified to maximize fishing seasons. With catch rates dramatically increasing, however, the number of trips and allowed hours of fishing for each vessel had to be steadily ratcheted down to keep the harvests below the annual catch limit (Mid-Atlantic Fishery Management Council 2007). Allowable fishing hours decreased from 1,752 hours in 1978 to 138 hours in 1986, a drop of 92 percent, even though the annual catch limit had increased greatly. In addition, there was a general decrease in the time periods (that is, hours per week) during which fishing was allowed (Mid-Atlantic Fishery Management Council 1988). The result of these effort restrictions was that vessels were moored for much of the time unless their owners also participated in the ocean quahog fishery (which demands larger vessels with greater capacity) or the New Jersey or New York inshore fisheries (both of which were managed with limited access programs and had trip limits and other restrictions) (National Research Council 1999).

Figure 12. Landings per Unit of Effort in the Surfclam and Ocean Quahog Fisheries, 1980–2016[1]



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.
[1]LPUE is total landings in bushels divided by total hours fished.

By the end of the 1980s, the overcapacity combined with the effort limitation system meant that capacity utilization in the surfclam fishery was very low (Mid-Atlantic Fishery Management Council 1988; National Marine Fisheries Service 2017b). With so many vessels operating well below an efficient scale of production, the surfclam fleet, together with the processors that depended upon them, were only marginally profitable, and financial institutions were notably reluctant to support fishing ventures (Weninger 1998; National Research Council 1999).

Post-SCOQ ITQ Program Period

As the excess harvest capacity became more evident and costly for surfclam fishery participants, pressure mounted to change the management regime (National Research Council 1999). The Council believed that an individual allocation system was the best means of achieving the objective economic efficiency in the fishery (Mid-Atlantic Fishery Management Council 1988), and the SCOQ ITQ program was implemented in 1990.

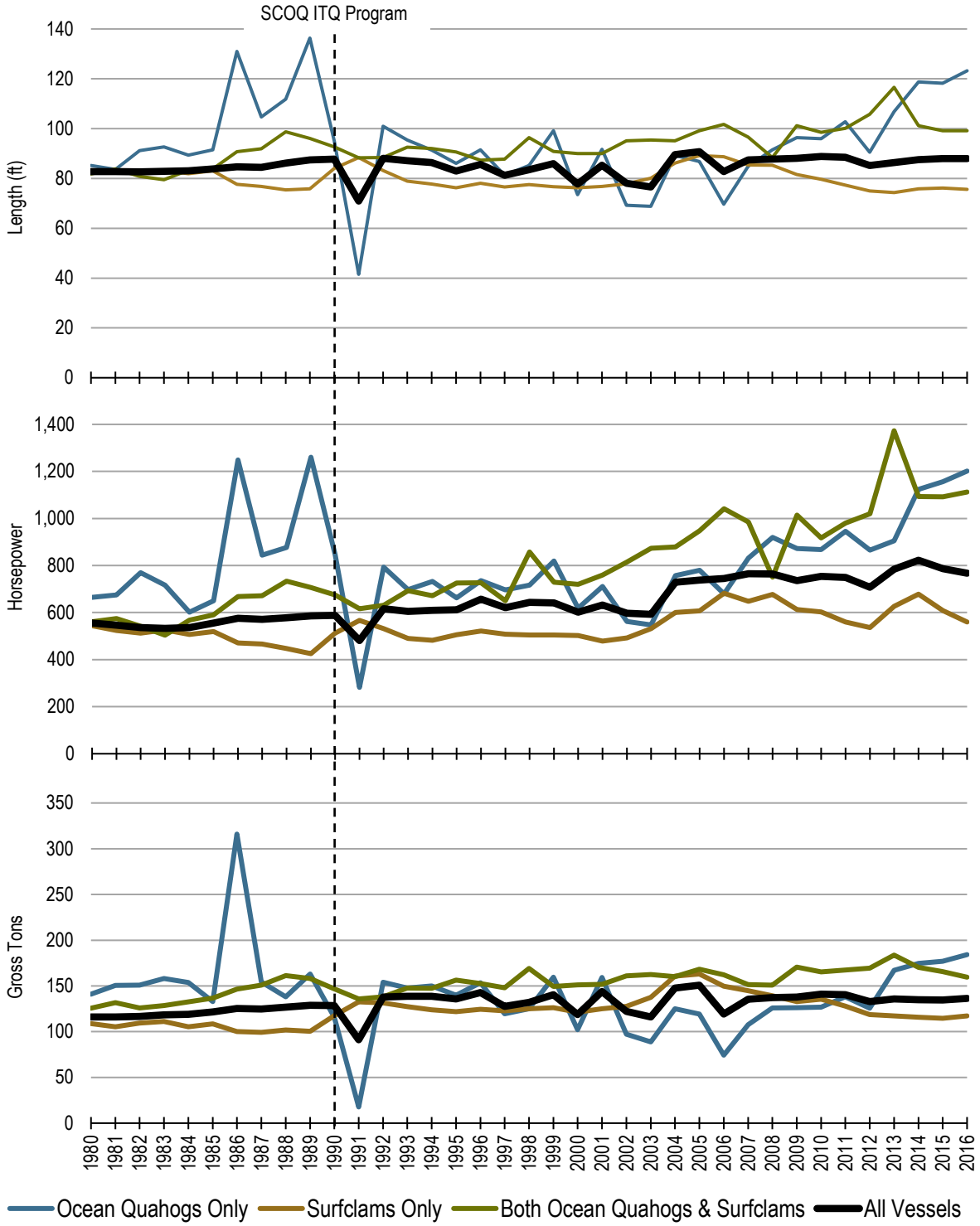
With few restraints on ownership or transfer of ITQ quota share, the program was extremely effective in rapidly eliminating economically excessive capacity (National Research Council 1999). Harvesters could consolidate their catch onto fewer vessels that could then operate at or near full capacity. As noted above, a number of vessel owners, including vertically integrated processors, had assembled large fleets during the 1980s, and thus many owners were in a position to withdraw one or more of their vessels from the surfclam fishery to economize (McCay and Brandt 2001). In addition, some vessel owners took advantage of the SCOQ ITQ program to divest themselves of the older vessels they had accumulated during the moratorium, while other owners chose to lease their ITQ quota share to others or to leave the surfclam fishery entirely (McCay and Brandt 2001). A major decrease in fleet size occurred at the onset of the program. The surfclam fleet shrank from 135 vessels to 34 vessels within seven years of program implementation (Figure 11). This represented a 75 percent reduction in fleet size. Less consolidation occurred in the ocean quahog fleet, but it was still substantial—a 48 percent decrease occurred during the first seven years of the program.

As shown in Table 6, between 1989 and 1999, the average number of surfclam vessels owned by harvesting firms fell from 5.2 to 2.5, the average number of ocean quahog vessels fell from 5.7 to 2.4, and the average number of vessels harvesting both surfclams and ocean quahogs vessels fell from 5.2 to 2.5. The average number of vessels owned by independent vessel owners fell from 6.1 to 4.0, and the average number of vessels owned by processors fell from 8.3 to 2.2.

The total number of vessels participating in the surfclam and ocean quahog fisheries were relatively stable from 1999 until the mid-2000s, when the fleets in both fisheries declined due to poor economic conditions. Myriad factors contributed to the difficulties in the industry—major users of clam meats had reduced their purchases and stopped advertising products like clam chowder in the media; imported meat from Canada and Vietnam contributed to an oversupply of clam meats in the marketplace; and the costs to vessels harvesting surfclams and ocean quahogs increased due to the rising costs of fuel and insurance (Mid-Atlantic Fishery Management Council 2010). Harvests were consolidated on fewer vessels for several years until economic conditions improved.

While fleet size has diminished since SCOQ ITQ program implementation, industry has shifted toward using vessels with greater fishing capacity (National Marine Fisheries Service 2009). For vessels fishing surfclams, the average dimensions and engine power increased after the program began as older and smaller vessels were retired (McCay and Brandt 2001). Moreover, with the elimination of fishing time restrictions, vessel owners were able to realize the advantage of larger vessels, including a relatively large output per unit of input once the vessel has reached a chosen fishing site (Weninger and Strand 2003). For vessels targeting ocean quahogs, the increase in capacity has occurred more recently. A comparison of the five-year averages of characteristics of ocean quahog-only vessels shows that between the 2002–2006 and 2012–2016 periods, average length increased by 45 percent, average horsepower increased by 58 percent, and average gross tonnage increased by 64 percent (Figure 13). These increases may be due to the exit of smaller vessels from the ocean quahog fleet as it was forced to travel farther in search of productive beds (McCay and Brandt 2001). As described in Section 5.3.2, while there has been no substantial decline in the ocean quahog stock as a whole, there is evidence of substantial biomass decline in heavily fished regions.

Figure 13. Average Length, Horsepower, and Gross Tonnage of Active Vessels in the Surfclam and Ocean Quahog Fisheries, 1980–2016[1]



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

[1]Chart values may vary slightly from those appearing in previously published reports due to the inclusion of vessels that both participated in the Maine ocean quahog fishery and made harvests using ITQ quota share (Section 6.2).

6.3.3 Fishing Inputs, Output, and Productivity

6.3.3.1 Changes in Inputs

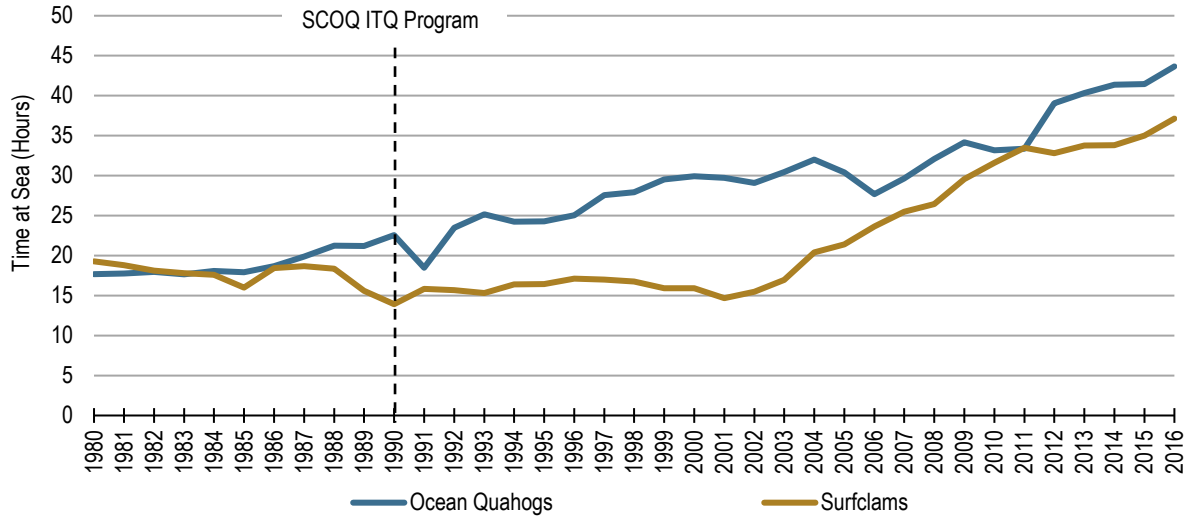
The effort limitation system tended to increase fishing input usage and operating costs in the surfclam fishery by encouraging harvesters to waste fuel rushing to and from fishing grounds and to invest in ever more elaborate vessels or equipment in a continuing attempt to harvest as many surfclams as possible within the time constraints of their authorized fishing periods (Mid-Atlantic Fishery Management Council 1988). In addition, under the vessel replacement policy during the moratorium, vessels could not be replaced unless they "involuntarily left" the fishery (e.g., sank, were destroyed by fire, or became inoperable). The result was that the fleet was aging, and the older vessels were more costly to maintain (Marvin 1992).

Under the SCOQ ITQ program, each harvester is able to use the least cost combination of fishing inputs since they are allocated an exclusive share of the annual catch limit. Consequently, they are encouraged to harvest the resource in a manner that is least costly to them, and thereby earn the most profit for themselves as well as the industry as a whole.

As described in Section 6.3.2, the program was extremely effective in rapidly eliminating economically excessive capacity. Significant efficiency gains emerged as the redundant capital that had accumulated under the pre-SCOQ ITQ program management regime was eliminated. Vessel owners transferred their ITQ quota share onto fewer vessels, and some less-efficient vessels exited the fishery (Weninger 1998). Further, vessel owners with the lowest harvesting costs expanded their catch by buying or leasing ITQ quota share from owners with higher-cost vessels, leading to lower overall harvest costs and more efficient outcomes for industry (Walden et al. 2012).

However, the time capital deployed at sea has increased since SCOQ ITQ program implementation. While the number of trips per year has declined, trip duration has increased (Figure 14). The increase may be partially explained by the elimination of the effort limitation system, which discouraged harvesters from taking time to explore and be selective in the beds that they fished in order to harvest larger and more valuable clams (Mid-Atlantic Fishery Management Council 1988).

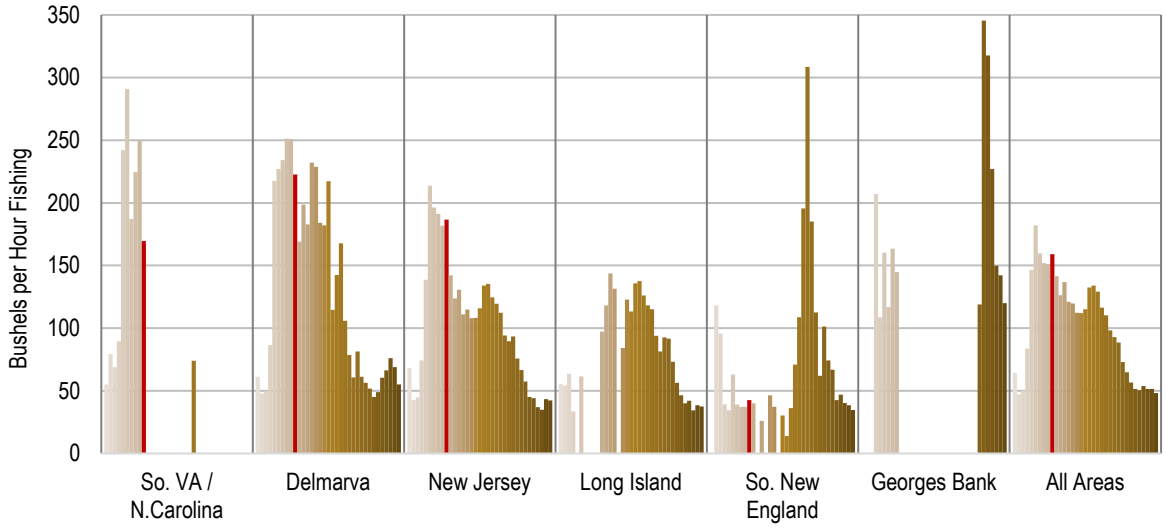
Figure 14. Mean Trip Length in the Surfclam and Ocean Quahog Fisheries, 1980–2016



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

However, trips harvesting surfclams and ocean quahogs may also have increased in length due to a decline in catch rates (Mid-Atlantic Fishery Management Council 2017b; Mid-Atlantic Fishery Management Council 2017c). As described in Section 5.3.2, the surfclam biomass has shifted northward, accompanied by a decline in southern regions. In terms of surfclam production, vessels came to depend most heavily on beds in the New Jersey region. As vessels concentrated on these beds, their biomass declined, the resource became less dense, and LPUE has reached a record low in some regions (Figure 15). As shown in Figure 12, LPUE for the surfclam fishery as a whole has shown a declining trend. As a result, surfclam vessels spent more time fishing and searching for additional clams. Moreover, the shift in biomass to the north was also accompanied by the closing of processing capacity in the more southern regions. Because vessels need to offload at processing facilities that have equipment that can lift heavy metal cages, the plant closures forced vessels that formerly offloaded at the plants to travel farther to offload their harvest (Walden et al. 2012).

Figure 15. Landings per Unit of Effort in the Surfclam Fishery by Stock Assessment Region, 1981–2016[1]



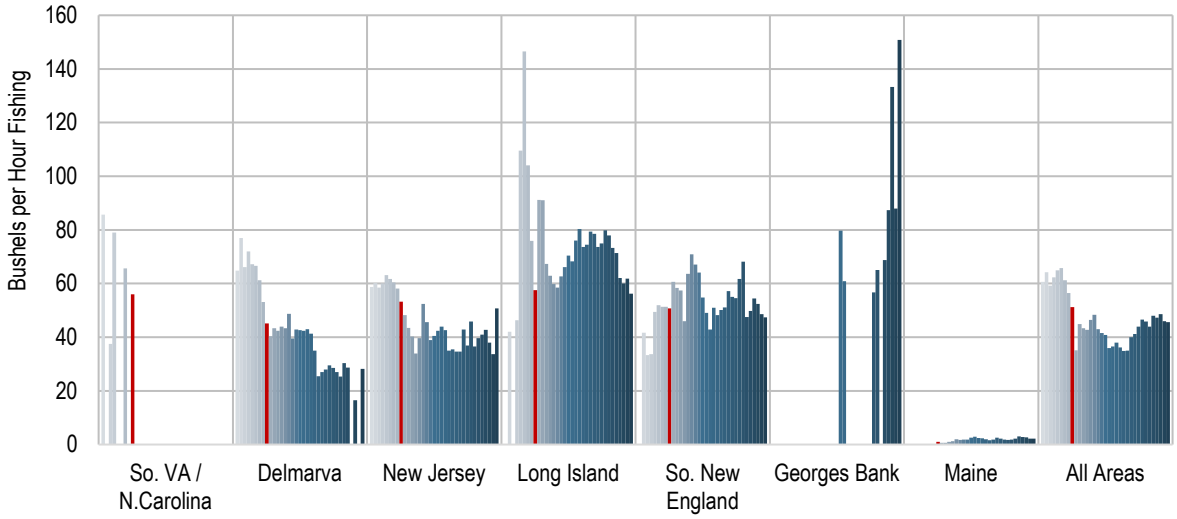
Red column indicates the start of the SCOQ ITQ Program (1990) during the 1981-2016 period.

Source: Developed using data from Mid-Atlantic Fishery Management Council (2018b).

[1]LPUE is total landings in bushels divided by total hours fished. Landings and fishing effort from unknown regions were prorated to region before LPUE was calculated.

The condition of the ocean quahog resource in some fishing areas has also deteriorated since SCOQ ITQ program implementation. Because the fishery can move to new areas when LPUE begins to decline, LPUE for the fishery as a whole has been basically stable since 1980 (Figure 12). However, LPUE has declined in the traditional southern fishing grounds of the Delmarva and New Jersey regions (Figure 16). LPUE in the Long Island and Southern New England regions, where the majority of fishing effort has been since 1990, has been stable or increasing (Chute et al. 2013), but the ocean quahog beds with the highest catch rates are found substantially offshore, meaning vessels spend more time at sea. Additionally, the depth of the ocean quahog beds being fished can be up to 300 feet, which is pressing the limit of modern harvest technology (Walden et al. 2012).

Figure 16. Landings per Unit of Effort in the Ocean Quahog Fishery by Stock Assessment Region, 1982–2016[1]



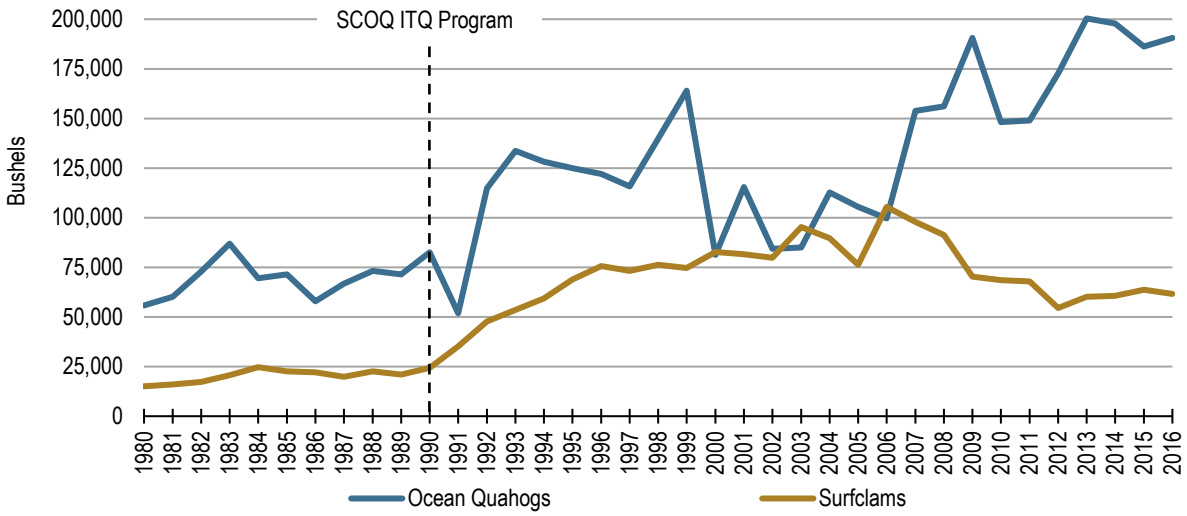
Red column indicates the start of the SCOQ ITQ Program (1990) during the 1982-2016 period.

Source: Developed using data from Mid-Atlantic Fishery Management Council (2018a).
[1]LPUE is total landings in bushels divided by total hours fished. Landings and fishing effort from unknown regions were prorated to region before LPUE was calculated.

6.3.3.2 Changes in Output

Along with changing input usage, outputs per vessel also changed. After SCOQ ITQ program implementation, vessels that remained in the fishery increased their landings. Because there were fewer vessels and no restrictions on fishing time, average catch per vessel of both surfclams and ocean quahogs increased markedly after the program began. In 2016, the average surfclam catch per vessel was about 150 percent larger than that of 1990, and the average ocean quahog catch was around 130 percent larger (Figure 17).

Figure 17. Annual Average Catch Per Vessel in the Surfclam and Ocean Quahog Fisheries, 1980–2016

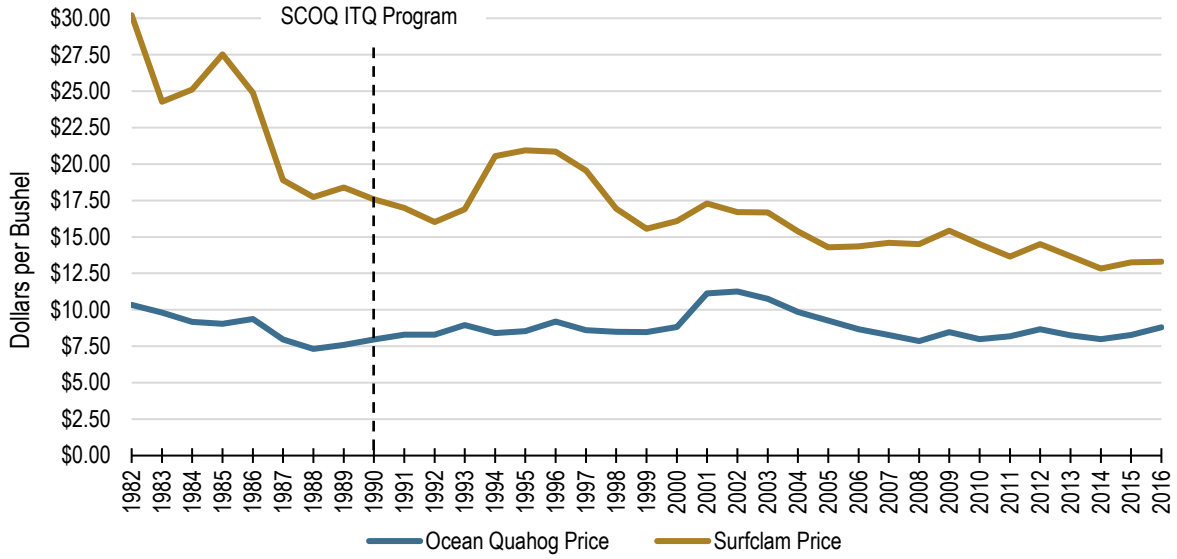


Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

In addition, an allocation of an exclusive share of the annual catch limit allows vessels to become more profitable by changing their output mix (Walden et al. 2012). At the time the FMP was developed vessels tended to specialize in the production of either surfclams or ocean quahogs. During the early 1980s, most vessels harvested only surfclams or only ocean quahogs (Figure 11). The trend was probably even more pronounced than these figures indicate because many ocean quahog vessels fished for surfclams once a year to maintain their surfclam permits. In spite of fishing almost exclusively for ocean quahogs, these vessels were counted as dual-species vessels (Marvin 1992).

However, the strict fishing time restrictions that were gradually imposed in the surfclam fishery under the early FMP management regime induced owners of surfclam vessels to diversify into the production of ocean quahogs to take advantage of otherwise idled vessel capital. Ocean quahogs are found in deeper waters than surfclams, thus necessitating larger vessels with more horsepower (Brandt 2003b). Vessels of sufficient size and horsepower can be used for both species; the only necessary gear change is the change to a longer hose before an ocean quahog trip (Brandt 2005). During the 1986-1989 period, when the most severe restrictions on surfclam fishing were imposed, the percentage of vessels landing both surfclams and ocean quahogs reached its highest point. After SCOQ ITQ program implementation many vessels returned to single-species production (Weninger and Strand 2003). This shift is likely due to a combination of differences in product value and biomass. The value of ocean quahogs has consistently been below that of surfclams (Figure 18). In terms of biomass, surfclams increased to peak levels in the 1990s before showing a declining trend (Section 5.3.2).

Figure 18. Inflation-Adjusted Average Annual Ex-Vessel Prices for Surfclams and Ocean Quahogs, 1982-2016[1]



Source: Developed from data in Mid-Atlantic Fishery Management Council (2018a; 2018b)

[1] Average price was computed as total revenue divided by total landed meat weight during each year, and then converted to bushels. Annual averages of prices for individual trips were not used to avoid the effects of small deliveries at relatively high prices. Prices are adjusted for inflation to 2017 dollars using the producer price index for processed and packaged seafood from U.S. Bureau of Labor Statistics (2018b).

6.3.3.3 Changes in Productivity

The combined effects of changes in inputs and outputs can be measured using a productivity index. Simply put, a productivity index describes how the landings from fishing vessels and the inputs (capital such as vessels and fishing gear, plus labor, fuel, etc.) used to produce those landings change through time. This indicator is important because productivity change is directly tied to profit change. If, for example, prices

for the fish landed are stable, and the inputs (such as fuel used on a fishing trip) do not change, profits can increase if vessels are able to produce more landings (outputs) for a given level of inputs.

Walden et al. (2012) estimated productivity change in the surfclam and ocean quahog fisheries through a Malmquist index from 1981–2008, capturing change before and after implementation of the SCOQ ITQ program. Results showed that vessels that entered the fisheries after the program began were generally more productive than continuing vessels, and vessels which exited the industry were less productive. Walden et al. observed that continuing vessels did not increase their productivity after program implementation. They suggest that since the acquisition of quota creates an additional barrier to entry, the owners of continuing vessels may not be concerned about increasing productivity to deter entry by new competitors.

According to Walden et al., in the early 1980s, productivity the surfclam and ocean quahog fisheries rose sharply until 1985, and then leveled off, or declined slightly until 1990. After 1990, productivity again increased until 1994. Subsequently, productivity has trended downward. Although the authors found no single explanatory factor for the decline, they indicate that it may be driven by a combination of worsening resource conditions resulting from fishing down productive fishing beds and external factors outside the control of fishing vessels. In addition, large, newly constructed vessels entered the ocean quahog fishery in 2001. Using more capital input with flat or declining outputs will lead to declines in productivity. This effect may be further amplified if the vessels are spending more time at sea searching for clams, or harvesting beds where their abundance is declining (Walden et al. 2012).

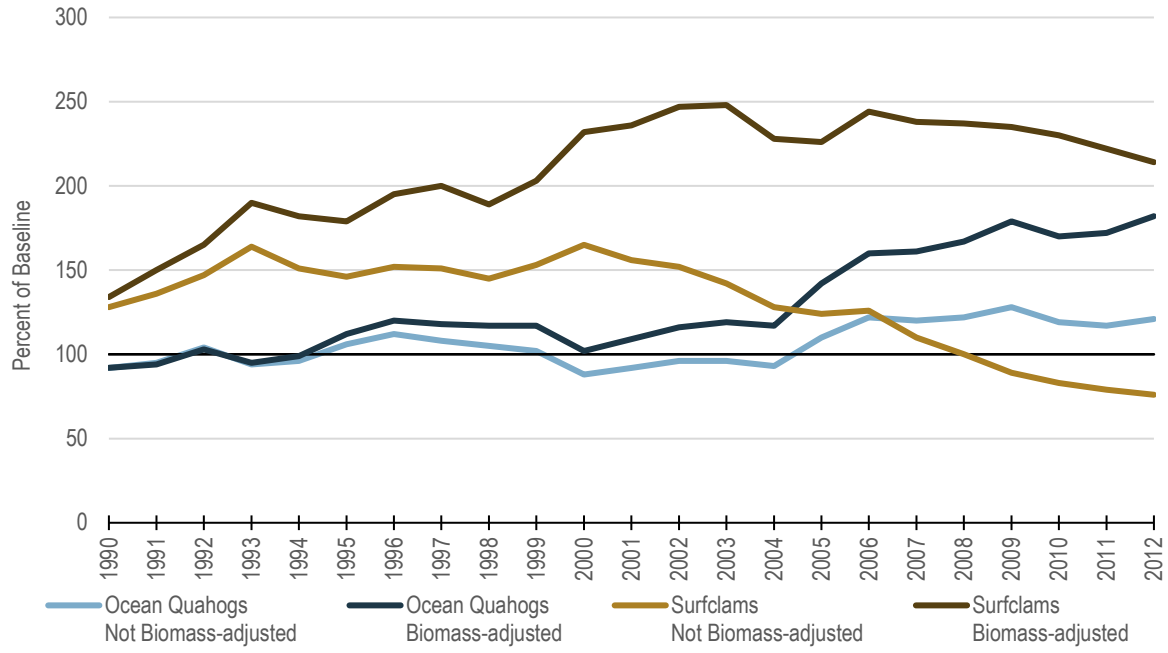
This productivity pattern is similar to that reported by Brandt (2003b) for the surfclam and ocean quahog fisheries. Brandt calculated annual productivity over the 1980-1995 period for the two fisheries using the Tornqvist index. The study found a large increase in productivity in the surfclam fishery from 1980–1984, a slowing from 1985-1989, and an increase from 1990-1995. Brandt noted that the depression of total factor productivity in the surfclam fishery during negotiation of the SCOQ ITQ program reflected firms' increased capital holdings as they returned previously inactive vessels to the fleet so they would be granted a larger portion of the eventual quota that was to be distributed to vessels. The recovery of productivity in the surfclam fishery after the implementation of the program reflected the retirement of those vessels once the incentive for their use (establishing catch histories) no longer applied. Brandt provides empirical evidence that the vessels that re-entered the fishery during the program negotiation period and those that exited immediately after program implementation were significantly less efficient than those vessels that remained in the surfclam fishery. A comparable decrease in productivity did not occur in the quahog fishery because it was not expected that the program would apply to that fishery.

Walden et al. (2014) assessed productivity changes in the surfclam and ocean quahog fisheries using a Lowe index adusted for changes in target species biomass. Biomass levels can influence the harvestability of surfclam and ocean quahog resources, but these levels are beyond the control of individual vessels in the fisheries. Unadjusted productivity indices underestimate productivity change when biomass is declining and overestimate productivity change when biomass is increasing. Accounting for biomass impacts yields measures of productivity change that are driven by factors internal to vessel operations. To account for biomass changes the productivity change index is multiplied by a biomass change index. That is, the biomass index acts as a "shifter" of unadjusted productivity change. When the biomass index is greater than 1.00 (biomass is declining), the adjusted productivity change is higher than the unadjusted change and the opposite occurred when the biomass is increasing (i.e. the biomass index is less than 1.00). The difference between adjusted and unadjusted productivity increases with the magnitude of the direction of change in the biomass index (Walden et al. 2014; Thunberg et al. 2015).

As shown in Figure 19, the analysis by Walden et al. estimated changes in productivity after SCOQ ITQ program implementation as the ratio of productivity measures in the post-program period to productivity measures in a pre-program base time period (1987-1989). Unadjusted productivity for the surfclam fishery was above the pre-program base from 1990 to 2007 before dropping below the base during 2009–2012.

This trend is consistent with the results found in Walden et al. (2012). As exploitable biomass has declined, vessels have had to use more inputs to produce the same output. However, biomass-adjusted productivity in the fishery remained above the pre-program base in every year between 1990 and 2012, and it was at least twice that of the base in every year between 1999 and 2012 (Thunberg et al. 2015). Similar trends were evident in the ocean quahog fishery, although they were not as pronounced. From 1990 through 1995, unadjusted productivity was nearly identical to that biomass-adjusted productivity because the biomass index was unchanged. Since 1995, the ocean quahog biomass has been declining resulting in an increasing biomass index and a positive trend in biomass-adjusted productivity relative to the pre-program base. Consequently, the divergence between unadjusted and biomass-adjusted productivity has increased (Thunberg et al. 2015). After adjusting the productivity index by the biomass index, there were only four years during the entire time period where productivity was less than one (1990-1994). The value of 1.82 in year 2012 showed that the fishery was 82 percent more productive in 2012 than in the base time period.

Figure 19. Unadjusted and Adjusted Productivity Indices in the Surfclam and Ocean Quahog Fisheries, 1990–2012[1]



Source: Developed using data from Walden et al. (2014)

[1] Plotted annual values are the ratio of productivity measures in the post-SCOQ ITQ program period to productivity measures in a pre-program base time period (1987-1989).

Walden et al. (2012) note that because an ITQ quota share allocation is not a complete property right, externalities still exist, which may limit a vessel's ability to increase productivity. For example, a vessel could choose to fish heavily on surfclam beds close to shore to harvest its quota. This could force other vessels to shift their fishing efforts further offshore, thereby increasing their input usage and lowering their productivity. The authors further note that the regulatory regime is also important. For instance, closure of a large fishing area (e.g., Georges Bank), combined with declining productivity of surfclam beds in open areas may contribute to declining vessel productivity in the surfclam fishery. Färe et al. (2015) note that the industrial structure in which the surfclam and ocean quahog fleets operate may also be limiting productivity gains. The authors note that vessels are now increasingly part of vertically integrated companies, and productivity gains in the harvesting activity may be less important. The profit center for processing firms is likely to be at the corporate or plant level. In addition, McCay and Brandt (2001) speculate that one reason why so many

vessel owners continue to participate in the fishery when their fishing operations from a normative perspective are inefficient is the "job satisfaction" factor, or the value that owners may place on remaining in the fishery despite the opportunity costs. For example, one family firm interviewed by McCay and Brandt has tried to keep as many boats operating as possible to provide employment for themselves, plus the relatives and neighbors with whom they have long worked.

Notwithstanding these possible constraints, the productivity gains described above suggest that the SCOQ ITQ program substantially facilitated economic efficiency in the surfclam and ocean quahog fleets by increasing the ability of vessel owners to optimize their harvesting operations as resource conditions, product markets, and input prices changed. However, the Council and NMFS acknowledged that one program provision did not promote economic efficiency, namely the prohibition on shucking at sea unless a NMFS-approved onboard observer is present. This provision generated considerable controversy at public hearings for Amendment 8. Many processors had invested in or wished to develop processor vessels, particularly for ocean quahogs, because of the high costs of land-based shucking plants.[5] In particular, industry argued that shucking at sea was a possible way of addressing the difficulty shoreside plants experienced in complying with increasingly stricter environmental pollution standards when disposing of clam shells and wastewater. In addition, onboard shucking would allow vessels to increase their haul of clams per trip. In response, NMFS pointed out that shucking at sea would seriously compromise enforcement because allocations of ITQ quota share are measured in bushels and the meat weight yields of shucked shell stock vary considerably (55 Fed. Reg. 24184 (June 14, 1990); Mid-Atlantic Fishery Management Council 1988).

No study has provided a quantitative analysis of changes in the productivity of surfclam and ocean quahog processors following SCOQ ITQ program implementation. However, Ross (1992) reported that processors felt the SCOQ ITQ program allows them to better control inventory to match market demand. Before the SCOQ ITQ program, processors had to pack when vessels had their fishing day and hold finished inventory in the plant. Now processors can plan out supplies and work with ITQ quota shareholders to schedule fishing effort when needed. This reduces the amount of capital tied up in finished product inventory and allows for other cost savings by scheduling for such things as down time for employee vacations, equipment maintenance, plant improvements, etc. without worrying about a vessel that has to fish 6 hours within a 3-week period.

6.3.4 Industry Planning and Investment Needs

Pre-SCOQ ITQ Program Period

As described in Section 6.3.1, the moratorium on new entrants and annual catch limit in the surfclam fishery were supported by a host of other measures, some of which were originally intended to be short-term attempts to stabilize the social and economic aspects of the fishery while the restrictive resource conservation program was carried out. These measures included fishing time restrictions to reduce the likelihood of a fishery closure. Closure of the fishery was judged a serious problem to be avoided because of the significant economic impact it would have on employees of processing plants, who received low wages and were only paid when work was available. However, the effort limitation system was inflexible and imposed an unnecessary level of governmental involvement in fishing industry practices (Mid-Atlantic Fishery Management Council 1988).

[5] In the 1980s, for example, Borden, Inc began to implement a long-considered project called "Shuck-at-Sea," which would enable vessels to shuck the clams on the boat and thereby provide a bigger haul of clams per boat trip. Borden developed the project because it would increase the return on its investment through reducing costs, would eliminate disposing of shells and visceral materials on land by returning them directly to sea, and would eliminate the need to drill a new freshwater well at Borden's Cape May, New Jersey processing plant (*Sons of Thunder, Inc. v. Borden, Inc.*, 690 A.2d 575, 587, 148 N.J. 396, 420 (N.J. 1997).

There was an increasing incidence of surfclam fishery closures, with four weeks lost to closure in 1978, none in 1979 through 1983, five in 1984, four in 1985, and six in 1986 (Mid-Atlantic Fishery Management Council 1988). In response, NMFS steadily decreased allowable fishing time per vessel. Allowable fishing hours were decreased from 1,752 hours in 1978 to 138 hours in 1986, a drop of 92 percent. In addition, there was a general decrease in the time periods (that is, hours per week) during which fishing was allowed (Mid-Atlantic Fishery Management Council 1988). The flexibility of a vessel operator was further constrained by the need to maintain uniform procedures, such as fishing in daylight hours so that surveillance over-flights at dawn or dusk could determine that the dredge and other fishing gear was out of the water and the vessel was heading for port (Nicholls 1985).

In 1987, the timed-based effort limitation system was altered to give vessel operators more flexibility in choosing fishing time. Rather than set the number of hours per week, NMFS set the number of allowable trips per quarter as estimated to be necessary to catch the quarterly limit (Mid-Atlantic Fishery Management Council 1988; 52 Fed. Reg. 4019 (February 9, 1987)). However, a vessel operator was required to choose the day or days he or she wished to fish in the of surfclam fishery, notified NMFS, and then had to "use or lose" the days. In the winter, one could obtain a bad weather makeup day, but if this day also was missed, the opportunity was lost. Moreover, to facilitate enforcement, a relatively long lead time of ten days was required for choosing fishing days so that NMFS enforcement agents and the Coast Guard could be aware of when a vessel was allowed to fish; this requirement severely restricted short-term planning by vessel owners (Mid-Atlantic Fishery Management Council 1988).

As described in Section 6.3.3, the effort limitation system also hampered the ability of processors to control inventory to match market demand. Processors had to pack when vessels had their fishing day and hold finished inventory in the plant.

Post-SCOQ ITQ Program Period

The SCOQ ITQ program eliminated the tightly structured regulations of the effort limitation system, thereby providing vessel owners more flexibility in operating their businesses without government intervention (Mid-Atlantic Fishery Management Council 1988; U.S. Congress 1994). ITQ quota share must be used during the year for which it was issued, but otherwise ITQ quota shareholders have the ability to harvest their quota when weather and market conditions are favorable. An owner of ITQ quota share (whether obtained by initial allocation or by purchase or lease) does not have to harvest their quota; they may obtain a permitted vessel to harvest their quota, or they may contract for the quota to be caught by any permitted vessel (Mid-Atlantic Fishery Management Council 1988). With specific respect to ITQ quota share sales and leasing, the form required by NMFS to process and register quota transactions is designed to be simple and easy to complete, thus giving businesses the ability to make timely business decisions (National Marine Fisheries Service 2005). An ITQ quota share owner interested in getting out of the surfclam or ocean quahog fishery entirely does not now have to find a buyer for their vessel; their quota can simply be sold (Mid-Atlantic Fishery Management Council 1988). Vessel owners with limited ITQ quota share may employ the flexibility of the program to associate with other vessel owners in a similar situation. Possibly, one vessel could be used to harvest several small allocations (Mid-Atlantic Fishery Management Council 1988).

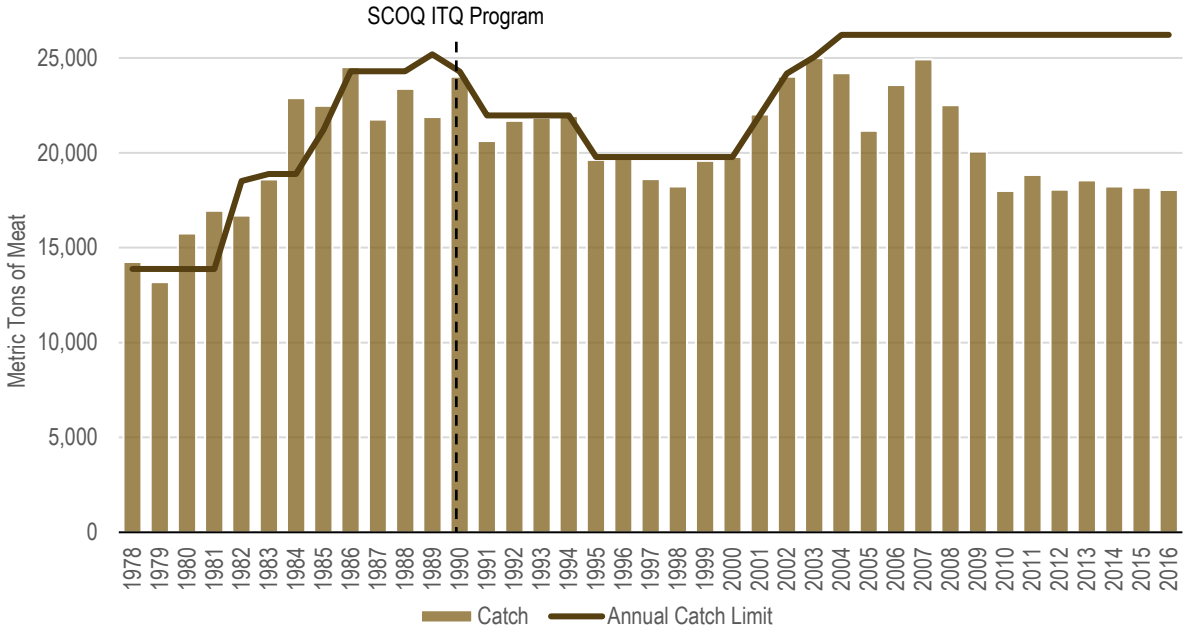
In addition, as described in Section 6.3.3, the SCOQ ITQ program allows processors to plan out supplies and work with ITQ quota shareholders to schedule fishing effort when needed. The result is that processors can better control inventory to match market demand.

6.3.5 Full Utilization

A comparison of utilization of the surfclam and ocean quahog annual catch limits before and after SCOQ ITQ program implementation indicates that the program had little, if any, effect. The level of utilization in both fisheries was mainly constrained by market limitations (National Marine Fisheries Service 2017b; National Marine Fisheries Service 2017a).

As shown in Figure 20, the percent of surfclams harvested in relation to the annual catch limit has shown a downward trend since the late-2000s, when myriad factors contributed to the difficulties in the surfclam and ocean quahog industry. Major users of clam meats reduced their purchases from industry and stopped advertising products like clam chowder in the media; imported meat from Canada and Vietnam contributed to an oversupply of clam meats in the marketplace; and the costs to vessels harvesting surfclams and ocean quahogs increased due to the rising costs of fuel and insurance (Mid-Atlantic Fishery Management Council 2010).

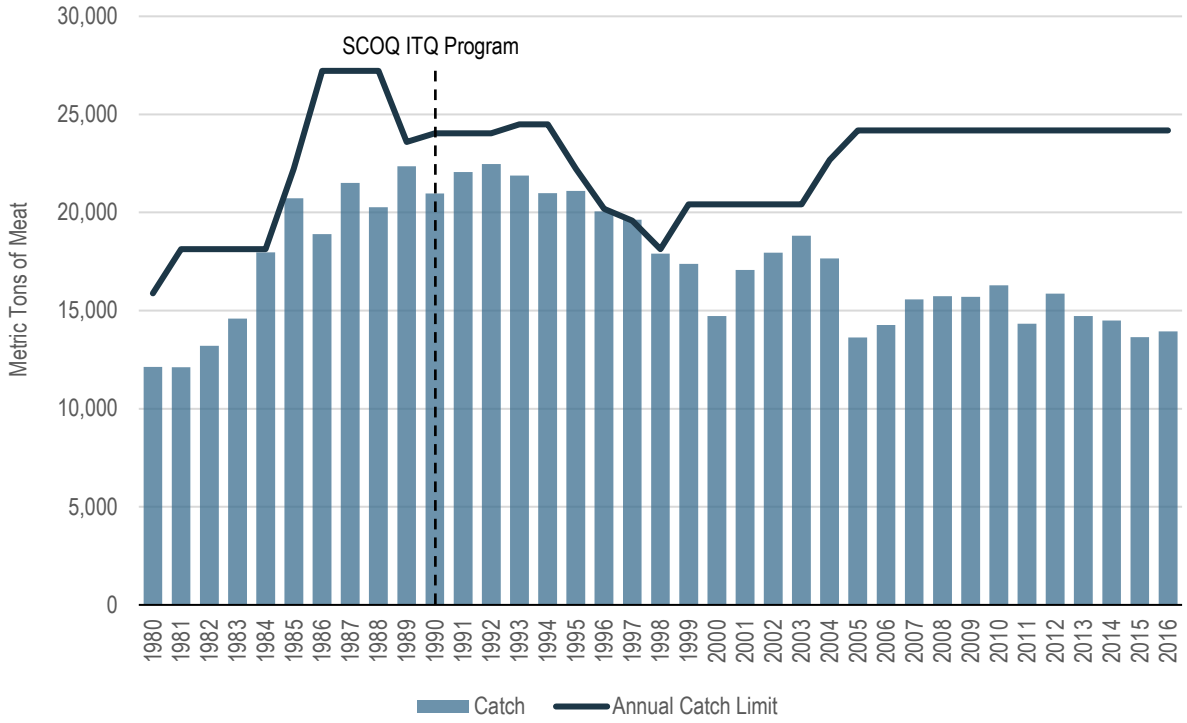
Figure 20. Annual Landings and Catch Limits in the Surfclam Fishery, 1978–2016



Source: Developed using data from National Marine Fisheries Service (2017b); Mid-Atlantic Fishery Management Council (2018b).

As shown in Figure 21, industry utilization of ocean quahogs has also varied across the years, influenced by the costs of harvesting ocean quahogs as well as market conditions. Traditionally, the dominant use of ocean quahogs was in such products as soups, chowders, and white sauces. Their small meat has a sharper taste and darker color than surfclams, which has not permitted their use in strip products or the higher-quality chowders (Mid-Atlantic Fishery Management Council 2010). In addition, ocean quahogs yield less meat per bushel than do surfclams (Mitchell et al. 2011). Due to these factors, the per-bushel price of ocean quahogs is lower than the per-bushel price of surfclams (Figure 18), and ocean quahogs have historically been a bulk, low-priced food item. The ocean quahog fishery has only been viable when large quantities can be harvested quickly and efficiently (Mid-Atlantic Fishery Management Council 2010).

Figure 21. Annual Landings and Catch Limits in the Ocean Quahog Fishery, 1980–2016



Source: Developed using data from National Marine Fisheries Service (2017a); Mid-Atlantic Fishery Management Council (2018a).

There was a shift toward greater utilization of quahog meats in 1997 and 1998. Both years saw almost all of the ocean quahog annual catch limit harvested, while a portion of the surfclam annual catch limit was left unharvested. However, ocean quahog harvests declined in 1999 as fuel prices rose, and combined with an increasing scarcity of ocean quahogs, the focus of harvesters returned to surfclams, which are found closer to shore. A resurgence of interest in ocean quahogs occurred from 2000 to 2003 due to increased prices, a shift by vessels to new, higher-yielding areas, and the entry into the fishery of large, newly constructed vessels with improved efficiency. During the mid-2000s, however, excess supply, together with the poor economic conditions that occurred in both the surfclam and ocean quahog fisheries, resulted in another declining trend, such that a substantial portion of the ocean quahog annual catch limit has been left unharvested (Mid-Atlantic Fishery Management Council 2010; SCS Global Services 2016).

6.3.6 Market Power

6.3.6.1 Concentration of ITQ Quota Share Ownership

Consolidation of ownership of ITQ quota share and the "rationalization" of the fleet were both anticipated and accepted in the development of the SCOQ ITQ program (Christel 2004). As stated in Amendment 8, "Consolidation of allocations on fewer vessels represents tremendous savings for owners of multiple vessels" (Mid-Atlantic Fishery Management Council 1988).

However, during the Council's decade-long debate leading up to SCOQ ITQ program implementation, the issue of ownership concentration was central. The industry long had one or more large players with concentrated harvesting or market power, and the future relationship of these large players to the smaller

players, particularly the independent owners of one or two vessels, was a major question framing negotiations over initial allocations, transfer rules, and other matters (McCay and Brandt 2001).

As described in Section 7.3.1, different formulas were used for the initial allocations of ITQ quota share. For vessels with permits to fish for surfclams in the Mid-Atlantic Area, 80 percent of the surfclam allocation was based on the vessel's reported average historic catch in the qualifying period, and 20 percent was based on a vessel's dimensions, which was a proxy for the owner's capital investment. In both the New England Area surfclam fishery and ocean quahog fishery, the allocation was based solely on average catch during the qualifying years.

Subject to the approval of NMFS, owners of ITQ quota share (i.e., cage tag allocation) may transfer to any person with an ITQ allocation permit all or part of their allocation on a permanent basis or may transfer tags to use on a temporary (annual) basis. Owners of ITQ quota share may harvest surfclam and/or ocean quahog on their own vessel(s) or pay someone else to provide harvesting services.

When the SCOQ ITQ program was implemented, the initial recipients of ITQ quota share were vessel owners who had harvested surfclams and/or ocean quahogs between 1970 and 1988. At that time, the ownership structure in the harvesting sector was highly skewed, with few large and powerful players and numerous smaller ones (McCay and Brandt 2001). Consequently, concentration of ITQ quota share in the surfclam and ocean quahog fisheries at program inception was a result of sizeable initial allocations for a few large firms based on concentration that occurred previous to the program implementation (Environmental Defense Fund 1994). Some of the large firms broke up after implementation of the SCOQ ITQ program, countering this otherwise strong tendency for concentrated ownership. Over the years, however, ITQ quota share has tended to concentrate in the hands of those with the largest shares at the initial allocation (National Research Council 1999; McCay and Brandt 2001).

As discussed in Section 8.3.4, until the applications for ITQ allocation permits and ITQ transfers were revised in 2016, NMFS did not gather sufficient ownership information to determine the identity of the individuals, partnerships, or corporations owning ITQ quota share. However, by working closely with industry members and Council staff to develop a record of "true" ITQ quota share ownership (i.e., ownership that accounts for affiliation among firms), McCay and Brandt (2001) estimated changes in the distribution of surfclam and ocean quahog quota holdings between 1990 and 1999.[6] As shown in Table 7, those firms with the largest allocations in 1990 had generally increased their share of the annual catch limit by 1999. The number of surfclam ITQ quota share owners was reduced by 21 percent between 1990 and 1999, while the percentage of the surfclam allocation held by the top-10 owners increased by 12 percent. The number of ocean quahog ITQ quota share owners declined even more, by 30 percent, while the percentage of the top-10 owners increased by 12 percent. However, the proportion held by the top-3, top-4, and top-5 owners decreased or stayed the same.

[6] Additional information on the creation of the owner database is provided in McCay et al. (1989) and Brandt (2005).

Table 7. Percent of Surfclam and Ocean Quahog ITQ Quota Share Held by Top Owners, 1990 and 1999

	Surfclam ITQ Quota Share					Ocean Quahog ITQ Quota Share				
Year	Top-3	Top-4	Top-5	Top-10	Number of Firms	Top-3	Top-4	Top-5	Top-10	Number of Firms
1990	47.5	51.8	55.0	67.1	57	46.1	50.3	54.4	70.7	43
1991	44.0	49.8	54.8	70.1	47	42.8	48.7	53.8	75.4	36
1992	44.0	49.8	54.8	70.1	48	42.8	48.7	53.8	75.4	37
1993	40.7	48.2	53.6	70.1	47	42.2	47.8	53.2	75.5	35
1994	39.4	48.7	55.2	71.8	45	44.6	51.3	56.9	80.2	32
1995	38.2	47.6	54.0	70.8	45	36.1	44.2	51.0	75.6	31
1996	41.9	49.6	56.0	72.6	45	33.3	41.4	48.2	73.8	31
1997	44.4	50.9	56.1	72.6	45	33.8	41.9	48.8	75.9	30
1998	47.7	53.4	58.6	72.5	47	40.6	47.4	53.1	77.7	31
1999	50.3	55.9	61.1	74.9	45	42.4	48.8	54.4	79.1	30
Percent change 1990-1999	**6**	**8**	**11**	**12**	**-21**	**-8**	**-3**	**0**	**12**	**-30**

Source: McCay and Brandt (2001)

However, an analysis of the distribution of ITQ quota share among firms conducted by NMFS in 2009 concluded that the allocation of ITQ quota share was relatively unconcentrated (National Marine Fisheries Service 2009). Following the same general methodology as McCay and Brandt (2001), NMFS drew quota ownership data from several public and private databases. The analysis relied on the Herfindahl-Hirschman Index (HHI), a commonly accepted measure of market concentration. The calculated HHI of ownership of surfclam ITQ quota share was 1,167, and the HHI of ownership of ocean quahog ITQ quota share was 993. According to U.S. Department of Justice guidelines, the HHI value for surfclam ITQ quota share would be considered mildly concentrated, and the value for ocean quahog ITQ quota share unconcentrated. The Department considers three ranges—an HHI below 1,000 is considered unconcentrated; between 1,000 and 1,800 is considered mildly concentrated; above 1,800 is considered highly concentrated (National Marine Fisheries Service 2009; Mitchell et al. 2011).

6.3.6.2 Concentration of Harvest

Logbook records indicate that a major share of the catch of both surfclams and ocean quahogs was landed by a minor portion of the fleet during the pre-SCOQ ITQ program period. When 1979-1987 catches are totaled by vessel, 34 vessels, or only 22 percent of the fleet, landed half of the surfclams (Table 8). Catch was even more concentrated for quahogs, where 13 vessels, or only 11 percent of the fleet, landed half of the catch (Mid-Atlantic Fishery Management Council 1988). These numbers likely underestimate the level of concentration in the harvesting sector because the number of unique harvesters is smaller than the number of vessels due to multi-vessel ownership.

Table 8. Concentration of Catch in the Surfclam and Ocean Quahog Fisheries, 1979–1987

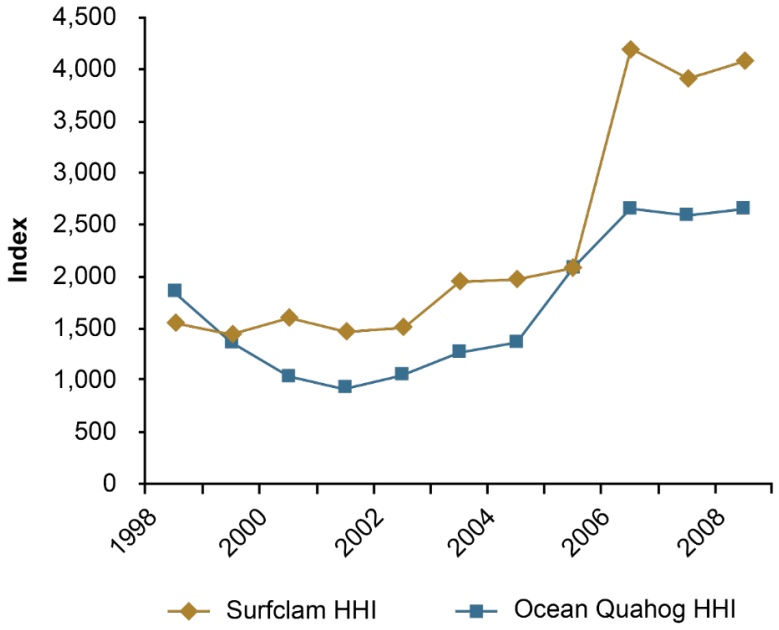
	Surfclam Fishery		Ocean Quahog Fishery	
Percent of Total Catch	Number of Vessels	Percent of Vessels	Number of Vessels	Percent of Vessels
10	4	3	2	2
20	9	6	4	4
30	16	11	7	6
40	24	16	9	8
50	34	22	13	11
60	47	31	17	15
70	61	40	23	20
80	79	52	30	26
90	101	66	41	36
100	152	100	114	100

Source: Mid-Atlantic Fishery Management Council (1988).

The aforementioned analysis conducted by NMFS suggests that catch in the surfclam and ocean quahog fisheries continued to be highly concentrated after SCOQ ITQ program implementation. The analysis found that while the ownership of ITQ quota share is mildly concentrated for surfclam ITQ quota share and unconcentrated for ocean quahog ITQ quota share, the use of quota in the two fisheries is highly concentrated (National Marine Fisheries Service 2009). NMFS conducted the analysis of quota usage by examining records showing the harvest amounts for vessels in the surfclam and ocean quahog fisheries and tracing their ownership. According to these data, 32 vessels owned by 14 firms, harvested surfclams in 2008. The data showed that 18 vessels, owned by nine firms, harvested ocean quahogs in 2008. A total of 17 firms harvested both surfclams and ocean quahogs in 2008.

The HHI of harvesting activity in the surfclam and ocean quahog fisheries estimated by NMFS would be considered highly concentrated based on U.S. Department of Justice guidelines. As shown in Figure 22, NMFS estimated the HHI of harvesting activity for surfclams in 2008 to be 4,080 and the HHI of harvesting activity for ocean quahogs to be 2,653. The HHI of harvesting activity in the surfclam and ocean quahog fisheries combined was 2,890. This was a 43 percent increase for ocean quahogs from 1998 levels, and a 161 percent increase for surfclams from 1998 levels (National Marine Fisheries Service 2009; Mitchell et al. 2011).

Figure 22. Herfindahl-Hirschman Index of Concentration in the Surfclam and Ocean Quahog Harvesting Sector, 1998–2008



Source: Adapted from National Marine Fisheries Service (2009)

Council staff examined the concentration of surfclam and ocean ITQ quota share ownership and use in 2016. Quota acquisition levels were calculated under the cumulative 100 percent model, which means the individual/business that appears as the quota owner, or the individual/business that receives the credits on a leasing transaction, is included in the calculation, and the quota owned or leased accrue over the year. Based on these calculations, maximum ownership interest in surfclam ITQ quota share at the smallest unit possible (i.e., the individual or, if an individual owner could not be identified, the business level) was 28 percent in 2016. However, if leased quota was also included, the maximum quota acquisition increased to 48 percent. For ocean quahog quota share, maximum ownership interest at the smallest unit possible was 22 percent in 2016. However, if leased quota was also included, the maximum quota acquisition increased to 38 percent (Coakley 2018). These calculations do not include additional quota held by unaccounted for family members or corporate officers. More detailed information on ITQ quota share ownership and use is expected to become available as the Council develops the excessive shares amendment to the FMP, as described in Sections 8.3.4 and 8.3.7.

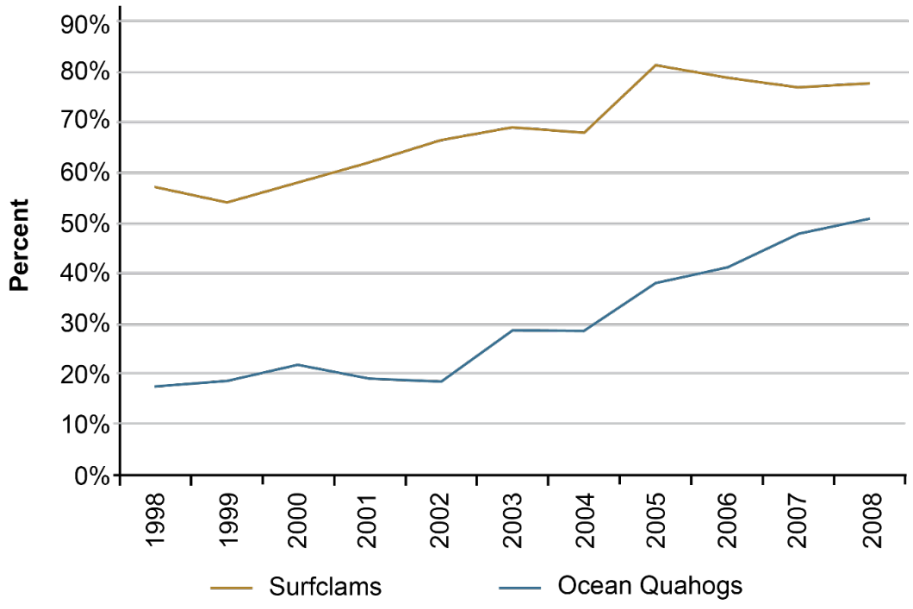
This concentration of harvesting has risen substantially during the SCOQ ITQ program period largely as the result of the backward integration of processors into harvesting and the proliferation of long-term contracts among ITQ quota share owners, vessel owners, and processing firms (McCay and Brandt 2001; Mitchell et al. 2011).

Throughout the history of the surfclam and ocean quahog fisheries, vertically integrated firms have been involved. Some of these were subsidiaries of multinational food corporations with fleets of a dozen or so boats, while others were small rural processing operations with one or two boats of their own. The ability of processors to rely on their own vessels to supply raw product for their plants gave them bargaining power vis à vis the independent vessel owners, which included small-scale owner-operators as well as corporations with sizeable numbers of vessels (McCay and Brandt 2001). Some of these independent vessel owners eventually developed processing operations of their own (McCay and Brandt 2001).

As discussed in Section 6.3.2, some processors amassed large fleets of surfclam vessels during the 1980s to secure the supply of surfclams and to establish a historical record of harvests. With implementation of the SCOQ ITQ program, an industry already marked by the dominance of a few large vertically integrated firms became even more so, as small-holders either sold out or chose to lease out their allocations rather than continue to fish (McCay et al. 2011a).

While some degree of vertical integration has been present in the surfclam and quahog fisheries for decades, the share of surfclam and ocean quahog harvest by processor-owned vessels has steadily increased (Figure 23). The current degree of vertical integration appears to dwarf prior periods in the history of the industry. According to the 2009 analysis conducted by NMFS, in 1998, 57.2 percent of the surfclams were harvested by processor-owned vessels, and by 2008, that total had risen to 77.7 percent. For vessels harvesting ocean quahogs, 17.7 percent was harvested by processor-owned vessels in 1998, and by 2008, the number had risen to 59.9 percent (National Marine Fisheries Service 2009). Recently, Council staff provided an updated estimate of the percent of total surfclam and quahog landings attributable to processor-owned vessels using a combination of NMFS affiliate, permit, logbook, and ownership data, along with other online public information to identify processor-owned vessels. According to this estimate, processor-owned vessels accounted for an average of 80 percent of both the surfclam and ocean quahog harvest during the 2015–2017 period (Coakley 2018). Taken together with the HHI calculation, these results point to a highly concentrated sector for harvest services, with most of the ownership residing with processors. This is due in part to the fact that there are many fewer companies in the industry today, and most of them have investments in vessels, processing capacity, and surfclam or ocean quahog ITQ quota share (National Marine Fisheries Service 2009).

Figure 23. Share of Harvest by Processor-Owned Vessels in the Surfclam and Ocean Quahog Fisheries, 1998–2008



Source: Adapted from Mitchell et al. (2011)

Moreover, surfclam and ocean quahog vessels have historically had strong ties to processing plants because of the nature of the industry. Processors aim to meet the schedules set by their customers, many of which are large consumer goods companies, such as Progresso or Campbell Soup Company, or large food service companies, such as Sysco (Mitchell et al. 2011). A consequence of the need to harvest and process clams

to meet a schedule is that the traditional institutional norm in the fisheries is long-run relationships between processors and harvesters, both in the form of written contracts and mutual understandings (Brandt 2003a).

This connection strengthened following implementation of the SCOQ ITQ program, in part due to industry consolidation following implementation of the program. Further, a vessel must have ITQ quota share at the time it harvests surfclams or ocean quahogs. Therefore, either processors or harvesters must arrange for the quota that a vessel requires before leaving port (Mitchell et al. 2011). It is common for a processor to enter into long-term contracts (five years or more) to lease ITQ quota share, which can then be used on the processor's own vessels, or the processor can negotiate exclusive contracts for harvest services with independent vessel owners (Mitchell et al. 2011). In instances where the vessel owners are responsible for supplying ITQ quota share for the catch, processors may have contracts with these owners that include incentives to encourage exclusive rights to all landings. These incentives may include paying more per bushel at the time of purchase, paying a premium per bushel at the end of the year, offering vessel services (fuel, dockage, gear storage etc.), or arranging for their bank to provide business loans (vessel mortgage, line of credit, etc.) (McCarthy 1992; Ross 1992).

As a result of this increase in vertical integration and in long-term contracts among ITQ quota share owners, vessel owners, and processing firms, processors now have direct or indirect control over the use of the majority of ITQ quota share in the surfclam and ocean quahog fisheries (McCay 2004). Control over such a large amount of ITQ quota share may lead to lower prices paid to independent vessels for their harvest (National Marine Fisheries Service 2009). NMFS examined the possible creation or exercise of oligopsony power through the ownership or contractual control of vessels. The agency found that the mean real price for surfclams declined by approximately 10 percent over the 2002–2008 period, while the mean real price of ocean quahogs declined slightly (roughly 2 percent). These trends by themselves yield no real answers about oligopsony power, but taken together with increasing fuel prices, they do suggest that vessels were likely not improving their economic position during that period (National Marine Fisheries Service 2009).

In addition, large holdings of ITQ quota share by processors, whether amassed through permanent or temporary transfers of ITQ quota share, raises the risk that processors with large quota holdings will be able to withhold quota, thereby raising quota prices. Mitchell et al. (2011) examined the creation or exercise of market power specifically through the ownership or contractual control of ITQ quota share by processors. The researchers report that evidence does not support a conclusion that market power is currently being exercised through withholding of quota in the surfclam and ocean quahog fisheries. In particular, processors note that once it is clear that there will be excess quota available in a season (well before the end of the season, leaving sufficient opportunity to continue to harvest if harvesters and processors deem there to be sufficient demand), the price of quota is very low. This is inconsistent with the exercise of market power based on quota holdings (Mitchell et al. 2011). Moreover, there appears to be ITQ quota share available from unconsolidated quota holders, even after temporary transfers of quota. For example, there are allocations of quota that are unused. This unconsolidated ownership or control of unused ITQ quota share can be a check on the exercise of market power by quota holders, by providing a source of additional quota should large quota holders attempt to withhold quota (Mitchell et al. 2011).

Data on the value of ITQ quota share expressed in short-term ("spot") transaction prices would be helpful to validate claims that quota are not being withheld from the market despite harvests below the annual catch limit (Mitchell et al. 2011). Further, more transparency and reliable data are needed for the ownership, transfers, and contracts for ITQ quota share (Katchova 2011). However, until recently, NMFS collected very little information on quota markets in the SCOQ ITQ program. Under the new ITQ allocation permit application process that became effective on January 1, 2016, NMFS began requesting price data for ITQ quota share transactions, but those data were not available for this review.

6.3.6.3 Concentration of Buyers

Historically, a fairly small number of processors have predominated the surfclam and ocean quahog industry. It is estimated that during the decade before implementation of the SCOQ ITQ program, processors purchasing surfclams and/or ocean quahogs numbered only 12 to 19 firms. Furthermore, the largest processors bought most of the landings, accounting for approximately 58 to 74 percent of the surfclam market (Wang and Tang 1993).

During the late period (1985-1990) under the pre-SCOQ ITQ program management system, the market share of the three largest surfclam processors declined steadily. However, it increased to a high level soon after the program began. The 1992 market share of the three largest processors was approximately 75 percent, the highest it had been since 1986 (Wang 1995). Consolidation on the processing side of the industry during the first years of the SCOQ ITQ program is also reflected by the reduced number of processors that owners of surfclam and ocean quahog vessels sold to (Table 22). In 1983, the overall mean was about 5.0 buyers per vessel; in 1999 it was 2.4, overall. Median data are even lower in 1999, closer to 2.0 for surfclams and 1.0 for ocean quahogs. This trend is also a reflection of increased reliance on long-term contracts (McCay and Brandt 2001).

Table 9. Average Number of Buyers per Vessel Owner in the Surfclam and Ocean Quahog Fisheries, 1983-1999

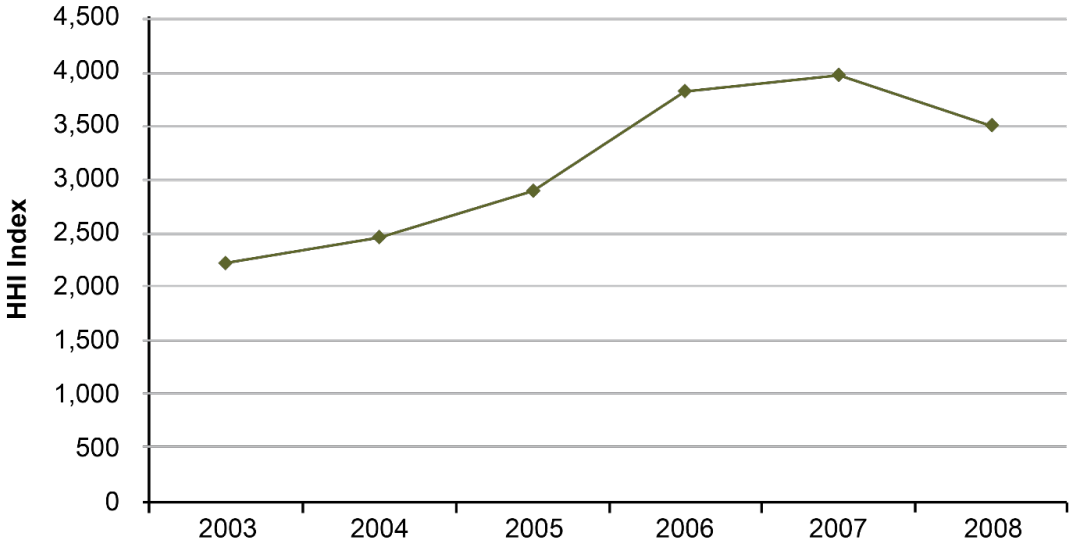
Year	Both	Surfclam	Ocean Quahog
1983	5.0	5.0	5.5
1984	4.8	5.5	5.1
1985	4.3	4.5	4.4
1986	4.3	4.3	4.7
1987	3.8	3.9	4.2
1988	3.7	3.7	3.9
1989	3.7	3.7	3.9
1990	4.0	4.0	4.3
1991	4.2	4.2	4.4
1992	3.4	3.5	3.7
1993	3.0	3.3	3.0
1994	3.4	3.3	3.6
1995	3.4	3.3	3.6
1996	2.6	2.7	2.5
1997	2.8	3.2	2.9
1998	2.3	2.5	1.8
1999	2.4	2.7	1.8

Source: McCay and Brandt (2001)

The previously mentioned HHI and market share analysis conducted by NMFS found that despite a relatively constant number of firms processing either surfclams or ocean quahogs, the concentration of the processing sector grew substantially between 2003 and 2008 as relatively large firms exited or merged and entering firms remained relatively small, allowing incumbent firms' shares to grow (National Marine Fisheries Service 2009). The HHI was calculated using the bushels of surfclams and ocean quahogs purchased by processors. The HHI of surfclam purchases by processors grew from 2,068 to 3,134 between 2003 and 2008, while the HHI of ocean quahog purchases grew from 3,437 to 4,369. As shown in Figure 24, the HHI of processor purchases for surfclams and ocean quahogs combined increased from 2,226 in 2003 to

3,479 in 2008. In 2008, the top four firms in terms of total bushels purchased, processed 85 percent of the surfclam and ocean quahog harvest. This was only slightly lower than the 2003 level of 86 percent (National Marine Fisheries Service 2009).

Figure 24. Herfindahl-Hirschman Index of Concentration in the Surfclam and Ocean Quahog Processing Sector, 1998–2008



Source: Adapted from National Marine Fisheries Service (2009)

However, while HHI calculations provide a helpful index, they are pertinent to the analysis of market power only when based on shares in a relevant market containing all close substitutes of the products of interest (Mitchell et al. 2011). The surfclam and ocean quahog fisheries provide almost the entire supply for domestic, processed clam products, including canned clam chowder, canned minced clams, canned sauces and juices, and breaded products (Brandt 2003b). On the other hand, surfclam and ocean quahog processors do not necessarily sell a final product. As noted above, primary processors typically sell surfclam and ocean quahog meats to large consumer goods companies that conduct additional value adding activities before selling the final consumable product in downstream markets (Weninger 1998). Several processors may be attempting to sell product to the same buyer; therefore, although there are only a few large processors, they may not be able to control their selling price (Mid-Atlantic Fishery Management Council 1988). Further, price increases for surfclam and ocean quahog meats may be constrained by the ability of consumer goods and food service companies to switch supply sources. Imports of other clam species provide a substitute for some uses, and processors report competition from imported clams from a number of countries, including Canada, Vietnam, Thailand, Chile, and others (Mitchell et al. 2011). A more conclusive determination of market power is hampered by a lack of data on substitutability of products and the elasticity of demand in the surfclam and ocean quahog industry (Arnason 2011; Katchova 2011).

6.3.7 Economic Effect of Cost Recovery Program

As discussed in Section 8.3.5, cost recovery provisions for the SCOQ ITQ program became effective July 15, 2016. These provisions are a source of increased costs to the industry. Under the cost recovery program, any ITQ allocation permit holder who has surfclam or ocean quahog ITQ quota share is responsible for paying a fee at the end of the year. The fee is based on the permit holder's surfclam or ocean quahog ITQ

quota share (i.e., cage tag allocation) that year. The fee percentage is based on the total recoverable costs from the prior fiscal year, adjusted for any prior over- or under-collection, divided by the total ex-vessel value of the fishery. As specified by section 304(d)(2)(B) of the MSA, the resulting percentage cannot exceed 3 percent of the ex-vessel value of the surfclams and ocean quahogs harvested. NMFS calculates a per-cage tag fee based on the total number of cage tags used to land surfclams or ocean quahogs in the previous year. This tag fee is separate from, and in addition to, the price ITQ allocation permit holders currently pay to the tag vendor to obtain the physical cage tags each year. If an ITQ allocation permit holder transfers some or all of their ITQ quota share after the start of the fishing year, they are still liable for any cost recovery fee based on landings of the initial allocation of cage tags.

As described in Section 8.3.5, the actual total amount billed to industry in 2017 for management, data collection, and enforcement costs was $21,942 in the surfclam fishery and $19,397 in the ocean quahog fishery. In that year, total gross receipts (ex-vessel value) were $28.96 million in the surfclam fishery (Mid-Atlantic Fishery Management Council 2018b), and $26.93 million in the ocean quahog fishery (Mid-Atlantic Fishery Management Council 2018a). Given these values, cost recovery fees represented less than one-tenth of one percent of the gross revenue in each fishery. The Chief Counsel for Regulation of the U.S. Department of Commerce certified to the Chief Counsel for Advocacy of the Small Business Administration that the cost recovery program would not have a significant economic impact on a substantial number of small entities (81 Fed. Reg. 14072 (March 16, 2016)).

6.3.8 Duration of Catch Privileges

At the time the SCOQ ITQ program was implemented, the Council and NMFS were careful to make clear that they did not consider the program to be forever immutable, nor to create property rights in the sense referred to in the Fifth Amendment's takings clause. The limited property right created by the program existed not to grant exclusive control over the resource to the industry participants who had been using it, but instead to promote economic efficiency in the industry and to make it easier for the government to control the harvest of the resource in a way that ensures its conservation (Marvin 1992).

Until January 1, 2016, an ITQ allocation permit never expired. After that date, ITQ allocation permits became subject to annual renewal requirement. In addition, ITQ allocation permits may be suspended, revoked, or modified by NMFS for violations of the FMP. Early in the SCOQ ITQ program industry members expressed concern that the ability of NMFS to suspend or revoke an ITQ allocation permit could have a negative effect on processors who contract with independent vessels to harvest their ITQ quota share. They argued that the potential for ITQ allocation permit owners to lose their quota through the actions of a contractor or subcontractor could cause financial institutions to stop extending credit for the purchase of ITQ quota share. However, NMFS noted that permit owners can protect themselves by contracting with reputable individuals. In addition, contracts for the harvest of ITQ quota share can provide for reimbursement by the harvester for any liability imposed on the ITQ quota share owner for any violation committed by the harvester (Schmitten 1994).

From the early years of the program, financial institutions demonstrated a willingness to hold ITQ quota share as collateral on a loan to purchase the quota over a long term. In this arrangement, an agreement establishes to whom the financial institution can transfer the ITQ quota share each year. The financial institution retains ownership of the ITQ quota share until the loan has been paid (U.S. General Accounting Office 2002). This arrangement is possible because ITQ quota share ownership is not restricted to individuals who actually do the fishing (Hannesson 2004).

Within a few years of the start of the SCOQ ITQ program, financial institutions became some of the largest holders of ITQ quota share (Schmitten 1994). Some critics of these lending practices complained that “the result of [the SCOQ ITQ program] has been to take the fishing business out of the hands of the fishermen and put it into the hands of bankers” (Kent 1992). Currently, financial institutions continue to be major

holders of ITQ quota share, accounting for about one-fifth of the reported quota owners in the 2017 initial surfclam allocations (National Marine Fisheries Service 2018f).

6.3.9 Costs of Entry

Before the FMP was implemented in 1977, harvesting privileges in the surfclam and ocean quahog fisheries were free and open to anyone willing and able to acquire a vessel to prosecute the fisheries (McCay 2001). With the enactment of a moratorium on new vessel entries in the surfclam fishery, the fishery became the first limited access fishery in the U.S. EEZ (National Research Council 1999). Under the moratorium, access to the surfclam fishery in the Mid-Atlantic Area was contingent on owning one of the original permitted boats or its replacement. There were no restrictions on sale or purchase of these vessels, and capitalized values of moratorium permits were very high, estimated at $50,000, $100,000 and $150,000 [about $104,255, $208,511 and $312,767 in 2017 dollars] for Class 1 (0-50 GRT), Class 2 (50-100 GRT), and Class 3 (100+ GRT) vessels, respectively (Mid-Atlantic Fishery Management Council 1988; National Research Council 1999).

No such eligibility restrictions existed for vessels fishing for surfclams in the New England Area or for vessels harvesting ocean quahogs. Harvesting rights in these fisheries remained free and open, subject to detailed logbook reporting requirements (McCay and Brandt 2001). By 1987, over 1,100 vessels had permits to harvest surfclams in the New England Area, although only nine participated in the fishery in that year. Both the New England Area surfclam fishery and ocean quahog fishery were dominated by vessels with moratorium permits (Mid-Atlantic Fishery Management Council 1988).

The implementation of the SCOQ ITQ program ended the moratorium in 1990. However, some vessel owners had to lease or purchase ITQ quota share from others to harvest enough surfclams or ocean quahogs to be profitable. While this approach was possible if financing was available, small fishing operations without adequate funding often sold out (Beal 1992). During the first years of the SCOQ ITQ program the prices of ITQ quota share were substantial. In the surfclam fishery, leases of quota were reported at $3.00-$4.25 per bushel for surfclams (which were selling for $8.00-$9.00 per bushel) and $0.40-$0.50 per bushel for ocean quahogs (which were selling for $3.00-$3.75 per bushel). These values imply resource rents equal to 30 to 50 percent of surfclam landed value and 10 to 15 percent of ocean quahog value (Townsend 1992).

In addition, as described in Section 7.3.5, the SCOQ ITQ program increased the costs for prospective new entrants, thereby decreasing opportunities for young people, crew, and hired captains to enter the surfclam and ocean quahog fisheries. An early criticism of the program was that the high cost of ITQ quota share restricted new entrants to the fisheries to large corporations or to individuals with substantial assets.

Section 7.3.5 notes that an effort was recently made to facilitate the entry of individuals who lack the assets to purchase quota in the open market. However, that effort was limited in scope and duration. In 2012, in response to requests from the Cape Cod fleet, the Cape Cod Fisheries Trust bought 31,136 bushels of surfclam ITQ quota share to lease to vessels on Cape Cod. At the same time, NMFS developed an exempted fishing permit that would allow harvesters to experiment with different ways of landing surfclams in smaller cages that could be safely stored in the hold or on the deck of a small vessel. The intent of these initiatives was to develop a niche market for surfclams harvested by day-boat vessels on Cape Cod. However, CCFT eventually sold its surfclam ITQ quota share, reportedly due to a combination of decline in interest among potential harvesters and difficulties in finding processors willing to purchase clams fished with the quota.

Section 7.3.5 also notes that the number of new processors entering the surfclam and ocean quahog fisheries since the program began has also been limited. One long standing member of the industry has recently pursued a niche market for specialty clam products rather than attempting to compete with larger processors producing traditional products.

While the barriers for new entrants into the harvesting and processing sectors of the surfclam and ocean quahog fisheries are substantial, there is insufficient information to definitively conclude that these barriers have led to market power being exercised and economic inefficiencies being created. As discussed in Section 6.3.6, the concentration of harvesting has risen substantially during the SCOQ ITQ program period largely as the result of the backward integration of processors into harvesting and the proliferation of long-term contracts among ITQ quota share owners, vessel owners, and processing firms. However, NMFS determined that there was insufficient information to definitively conclude that this concentration has reduced the bargaining power of vessels over ex-vessel prices or ITQ quota share prices (National Marine Fisheries Service 2009; Mitchell et al. 2011). With respect to the processing sector, the concentration of this sector has grown substantially. However, the competition for buyers and availability of imported substitutes suggest that processors are unable to control their selling price.

6.4 Summary of the Effects of the Program

Table 10 provides a listing of the program review questions and summary of the economic effects of the program.

Table 10. Program Review Questions and Summary of Economic Effects of the Program

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
Questions that derive from program goals and objectives (G&Os)			
ECON-1	G&O: 1	Has the program conserved and rebuilt surfclam and ocean quahog resources by stabilizing annual harvest rates throughout the management unit in a way that minimizes short-term economic dislocations?	Surfclam landings have been relatively stable since SCOQ ITQ program implementation. After the population decline off the Delmarva Peninsula due to changing environmental conditions, the surfclam fishery came to depend heavily on the New Jersey region. The reopening of a portion of the Georges Bank region for harvesting of surfclams allowed some relief from fishing pressure in the New Jersey region and helped maintain surfclam harvest levels. The recent downturn in surfclam catches may be due to market constraints. Overall, ocean quahog landings have declined. While there has been no substantial decline in the ocean quahog stock as a whole, there is evidence of substantial biomass decline in heavily fished regions. As with surfclams, catches of ocean quahogs are constrained by market limitations. In addition, with their lower ex-vessel price in comparison to surfclams, ocean quahogs have historically been a bulk, low-priced food item, and the ocean quahog fishery is only viable when large quantities can be harvested quickly and efficiently.
ECON-2	G&O: 3	Has the program promoted economic efficiency by bringing harvest capacity in line with processing and biological capacity?	With few restraints on ownership or transfer of ITQ quota share, the SCOQ ITQ program was extremely effective in rapidly eliminating economically excessive capacity. Harvesters could consolidate their catch onto fewer vessels that could then operate at or near full capacity. A number of vessel owners, including vertically integrated processors, had assembled large fleets during the 1980s, and thus many owners were in a position to withdraw one or more of their vessels from the surfclam fishery to economize. In addition, some vessel owners took advantage of the program to divest themselves of the older vessels they had accumulated during the moratorium, while other owners chose to lease their ITQ quota share to others or to leave the surfclam fishery entirely. A major decrease in fleet size occurred at the onset of the program. The surfclam fleet shrank from 135 vessels to 34 vessels within seven years of program implementation. This represented a 75 percent reduction in fleet size. Less consolidation occurred in the ocean quahog fleet—a 48 percent decrease occurred during that period.

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
ECON-3	G&O: 3	Has the program allowed industry participants to achieve economic efficiency, including efficient utilization of capital resources by the industry?	In the surfclam fishery, productivity adjusted for changes in biomass remained above that of the pre-SCOQ ITQ program base time period (1987-1989) in every year between 1990 and 2012, and it was at least twice that of the base in every year between 1999 and 2012. Under the program, each harvester can use the least cost combination of fishing inputs since they are allocated an exclusive share of the annual catch limit. Vessel owners transferred their ITQ quota share onto fewer vessels, and some less-efficient vessels exited the fishery. Vessel owners with the lowest harvesting costs expanded their catch by buying or leasing ITQ quota share from owners with higher-cost vessels, leading to lower overall harvest costs and more efficient outcomes for industry. Because there were fewer vessels and no restrictions on fishing time, average catch per vessel of both surfclams and ocean quahogs increased markedly after the program began. Unadjusted productivity for the surfclam fishery was above the pre-program base from 1990 to 2007 before dropping below the base during 2009–2012. As exploitable biomass has declined, vessels have had to use more inputs to produce the same output. In addition, an allocation of an exclusive share of the annual catch limit allows vessels to become more profitable by changing their output mix. Similar trends were evident in the ocean quahog fishery, although they were not as pronounced. From 1990 through 1995, unadjusted productivity was nearly identical to that biomass-adjusted productivity because the biomass index was unchanged. Since 1995, the ocean quahog biomass has been declining resulting in an increasing biomass index and a positive trend in biomass-adjusted productivity relative to the pre-program base. Consequently, the divergence between unadjusted and biomass-adjusted productivity has increased. After adjusting the productivity index by the biomass index, there were only four years during the entire time period where productivity was less than the base (1990-1994). The value of 1.82 in year 2012 showed that the fishery was 82 percent more productive in 2012 than in the base time period.
ECON-4	G&O: 4	Has the program created a management approach that is consistent with long-term industry planning and investment needs?	The SCOQ ITQ program eliminated the tightly structured regulations of the effort limitation system, thereby providing vessel owners more flexibility in operating their businesses without government intervention. ITQ quota share can be used during the year for which it was issued, but otherwise ITQ quota shareholders have the ability to harvest their quota when weather and market conditions are favorable. An owner of ITQ quota share (whether obtained by initial allocation or by purchase or lease) does not have to harvest their quota; they may obtain a permitted vessel to harvest their quota, or they may contract for the quota to be caught by any permitted vessel. An ITQ quota share owner interested in getting out of the surfclam or ocean quahog fishery entirely does not now have to find a buyer for their vessel; their quota can simply be sold. In addition, the program allows processors to plan out supplies and work with ITQ quota shareholders to schedule fishing effort when needed. The result is that processors can better control inventory to match market demand
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
ECON-5	KA: D	How has the program as implemented (or as evolved over time) affected technical and economic efficiency for firms operating in the program?	See ECON-3

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
ECON-6	KA: E	Has the program encouraged full utilization of the available ACL, total allowable catch, or quota?	A comparison of utilization of the surfclam and ocean quahog annual catch limits before and after SCOQ ITQ program implementation indicates that the program had little, if any, effect. The level of utilization in both fisheries was mainly constrained by market limitations.
ECON-7	KA: F	How has the program as implemented (or as evolved over time) affected market power in the markets for harvested fish and shellfish, product markets, input markets, and/or markets for limited access privileges?	An analysis conducted by NMFS in 2009 found that while the ownership of ITQ quota share is mildly concentrated for surfclam ITQ quota share and unconcentrated for ocean quahog ITQ quota share, the use of quota is highly concentrated. The concentration of harvesting has risen substantially during the SCOQ ITQ program period largely as the result of the backward integration of processors into harvesting and the proliferation of long-term contracts among ITQ quota share owners, vessel owners, and processing firms. As a result of this increase in vertical integration and in long-term contracts, processors now have direct or indirect control over the use of the majority of ITQ quota share in the surfclam and ocean quahog fisheries. NMFS examined the possibility that control over such a large amount of ITQ quota share is leading to lower prices paid to independent vessels for their harvest. However, the agency determined that there was insufficient information to definitively conclude that oligopsony power is being exercised. In addition, large holdings of ITQ quota share by processors, whether amassed through permanent or temporary transfers of ITQ quota share, raises the risk that processors with large quota holdings can withhold quota, thereby raising quota prices. However, the evidence does not support a conclusion that market power over quota prices is currently being exercised. Historically, a fairly small number of processors have predominated the surfclam and ocean quahog industry. NMFS found that despite a relatively constant number of firms processing either surfclams or ocean quahogs, the concentration of the processing sector grew substantially between 2003 and 2008 as relatively large firms exited or merged and entering firms remained relatively small, allowing incumbent firms' shares to grow. However, surfclam and ocean quahog processors do not necessarily sell a final product. Several processors may be attempting to sell product to the same buyer; therefore, although there are only a few large processors, they may not be able to control their selling price. Further, price increases for surfclam and ocean quahog meats may be constrained by the ability of these buyers to switch to foreign sources of clams.
ECON-8	KA: F	How has the program as implemented (or as evolved over time) affected consolidation?	See ECON-7
ECON-9	KA: F	How has the program changed capacity and overcapacity in the fleet?	See ECON-2
ECON-10	KA: G	What is the current economic effect of cost recovery program fees on fishery participants (e.g., what is the reduction in gross revenue, net revenue, or profits on average per participant?	The total amount billed to industry for 2017 management, data collection, and enforcement costs was $21,942 in the surfclam fishery and $19,397 in the ocean quahog fishery. In that year, total gross receipts (ex-vessel value) were $28.96 million in the surfclam fishery and $26.93 million in the ocean quahog fishery. Given these values, cost recovery fees represented less than one-tenth of one percent of the gross revenue in each fishery. The Chief Counsel for Regulation of the U.S. Department of Commerce certified to the Chief Counsel for Advocacy of the Small Business Administration that the cost recovery program would not have a significant economic impact on a substantial number of small entities.

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
ECON-11	KA: I	What are the economic effects of the current duration of catch privileges, given the program's goals and objectives and other factors (e.g., lending practices of financial institutions)?	At the time the SCOQ ITQ program was implemented, the Council and NMFS were careful to make clear that the limited property right created by the program existed not to grant exclusive control over the resource to the industry participants who had been using it, but instead to promote economic efficiency in the industry and to make it easier for the government to control the harvest of the resource in a way that ensures its conservation. Until January 1, 2016, an ITQ allocation permit never expired. After that date, ITQ allocation permits became subject to annual renewal requirement. In addition, ITQ allocation permits may be suspended, revoked, or modified by NMFS for violations of the FMP. Early in the program industry members expressed concern that the ability of NMFS to suspend or revoke an ITQ allocation permit could have a negative effect on processors who contract with independent vessels to harvest their ITQ quota share. They argued that the potential for ITQ allocation permit owners to lose their quota through the actions of a contractor or subcontractor could cause financial institutions to stop extending credit for the purchase of ITQ quota share. However, NMFS noted that permit owners can protect themselves by contracting with reputable individuals. In addition, contracts for the harvest of ITQ quota share can provide for reimbursement by the harvester for any liability imposed on the ITQ quota share owner for any violation committed by the harvester. From the early years of the program, financial institutions demonstrated a willingness to hold ITQ quota share as collateral on a loan to purchase the quota over a long term. In this arrangement, an agreement establishes to whom the financial institution can transfer the ITQ quota share each year. The financial institution retains ownership of the ITQ quota share until the loan has been paid. This arrangement is possible because ITQ quota share ownership is not restricted to individuals who actually do the fishing.
ECON-12	KA: J	What are the costs of entry into the program? Have entry costs increased to the point where market power is being exercised and economic inefficiencies are being created?	The implementation of the SCOQ ITQ program ended the moratorium on new vessel entries in the surfclam fishery. However, some vessel owners had to lease or purchase ITQ quota share from others to harvest enough surfclams or ocean quahogs to be profitable. While this approach was possible if financing was available, small fishing operations without adequate funding often sold out. Moreover, the high cost of ITQ quota share created an obstacle for prospective new entrants, thereby decreasing opportunities for young people, crew, and hired captains to enter the surfclam and ocean quahog fisheries. Section 7.3.5 notes that in recent years an effort was made to facilitate the entry of individuals who lack the assets to purchase quota in the open market. However, that effort was implemented by the private sector and was limited in scope and duration. The number of new processors entering the surfclam and ocean quahog fisheries since the program began has also been limited. One long standing member of the industry has recently pursued a niche market for specialty clam products rather than attempting to compete with larger processors producing traditional products. While the barriers for new entrants into the harvesting and processing sectors of the surfclam and ocean quahog fisheries are substantial, there is insufficient information to definitively conclude that these barriers have led to market power being exercised and economic inefficiencies being created.
Questions that derive from national standards (NSs) not encompassed by KA questions			
--	--	None applicable.	--

7 Social Context and Effects Analysis

7.1 Questions to be Answered

Table 11 provides a summary of program review questions used to guide the social context and effects analysis. These questions are based on the SCOQ ITQ program goals and objectives, the NMFS Catch Share Review Guidelines, and, where not already encompassed by the provisions of the NMFS Catch Share Review Guidelines, the MSA national standards. The methodological approach used to answer these questions is presented in the Section 7.2.

Table 11. Program Review Questions for the Social/Community Analysis

Question Number	Element Number	Question to be Answered	Section Number
Questions that derive from program goals and objectives (G&Os)			
--	--	None applicable.	--
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
SOC-1	KA: B	Are the program allocations between individuals or entities within the program fair and equitable with respect to community and regional indicators of engagement (consistent with NS 4)?	7.3.1
SOC-2	KA: C	What have been the effects of the program on "historical" participants who were previously but are no longer involved in the fishery or program?	7.3.2
SOC-3	KA: D	What are the impacts of the program's quota share (QS) or quota pounds (QP) transferability provisions on equity, including changes in local and regional patterns of fishery engagement, and the sustained participation of fishing communities in the fishery?	7.3.6
SOC-4	KA: F	What has been the equity/distributional impact of the program's limited access privileges caps (or absence of caps)?	7.3.4
SOC-5	KA: J	Does the program have a QS or QP set-aside for new entrants?	7.3.5
SOC-6	KA: J	Do the transferability rules make it more or less difficult for new entities to participate in the program?	7.3.3
SOC-7	KA: J	Have loan programs been established to help new entities participate in the program, consistent with Section 303A(g) of the MSA?	7.3.5
Questions that derive from national standards (NSs) not encompassed by KA questions			
SOC-8	NS: 8	Has the program provided for the sustained participation of fishing communities?	7.3.6
SOC-9	NS: 10	Has the program promoted safety of human life at sea?	7.3.7

7.2 Methodological Approach

The discussion of social effects of the SCOQ ITQ program includes a qualitative discussion regarding how the distribution of SCOQ fisheries has changed over time with the implementation of the program. A primary source of information on social impacts was the extensive array of journal publications that have investigated various SCOQ ITQ program outcomes. Other primary sources were the environmental reviews prepared for amendments to the surfclam and ocean quahog fisheries FMP. These published information sources were supplemented with information obtained from personal communications with the Council and NMFS Northeast Fisheries Science Center staff; information collected from a limited number of key

person interviews conducted with individuals engaged in the surfclam and ocean quahog fisheries; and fisheries data provided in response to requests submitted to the NMFS Greater Atlantic Regional Fisheries Office. In general, the methodological approach for the social analysis section was to summarize the appropriate fishery information for the pre- and post-implementation periods, and then to use those summaries to develop answers to the program review questions.

7.3 Environment Before and After Program Implementation

Seven issue categories and, where available, associated annual time series data spanning the pre- and post-SCOQ ITQ program periods were used to organize and summarize the information needed to address the nine social analytic questions to be answered as listed in Table 11. These issue categories, each addressed in separate subsections below, are:

- Fair and Equitable Allocations
- Effects on Fishery Participants
- Transferability Rules and New Entrants
- Equity/Distributional Impacts of Absence of Caps
- New Entrants Set-Asides and Loan Programs
- Sustained Participation of Fishing Communities
- Safety of Human Life at Sea

7.3.1 Fair and Equitable Allocations

The Council was considering some form of annual individual transferable allocation system as a substitute for the effort limitation system in the surfclam fishery from the time the FMP was first developed in 1979 (Mid-Atlantic Fishery Management Council 1988). By the mid-1980s, rapid growth in harvesting capacity and resulting inefficiencies in the surfclam fishery accelerated the debate over establishing tradable fishing privileges (Brandt 2003b). The formal negotiations over an annual individual transferable allocation system began with a discussion paper written and circulated by the Council in 1986 (Mid-Atlantic Fishery Management Council 1986b).

From the beginning of these negotiations, it was clear that the initial allocations of fishing privileges in the surfclam fishery would be granted gratis rather than through an auction (Brandt 2003b). However, that left the Council with the difficult task of developing a formula for apportioning shares of the annual catch limits among fishery participants. From the mid-1980s through 1988, Council meetings were dominated by this contentious issue (Creed 1991). The negotiations throughout this entire period focused solely on the surfclam fishery. The addition of the ocean quahog fishery occurred in the final stages of program revisions (Brandt 2003a).

The long period of debate by the Council about the method of initial allocation was fueled by concerns regarding the power relations among different kinds of vessel owners (McCay and Brandt 2001). Within the industry, people distinguish between "independents" and "processors" as the major contrast in types of vessel owners; the processors being vertically integrated firms. Throughout the history of the surfclam and ocean quahog fisheries, vertically integrated firms have been involved. Some of these were subsidiaries of large food corporations with fleets of a dozen or so boats; others a family-owned processor with large fleets; and yet others were small, rural processing operations with one or two boats of their own. Independents are further classified by the number of vessels owned by harvesting firms: small independents own less than three vessels, while large independents own more than two vessels.

The relationship between independent harvesters and processors and, to some extent, between large players and smaller players, was a major question framing negotiations over the initial allocation and transfer rules of an individual allocation system (McCay and Brandt 2001). During the pre-SCOQ ITQ program period, the conflicts between independent harvesters and processors shaped almost every management decision made by the Council. Independent harvesters, especially the smaller operations, were afraid of any change in management that would reduce their bargaining power over price and supply of surfclams and ocean quahogs vis-a-vis the processors. Moreover, with increased vertical integration within the industry, an increasing portion of the annual catch limit could be harvested by vessels owned or closely associated with processors, leaving independent vessels with decreasing opportunities to participate in the fisheries. This became most evident after 1987, when NMFS allowed more flexibility in scheduling trips under the effort limitation system in the surfclam fishery; rather than being assigned trips equally throughout the quarter, a vessel owner could arrange their assigned trips any way they wanted (52 Fed. Reg. 4019 (February 9, 1987)). There were claims that vertically integrated processors were not contracting with independent vessels so that the quarterly catch limits were not reached, thus enabling processors to use their own vessels when additional trips were authorized to make up the shortfall in landings (Mid-Atlantic Fishery Management Council 1988). For their part, processors, with one exception (a firm that had avoided vessel ownership entirely), had an interest in reducing their dependence on the independent harvesters and thus favored any management measure that would enable their own vessels to increase their catches (McCay 1989).

Major processors that owned some of the largest vessels held to the view that allocation should be based on historic performance—the vessels that caught the most in the past should get the largest share of the annual catch limit. Independent harvesters generally argued that vessel size, with or without consideration for historic performance, should be the basis of allocation. This stance reflected the fact that many independent harvesters (and some processor fleets) responded to restrictions in the surfclam fishery by devoting most of their time to the ocean quahog fishery, while maintaining their vessel permits in the surfclam fishery. Plus, it was seen as unfair to reward those with high historic catches because many of these catches were allegedly heavily based on illegally caught, usually undersized, surfclams. Finally, a group of owners of smaller vessels argued that all vessels should have equal shares of the annual catch limit no matter what their size or catch history. Given the extreme overcapacity that existed in the surfclam fishery, they asserted it was unfair to reward those who had invested in an excessive level of capital inputs (e.g., vessel and gear improvements) to maximize their catches within the time constraints of the effort limitation system (McCay 1989).

The difficult task for the Council was to come up with a formula for the surfclam and ocean quahog fisheries that struck a balance between independent harvesters and processors as well as among those who 1) had recently entered the surfclam and ocean quahog fisheries; 2) suffered long breakdowns or loss of markets through no-fault of their own; 3) entered the fisheries for only part of a fishing year; 4) and/or turned a vessel's catch performance around in the past few years. At the same time, the Council did not want to adopt a formula that would unjustly enrich those who had not actively participated in the fishery but sought to capitalize on their moratorium permit (55 Fed. Reg. 24184 (June 14, 1990)).

The allocation method was gradually determined through a participatory process within the Council, although comments recorded in the literature immediately after SCOQ ITQ program implementation suggest a mixed view of how the process actually unfolded (Callout 2).[7] The Council's Surfclam Committee, staff members of the Council and NMFS, and a Plan Development Team held consultations with an Industry

[7] The Social Context and Effects Analysis makes use of callouts to provide key observations, comments, and perspectives captured in the literature at various times following SCOQ ITQ program implementation. This information represents viewpoints and accounts contemporaneous to changes occurring in the surfclam and ocean quahog fisheries as a result of the program and other events.

Advisory Committee during the two years leading up to the Council's adoption of the SCOQ ITQ program in 1989. Council members voted in favor of Amendment 8 to the FMP only when they knew that there was widespread, nearly unanimous, agreement among industry representatives (McCay 2001). Gaining that agreement depended on an approach to the initial allocation that was perceived as equitable. (McCay 2001). In particular, a primary objective of the Council for the initial allocation appears to have been to

Callout 2. Decision-making Process: Perspectives from the Early Program Years

…I feel like we have been railroaded, I think that [SCOQ Committee Chairman] has given an honest effort here. I think [he] listened to industry. [Council] Staff has listened, but they have gone on a tack that has been their own. We have been railroaded. They are not listening to 80 percent to 90 percent of the industry (Processor quoted in Creed (1991)).

What has really happened over the course of many years of working on this, and months and years we have worked primarily at the request of industry. I think that should be emphasized. I think that all of the evidence that I see indicates very clearly that industry has been a real part of the negotiations and the activity. I would also echo…that allocation is necessary and right, but there can't be a real agreement by the industry on how that can be done. Therefore, the question really seems to arise as to who is to do it then? It seems to me that this Council has a real and very definite responsibility (MAFMC member quoted in Creed (1991)).

When we are talking about requirements, we are also talking about being responsive to industry's identified problems. It is necessary at times to differentiate between problems and desires. Certainly, we want to utilize industry's desires where they present an approach that responds to the planning requirements and provides for the most fair and equitable solution to the total industry. We understand that there will be individual problems that we may not be able to address. We have made every attempt to address what fits best for the total (MAFMC Executive Director quoted in Creed (1991)).

reproduce the existing distribution of catch as much as possible. Finding an allocation formula that came close to the status quo was important to gain support for the proposed individual allocation system in the context of widespread industry concern about possible "winners" and "losers" as a consequence of the process (McCay 2001). Section 303(b)(6)(B) of the MSA required the Council to take into account historical fishing practices in, and dependence on, the fisheries when assigning the initial allocation. However, other considerations argued against an allocation based purely on history. In addition to the concerns of industry participants described above, the Council noted that historical data were tied to vessels rather than participants. There had been a great deal of trade in vessels during the pre-SCOQ ITQ program period, so that vessels with high catch histories were not necessarily associated with the harvesters who caught the surfclams (Marvin 1992).

In an attempt to address all the aforementioned issues, the Council elected to make the initial allocation based on vessel history, but with certain modifications. For vessels with permits to fish for surfclams in the Mid-Atlantic Area, which included the vast majority of vessels in the surfclam fishery, 80 percent of the surfclam allocation was based on a vessel's reported historic catch. To take into account historical fishing practices in, and dependence on, the surfclam fishery, catch data as far back as 1979 were used. However, average reported catch was modified to make allowance for vessel breakdowns, loss of markets, and recent entry into the fishery—the last four years were counted twice, and the two worst years were excluded.[8] The

[8] There is an ambiguity in this formula, especially in the regulations, when a vessel's worst two years both fall between 1985 and 1988. There is a question as to whether only one or both of these years are excluded because they are counted double to begin with. See 50 CFR § 652.20(b)(1)(A) (1990). The regulations suggest that only one year's

resulting values were summed and divided by the total catch of all harvesters for the period. The remaining 20 percent of the allocation was based on a vessel's capacity (length x width x depth) as a proxy for investment (Mid-Atlantic Fishery Management Council 1988). This so-called "cost factor" was a key element in coming to agreement, as it addressed concerns of newer participants in the surfclam fishery who had invested in larger (replacement) vessels that did not have strong historical landings, and/or had large vessel mortgages (Creed 1991). By considering both vessel catch history and vessel size, the final allocation formula took into account, to the degree it could, the benefits that vessel owners whose catch histories included substantial illegal catch derived from a history-only allocation scheme, and the windfall that owners of large dormant vessels would receive under a dimensions-only allocation scheme (55 Fed. Reg. 24184 (June 14, 1990)).

Factors determining the allocation formula for the New England Area surfclam fishery and the ocean quahog fishery were the open access nature of the fisheries, the lack of effort restrictions, and the fact that the fisheries started years later than the Mid-Atlantic Area surfclam fishery (55 Fed. Reg. 24184 (June 14, 1990)). In both fisheries the initial allocation was based solely on average catch during the qualifying years (Mid-Atlantic Fishery Management Council 1988).

The data required to determine the initial allocations were historical landings and vessel size. Vessel size information was readily available through NMFS and U.S. Coast Guard registries. Historical landings data were readily available because of the detailed logbook requirements implemented under the initial FMP, which applied to both the surfclam and ocean quahog fisheries (McCay 2001). However, in some cases, records for the determination of historical shares of the catch were complicated by ownership transfers of moratorium permits, including the associated vessels (Mid-Atlantic Fishery Management Council 1988). In addition, some ocean quahog vessel owners claimed that they had not expected an individual allocation system to include the ocean quahog fishery. Consequently, they had not taken care to record their ocean quahog landings accurately, in contrast with surfclam landings, and were therefore disadvantaged (McCay 2001).

The final rule implementing the SCOQ ITQ program became effective on September 30, 1990. Almost immediately lawsuits were filed by groups of harvesters and processors challenging various features of the program, most notably the formula for allocating fishing privileges among fishery participants. The case *Sea Watch International v. Mosbacher*, 762 F. Supp. 370 (D.D.C. 1991) illustrates the major legal challenges to the initial allocation. In general, the plaintiffs in the case argued that the initial allocation was not fair and equitable and therefore in violation of National Standard 4 of the MSA. The arguments of the plaintiffs and the court's decision regarding each of the asserted violations are summarized below:

- The plaintiffs noted that the initial allocation was based on vessel catch histories rather than individual catch histories. Thus, plaintiffs asserted, the assignments ignored the high rate of vessel turnover in the industry, excluding individuals with a substantial catch history who recently sold a vessel, and awarding a "windfall" to individuals with little or no history who recently purchased a vessel. They claimed this result was inherently unfair and inequitable under subsection (A) of National Standard 4.

In rejecting this claim, the court stated: "National Standard 4 does not require that allocations of quotas to fishermen be made by calculating the exact historical catch of each fisherman on an individual basis. …The record supports defendants' claim that vessel catch data ... were the only accurate data available. …Plaintiffs have failed to demonstrate that this use of past histories is irrational, or that it violates the [MSA]."

- The plaintiffs asserted that the initial allocation rewarded fishermen who violated previous regulations in the Mid-Atlantic Area surfclam fishery by fishing longer than allowed. Reportedly,

worth of bad catch is excluded if it is a double-counted year. That, at any rate, is the way the Council calculated the allocation formula when it received the alternatives (Marvin 1992).

even vessel owners who were caught and fined for illegal fishing (e.g., landing undersized surfclams, fishing in closed areas, or fishing outside the allowed times) received credit for the surfclams they had unlawfully caught (McCay 2001).

In rejecting this claim, the court stated: "…it is not clear how adjustments could be made to eliminate the effect of previous violations, many of which…were never detected, and others of which have already been punished." The court also accepted the government's contention that the only way to address the cheating issue was by basing part of a vessel's allocation on its size rather than its catch history.

- The plaintiffs argued that the initial allocation was intended to drive single vessel and small fleet owners out of the surfclam and ocean quahog fisheries. According to the plaintiffs, the transferability of ITQ quota share gave large fleet owners a competitive advantage because they could easily consolidate their allocations onto their largest, most efficient vessels. Moreover, small fishermen could not afford to purchase enough ITQ quota share to run their ships at full capacity and would ultimately be driven out of business.

In rejecting this claim, the court stated: "…it is quite possible that scale economies and transferability of ITQs will produce some consolidation. It is also possible that small fishermen enjoy advantages of their own, and nothing prevents coalitions of small owners from pooling their allocations to obtain efficiencies." The court noted that not all small fishermen would be placed at a disadvantage by the SCOQ ITQ program—some small fishermen may have a substantial catch history which would allow them to operate at or near full capacity, and "…[e]ven where a fisherman with a small allocation decides to exit, transferability of the ITQ provides at least some compensation." The court dismissed the plaintiffs' argument by noting that "[t]here is nothing intentionally invidious or inherently unfair" in the allocation scheme and by citing 50 CFR § 602.14(c)(3)(i), which states that "inherent in an allocation is the advantaging of one group to the detriment of another."

- The plaintiffs claimed that the initial allocation allowed particular individuals, corporations, or other entities to acquire an excessive share of fishing privileges. Plaintiffs alleged that the allocation would concentrate 40 percent of the annual catch quota for the ocean quahog fishery in two fishermen, and that fragmentation of the remaining shares would result in further consolidation as holders of small shares sold their interests, creating an impermissible restraint on competition.

The court noted the 40 percent number "does give pause" but found the MSA has no definition of the term "excessive shares" and that the judgment of NMFS of what is excessive "deserves weight." Further, the court stated, "Even if the raw number measured a true economic market—which is by no means clear—a judgment of undue concentration could not be based on the mere existence of such a share possessed by the two largest participants." With that, the court dismissed the plaintiffs' argument.

Although early court cases ruled that the program is consistent with National Standard 4, Section 8.3.4 notes that in 2015, NMFS determined that the FMP is out of compliance with that national standard because it did not include an excessive share cap. Consequently, the Council is currently developing an FMP amendment to adopt an excessive share regulation

7.3.2 Effects on Fishery Participants

This section describes impacts of the SCOQ ITQ program to the harvesting and processing sectors of the surfclam and ocean quahog fisheries, while taking into account the heterogeneity of the participants in each sector. Impacts of the program to the communities in which these participants are located are described in Section 7.3.6.

Pre-SCOQ ITQ Program Period

7.3.2.1 Vessel Owners

As described in Section 6.3.2, the years before SCOQ ITQ program implementation showed an increase in active vessels as vessel owners competed with each other and against time to catch as much as possible under the quarterly catch limits and effort limitation system and as they sought to build up catch histories in anticipation of implementation of the program. However, Section 6.3.2 further describes how the increasing excess harvesting capacity in the surfclam fishery led to further restrictions on fishing time, so that by the late-1980s vessels were moored for much of the time unless their owners also participated in the ocean quahog fishery or state inshore surfclam fisheries.

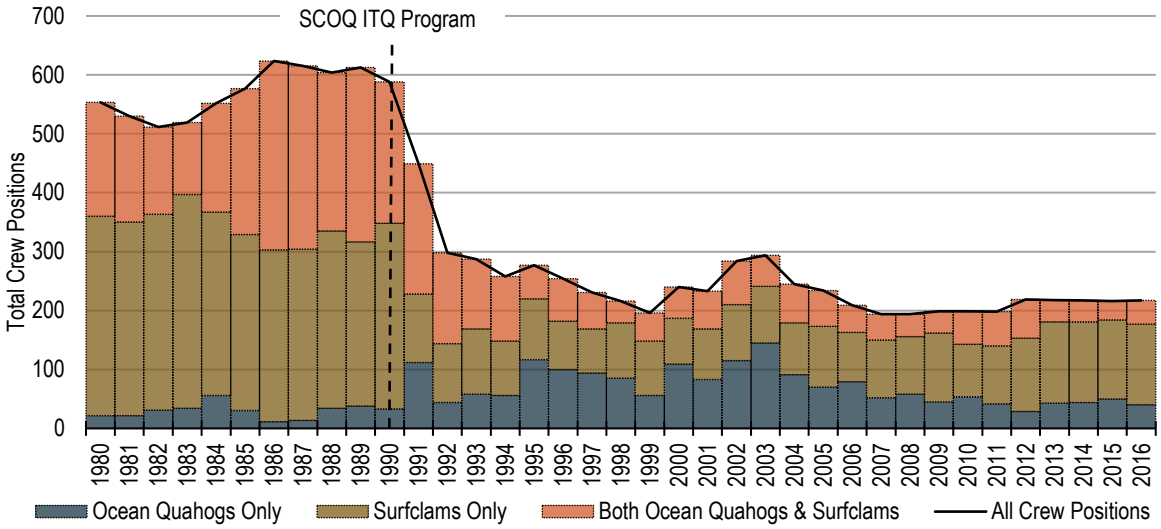
On the other hand, some vessel owners, whose boats were paid for, saw the effort limitation system as a way of working fewer hours while keeping the price of surfclams high, and of eliminating some of the competition from the small independent owners (Valente 1978). Small independent vessel owners were also placed at a disadvantage as a result of the "gold rush" mentality engendered by the effort limitation system (Section 6.3.2). Owners of one or two small (Class 1 and 2) surfclam vessels could not afford the $80,000 to $100,000 to fit their vessels with a second dredge to increase their hourly harvesting capacity. In addition, many of these vessels were too small to safely adopt this "double-rigging." As a result, some small vessel operations were unable to harvest enough surfclams before the quarterly limit was attained to remain economically viable (Mid-Atlantic Fishery Management Council 1979b).

7.3.2.2 Crewmembers

Historically, the fleets participating in the surfclam and ocean quahog fisheries were highly transient, responding to changes in the productivity of clam beds and the locations of processors (National Research Council 1999). Thus, for example, the Atlantic City fleet had little direct connection with Atlantic City—the vessel owners and crew lived primarily in old "baymen" towns such as Absecon and Tuckertown, New Jersey, with some crewmembers commuting as far away as Virginia (National Research Council 1999; McCay and Cieri 2000). For those individuals residing in ports such as Cape May and Wildwood, New Jersey that have economies primarily based on seasonal tourism, commercial fishing was one of the very few year-round occupations (National Research Council 1999).

As noted above, while the number of surfclam vessels with moratorium permits could not change during the pre-SCOQ ITQ program period, the number of active vessels increased. As shown in Figure 25, the result of this increase was an increase in crew employment.

Figure 25. Number of Crew Positions in the Surfclam and Ocean Quahog Fisheries, 1980–2016

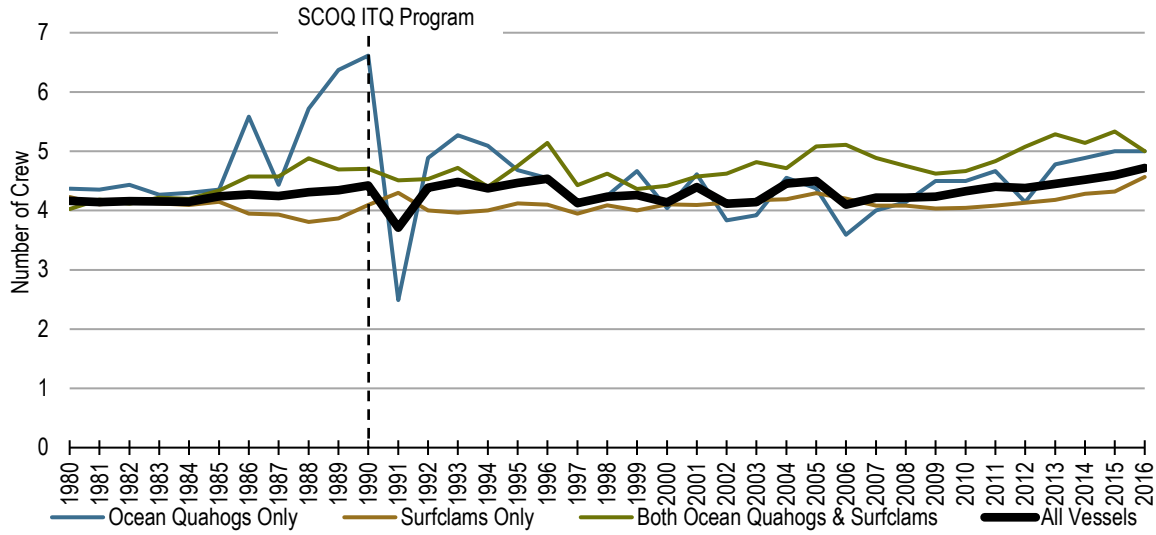


Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

As described above, the effort limitation system in the surfclam fishery resulted in vessels being moored for much of the time unless their owners also participated in the ocean quahog fishery or state inshore surfclam fisheries. Crew recruitment was negatively affected by the long layup periods (Mid-Atlantic Fishery Management Council 1988). Owners of multiple vessels adapted to fishing time restrictions by rotating a single crew among vessels if none were fishing simultaneously. Vessel owners were able to select the more productive, more reliable, and less injury-prone crewmembers (McCay and Creed 1987). The trend of crew consolidation further increased when the price of surfclams dropped in response to a market glut caused by the discovery of surfclams in New York inshore waters in 1986 (Weissmann 1985; McCay and Creed 1987).

While the decrease in crew employment was substantial, it would have been higher had not more surfclam vessels diversified by entering the ocean quahog fishery. In addition to being able to operate without time restrictions, vessels harvesting ocean quahogs had a larger crew size in comparison to vessels that only harvested surfclams, as shown in Figure 26, reflecting the larger size of the vessels (McCay and Creed 1987). However, the ocean quahog fishery alternative was restricted for independent vessels owners since the aforementioned glut in supply of surfclams sharply reduced quahog purchases from these vessels by processors with their own vessels (Mid-Atlantic Fishery Management Council 1988). Moreover, some independent vessels were too small to participate in the ocean quahog fishery. Vessel owners that did not participate in the ocean quahog fishery experienced greater difficulty hiring and retaining good crewmembers because of their fewer total fishing trips (McCay and Creed 1987).

Figure 26. Average Crew Sizes of Active Vessels in the Surfclam and Ocean Quahog Fisheries, 1980–2016



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

Consolidation likely had its most pronounced effects on those individuals employed as hired captains since opportunities for their specialized skills were limited in alternative fisheries. Deckhands were able to move more freely to other fisheries as well as to shoreside occupations, although they likely preferred surfclam and ocean quahog fishing due to the higher wages (Mid-Atlantic Fishery Management Council 1988). Most of the crewmembers of surfclam and ocean quahog vessels were involved in other fisheries, but few of those interviewed in the mid-1980s wished to make a permanent switch. Harvesting surfclams and ocean quahogs was for most crewmembers a highly valued way of life—it was the most remunerative and satisfying of the work opportunities available to them given their levels of education, training, and experience (McCay and Creed 1987).

7.3.2.3 Processors

As described in Section 6.3.6, the initial processors of surfclams and ocean quahogs generally do not sell a final product, but rather produce fresh and frozen shucked meats. These intermediate products are then transported to other plants for further processing. In general, the final products of surfclams and ocean quahogs (canned clam chowder, canned whole and minced clams, canned sauces, canned juices, and breaded products) are manufactured in multi-product food plants owned by large food processors such as Progresso and Campbell Soup Company. The method of raw material acquisition differs among these plants. Some plants produce their own shucked output which is consumed in their own finished product forms. Some of the same plants also offer some of this shucked output for sale to other finished product plants. On the other hand, some finished product plants acquire all of their shucked raw material from those plants that produce only shucked output (Mid-Atlantic Fishery Management Council 1979b).

From 1979 through 1989, the moratorium on new entrants and annual catch limit in the surfclam fishery were supported by a host of other measures, some of which were originally intended to be short-term attempts to stabilize the social and economic aspects of the fishery while the restrictive resource conservation program was carried out (Nicholls 1985). The Council recognized that with the catch limit, it would have to offer present and future security and stability to the existing industry as compensation for the immediate reduction of fishing opportunities. In particular, there was concern that even if a given processor paid a higher price for the catch late in the year, it would be unable to obtain surfclams if other processors

had already bought the entire annual catch limit. Processors would be forced to build up large inventories of finished products during the first part of the year, while lying idle during the last part (Marvin 1992). To even out product input to processors, the annual catch limit for the surfclam fishery was divided in unequal quarterly limits reflecting the expectation that greater fishing activity and harvest would occur from the late spring through early fall (Nicholls 1985).

In addition, NMFS could decrease allowable fishing time per vessel to spread out the catch over each quarter and reduce the likelihood of a fishery closure should a quarterly limit be exceeded. Closure of the fishery was judged a serious problem to be avoided because of the significant economic impact it would have on employees of processing plants, who received low wages and were only paid when work was available (Nicholls 1985).

The exit of some small-boat, independent vessel owners from the surfclam fishery as a result of the effort limitation system had a negative economic impact on the plants that depended on them (Mid-Atlantic Fishery Management Council 1979b). However, the number of surfclam and ocean quahog processing plants in each state remained relatively constant over the 1976-1986 period, with most activity concentrated in New Jersey (Table 12). A small shift from New Jersey to Virginia was evident over this time frame and reflected the slight decline in New Jersey landings from 1978 through 1980. There was about a 20 percent decline in the total number of plants after 1976 until a resurgence of activity in Maine and Massachusetts brought the total back up in 1986 (Mid-Atlantic Fishery Management Council 1988). Due to data confidentiality constraints, it is not possible to disaggregate these data to the community level, or to meaningfully update this table with more recent data. Further, the available data do not report the number of firms operating these plants. Some of the processing facilities were small, independently-owned firms, while others were owned by large national or multinational corporations.

Table 12. Number of Plants Processing Surfclams and/or Ocean Quahogs by State, 1976-1986

										Species Processed		
	MA	RI	NY	NJ	DE	MD	PA	VA	Total	Surfclams Only	Ocean Quahogs Only	Surfclams and Ocean Quahogs
1971	7	5	5	16	3	9	2	7	**55**			
1972	5	5	4	14	3	8	2	8	**50**			
1973	6	3	4	15	3	7	2	6	**47**			
1974	6	4	4	15	3	7	2	7	**49**			
1975	7	6	4	13	3	7	2	7	**50**			
1976	6	4	3	15	3	6	2	8	**48**	45	2	1
1977	5	4	3	13	3	7	3	8	**47**	36	2	9
1978	5	3	3	14	3	6	3	11	**49**		3	12
1979	5	3	3	11	3	6	2	10	**44**	30	3	11
1980	5	3	3	10	3	5	2	10	**42**	21	8	13
1981	6	2	3	10	3	4	1	10	**41**	25	5	11
1982	3	2	3	10	3	5	1	11	**39**	23	4	12
1983	3	3	3	10	3	6	1	11	**41**	24	4	13
1984	2	3	3	10	3	6	1	10	**39**	21	3	15
1985	2	3	3	10	3	6	2	9	**40**	21	4	15
1986	5	4	4	9	3	6	2	9	**46**	27	6	13

Source: Mid-Atlantic Fishery Management Council (1979b; 1988)

Despite the high number of plants processing surfclams and/or ocean quahogs during the pre-SCOQ ITQ program period, most were not high volume. Of the 46 plants processing surfclams or quahogs in 1986, more than half (26) processed less than one percent of the combined total plant output for clams. The proportion of plant revenue attributable to surfclam and ocean quahog processing varied between 41 percent and 68 percent, with signs of an increasing trend (Mid-Atlantic Fishery Management Council 1988).

Post-SCOQ ITQ Program Period

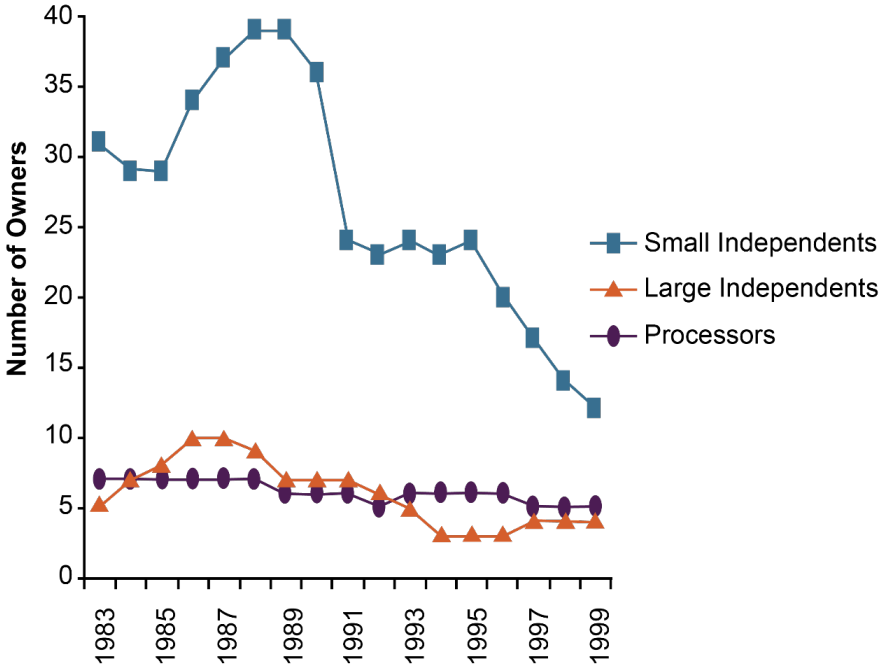
7.3.2.4 Vessel Owners

Vessel Owners in the Surfclam and Ocean Quahog Fisheries

As noted above, at that time of SCOQ ITQ program implementation, the ownership structure in the harvesting sector of the surfclam and ocean quahog fisheries included small independents (firms owning less than three vessels), large independents (firms owning more than two vessels), and processor-owned vessels. To track changes in this ownership structure after SCOQ ITQ program implementation, McCay and Brandt (2001) used an ownership database that mapped the surfclam and ocean quahog vessels actively engaged in harvesting surfclams and/or ocean quahogs onto individual firms.[9] These firms were then characterized as processor-owned, small independents (firms owning less than three vessels), and large independents (firms owning more than two vessels). Figure 27 shows that the number of active independent vessel owners increased during the late 1980s but declined dramatically after the SCOQ ITQ program began. The decline was marked for both small and large independent vessel owners. It is important to note that some of the large independents became small-scale ones by consolidating their ITQ quota share and effort onto one or two vessels, which explains the relative stability of the number of small independent vessel owners between 1992 and 1996. Nevertheless, by the end of the 1990s, proportionately more of the active vessels owners were vertically integrated firms or owners of large fleets of boats—43 percent in 1999 compared with 25 percent in 1989 (McCay and Brandt 2001).

[9] Additional information on the creation of the owner database is provided in McCay et al. (1989) and Brandt (2005).

Figure 27. Number of Active Vessel Owners in the Surfclam and Ocean Quahog Fisheries by Firm Type



Source: Adapted from McCay and Brandt (2001)

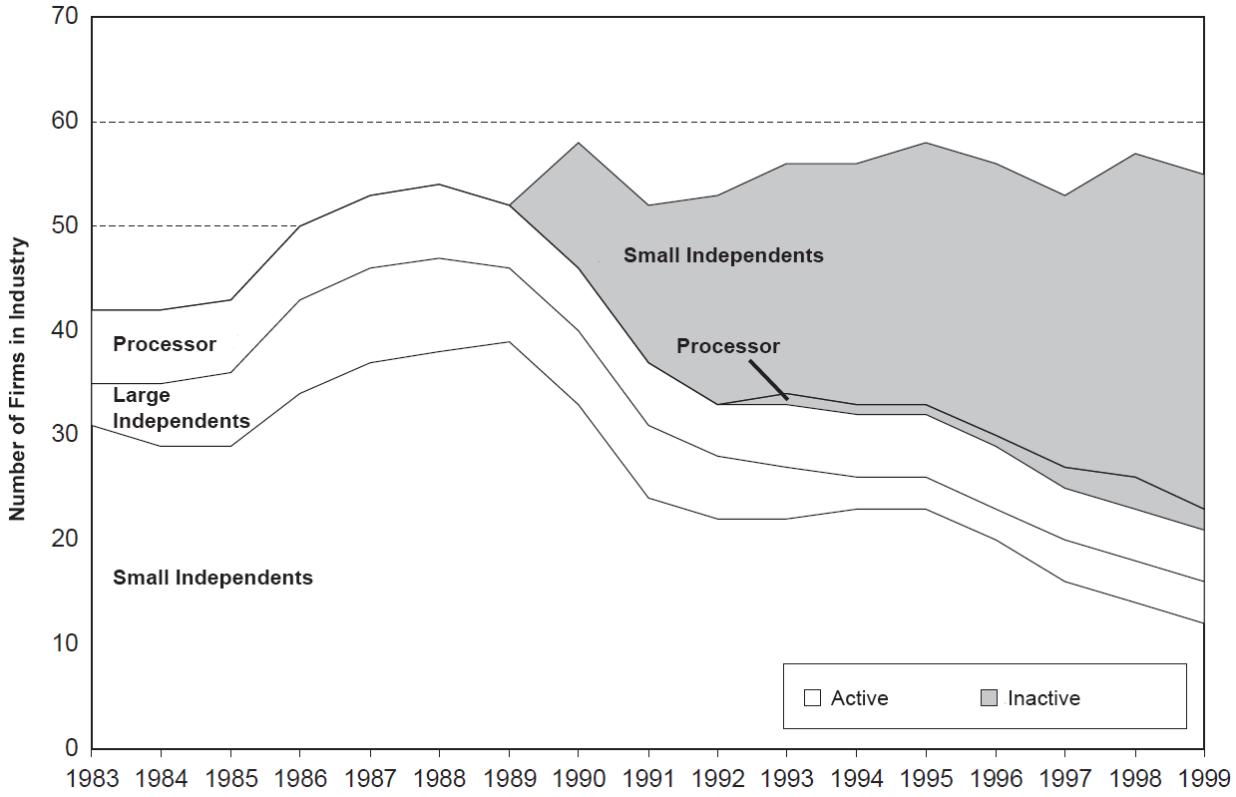
From a social equity perspective, however, it is not only the number of active vessels that is of interest, but also the number of ongoing participants in the surfclam and ocean quahog industry. There are two reasons the change in number of active vessels alone following adoption of the SCOQ ITQ program does not accurately capture the change in participation. First, a significant portion of the reduction in active vessels was due to a decision by independent firms owning large fleets and vertically integrated firms to consolidate harvesting on fewer vessels.

Second, firms owning ITQ quota share that have ceased harvesting but participate in the surfclam and ocean quahog fisheries by leasing their quota are overlooked by a vessel-level analysis. As discussed in Section 7.3.1, during the public hearing process for the SCOQ ITQ program, a common criticism was that independent firms that owned less than three vessels would not receive enough ITQ quota share to support their vessels. Since the industry was grossly overcapitalized and had a stringent annual catch limit, this criticism appears valid (Wallace 1994). However, the program permitted vessels owners to retain ownership of their ITQ quota share even if they terminated harvesting and sold their vessel. Consequently, in contrast to the pre-SCOQ ITQ program management regime, during which vessel owners could participate in the industry only as harvesters, under the program, vessel owners could adopt a new business model where they no longer harvested but instead generated revenue by leasing ITQ quota share to an independent vessel owner continuing to harvest or to a processor (Brandt 2005). Many of those who ceased fishing but remained in the fisheries as lessors owned old and inefficient boats at the time the SCOQ ITQ program began (Milliken 1994). They found that they could receive more money from leasing their ITQ quota share than from running their boats (Hall-Arber 1992).

This change in the way firms participated in the surfclam and ocean quahog fisheries was illustrated by Brandt (2005) using vessel ownership information in the aforementioned database developed by McCay and Brandt (2001). Figure 28 shows the impact of the SCOQ ITQ program on the type of firms in the harvesting sector of the two fisheries. The white area at the bottom of the figure is the number of small independent active harvesters, which increases in the mid-1980s and rapidly declines after 1990. The next layer is the number of active large independents. Above them in the figure are the active vertically integrated

processors. The total number of firms actively harvesting is the total of the three areas. This total showed an upward trend during the pre-SCOQ ITQ program period and a decline after program implementation. However, the total number of both active firms and inactive firms (i.e., firms leasing their allocations), which is represented by the shaded area, remained fairly constant after 1990. The inactive firms consisted mainly of small independents, with a smaller number of processors that owned ITQ quota share but did not harvest. In 1999, the distribution of all firms in the harvesting sector was 80 percent small independents, 7 percent large independents, and 13 percent processors, showing little change from the situation in 1983 (Brandt 2005).

Figure 28. Participation of the Surfclam and Ocean Quahog Fisheries Harvesting Sector by Firm Type, 1983-1999



Source: Adapted from Brandt (2005)

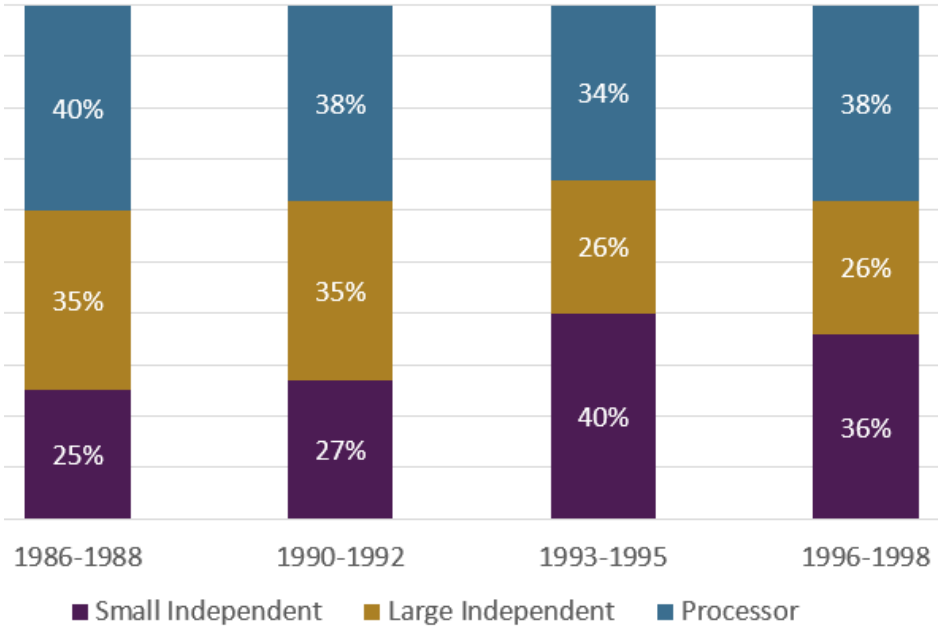
Starting in the late 2000s, some small independent firms that opted to remain in the fisheries as ITQ quota share lessors have found it increasingly difficult to find lessees and/or have been forced to reduce quota lease prices (McCay et al. 2011b). As described in Section 6.3.5, substantial portions of the surfclam and ocean quahog annual catch limits have been left unharvested due to weak or stagnant demand for clam products. The resulting surplus of ITQ quota share has undermined the quota market.

On the other hand, some lessees of ITQ quota share welcome the devaluation of quota. Moreover, a number of interviewed industry representatives expressed resentment that they continue to be obliged to lease quota from former vessel owners and supported some means of limiting the amount of quota that can be held by lease-only participants, allowing only a certain percentage of quota to be leased out, with the rest either having to be caught by the owner or forfeited.

In addition to changes in the way firms participate in the fisheries (as measured by number of active and inactive firms), Brandt (2005) examined how the distribution of harvests across firm types has changed since SCOQ ITQ program implementation. Figure 29 shows that small independent firms increased their share

of harvests under the SCOQ ITQ program. By the 1996–1998 period, the relative position between large and small independent harvesting firms had reversed. During this period, it is estimated that more than two-thirds of all surfclams harvested were taken by vessels that had no financial connection with the ITQ quota share owner (Wallace 1994). They were caught by independent vessels that were contracted to catch the ITQ quota share for a fee. The typical ITQ quota share trade was from the allocation owner to a processor, to an independent vessel owner. The ITQ quota share owner, in many cases, had no idea which vessel was going to catch their allocation (Wallace 1994).

Figure 29. Share of Surfclam Harvest by Vessel Owner Firm Type, Selected Periods



Source: Adapted from Brandt (2005)

More recently, the reduced harvest of surfclam and ocean quahog resources has also placed active small independent vessel owners at a disadvantage—processors are more likely to be able to meet their supply requirements using their own vessels. This difficulty of finding buyers, together with the increasing costs of fuel, insurance, and other fishing inputs (McCay et al. 2011b), forced out more of the small independent firms that had continued to harvest after SCOQ ITQ program implementation. Currently, all but one or two surfclam vessels work exclusively for a single processor, and the majority of vessels are owned or managed by the processors they supply (Interstate Shellfish Sanitation Conference 2018). Many of the active independent ocean quahog vessels are members of the Maine ocean quahog fleet that lease small amounts of ocean quahog ITQ quota share. As discussed in Section 6.3.6, during the 2015–2017 period, independent vessels accounted for only about 12 percent of the surfclam harvest and 12 percent of the ocean quahog harvest.

Vessel Owners in Other Fisheries

After implementation of the SCOQ ITQ program many vessel owners merged harvesting operations or leased their ITQ quota share, leading to a significant reduction in vessel numbers in the surfclam and ocean quahog fisheries. Vessels could use the relative security of their ITQ quota share to facilitate entry into other fisheries in which they had not previously been engaged. However, a number of factors mitigated the possibility of a "spillover effect" in which competition and congestion would occur in non-surfclam and ocean quahog fisheries as a result of the enhanced ability of surfclam and ocean quahog vessel owners to

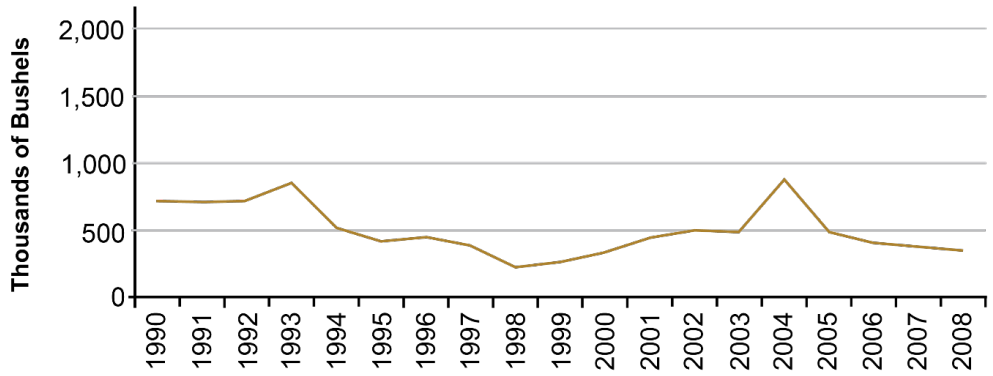
increase their participation in those fisheries. When the program began, the average age of surfclam vessels was high because of the restrictions of the vessel replacement policy. Many of the older boats were unfit to be converted to other fisheries or even sold. As a result, a number of vessels were scrapped (Beal 1992).

In addition, the specialized nature of clamming gear makes outfitting a vessel for the surfclam and ocean quahog fisheries a complex and expensive undertaking (Marvin 1992). This gear cannot be used in other fisheries. As noted by McCarthy (1992), surfclam and ocean quahog vessels "are unique hydraulic dredge rigs, ill-suited to multi-fishery conversion and use." During the development of the SCOQ ITQ program, the Council noted that the allocation of ITQ quota share, together with the elimination of fishing time restrictions, would improve the possibility of engaging in other fisheries since vessels would not have to be re-rigged to utilize their allowable fishing time each quarter; however, it concluded that it is generally difficult to use surfclam and ocean quahog vessels in other fisheries (Mid-Atlantic Fishery Management Council 1988). Creed (1991) noted that the effort limitation system during the pre-SCOQ ITQ program period had induced some surfclam vessel owners to refit their boats for the groundfish or scallop fisheries, but such a refit required a considerable investment in new equipment. Moreover, limited entry and highly restrictive quotas and seasons in most other fisheries limit the alternative of moving a surf clam or ocean quahog vessel into another fishery (Mid-Atlantic Fishery Management Council 2003).

A more pressing concern for the Council during the development of the SCOQ ITQ program was to prevent a spill-over problem due to the transfer of effort from the surfclam fishery to the ocean quahog fishery if the former was managed under an individual allocation system and the latter was not (Tipton 1995; Walden et al. 2014). As discussed above, a surfclam vessel is easily rigged for ocean quahog fishing. Consequently, there was a possibility that the enormous excess harvesting capacity of the surfclam fleet could shift to the ocean quahog fishery once the SCOQ ITQ program was implemented (Marvin 1992). To avert this prospect, the Council chose to include the ocean quahog fishery in the program despite the health and stability of the fishery at the time of implementation.

However, no measures were taken to prevent surfclam vessels from shifting to state inshore surfclam fisheries. There is evidence that such a shift occurred, particularly in the surfclam fishery managed by New York. This fishery started after the discovery of large beds of surfclams in New York inshore waters in 1986 (Weissmann 1985; McCay and Creed 1987). Before the start of the SCOQ ITQ program only about 5 vessels participated in the New York fishery, but there were around 27 vessels in the years immediately following program implementation (Doxsee 1994). Landings from state waters, primarily from New York and New Jersey, increased from 8,100 mt in 1989 to over 11,000 mt during 1992-1993 (Weinberg 2000). This increase in effort and catch likely had a negative economic impact on fishing operations that traditionally fished in the New York fishery (Doxsee 1994). As shown in Figure 30, production from the New York fishery declined after the early 1990s upturn in effort and catch, largely as the result of reduced populations of surfclams (Mitchell et al. 2011).

Figure 30. Annual Harvest in the New York Surfclam Fishery, 1990-2008



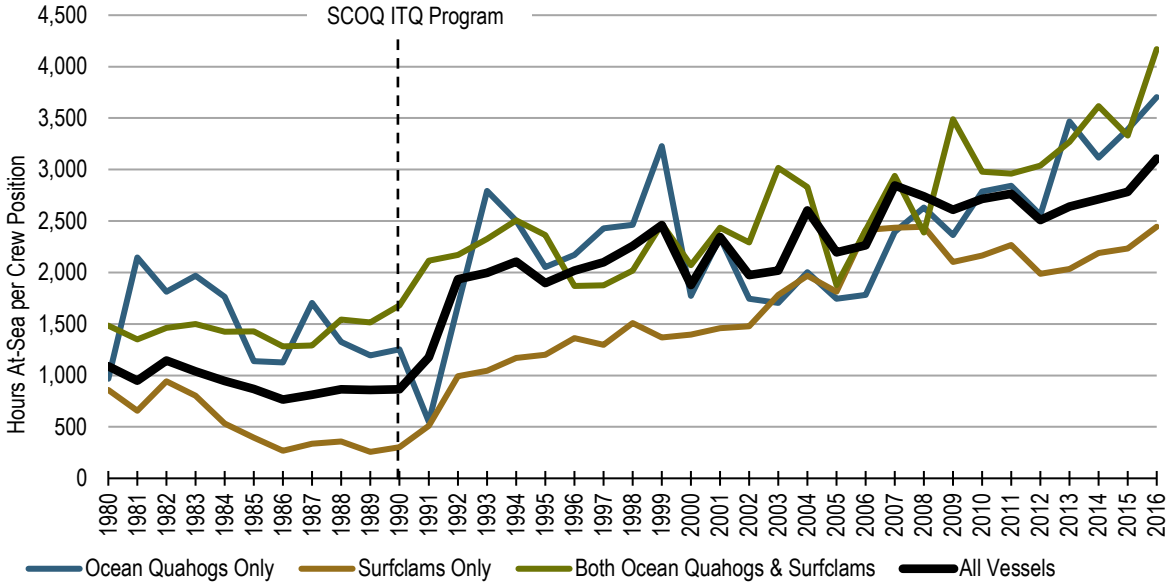
Source: Adapted from Mitchell et al. (2011)

7.3.2.5 Crewmembers

As might be expected from the downsizing of the surfclam and ocean quahog fleets following SCOQ ITQ program implementation, employment opportunities in the fisheries declined. Within seven years of the introduction of the program the number of crew positions in the two fleets fell from around 600 to about 250 (Figure 25). This was less than would be expected by the reduction in the number of boats because some retired vessels were only part-time participants in the fisheries (Schmitten 1994). Nonetheless, the unemployment among crew was considerable, and some vessel owners tried to mitigate the impacts by keeping boats fishing even when not needed (McCay and Brandt 2001). A study of 27 unemployed crewmembers conducted a few years after the program began found that only 6 still worked in commercial fisheries despite efforts to remain in fishing. Ten had found jobs ashore, five were unemployed, and three were retired (McCay and Creed 1994a; cited in Hall-Arber 1992). While fleet consolidation led to more labor becoming available for employment in other industries, substantial economic and social dislocation in the surfclam and ocean quahog fisheries was created in the process (Wang 1995).

As discussed above, during the years leading up to SCOQ ITQ program implementation, most crewmembers were employed part-time, and vessel owners would rotate one crew on to more than one vessel. Once the SCOQ ITQ program was implemented, vessel owners began to more fully utilize the vessels remaining in the fisheries, and the crewmembers who retained their jobs became more fully employed without having to switch vessels (Wallace 1994). The average at-sea hours per crew position on surfclam vessels increased from under 900 hours in 1980 (and from under 300 hours in 1989 under the effort limitation system) to nearly 2,500 hours in 2016 under the SCOQ ITQ program (Figure 31), while crew size per vessel stayed relatively flat (Figure 26). Hiring reliable deckhands continued to be a significant challenge for vessel captains, and in some cases the difficulty was compounded by the prevalence of substance-abuse problems among crewmembers, which was made public in National Transportation Safety Board and U.S. Coast Guard inquiries into the sinking of the ocean quahog boat *Cape Fear* in 1999 (Mid-Atlantic Fishery Management Council 2003).

Figure 31. Average Time at Sea per Crew Position on Active Vessels in the Surfclam and Ocean Quahog Fisheries, 1980–2016



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

Perhaps the hardest hit by the fleet consolidation that followed SCOQ ITQ program implementation were the hired captains who lost their jobs when the fleet was consolidated (Hall-Arber 1992). During the pre-SCOQ ITQ program period, the surfclam and ocean quahog fisheries were heavily dependent on hired captains, as many of the owner-operator vessels had been sold to become parts of large fleets. During the initial allocation process, ITQ quota share was assigned only to vessel owners. Consequently, none of the hired captains received quota, and because a major direct effect of the program was a reduction in the number of vessels in the fisheries, many of these captains lost their jobs (McCay 2001).

Another major social effect of the SCOQ ITQ program was the changes in the share system of returns to vessel owners and crew. A common practice adopted with the introduction of the program was for the vessel owners to deduct the cost of leasing ITQ quota share from the amount that would be shared out. Almost all remaining active vessels leased more ITQ quota share than their owners held; in some cases, the leases were among corporations owned by the same persons or company. In short, the lease price for ITQ quota share became an operating expense similar to the cost of fuel and food, and crew share of catch revenue was reduced accordingly (McCay and Brandt 2001). Vessel owners who had not yet changed their crew's share reported that they felt pressure to do so in order to be able to sell their catch at prices competitive with the owners who lowered their crew's share (Hall-Arber 1992).

This deduction of the cost of leasing ITQ quota share might be done even if the vessel owner actually owned the quota. For example, vessel owners may lease out their own quota and base their operations on shares leased from others to legitimize the deduction of leasing costs (Hannesson 2004). Other vessel owners may transfer the ITQ quota share to a processor and lease it back to improve corporate profits for tax purposes. Depending on use of general accounting practices for income tax determination, the money used to "lease" an allocation may be taxed differently from the vessel "owned" allocation (Goodale and Raizin 1992; Ross 1992).

The reduction of vessels and concomitant decrease in the demand for labor also led to a decline in the bargaining power of crewmembers (Hannesson 2004), which in turn led to a decline in crew compensation.

As McCay and Creed (1994a; cited in Hannesson (2004)) noted: "Given newly redundant labor with the layoffs, owners did not have to provide [any] rewards to keep crew." Moreover, the social distance between vessel owners and crew increased with the introduction of the SCOQ ITQ program. Many owners had been deckhands and captains themselves, working their way to vessel ownership. With the advent of the program, some of them, particularly those who had established sizeable fleets before the initial allocation of ITQ quota share, became wealthy from their new quota assets. After program implementation, prospects for working one's way up to become a vessel owner diminished, given the large cost of owning or leasing the ITQ quota share needed to participate in the surfclam or ocean quahog fisheries (McCay and Brandt 2001).

7.3.2.6 Processors

After the SCOQ ITQ program began, the number of processors of surfclams and ocean quahogs declined. Some small, independently-owned processors that did not receive substantial initial allocations of ITQ quota share (because they had few or no vessels) had difficulty getting financing to purchase additional quota and left the industry (McCay and Brandt 2001). The difficulty these processors faced is captured in comments recorded in the literature (Callout 3).

Callout 3. Small, Independent Processors: A Perspective from the Early Program Years

When [the SCOQ ITQ program] was implemented, only one processor advocated this, and they stood to gain great allocations through vessels they owned. Most of the fishermen opposed this plan, and I am going to feel better after I tell you that this was crammed down our throats… And how has that affected my business? My cost of ocean quahogs is up by a third. My cost of surfclams is up better than 50 percent. I am getting squeezed out of the EEZ clams. I can't buy them from the good suppliers that I have had over the years because of leveraging schemes by big corporations that come in and have the assets to buy the ITQs. I am being forced to use lower quality clams and go further to get them. The quality of my product, and that is the way I built my business, is not what it ought to be.

And what has happened to my competitors? Well, the one processor that I told you was in favor of this has sold out and is gone. They are not even in the business anymore. And when they sold out their quota, all the big manufacturers (or other players that had money) were in danger of losing their supply. They were in danger of people coming in and buying their quota. So they said we better go out and buy these ITQs or we are going to be out of business. The problem is that an independent processor like myself cannot go out and borrow the money to do it. Large corporations are the only ones that I am aware of that have been able to finance either directly or through loans that let people come in and buy these ITQs and then use them as leverage… Now, the cost of ITQs to me as an independent processor is just ridiculous. It would cost me one and a half to two and a half times my annual gross sales just to go out and buy the right to buy or get the clams that I need… A bank won't lend me 10 cents to buy allocation. A competitor who has money can come in and buy the allocation, go to one of my fishermen who has been fishing for me for years, and the man has ITQ to fish for 6 months of each year and he is out of ITQ. They would go to him and they say, "I will tell you what, Joe. You fish your ITQ, and you sell it to me, and I will let you fish an equal number of my tags, and you can fish your boat all year." Gentlemen, that is not a very hard decision to make at all. I know what I would do… I am here to tell you that ITQs in the surfclam industry won't work. The way they have been implemented in this surfclam industry is not right. It is going to lead to bigger businesses, and vertically integrated players and contract vessels (Testimony of owner of independently-owned processor presented in U.S. Congress (1994)).

In contrast, processors owned by large national or multinational corporations with strong financial backing were able to buy or lease ITQ quota share and contract with independent vessels to harvest the quota, giving them greater access to the surfclam and ocean quahog resources (U.S. Congress 1994). Small

independent vessel owners who were unable to fish their limited ITQ quota share economically were forced to switch and fish for these processors, as they could offer them additional ITQ quota share (Gordon 1994). Large processors also acquired greater control of supply of raw product for their plants by becoming more vertically integrated. As described in Section 6.3.6, some degree of vertical integration has been present in the surfclam and quahog fisheries since their inception, but the share of surfclam and ocean quahog harvest by processor-owned vessels has steadily increased in recent years. Section 6.3.6 notes that as a result of this increased backward integration of processors into harvesting, together with the proliferation of long-term contracts among ITQ quota share owners, processing firms, and vessel owners, processors now have direct or indirect control over the use of the majority of all ITQ quota share. In 2009, there were only 10 companies reporting purchases of surfclams and/or ocean quahogs (National Marine Fisheries Service 2010a). The 12 processing plants operated by these companies are listed in Table 13. By 2016, the number of companies had dropped to nine (Mid-Atlantic Fishery Management Council 2017b).

Table 13. Surfclam/Ocean Quahog Processing Facilities, 2009

	Processing facility	Species processed
Massachusetts	Blount Seafood Corporation (Fall River)	Surfclams and ocean quahogs
	Fair Tide Shellfish (New Bedford)	Surfclams only; hand-shucked
	Intershell Seafood (Gloucester)	Surfclams only
	Sea Watch International (New Bedford)	Surfclams and ocean quahogs
	Harbor Blue Seafood (Fairhaven)	Offloading of surfclams only – no processing
Rhode Island	Blount Seafood Corporation (Warren)	Surfclams and ocean quahogs
	Galilean Seafoods (Bristol) - Owned by Atlantic Cape Fisheries	Surfclams only; hand-shucked
New Jersey	Atlantic Capes Fisheries (Point Pleasant Beach) - Offices in Cape May	Surfclams only; hand-shucked
	LaMonica Fine Foods (Millville)	Surfclams only; hand-shucked
	Surfside Products (Port Norris)	Primarily ocean quahogs, some surfclams
Delaware	Sea Watch International (Milford)	Surfclams and ocean quahogs
Maryland	Sea Watch International (Easton)	Secondary processing
Virginia	J. H. Miles & Company (Norfolk)	Surfclams and ocean quahogs

Source: National Marine Fisheries Service (2010a)

Other factors unrelated to the SCOQ ITQ program also contributed to the contraction of the processing sector, including decreases in resource availability, stricter wastewater discharge regulations, formerly industrial neighborhoods on the waterfront becoming gentrified, and depressed markets for surfclam and ocean quahog products. In some cases, plants did not completely close due to these factors but instead shifted their production focus. The impacts of factors exogenous to the program on both the processing and harvesting sectors of the surfclam and ocean quahog fisheries, and on the communities in which these sectors operate, are described in Section 7.3.6.

7.3.3 Transferability Rules and New Entrants

The ITQ quota share transferability rules of the SCOQ ITQ program facilitate the entry of new entities into the surfclam and ocean quahog fisheries. There are few restrictions on the transfer of ownership of either ITQ allocation permits or the annual allocations of ITQ quota share (cage tags). The original owners of ITQ

allocation permits and ITQ quota share were owners of permitted vessels in the surfclam and/or ocean quahog fisheries. Thereafter, any entity that meets requirements for owning a U.S. Coast Guard documented fishing vessel is eligible to own ITQ quota share. Initially, an allocation could not be transferred in amounts less than 160 bushels (i.e., 5 cages), but Amendment 13 to the FMP eliminated this restriction in 2004. There is no maximum amount that can be transferred, nor is there any limit on the percentage of the total ITQ quota share that can be held by one person. Quota can be transferred only within a given year and cannot be transferred between 15 October and 31 December of any year.

All transfers, whether permanent sales of ITQ quota share or temporary transfers of the annual allocations (i.e., leasing of ITQ quota share), must be approved by NMFS for monitoring and enforcement purposes. Under the new ITQ allocation permit application process that became effective on January 1, 2016, a transfer is not complete until the new owner receives an ITQ allocation permit from NMFS. The ITQ quota share transfer form is designed to be simple and easy to complete, thus saving time for both industry and NMFS (National Marine Fisheries Service 2005).

The ease of transferring ITQ quota share is evidenced by the large amount of ITQ quota share transferred each year. For example, Council staff estimated that in 2016, 41 percent of the surfclam ITQ quota share and 26 percent of the ocean quahogs ITQ quota share was temporarily transferred (Coakley 2018). These transactions included myriad types of transfers between entities, including transfers 1) between industry entities through short- and long-term contracts; 2) between financial institutions holding ITQ quota share as collateral and industry entities; and 3) between related industry entities (e.g., transfers within a company or between different entities owned by the same company).

However, transfers of ITQ quota share to new entrants appear to be limited. As discussed in Section 7.3.5, the industrial scale of the fisheries has long posed an economic barrier to entry for new entrant, and the cost of acquiring ITQ quota share after implementation of the SCOQ ITQ program created an additional obstacle. Only relatively recently was a program implemented that set aside ITQ quota share for new entrants who lack the assets to purchase quota in the open market. That program was implemented by the private sector and was limited in scope and duration.

Initially, some industry participants tried to create a niche for brokers of allocations to further facilitate ITQ quota share transfers. However, a brokerage sector never fully developed, and transfers of ITQ quota share have been dominated by bilateral transactions between ITQ quota share owners and lessees (Brandt 2005). Moreover, until recently, NMFS collected very little information on quota transfers and markets in the SCOQ ITQ program, and price information on ITQ quota share is not publicly available. Holland et al. (2015) suggest that a failure to mandate reporting of prices from quota transactions generally results in a shortage of reliable price information, which in turn undermines market efficiency and other benefits that could be realized with good, publicly-available price information. Under the new ITQ allocation permit application process that became effective on January 1, 2016, NMFS began collecting price data for ITQ quota share transactions, but those data were not available for this review.

7.3.4 Equity/Distributional Impacts of Absence of Caps

As discussed in Section 7.3.1, during the development of an annual individual transferable allocation system the Council engaged in an extended debate about regulations concerning transfer of ITQ quota share. Section 8.3.4 describes how the SCOQ ITQ program addressed MSA requirements to prevent an individual, partnership, or corporation from acquiring an excessive share of fishing privileges. As described above in Section 7.3.3, the program allows individual allocations of both surfclams and ocean quahogs to be traded freely and placed no limits on the amount of ITQ quota share an individual, partnership, or corporation could hold.

Immediately following SCOQ ITQ program implementation, some industry members continued to express concern that a few major firms would be able to acquire a controlling percentage of the surfclam and/or ocean quahog allocations. For example, the following excerpt is from a report prepared by Ross (1992), in which program issues identified by processors were summarized:

> The number one concern from processors, large and small, was "control" of a majority of the clam allocation by one major processor. The issue of control verses ownership is important here. Many vessel owners do not own enough allocation to profitably run their business without acquiring (leasing/renting) more from allocation holders with excess. Processors with allocations can rent/lease their allocation in exchange for exclusive rights to all landings by a given vessel owner—in effect the vessel becomes a company-controlled vessel. To ensure consistent supply, processors without allocations have to use other incentives to encourage exclusive rights to all landings (p. 2).

These industry concerns appear to have been well-founded, although perhaps overstated to some extent. As described in Section 6.3.6, an analysis conducted by NMFS of concentration in the harvesting sector after SCOQ ITQ program implementation found that the ownership of ITQ quota share is mildly concentrated for surfclam ITQ quota share and unconcentrated for ocean quahog ITQ quota share. However, the NMFS analysis concluded that the use of ITQ quota share in both the surfclam and ocean quahog fisheries is highly concentrated. Section 6.3.6 notes that as a result of the backward integration of processors into harvesting, together with the proliferation of long-term contracts among ITQ quota share owners, processing firms, and vessel owners, processors now have direct or indirect control over the use of the majority of ITQ quota share in the two fisheries.

As further noted in Section 6.3.6, in 2015, NMFS determined that the FMP is out of compliance with National Standard 4 and Section 303A(c)(5)(D) of the MSA because it did not include an excessive share cap, and the Council is currently developing an FMP amendment to adopt an excessive share regulation.

7.3.5 New Entrants Set-Asides and Loan Programs

According to interviewed industry representatives, the industrial scale of the fisheries has long posed an economic barrier to entry for new entrants to the surfclam and ocean quahog fisheries. Vessels and fishing gear are expensive, and it can be difficult to find buyers, especially when the product market is tight. The cost of acquiring ITQ quota share after implementation of the SCOQ ITQ program created an additional obstacle. An early criticism of the SCOQ ITQ program was that it increased the costs for new entrants without initial allocations, thereby decreasing opportunities for young people, crewmembers (including hired captains), and others to become vessel owners (McCay 2004). These criticisms are captured in comments recorded in the literature from the mid-1990s (Callout 4).

Callout 4. New Entrants: A Perspective from the Early Program Years

While [the SCOQ ITQ program] has reduced over-capitalization in the harvesting segment, it has become almost impossible for an individual to follow the American dream by starting out as a crew member, learning and working his way through mate to captain, and eventually buying his own vessel and becoming an "independent fisherman."… Before Amendment 8, an individual could have purchased a high quality, fully licensed fishing vessel at a cost in the neighborhood of $750,000 to $1,000,000. This was a bankable purchase [i.e., financing was available through normal commercial sources]*. An aggressive fisherman could then harvest in the neighborhood of 35,000 bushels of surfclams and 150,000 bushels of quahogs, and properly managed would have a "doable deal." Under today's system, in addition to the boat, an owner would have to purchase* [ITQ quota share] *at a cost in the neighborhood of $2,500,000. Currently, this is not a bankable purchase. It, therefore, restricts new entrants to the industry to large corporations or to individuals with substantial assets* (Gordon 1994)

Only relatively recently was a program implemented that set aside ITQ quota share for new entrants who lack the assets to purchase quota in the open market, and that program was limited in scope and duration. The program was administered by the Cape Cod Fisheries Trust (CCFT), which is part of the Cape Cod Commercial Fishermen's Alliance. CCFT is a non-profit permit bank designed to provide quota at reasonable rates in order to stabilize local fishing fleets.

At one time, surfclams provided a significant amount of income for Cape Cod, Massachusetts fishermen. By 2000, however, no surfclam ITQ quota share was owned on Cape Cod (Cape Cod Commercial Fishermen's Alliance 2013). In 2012, in response to requests from the Cape Cod fleet, the CCFT bought 31,136 bushels of surfclam ITQ quota share to lease to local vessels. However, it quickly became apparent that operating in the surfclam fishery using the standard 32-bushel cages presented significant safety hazards for some boats. Current regulations require that all surfclams be landed in a 60-square foot cage. This poses an obstacle to small, "day-boat" vessels, as the metal cages are too large to be safely stored in the hold or on deck. Small-boat owners addressed this issue by waiting until they returned to the dock before offloading their harvests into cages. However, the handling both on board and at the dock, together with the compression of bottom clams by the weight of those above in the cage, could lead to shells breaking and a lower quality product.

In light of these concerns, the Cape cod fleet, CCFT, and NMFS collaborated to develop a study to experiment with different size containers to store surfclams. In 2013, NMFS granted an exempted fishing permit to CCFT that allowed the use of alternative landing containers and tag protocols to support a niche market for surfclams harvested by local small vessels. Surfclams landed under this permit were low-volume but high-quality, and they provided access to new market opportunities, such as live and sushi-grade clams. The lower volume could be made up for by the higher price. The research conducted under the exempted fishing permit was performed in federal waters surrounding Nantucket Island. The ultimate objective of the permit was to support the efforts of Cape Cod vessel owners to diversify and strengthen their businesses and eventually purchase ITQ quota share of their own (Cape Cod Commercial Fishermen's Alliance 2013; National Marine Fisheries Service 2013d).

Although CCFT did not own sufficient surfclam ITQ quota share to support a full-time surfclam vessel, five or six different vessels acquired some quota through the leasing program (Parker 2019; Rolbein 2019). However, CCFT eventually sold its surfclam ITQ quota share to another entity on Cape Cod. Reported problems included difficulties in finding processors willing to purchase surfclams fished with the quota and a decline in interest among potential surfclam harvesters, due, at least in part, to depletion of fishing grounds closer to shore that are accessible to small-boat operations (Parker 2019; Rolbein 2019). The exempted

fishing permit issued to CCFT that allowed the use of alternative landing containers and tag protocols was not renewed in 2016.

The number of new processors entering the surfclam and ocean quahog fisheries since the SCOQ ITQ program began has also been limited. Possible barriers to entry include market uncertainty; the large capital investment involved, especially if automatic shucking machines are used; strict government wastewater discharge standards for facilities that hand-shuck clams; difficulty in acquiring distributor and supplier agreements; and the cost of creating a competing brand. One relatively new entrant is Nantucket Sound Seafood, which started processing surfclams in early 2014. The company owner had previously been participating in the harvesting sector, and he became involved in processing to secure a stable market for his catch. The company is vertically integrated, with all surfclams processed at the plant supplied by company-owned vessels. The plant's vessels use surfclam ITQ quota share owned by the plant owner and quota leased from other quota holders, including quota formerly owned by CCFT. Rather than competing with larger processors, Nantucket Sound Seafood has pursued a niche market for specialty products such as live clams, together with a market for higher-quality traditional products such as clam strips (Rencurrel 2018).

7.3.6 Sustained Participation of Fishing Communities

National Standard 8 of the MSA requires an FMP to take into account the importance of fishery resources to fishing communities in order to provide for the sustained participation of such communities, and to the extent practicable, minimize adverse economic impacts on such communities (Sec. 301(a)(8)). The term "fishing community'" means a community that is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities (Sec. 3(17)). This section identifies fishing communities that were potentially affected by implementation of SCOQ ITQ program, and then assesses their differing levels of dependence on and engagement in the surfclam and ocean quahog fisheries over the years, consistent with National Standard 8 analysis guidance (Sec. 600.345(c)(3)).[10] Determining the extent to which the program influenced local and regional patterns of engagement in the two fisheries is made complicated by the influence of concurrent factors unrelated to the program. This section discusses a number of these factors, including changes in resource availability, wastewater discharge regulations, demographics and economic development, markets for surfclam and ocean quahog products, and economic conditions in other fisheries. In addition, this section describes the social factors that affect a community's capacity to respond to the compounding effect of external forces of change.

As described in Section 6.3.6., the initial processors of surfclams and ocean quahogs generally do not sell a final product, but rather produce fresh and frozen shucked meats. These intermediate products are then transported to multi-product food plants in other communities for further processing into a variety of finished product forms, including canned clam chowder, canned whole and minced clams, canned sauces,

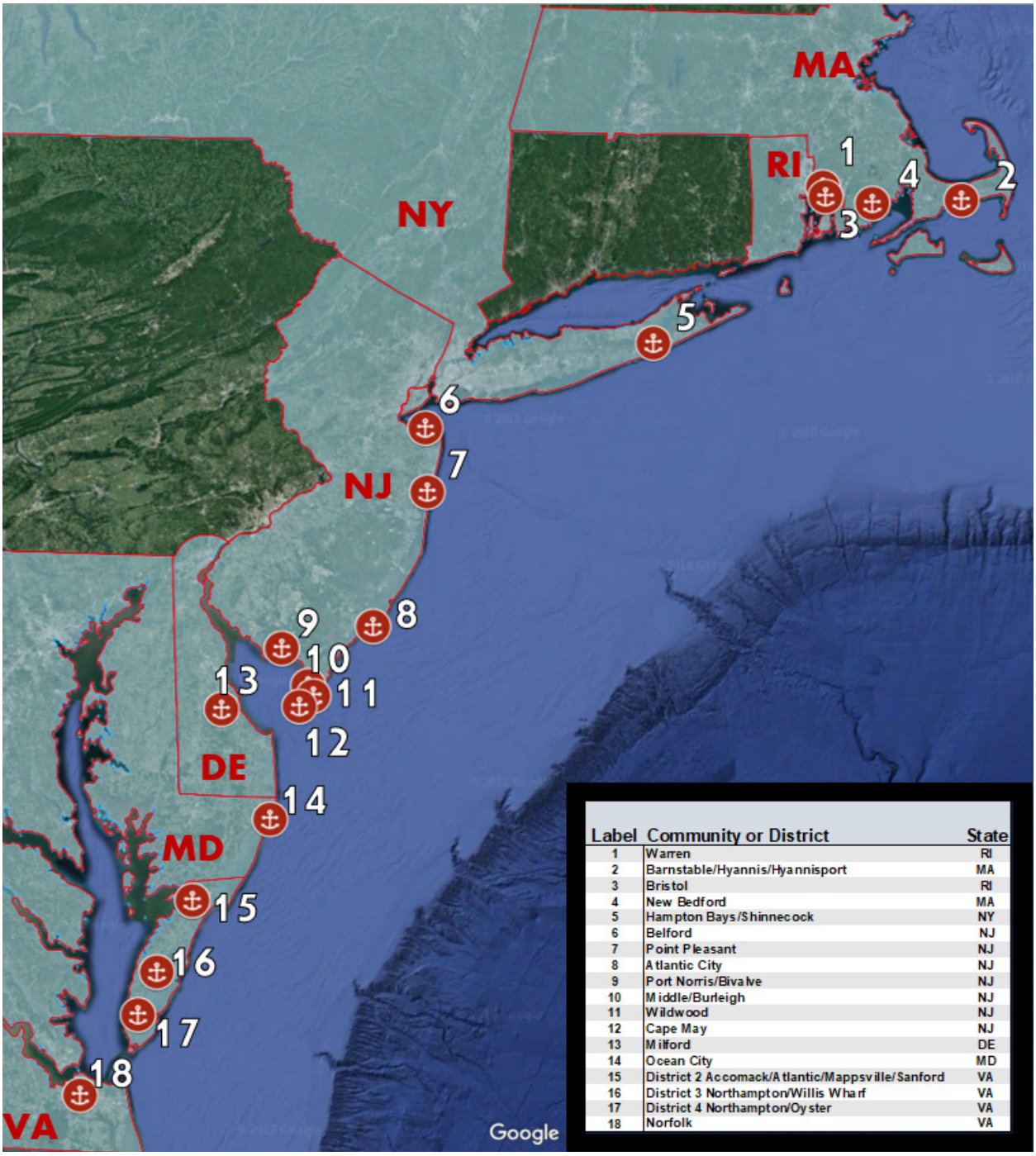
[10] While the terms engagement and dependence are not defined in the MSA, engagement is typically described through use of the best available data on the history, extent, and type of participation of these fishing communities in the fishery. Dependence, on the other hand, is typically described through an assessment of the relative economic value of participation in the relevant fishery(ies) compared to participation in other fisheries (and/or non-fishing activities, if applicable) that provide employment and income opportunities for a given fleet, sector, population, group, or community. Beyond a relative contribution to total revenues, however, dependence of any given entity or community on a fishery also may vary based on year-to-year variations in resource availability; where that fishery fits into an annual round (e.g., during a time in the cycle when alternate employment and income opportunities would otherwise be limited); and the strategic importance of participation in the fishery (e.g., its role in maintaining mutually beneficial relationships between processors and delivering fleets), among a range of other factors.

canned juices, and breaded products. The review focuses on the communities in which the initial processing occurs; the communities in which the finished food products are manufactured are largely excluded.

7.3.6.1 Fisheries Engagement

Due to the relatively few harvesters and dealers/processors involved in the surfclam or ocean quahog fisheries in individual communities, data confidentiality restrictions prevent the disaggregation of quantitative measures of fisheries engagement and dependency, such as volume or value of landings, to the community level. For this reason, this description of changes in community engagement in the surfclam and ocean quahog fisheries relies on the report prepared by Colburn et al. (2017), which analyzed trends in the level of involvement of communities in various U.S. fisheries managed by catch share programs. For each fishery, the researchers developed community-specific Fishing Engagement Index scores that measure the presence of the fishery in a community through fishing activity, including the amount and value of landings and the number of vessels and dealers/processor. The combination of variables used to create the index results in a more holistic measure of community dependence on the fisheries as compared to the consideration of landings or landed value alone. To facilitate the description of affected fishing communities, Figure 32 shows the locations of the communities determined by Colburn et al. (2017) to be highly engaged in the surfclam and/or ocean quahog fisheries one or more years from the report's baseline (1987-1989) period through 2013.

Figure 32. Communities Highly Engaged in the Surfclam and/or Ocean Quahog Fisheries for One or More Years, Baseline (1987-1989)–2013



Label	Community or District	State
1	Warren	RI
2	Barnstable/Hyannis/Hyannisport	MA
3	Bristol	RI
4	New Bedford	MA
5	Hampton Bays/Shinnecock	NY
6	Belford	NJ
7	Point Pleasant	NJ
8	Atlantic City	NJ
9	Port Norris/Bivalve	NJ
10	Middle/Burleigh	NJ
11	Wildwood	NJ
12	Cape May	NJ
13	Milford	DE
14	Ocean City	MD
15	District 2 Accomack/Atlantic/Mappsville/Sanford	VA
16	District 3 Northampton/Willis Wharf	VA
17	District 4 Northampton/Oyster	VA
18	Norfolk	VA

Source: Developed using information from Colburn et al. (2017).

The geographical distribution of communities highly engaged in the surfclam fishery are presented in Table 14, with rows listed in a north to south order. There were 16 communities highly engaged (1.0 standard deviation or more above the mean) in the surfclam fishery for at least one year from the baseline period (1987-1989) through 2013. None of the more southern communities that were highly engaged during the baseline period, i.e., Cape May, New Jersey; Willis Wharf and Oyster, Virginia; and Milford, Delaware,

were found to be highly engaged by 2013. Rather, there is a clear geographic shift northward for the most highly engaged communities. A similar trend can be seen in communities that were highly engaged for fewer than 10 years. The patterns are more complex as communities move in and out of high engagement, but 2003 to 2004 represents a shift in engagement (either positive or negative) for most communities (Colburn et al. 2017).

Table 14. Communities Highly Engaged in the Surfclam Fishery for One or More years, Baseline (1987-1989)–2013

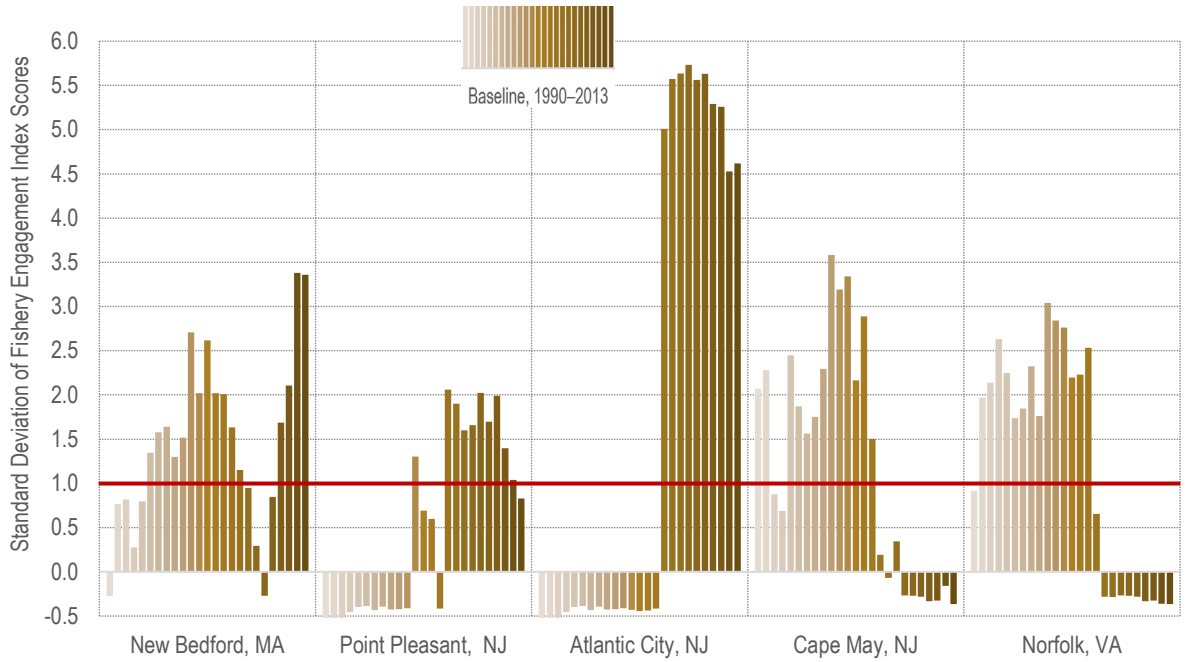
Community/ Communities	State	Latitude (deg. N.)	Highly engaged in any Baseline Year (1987–1989)	Highly engaged during Transition Year (1990)	First 5 years: 1991-1995	Second 5 Years: 1996–2000	Third 5 Years: 2001–2005	Fourth 5 Years: 2006–2010	Most Recent 3 Data Years: 2011–2013	ITQ Program Years Highly Engaged
					Percent of Years the Communities are highly engaged					
Warren	RI	41.73	No	Yes	20%	40%	20%	0%	0%	4
Barnstable/Hyannis/ Hyannis Port	MA	41.70	No	No	0%	0%	40%	100%	100%	7
Bristol	RI	41.68	No	No	20%	100%	60%	0%	0%	9
New Bedford	MA	41.64	No	No	40%	100%	0%	0%	0%	7
Point Pleasant	NJ	40.08	No	No	0%	20%	40%	100%	67%	10
Atlantic City	NJ	39.36	No	No	0%	0%	40%	100%	100%	10
Port Norris/Bivalve	NJ	39.25	No	Yes	40%	60%	0%	0%	0%	5
Middle/Burleigh	NJ	39.05	No	Yes	40%	0%	0%	0%	0%	2
Wildwood	NJ	38.99	No	No	40%	100%	100%	20%	100%	16
Cape May	NJ	38.94	Yes	Yes	60%	100%	60%	0%	0%	11
Milford	DE	38.91	Yes	No	0%	0%	0%	0%	0%	0
Ocean City	MD	38.34	No	No	60%	40%	0%	40%	33%	8
District 2 Accomack/ Atlantic/ Mappsville/ Sanford	VA	37.93	No	No	20%	20%	60%	0%	0%	5
District 3 Northampton/ Willis Wharf	VA	37.52	Yes	Yes	20%	0%	0%	0%	0%	1
District 4 Northampton/Oyster	VA	37.29	Yes	Yes	60%	0%	0%	0%	0%	3
Norfolk	VA	36.85	No	Yes	100%	100%	60%	0%	0%	13
Number of Communities Highly Engaged At least One Year During Relevant Period			**4**	**7**	**12**	**10**	**9**	**5**	**6**	**--**

Source: Adapted from Colburn et al. (2017)
Shades and percentages indicate frequency of high engagement

0%	20%	40%	60%	80%	100%

For the communities highly engaged in the surfclam fishery for at least 10 years, there was a sharp decline in engagement scores for Cape May and Norfolk, Virginia and a noticeable increase for Atlantic City, New Jersey (Figure 33). Only New Bedford, Massachusetts and Point Pleasant, New Jersey were highly engaged for some years prior to 2003 and after 2004. Atlantic City and Point Pleasant shifted in 2004 from low to high engagement and stayed there through 2013. New Bedford was more variable, but apart from 2008, it remained moderately to highly engaged for the entire period, with high engagement over the last four years of the analysis (Colburn et al. 2017).

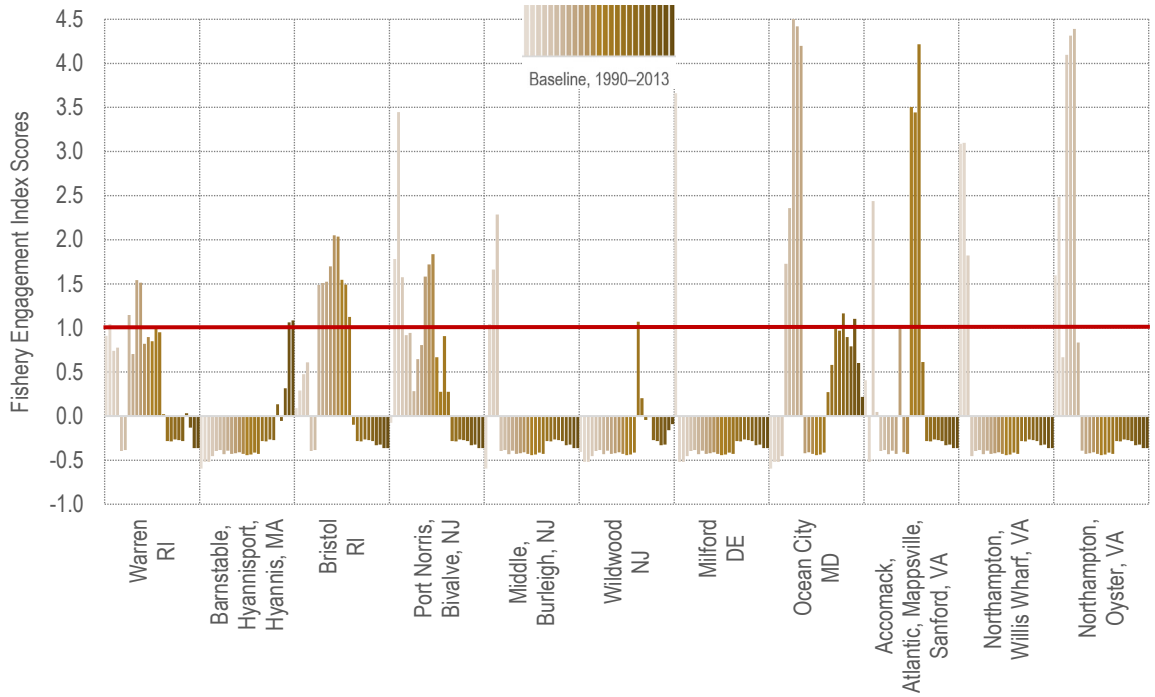
Figure 33. Fishing Engagement Index Scores of Communities Highly Engaged in the Surfclam Fishery for at Least 10 Years, Baseline (1987-1989)–2013[1]



Source: Developed using data from Colburn et al. (2017).
[1]Red horizontal line indicates a standard deviation of 1.0 (i.e., the "high engagement" threshold).

Figure 34 shows the 11 communities that were highly engaged in the surfclam fishery for fewer than 10 years. The majority of these communities were highly engaged in the fishery only from the Baseline (1987-1989) through 2004, and generally not for that entire period. Port Norris, New Jersey showed moderate to high engagement in the surfclam fishery from the Baseline through 2004. After experiencing a decrease in 2004, the engagement score for Point Norris stayed at a very low level through 2013. Although engagement fluctuated greatly, Ocean City, Maryland was sporadically highly engaged from 1992 through 1997 and then again from 2006 through 2011. In contrast, the engagement score for Barnstable, Massachusetts was low until 2012 and 2013 when the engagement score increased to high (Colburn et al. 2017).

Figure 34. Fishing Engagement Index Scores of Communities Highly Engaged in the Surfclam Fishery for Fewer Than 10 Years, Baseline (1987-1989)–2013[1]

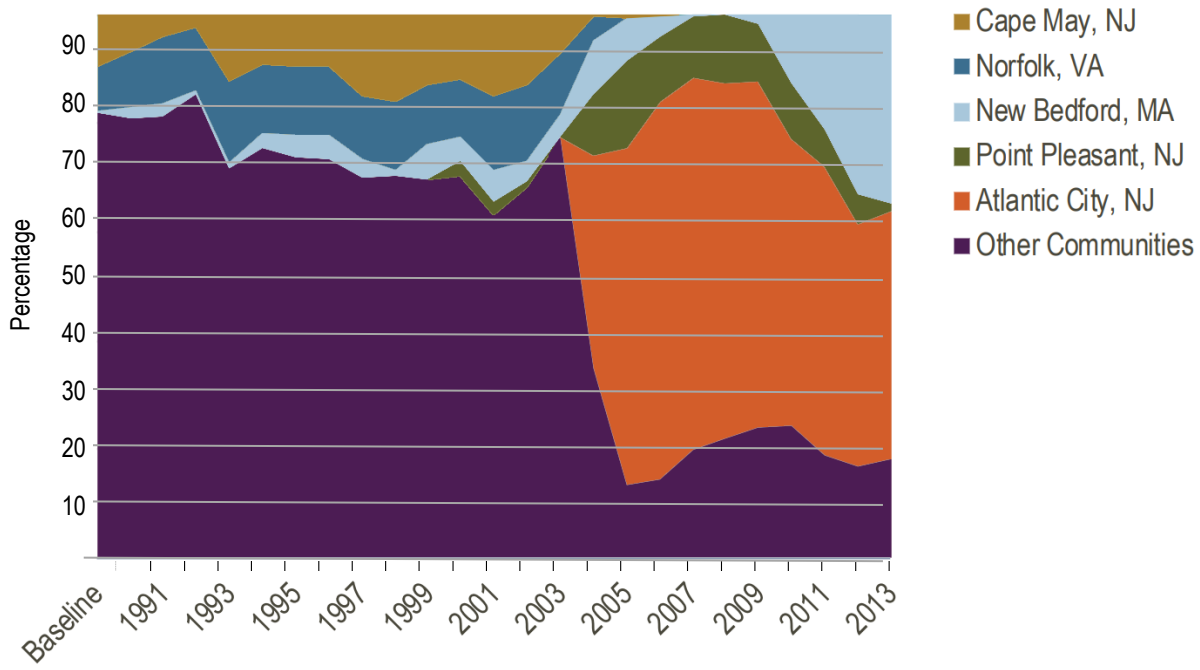


Source: Developed using data from Colburn et al. (2017).
[1]Red horizontal line indicates a standard deviation of 1.0 (i.e., the "high engagement" threshold).

Another measure of a community's involvement in the surfclam fishery is the proportion of surfclams landed within a community out of the total amount of surfclams landed in the Northeast U.S., which has been termed the Regional Quotient (Colburn et al. 2017).[11] Figure 35 shows the percentage for the five communities that were highly engaged for at least 10 years from the baseline through 2013, and the percentage for all other communities, which are collectively labeled as "Other Communities." The communities in the "Other Communities" category contributed to the majority of pounds landed from the baseline through 2002. In 2003, there was a shift in landings from Norfolk and Cape May to Atlantic City, Point Pleasant, and New Bedford. The distribution of landed value for surfclams is almost identical to the distribution for landed pounds (Colburn et al. 2017).

[11] The "Local Quotient," which is a measure of the importance of a particular species or species group relative to all species landed in a community, is not reported for the surfclam or ocean quahog fishery due to compatibility issues with data sources (Colburn et al. 2017).

Figure 35. Percentage of Total Surfclams Landed within Communities Highly Engaged in the Surfclam Fishery for at Least 10 Years, Baseline (1987-1989)–2013



Source: Adapted from Colburn et al. (2017)

The geographical distribution of communities highly engaged in the ocean quahog fishery are presented in Table 15, with rows listed in a north to south order. The time series for this fishery begins in 1991, as it was not possible to consistently aggregate fisheries data at the community level during either the baseline period (1987-1989) or the first year of the SCOQ ITQ program. Therefore, the results presented here should be considered a partial picture of changes in community engagement in the ocean quahog fishery. There were seven communities highly engaged (1.0 standard deviation or more above the mean) in the ocean quahog fishery for at least one year from 1991 through 2013. Though not as prominent as in the surfclam fishery, a northward trend over time is also apparent in the ocean quahog fishery.

Table 15. Communities Highly Engaged in the Ocean Quahog Fishery for One or More years, 1991–2013

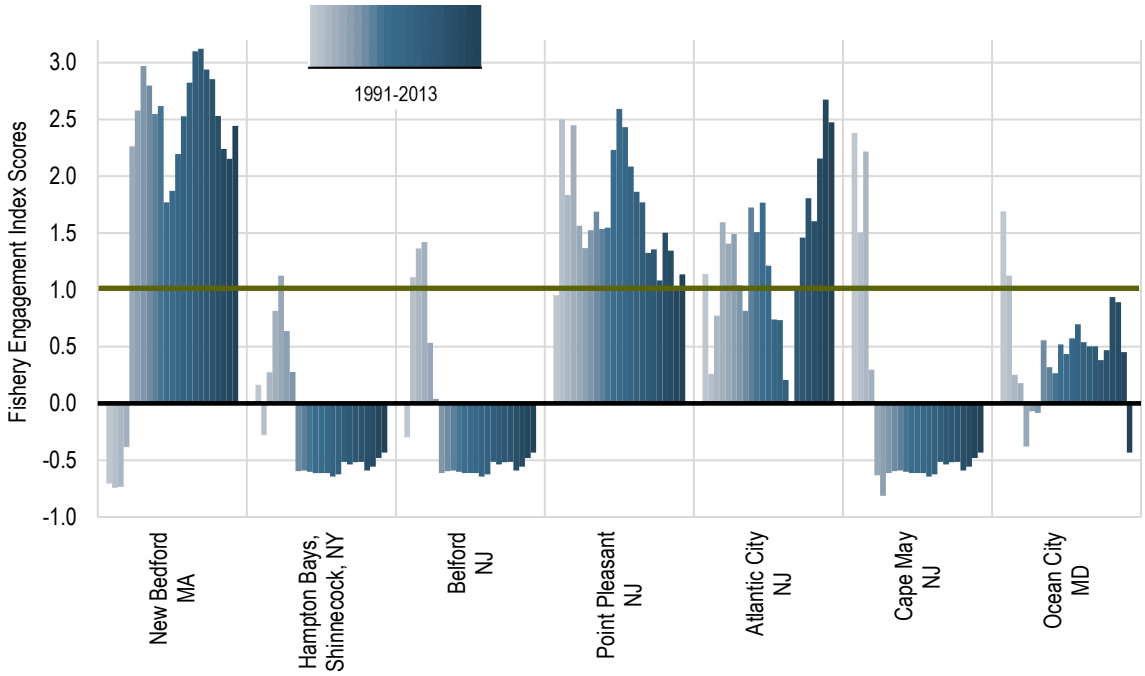
Community/ Communities	State	Latitude (deg. N.)	Highly engaged in any Baseline Year (1987–1989)	Highly engaged during Transition Year (1990)	First 5 years: 1991-1995	Second 5 Years: 1996–2000	Third 5 Years: 2001–2005	Fourth 5 Years: 2006–2010	Most Recent 3 Data Years: 2011–2013	ITQ Program Years Highly Engaged
					Percent of Years the Communities are highly engaged					
New Bedford	MA	41.64	N/A	N/A	20%	100%	100%	100%	100%	19
Hampton Bays/Shinnecock	NY	40.90	N/A	N/A	20%	0%	0%	0%	0%	1
Belford	NJ	40.43	N/A	N/A	60%	0%	0%	0%	0%	3
Point Pleasant	NJ	40.08	N/A	N/A	80%	100%	100%	100%	67%	21
Atlantic City	NJ	39.36	N/A	N/A	60%	80%	40%	80%	100%	16
Cape May	NJ	38.94	N/A	N/A	60%	0%	0%	0%	0%	3
Ocean City	MD	38.34	N/A	N/A	40%	0%	0%	0%	0%	2
Number of Communities Highly Engaged At least One Year During Relevant Period			**N/A**	**N/A**	**7**	**3**	**3**	**3**	**3**	**NA**

Source: Adapted from Colburn et al. (2017)
Shades and percentages indicate frequency of high engagement

0%	20%	40%	60%	80%	100%

Three of these communities were highly engaged in the ocean quahog fishery for at least 10 years from 1991 through 2013: Point Pleasant, Atlantic City, and New Bedford (Figure 36). New Bedford gained prominence in the ocean quahog fishery in the mid-1990s and remained dominant except for dips from 2001 through 2003 and from 2011 through 2013. Atlantic City had a clear dip in prominence from 2002 through 2006, but then showed a steady increase. Point Pleasant had more dramatic fluctuations. Though highly engaged for more than 20 years, particularly in the early years of the SCOQ ITQ program, after reaching a peak in 2002, Point Pleasant's engagement score declined gradually so that in 2013 it was almost at its 1991 level (Colburn et al. 2017).

Figure 36. Fishing Engagement Index Scores of Communities Highly Engaged in the Ocean Quahog Fishery in Any Year, 1991–2013[1]

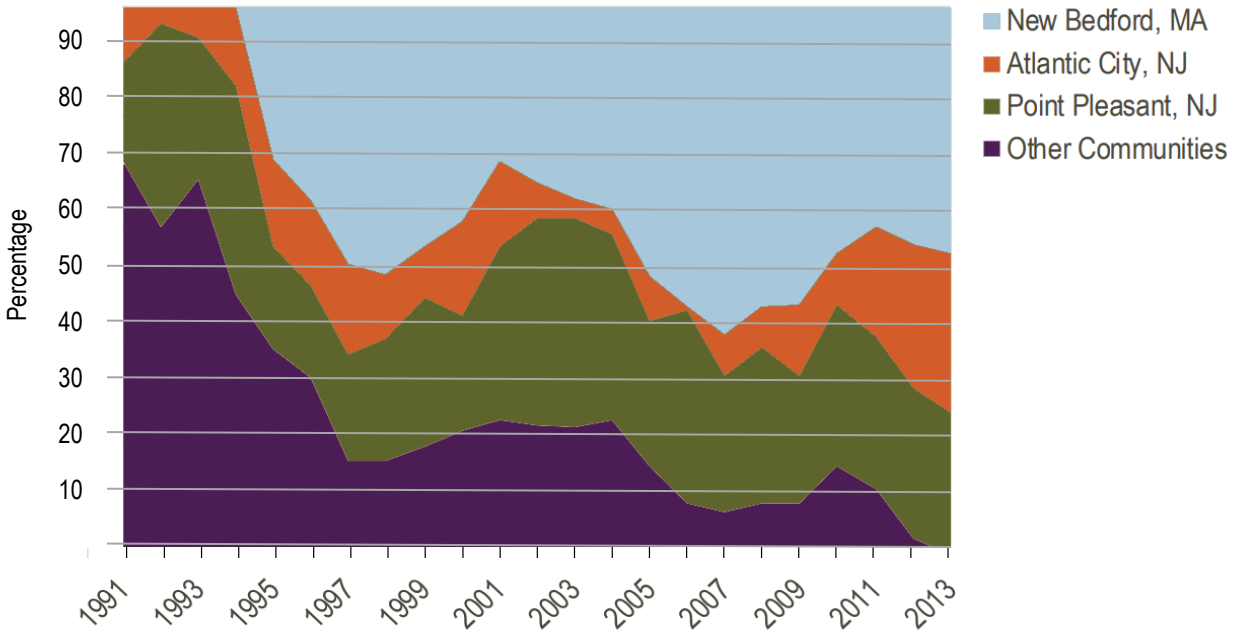


Source: Developed using data from Colburn et al. (2017).
[1]Green horizontal line indicates a standard deviation of 1.0 (i.e., the "high engagement" threshold).

Figure 36 also shows a clear trend for the four communities (Cape May and Belford, New Jersey; Ocean City; and Hampton Bays/Shinnecock, New York) that were highly engaged for fewer than 10 years from 1991 through 2013. All four showed high engagement for at least one year from 1991 through 1994. Engagement decreased gradually in three of the communities (Cape May, Belford, and Hampton Bays/Shinnecock) and reached a lower than average level by 1998. Only Ocean City consistently showed a moderate level of engagement, until a drop in 2013 to low engagement (Colburn et al. 2017).

With respect to the proportion of ocean quahogs landed in the Northeast U.S., Figure 37 shows the percentages for the three communities that were highly engaged for at least 10 years from 1991 through 2013, and the percentage for all other communities. There was a shift in community dominance from 1991 through 2013. Point Pleasant and Atlantic City consistently showed landings from the early years of the program through 2013. However, the percent contribution changed over time, with both communities contributing nearly the same amount, around 20 percent each, by 2013. Although not involved in the early years of the SCOQ ITQ program, New Bedford quickly gained prominence in the mid-1990s, and emerged as the dominant community by 2013, contributing almost half of the total ocean quahog pounds landed. However, the communities in the "Other Communities" category contributed the majority of pounds landed from 1991 through 1993. Nearly identical trends were found for value landed for the same time period (Colburn et al. 2017).

Figure 37. Percentage of Total Ocean Quahogs Landed within Communities Highly Engaged in the Ocean Quahog Fishery for at Least 10 Years, 1991–2013



Source: Adapted from Colburn et al. (2017)

As described in Section 7.3.2, the industry consolidation and changes in resource access that occurred as a result of the SCOQ ITQ program significantly affected participants in both the harvesting and processing sectors of the surfclam and ocean quahog fisheries, and the analysis by Colburn et al. (2017) clearly shows that the level of engagement in the surfclam and ocean quahog fisheries of many communities changed after the SCOQ ITQ program was implemented. Moreover, excerpts from the available literature reporting the socioeconomic effects of the SCOQ ITQ program in the first decade following program implementation suggest that these effects account for at least some of the community-level changes in fishery engagement (Callout 5). However, it is difficult to disentangle the effects of the program from the effects of other factors that were occurring at the same time (McCay and Brandt 2001). As noted in the preface to Section 7.3.6, these factors include changes in resource availability, wastewater discharge regulations, demographics and economic development, markets for surfclam and ocean quahog products, and economic conditions in other fisheries. The social and economic impacts of each of these factors may have exacerbated or mitigated the negative effects of the program on fishing communities over both the short- and long-terms. These factors and their community-level impacts are described in the sections below.

Callout 5. Community Impacts: Excerpts from the Literature in the Program's First Decade

Accomack County and Northampton County, Virginia — Prior to 1990, Accomack County and Northampton County, Virginia, two rural areas on the Delmarva Peninsula, had economies heavily dependent of commercial fishing. Surfclams and ocean quahogs accounted for a large percentage of the total annual value of local landings (Kirkley 1997). Regional ports that received landings of surfclams during this period included Chincoteague, Cape Charles, Kiptopeake, and Oyster. Vertically integrated processing plants operated in Oyster and Mappsville. However, with a general shift of harvesting effort to the north and consolidation in the industry following implementation of the SCOQ ITQ program, landings in these ports declined (Mid-Atlantic Fishery Management Council 2003). In 1990, the surfclam and ocean quahog fleet left Accomack County ports, and by 1994, surfclam and ocean quahog landings in the county were zero. Similarly, Northampton County also suffered from the exit of the fleet. By the early 2000s, no Virginia ports were landing surfclams or ocean quahogs, although some processing activities remained (Kirkley 1997; Mid-Atlantic Fishery Management Council 2003).

Ocean City, Maryland — During the early 1980s, there were 30 surfclam and ocean quahog boats docked in Ocean City, with 20 vessels over 75 feet (McCay et al. 1993; Clay et al. 2010). Surfclams were handled by several packing houses, two of which specialized in surfclams (McCay and Cieri 2000). During the late 1980s, some of the boats moved to New Jersey as the surfclam resources in that region recovered (Mid-Atlantic Fishery Management Council 2003). By the early 1990s, only six surfclam and ocean quahog vessels remained in Ocean City (McCay et al. 1993). The sharp decline was reportedly a direct result of the consolidation following SCOQ ITQ program implementation (McCay et al. 1993; Mid-Atlantic Fishery Management Council 1998; Clay et al. 2010). Businesses in Ocean City that serviced the surfclam and ocean quahog fisheries, such as trucking, fuel, and ice, declined tremendously. Some commercial boats could not get ice during the summer of 1993 and had to wait a couple of days before they could go out. One of the fish houses has since gotten its own ice machine. Most of the welding that was done was for the ocean quahog boats. Right now there is one individual doing the welding. More and more of the captains are becoming proficient at welding as a result. When the number of surfclam vessels declined, many boat maintenance businesses were lost. Very few ancillary businesses in Ocean City specialize in marine repairs (McCay et al. 1993; Mid-Atlantic Fishery Management Council 1998).

Pocomoke City, Maryland — In the early 2000s, seafood processing was one of the two principal businesses in the small rural town of Pocomoke City. The city manager has heard no complaints about owned by Mid-Atlantic Foods' processing plant, whose owners are civically active members of the community. The plant employs about 75 people, most living in Pocomoke City or nearby. Some of the skilled and semi-skilled employees commute from towns about an hour's drive away, or further. There is a county bus that transports some people to and from work, others drive or carpool. Of the 50 or so hourly employees who work the production line, the company owner categorized 30 as low skilled and 15 or 20 as semi-skilled. The plant recently offered a benefits package and increased wages to their hourly employees in an effort to keep them during the summer months when high paying jobs become available in the Ocean City tourist industry. More than 70 percent of the local seafood processor's business is surfclams and ocean quahogs, but the owner foresees a time in the near future when they will comprise less than 50 percent of his business. This is mostly due to his inability to secure shucked clams or shell stock because of the plant's vulnerable position in the ITQ quota share network. It is one of the plants that did not own vessels and hence was not allocated ITQ quota share at the time the SCOQ ITQ program was created. Banks did not recognize ITQ quota share as property, making it difficult to obtain financing to obtain quota. This has made a big difference: "We were the largest employer in our town before ITQs." The plant is no longer able to compete for surfclams directly from harvesters, including those in nearby Ocean City, relying instead on shucked product from other companies (Mid-Atlantic Fishery Management Council 2003).

Callout 5, contd.

Point Pleasant, New Jersey — A processing plant began hand-shucking surfclams in Point Pleasant in 1999. According to the owner, interviewed in 2001, the plant is "the smallest in the nation." The shucked meats are contracted for by one of the larger clam processing firms in New Jersey or Delaware or one of the small plants in Rhode Island or New Bedford for further processing. The plant runs far below capacity, a not atypical situation for the smaller shucking plants. Supply is limited by access to ITQ quota share. The owner of the plant owns one surfclam boat and some quota, which is used to attract others to harvest for the company. Much of the surfclam harvest landed at Point Pleasant goes elsewhere, to competitors, depending on who "owns" the clams. By the end of the calendar year, when ITQ quota share is used up, the New Jersey inshore fishery becomes very important to plants like this, even though the quality and yield of the clams are lower (Mid-Atlantic Fishery Management Council 2003).

Bristol, Rhode Island — The small surfclam processing plant in Bristol is a hand-shucking business that employs about 11 skilled people in the front office and management, and about 30 semi-skilled shuckers and pickers. With no vessels of its own, it is one of the plants that has no ITQ quota share allocation, and thus appears very vulnerable to changes in the industry and the regulatory system. Like other small hand-shucking plants dependent on surfclams, this one has difficulty obtaining raw product and hence running the plant at full capacity. It is currently dependent on one local boat and a contract with a New Jersey firm (Mid-Atlantic Fishery Management Council 2003).

Resource Availability

The mobility of the surfclam and ocean quahog harvesting sector and, to some extent, the processing sector in response to changes in resource availability was proven long before the start of the SCOQ ITQ program. In the early 1970s, reacting to the decline in surfclam abundance off New Jersey and the discovery of unfished beds off the Delmarva Peninsula coast during the late 1960s, vessels transferred to ports in the more southerly states (Ropes 1982). As the surfclam resources off New Jersey recovered during the mid-1980s, the harvesting sector moved back north to waters off New Jersey, although some processing plants remained in the south, particularly on the Delmarva Peninsula. The ocean quahog industry began in New Jersey; it too has moved around, particularly to the north, with the establishment of operations in New Bedford (Mid-Atlantic Fishery Management Council 2003).

As described in Section 5.3.2, over the past 30 years there have been decreases in resource availability, particularly off southern states. A northward and offshore progression of the boundary of the surfclam's range due to climate change and subsequent contraction of the fishing grounds was accompanied by the termination of the once thriving surfclam fishery in the most southerly regions. Fishing vessels were moved from southern ports, resulting in closure or near-closure of southern surfclam fishing ports in Virginia and Maryland. Surfclam processing capacity moved to more northern locations. Processing plants in Virginia were closed and new capacity was built in Massachusetts and othe New England states (Hofmann et al. 2018). While there has been no apparent shift in the southern boundary for the ocean quahog stock, the ocean quahog fishery too has moved around since it began off New Jersey in the late 1970s. During the last three decades, the fishery has shifted to more northern areas, including the Long Island and Southern New England regions, as catch rates decreased on the original fishing grounds in the southern regions of Delmarva and New Jersey. A number of community-level examples of locational shifts by the harvesting and processing sectors in response to these changes in resource availability are provided in the literature (Callout 6).

Callout 6. Geographical Shifts by Harvesters and Processors: Excerpts from the Literature in the 2000s

Point Pleasant and Cape May, New Jersey — A steam-shucking plant that was in Point Pleasant in the 1970s had moved to Cape May by the early 1980s as the fleet moved south (Mid-Atlantic Fishery Management Council 2003).

Oyster and Chincoteaque, Virginia — Oyster and Chincoteaque were once ports of landing for surfclams and ocean quahogs, and waterfront property is still owned by industry firms in Oyster. However, with a general shift of harvesting effort to the north and consolidation in the industry, all landings in these ports ended (Mid-Atlantic Fishery Management Council 2003).

New Bedford, Massachusetts — In the early 1990s, when the effects of climate change on the distribution of surfclams became apparent, Sea Watch International decided to expand its business to better follow the resource. In 1994, the company acquired a 50,000-square-foot facility on New Bedford's Acushnet River and began processing (Rowley 2013). At that time, New Bedford was also attracting surfclam and ocean quahog businesses with generous tax packages as part of its attempts at economic redevelopment (Mid-Atlantic Fishery Management Council 2003).

Port Norris, New Jersey and Norfolk, Virginia — In 2012, Surfside Seafood Products, which is based in Port Norris, New Jersey, purchased the assets of J. H. Miles & Company, which included a fleet of surfclam and ocean quahog boats registered in Virginia and processing equipment in a plant in Norfolk, Virginia (New Jersey Economic Development Authority 2014). One reason for the sale was the depletion of the surfclam and ocean quahog beds off the Delmarva peninsula (Pierceall 2016).

Also important to an understanding of how the surfclam and ocean quahog industry adapts to changes in resource availability is the mobility of shell stock (i.e., surfclams and ocean quahogs that remain in their shells) as well as the vessels and processors. Landed raw material may be trucked from the port of landing to shucking facilities located many miles away. This road transport provides industry with added flexibility in deciding where shell stock can be most economically landed and processed as internal and external factors evolve, including the geographical distribution of surfclam and ocean quahog resources. To some extent, moving shell stock overland is limited because trucking and storage time can have a more negative impact on product quality and yield than vessel steam time to and from the surfclam and ocean quahog beds, especially for surfclams (Mid-Atlantic Fishery Management Council 2003). Moreover, according to interviewed industry representatives, surfclam and ocean quahog processors have been struggling with the shortage of truck drivers that the U.S. trucking industry has experienced over the past several years (Costello and Suarez 2015). Nonetheless, several examples of how shell stock transport affects community engagement in surfclam and ocean quahog fisheries are cited in the literature (Callout 7).

Callout 7. Shell Stock Transport: Excerpts from the Literature in the 2000s

Atlantic City, New Jersey — By the late 1990s, Atlantic City was by far the most important port for the surfclam/ocean quahog industry, with landed weight almost double that of the second-ranked port, New Bedford (Mid-Atlantic Fishery Management Council 1998). However, there are no processing facilities in Atlantic City, so all landings must be trucked to plants in southern New Jersey or on the Delmarva peninsula (National Marine Fisheries Service 2010a; Garden State Seafood Association undated).

Point Pleasant, New Jersey — All of the ocean quahogs and most of the surfclams offloaded in Point Pleasant are trucked to plants in other New Jersey communities and in Massachusetts, Delaware, and Maryland communities (Mid-Atlantic Fishery Management Council 2003).

New Bedford and Hyannis, Massachusetts and Bristol, Rhode Island — Galilean Seafoods, Atlantic Capes Fisheries' surfclam harvesting, processing, and marketing division, operates New England's largest hand-shucking plant in Bristol. Atlantic Capes Fisheries uses its own trucks and truck contracted from trucking companies to transport surfclams landed in Hyannis and New Bedford to Bristol shucking facility in less than four hours from port of offloading (Anonymous 2017; Interstate Shellfish Sanitation Conference 2017).

Gentrification

Along the U.S. seaboard socio-demographic and economic transformations in many coastal communities have placed pressure on commercial fishing harbors and seafood processing facilities to close or relocate (Gale 1991; Colburn and Jepson 2012). For the surfclam and ocean quahog industry, this process of "gentrification" has made it more difficult for harvesters and processors to operate in some communities.

Colburn et al. (2017) analyzed trends in gentrification in communities that were highly engaged in the surfclam and/or ocean quahog fisheries for at least one year from the baseline years (1987-1989) through 2013. The researchers identify factors that over time may indicate a threat to the viability of a commercial working waterfront as non-fishing related businesses compete for waterfront locations and fishing community populations grow with the influx of new residents often from outside the area. These factors are captured in a series if indices that measure various aspects of gentrification pressure. The Retiree Migration Index characterizes areas with a higher concentration of retirees and elderly people in the population that often bring higher rents and home values and an increased need for services. A high score indicates a population more vulnerable to gentrification as retirees seek out the amenities of coastal living. The Urban Sprawl Index indicates areas experiencing increasing population, often a spillover from population centers, and higher costs of living that can lead to gentrification. A high score indicates a population more vulnerable to gentrification. The Housing Disruption Index represents factors that signify a changing housing market where rising home values and rents may cause displacement. A high score means more vulnerability for those in need of affordable housing.

As shown in Table 16, two communities, New Bedford and Point Pleasant, that are among the most highly engaged in the surfclam and ocean quahog fisheries rated moderately vulnerable or higher for two of the three indices, while Atlantic City only scored moderately vulnerable or higher for one index. This is in contrast to Cape May, which showed moderate to high vulnerability for all three indices. The Housing Disruption Index was moderately to highly vulnerable for all communities, followed by the Urban Sprawl Index, which was moderately to highly vulnerable for six communities. For most of these communities, the start of gentrification predates implementation of the SCOQ ITQ program. For example, an early study on the effects of gentrification on U.S. fishing communities conducted by Gale (1991) noted that Cape May was a coastal resort destination where tourism and vacationing is a major component of the local economy.

Table 16. Gentrification Pressure Vulnerability Indices for Communities Highly Engaged in the Surfclam and/or Ocean Quahog Fishery for One or More Years, Baseline (1987-1989)–2013[1]

Community	Housing Disruption	Retiree Migration	Urban Sprawl
Warren, RI	Med High	Low	Low
Barnstable/Hyannis/Hyannis Port, MA	N/A	Moderate	Moderate
Bristol, RI	N/A	Moderate	Low
New Bedford, MA	Moderate	Low	Med High
Hampton Bays/Shinnecock, NY	High	Low	High
Belford, NJ	High	Low	Moderate
Point Pleasant, NJ	Moderate	Low	Moderate
Atlantic City, NJ	High	Low	Low
Port Norris/Bivalve, NJ	High	Low	Low
Middle/Burleigh, NJ	High	Moderate	Low
Wildwood, NJ	High	Low	Low
Cape May, NJ	High	High	Moderate
Milford, DE	Med High	Moderate	Low
Ocean City, MD	Moderate	High	Low
District 2 Accomack/Atlantic/ Mappsville/Sandford, VA	Med High	Moderate	Low
District 3 Northampton/ Willis Wharf, VA	High	Moderate	Low
District 4 Northampton/ Oyster, VA	Low	Moderate	Low
Norfolk, VA	Med High	Low	Low

Source: Adapted from Colburn et al. (2017)
[1] Communities highly engaged for all years are shaded blue.

The existing literature provides several examples of how gentrification in specific communities has affected the surfclam and ocean quahog industry over the years (Callout 8). In some of these communities the start of the gentrification process, including a general decline of commercial fishing in respect to tourist-focused industries, predates the implementation of the SCOQ ITQ program.

Callout 8. Gentrification: Excerpts from the Literature in the 2000s

Ocean City, Maryland — Issues concerning the rezoning of harbor land and dredging the shoaling waters are very important, as is competition for scarce dock space, including some resentment of the surfclam and ocean quahog industry which, since implementation of the SCOQ ITQ program, had more capital to outbid other commercial fishermen for dock space (Mid-Atlantic Fishery Management Council 2003).

Atlantic City, New Jersey — There is little community support for the surfclam and ocean quahog industry in Atlantic City, except that some accommodations have been made on both sides. At one dock used by the industry, the dockworkers work in two shifts and now may only work from 6 a.m. to 11 p.m. due to a city ordinance. The ordinance went into effect a few years back due to the complaints of local townhouse residents about the noise. Prior to the ordinance, the dockworkers would work all the time. If there is bad weather, they may continue working until 1:30 a.m. but often must get verification from the Coast Guard that this is allowed. When the townhouses were built in 1994 they replaced a depressed residential neighborhood. However, some of the buyers of the condominiums claim that the salespeople told them that the fishing dock was moving, and several of these remain unhappy that this did not happen. The dock has made other accommodations, including trying to keep the trucks quiet at night and using electric rather than diesel cranes to reduce noise (Mid-Atlantic Fishery Management Council 2003). One informant said in 1999 that clamming is the second biggest industry in Atlantic City, after the casinos, and yet the city does not support the fishing industry: "They have no time for the small fries…They only care about the gamblers" (McCay and Cieri 2000). As gentrification of Atlantic City's depressed residential neighborhoods around the docks increases, these conflicts may be expected to increase (Mid-Atlantic Fishery Management Council 2003).

Warren, Rhode Island — Clams have been processed in Warren since the 1940s. The processing plant is at the edge of a historic district on the Warren waterfront, and it therefore suffers from some "nuisance" complaints (Mid-Atlantic Fishery Management Council 2003).

Cape May, New Jersey — Cape May is a seaside resort and is also one of the most important commercial fishing ports in New Jersey. The community has historically been a major center of the surfclam and ocean quahog industry. Over the years, however, commercial fishing businesses and uses of the waterfront are lower priority than recreational and resort-oriented uses within the community (McCay and Cieri 2000).

Water Quality Regulations

As described in Section 7.3.2, a major reason a number of surfclam and ocean quahog processing plants have been closed over the last few decades has been the high cost of complying with stricter wastewater discharge regulations. Water discharge regulations at processing plants especially tightened in states in the southern regions of the surfclam and ocean quahog fisheries (National Marine Fisheries Service 2009; Hill 2017). According to interviewed industry representatives, access to adequate supplies of freshwater at an economical price was also a major constraint. In particular, water treatment and supply are potential problems for processors engaged in hand-shucking operations because of the large volume of water these operations require.

The disposal of the solid and liquid waste products of surfclam and ocean quahog processing has long been costly and troublesome for industry (Carawan et al. 1979). As described in Section 6.3.3, during the 1980s, many processors supported shucking at sea as a possible way of addressing the difficulty shoreside plants experienced in complying with environmental pollution standards. In the early 1990s, Creed (1991) noted that several processors that owned shucking houses, especially hand-shucking houses, had been cited for violating state water quality standards, and the states had notified the processors of impending closures. A

number of cases of specific communities being affected by waste disposal issues have appeared in the literature over the past few decades (Callout 9). For some communities the emergence of these issues was directly related to the gentrification process as well as more stringent regulations.

Callout 9. Water Quality Regulations: Excerpts from the Literature Over the Years

Oyster, Virginia — In the early 1990s, Sea Watch International closed its quahog shucking plant in Oyster when it was no longer allowed to discharge plant effluents into Oyster Harbor unless it dredged the entire harbor (Mid-Atlantic Fishery Management Council 1988).

Mappsville, Virginia — Initially, the plant in Mappsville eliminated its wastewater with an irrigation system over fields of winter wheat and corn. While the smell associated with this sort of system drew complaints from residents and new businesses in some areas, it seemed to work well in this less developed area (Mid-Atlantic Fishery Management Council 2003). In 2005, the plant exceeded its 95,000,000 gallon permitted offshore (10 miles) waste discharge, resulting in a consent order from the Virginia Department of Environmental Quality (Virginia Coastal Zone Management Program 2013). The Mappsville plant began scaling back operations in 2005 and shut down completely in 2008. The plant's owner moved processing operations to its plants in Easton, Maryland and Milford, Delaware (Walden et al. 2012).

Cape May, New Jersey — Cape May Foods operated a processing plant in Cape May until 2000, at which time it moved its processing operations to the inland community of Millville, New Jersey (LaMonica Fine Foods 2017). Problems between the plant and the Cape May local government had emerged over the years, particularly over sewage treatment and wastewater disposal (Mid-Atlantic Fishery Management Council 2003).

Norfolk, Virginia and Warren, Rhode Island — In the early 2010s, the plant in Norfolk owned by J. H. Miles & Company and a plant in Warren owned by the Blount Seafood Corporation were grandfathered in before the Clean Water Act and had water permits coming due. Currently, neither facility is being used for shell stock processing; they are doing secondary processing such as individual quick frozen and other value added clam products (Surfclam and Ocean Quahog Advisory Panel 2013).

Port Norris, New Jersey — In the plant in Port Norris, pig farmers take the clam bellies. Someone else is paid by the plant to dispose of the shells. Wastewater is filtered and then pumped into the Maurice River, in compliance with New Jersey Department of Environmental Protection standards (Mid-Atlantic Fishery Management Council 2003).

Burleigh, New Jersey — In Burleigh, a small inland town on the Cape May peninsula, a hand-shucking plant for surfclams that began in 1970 was scheduled to move out of the community [in the early 2000s]. One of the major reasons is the township demanded that the plant install pre-treatment facilities for the water used, because of the large volume of solids left after shucking clams. According to the director of the Middle Township Sewer Department, over the years there have been odor complaints associated with the plant. She said that the taxes lost by the company's decision to move rather than install pre-treatment facilities will be recovered because the land will be rapidly purchased and converted to another use. Not far from the plant is a developing retailing area with major national consumer retail stores. The plant is thus a casualty of a changing economy, from industrial to consumer retailing, and of increased population density. As an owner said in an interview: "It's been smelling since 1970 but there was no one around then." (Mid-Atlantic Fishery Management Council 2003).

Product Markets

Changing economic conditions in the close-margin surfclam and ocean quahog industry also led to fewer processors (National Marine Fisheries Service 2009). The U.S. seafood industry as a whole has faced significant economic challenges over the past two decades. Beginning in the early 1990s, foreign-produced

seafood products captured an increasingly larger share of the domestic market, exposing American seafood producers to strong competition against overseas producers who rely on much lower wage labor (Mishra and Gillespie 2016). The mid-2000s saw imports of other clam species that can be substituted for surfclams and ocean quahogs for some uses. Domestic processors reported competition from imported clams from a number of countries, including Canada, Vietnam, Thailand, and Chile (Mitchell et al. 2011). In particular, the elimination of tariffs on Canadian clams, together with an increase in U.S. clam prices in the late 2000s, let Canada's Stimpson surfclams slip into the North American market. The U.S. clam market has remained soft as the industry continues to contend with foreign competition and loss of market share, and processors' margins remain tight (Finn 2013).

Linking these industry-wide fluctuations in market conditions to changes in harvesting and processing operations in specific communities is difficult. The major companies involved in the industry own vessels and/or processing facilities operating in multiple communities. Moreover, some of these companies are subsidiaries of much larger corporations. The strategic responses of these companies to changes in product markets are holistic in nature, as they take into account the profitability of assets in all locations. Consequently, the cause-and-effect relationships between market changes and community impacts tend to be obscured.

Economic Conditions in Other Fisheries

In a few communities, such as Atlantic City, the local fishing industry is heavily specialized in the surfclam and ocean quahog fisheries. However, for most communities, the harvesting and/or processing of surfclams and ocean quahogs are only part of a large suite of fishing-related activities, both commercial and recreational. This diversity of activities can affect a community's level of engagement in the surfclam and ocean quahog fisheries. For instance, the presence of other fisheries in a community can help ensure that the shoreside infrastructure and services necessary to attract and retain surfclam and ocean quahog vessels are available. In addition, fisheries diversity can help mitigate some of the negative impacts on community populations of the SCOQ ITQ program or one of the other factors discussed above. For example, crewmembers or processor workers who lose their jobs as a result of contraction of the surfclam and ocean quahog harvesting or processing sectors could potentially be absorbed by other segments of a community's fishing industry. Over the past three decades, however, alternative fishing opportunities in most fishing communities in the Northeast U.S. have declined. Many fishery resources in the region, such as groundfish (Measuring the Effects of Catch Shares 2019), are heavily exploited, and their catches are strictly limited by management.

New Bedford illustrates how the relative importance of various fisheries in a community can change over time. During the 1980s, the groundfish fishery was the mainstay of New Bedford's fishing industry. However, that fishery suffered a severe decline in the 1990s, and the community was forced to significantly restructure its fishing sector. New Bedford began attracting surfclam and ocean quahog businesses with generous tax packages as part of its attempts at economic redevelopment (Mid-Atlantic Fishery Management Council 2003). As described above, New Bedford quickly gained prominence in the surfclam and ocean quahog fisheries in the mid-1990s and emerged as the dominant community by 2013, contributing almost half of the total ocean quahog pounds landed. However, by the early 2000s, the scallop fishery was quickly gaining importance in New Bedford, and by 2012, scallops made up an estimated 80 percent of the community's $411 million in landings (Dyer 2013). The success of New Bedford's scallop industry enhances the hub of surfclam and ocean quahog harvesting and processing activities based in the port by supporting access to well-managed waterfront infrastructure.

It is also important to note that although surfclam and ocean quahog harvesting and/or processing operations have long been situated in certain communities, none of these communities are economically dependent on those fisheries or even fishing in general (McCay et al. 2011b). The communities engaged in the surfclam

and ocean quahog fisheries are, for the most part, gentrified/tourism-oriented or industrialized coastal communities, or rural, inland communities with primarily agriculture-based economies.

7.3.6.2 Social Vulnerability

A community's capacity to respond to the compounding effect of external forces of change is determined by an array of social factors. Colburn et al. (2017) analyzed trends in the factors that shaped the resiliency of communities engaged in the surfclam and/or ocean quahog fisheries. These factors are captured in a series of indices that measure various aspects of social vulnerability, which can be seen as the opposite of resilience, or more broadly to contain the characteristics of exposure, sensitivity, and capacity of response to change or perturbation (Colburn and Jepson 2012).

The Personal Disruption Index includes variables that affect an individual's vulnerability (e.g., low education levels or unemployment) that can then influence the overall well-being of a community. A higher Personal Disruption Index score can be associated with lower levels of well-being as communities show higher unemployment rates, higher number of residents without a high school diploma, more residents in poverty, and more separated female residents. The Population Composition Index is a measure of the presence of vulnerable populations within a community (e.g., minorities or those who may express vulnerabilities due to their circumstances or a single parent living in a household with children). A higher Population Composition Index score indicates lower well-being in the community. The Poverty Index is an overall measure of poverty that looks at several different groups experiencing hardship (e.g., receiving social assistance). A higher Poverty Index score implies higher vulnerability as more residents receive public assistance and are considered to be below national poverty lines. The Labor Force Structure Index measures the stability and overall makeup of the labor force by gauging the number of people participating in it. It is reverse scored, so a higher rank means fewer opportunities and a more vulnerable population that relies more on self-employment. The Housing Characteristics Index is a measure of infrastructure vulnerability and includes factors that indicate housing that may be vulnerable to coastal hazards. It is also reverse scored so that a high rank means a more vulnerable infrastructure and a more vulnerable population.

Table 17 shows the social vulnerability indices for communities that were highly engaged in the surfclam and/or ocean quahog fisheries for at least one year from the baseline years (1987-1989) through 2013. With the exception of Cape May, the population size of the majority of the communities that were highly engaged for all years is notably larger than for other communities. Atlantic City ranked from moderately to highly vulnerable on all five indices, followed by New Bedford and Norfolk which ranked moderately to highly vulnerable on four indices. This is in contrast to Point Pleasant, which ranked low on all indices. Both the Housing Characteristics and Labor Force Structure Index scores ranged from moderate to high for most communities.

Table 17. Social Vulnerability Indices for Communities Highly Engaged in the Surfclam and/or Ocean Quahog Fisheries for One or More years, Baseline (1987-1989)–2013[1]

Community	Population Size (2013)	Personal Disruption	Population Composition	Poverty	Labor Force Structure	Housing Characteristics
Warren, RI	10,597	Low	Low	Low	Low	Moderate
Barnstable/Hyannis/ Hyannis Port, MA	44,944	Low	Low	Low	Moderate	Low
Bristol, RI	22,531	Low	Low	Low	Low	Moderate
New Bedford, MA	94,927	Med High	Med High	High	Low	Moderate
Hampton Bays/ Shinnecock, NY	12,680	Low	Low	Low	Low	Low
Belford, NJ	1,453	Low	Low	Low	Low	Low
Point Pleasant, NJ	18,466	Low	Low	Low	Low	Low
Atlantic City, NJ	39,591	High	High	High	Moderate	Med High
Port Norris/Bivalve, NJ	1,934	Med High	Med High	High	Moderate	Low
Middle/Burleigh, NJ	18,864	Moderate	Low	Low	Moderate	Moderate
Wildwood, NJ	5,269	High	Med High	Med High	Low	Med High
Cape May, NJ	3,585	Low	Low	Low	High	Moderate
Milford, DE	9,735	Moderate	Moderate	Moderate	Moderate	Moderate
Ocean City, MD	7,108	Low	Low	Low	Med High	Med High
District 2 Accomack/Atlantic/ Mappsville/Sandford, VA	3,432	Low	Low	Low	Moderate	Med High
District 3 Northampton/ Willis Wharf, VA	1,516	High	Low	Low	Moderate	High
District 4 Northampton/ Oyster, VA	2,589	Moderate	Moderate	Moderate	Moderate	Med High
Norfolk, VA	244,090	Med High	Moderate	Med High	Low	Moderate

Source: Adapted from Colburn et al. (2017)

[1] Communities highly engaged for all years are shaded blue.

The literature going back to the early 2000s includes several descriptions of the historical vulnerability of specific communities engaged in surfclam and ocean quahog fisheries, including both seaport and inland communities (Callout 10). Over the past few decades it has been noted that the most vulnerable participants in the surfclam and ocean quahog industry are workers in processing plants, many of whom are members of ethnic or minority groups (National Research Council 1999; McCay and Brandt 2001; McCay et al. 2011b).

Callout 10. Processor Workers: Excerpts from the Literature in the 2000s

Oyster and Mappsville, Virginia — During the 1980s, processing plants were operated in the rural communities of Oyster and Mappsville, Virginia. These plants were one of the major employment opportunities in the areas. When the Oyster plant closed in the early 1990s due to wastewater treatment issues many of its employees commuted to the Mappsville plant, a distance of more than 50 miles. As in many surfclam and ocean quahog processing plants, the Mappsville plant only offered production crews unstable hours. The workers tended to hold more regular jobs at nearby chicken processing facilities and supplement those stable hours with extra hours from the clam plant. While the plant contributed a significant employment opportunity to less educated residents of the county, hiring and retaining skilled workers for the administrative and management staff was difficult because the education system in the area was not very good. He likens the region in which to the plant is located to the Mississippi delta in terms of poverty, unemployment, rural character, and poor schools (Mid-Atlantic Fishery Management Council 2003). When the Mappsville plant closed in 2008, processing workers, many of whom were African Americans, were left behind. Closure of the large processing plant removed one of the last sources of jobs in this rural area (McCay et al. 2011b).

Atlantic City, New Jersey — By the late 1990s, Atlantic City was by far the most important port for the surfclam and ocean quahog industry, with landed weight almost double that of the second-ranked port, New Bedford (Mid-Atlantic Fishery Management Council 1998). The Atlantic City fishing fleet is heavily specialized in the surfclam and ocean quahog fisheries. There are no processing facilities in the city, so the clams must be trucked to plants in Southern New Jersey or on the Delmarva peninsula (National Marine Fisheries Service 2010a; Garden State Seafood Association undated). Atlantic City has long been a favored port for these fisheries because of ready access to dense beds of clams off the central coast of New Jersey and a fairly deep and relatively safe inlet. As of the summer of 2001, there were three major docks in Atlantic City, used by 18 surfclam boats. The docks are owned by vertically integrated companies involved in shucking and further processing as well as harvesting. The docks are in a back bay of the barrier beach that supports the large gambling casinos, restaurants, and hotels of Atlantic City. Some of the docks are on an inlet reached by Rhode Island Avenue, in an area that has recently been redeveloped with up-scale townhouses known as Gardner's Basin. Maryland Avenue runs along a second inlet, the site of another large dock, a company that sells bait, tackle and ice, a deep sea and wreck charter boat, a number of run-down buildings and vacant lots, and a restaurant. Across this inlet are low-income housing. The resident population is predominately African American. Very few members of the surfclam and ocean quahog industry live here, and there are few ties between the industry and the neighborhood (McCay and Cieri 2000; Mid-Atlantic Fishery Management Council 2003). The crewmembers of the surfclam and ocean quahog boats live in several outside areas, including Cape May, Philadelphia, Tuckahoe, and Tuckerton (McCay and Cieri 2000).

Port Norris, New Jersey — A surfclam and ocean quahog processing plant began operating in Port Norris in 1991. Fifteen vessels supply this plant from all of the major ports, particularly Point Pleasant and Atlantic City. There are 100 employees, working two production shifts and one clean-up shift. When shucking ocean quahogs, there are usually 24 people per shift; when shucking surfclams, 36. It appears that at least half are women. Most are said to be permanent workers. Prisoners are hired for a third shift at times. The majority of the workers are African Americans. About one-fourth live in the local area, and the rest live within a 30-mile radius. In addition, a contractor transports about 10 workers by van, mostly from Philadelphia and Bridgeton. The contract workers are African American, Asian, and Hispanic. High turnover of employees has been a major problem. To retain employees, the company has recently offered employees health insurance, a retirement savings plan, and state unemployment insurance. Poverty and unemployment are serious problems in Port Norris and the larger Commercial Township, and the surfclam and ocean quahog plant has become one of the few sources of local jobs (Mid-Atlantic Fishery Management Council 2003).

Callout 10, contd.

Burleigh, New Jersey — The plant in Burleigh, a small inland town on Cape May's peninsula that is the headquarters for Cape May Foods, is a hand-shucking plant for surfclams that began in 1970. The plant has 150 employees. Shuckers and other workers are paid on a piecework basis. Men shuck the clams; women have the job of separating the shucked meat from the "bellies" or viscera. State- and federal-authorized contractors provide labor. Local contract labor comes from the Wildwood area, on the coast, and from Bridgeton, inland. Some workers come from a work release program at a local prison (Mid-Atlantic Fishery Management Council 2003).

Point Pleasant, New Jersey — In the early 2000s, from 6 to 10 boats landed surfclams and ocean quahogs in Point Pleasant. There were 15 dockside workers and about 50 on the boats. According to a manager, the captains and crew-members often lived on the boats during the week and returned to their homes in south New Jersey or Virginia on the weekends; a few were local to the Point Pleasant area. The dockside workers were immigrants from Peru, Mexico, and the Ukraine. A processing plant began hand-shucking surfclams in Point Pleasant in 1999. According to the owner, interviewed in 2001, there were 40 full-time positions in the plant, but up to 80 people were employed at any given time, depending on the workload. They are contract laborers, and the people working at the plant have been Laotians and other Asians, from as far away as Philadelphia, and Mexicans. Now they are all Mexicans, coming from Asbury Park, a few miles north, and other local areas. Turnover is a major problem, worsened by difficulty getting enough supply to keep the plant running at least five days a week. In the hand-shucking process, both men and women shuck for the first three hours, and then the women move to another line for "squeezing and separating" (Mid-Atlantic Fishery Management Council 2003).

Bristol, Rhode Island — The small surfclam processing plant in Bristol is a hand-shucking business that employs about 11 skilled people in the front office and management, and about 30 semi-skilled shuckers and pickers. The shuckers are almost always men, and the pickers are women. They are mostly Hispanic. As is typical in the surfclam and ocean quahog industry, the semi-skilled employees are paid on a piecework basis (Mid-Atlantic Fishery Management Council 2003).

Warren, Rhode Island — The processing plant in Warren employs about 140 people, 90 percent of whom are long-term employees rather than transients. About one half are women, and about 90 percent were born in the United States (Mid-Atlantic Fishery Management Council 2003).

New Bedford, Massachusetts — New Bedford attracted surfclam and ocean quahog businesses during the 1990s with generous tax packages as part of its attempts at economic redevelopment. A major goal was the creation of new local jobs as well as becoming a food processing "cluster." However, some city officials expressed disappointment in the commercial fishing industry in general and Sea Watch International's processing plant in particular. This disappointment stemmed from the plant's alleged failure to fulfill a promise to hire locals for the production line in exchange for favorable tax package guaranteed to the plant's former owners. Most of the workers, generally Hispanics, are contract laborers, mostly from Providence, Rhode Island, who travel in daily for work. Their employment is handled by Workforce Unlimited, a Rhode Island temporary work agency, and plant managers know little or nothing about the pay or other conditions of employment (Mid-Atlantic Fishery Management Council 2003; Rios 2014). According to a representative of the Massachusetts Coalition for Occupational Safety & Health, the use of temporary workers puts pressure on all workers to keep quiet about unsafe working conditions, knowing they can be easily replaced by temporary workers. He noted that, "We have found that when plants like Sea Watch utilize temp workers, not only are these workers not properly trained, but actual employees receive less health and safety training than if the plant employed all its workers" (Rios 2014).

A hand-shucking plant purchased by a Rhode Island company in 1994 employs about 40 people, approximately three-fourths of whom are women. Fifty to sixty percent were born in the United States. They are said to be long-term employees with low turnover (Mid-Atlantic Fishery Management Council 2003).

Callout 10, contd.

Milford, Delaware — Sea Watch International's processing plant in Milford is among the top four employers in the area, although chicken processing is the largest employer by far. The Sea Watch plant employs around 300 people, with nearly 200 of those being unskilled production line workers. They work in two shucking shifts; the third shift is mostly sanitation. There are also frying shifts, mostly for clam strips but also some calamari. About 40 percent of the employees in live in the community. According to the plant managers, about 55 percent of the plant's unskilled employees were not born in the U.S. Most are Spanish-speaking immigrants, including Guatemalans, as well as French-speaking Haitians. During the summer months, the plant has trouble retaining employees because tourist industry jobs in nearby beach areas lure them away. In order to attract and keep a reliable labor force, the plant provides regionally good wages and benefits, including medical, dental, and vision "to keep up with Perdue." To help employees during "short-time," when there are no clams, the company relies on the state unemployment system, aided by the State of Delaware's re-hire credit program (reducing the plant's unemployment tax because of the company's performance in re-hiring employees who received unemployment during short-times at the plant) (Mid-Atlantic Fishery Management Council 2003).

Easton, Maryland — Easton is a fast-growing regional center within a short driving distance to Annapolis. Sea Watch has been in Easton for 20 years, and many of the employees who were with the various companies that consolidated into this one stayed much longer. There are 30 people permanently employed at the corporate headquarters, 20 of them women; the majority live within 30 to 35 miles of the plant, in the Easton area, the rest live in Delaware or in Annapolis, Maryland. The Easton clam frying plant receives shucked clams from Sea Watch's New Bedford and Milford plants. The plant has 27 people working in the daytime and 7-8 people who work at night to clean up. Most are hourly employees who live in the local community. Seventy percent are female, and about 80 percent are black and/or Hispanic. Many are Guatemalan. Workers are hired through a local agency or newspaper advertisements. None are sub-contracted through an agency, and the workers all have unemployment insurance. In the Easton area it is difficult to obtain semi-skilled labor. The plant was fortunate to be able to hire workers from canneries that closed in Virginia. The plant is located in an industrial park close to an airport, and according to the town planner interviewed, most people in Easton probably do not know that the plant exists. Therefore, there would be little concern if the plant shut down (Mid-Atlantic Fishery Management Council 2003).

In particular, the literature highlights that, as with many other U.S. seafood processing facilities (Mishra and Gillespie 2016; New American Economy 2017), many surfclam and ocean quahog processors are staffed largely by immigrant workers. The historical circumstances that led to the heavy reliance on these workers by surfclam and ocean quahog processors are not well documented. However, interviewed industry representatives suggested that the experience of those processors is similar to that described for blue crab processors in Maryland. According to Griffith (1997), Maryland crab companies traditionally relied on African American women from local, low-income households who relied on crabpicking and a mix of other jobs to meet their economic needs. Over time, however, increased educational and employment opportunities led local residents to avoid the tedious, seasonal work of crabpicking. As a result, blue crab processors, which operate on a seasonal basis, turned to the H-2B visa program, a guest worker program started in the late 1980s that allows U.S. employers to recruit and employ foreign workers for temporary non-agricultural work. Surfclam and ocean quahog processors, especially those engaged in labor intensive operations such as hand-shucking, experienced similar difficulties hiring local residents, but because most currently operate year-round, they compensated for a shrinking labor pool by relying on workers supplied by private labor contractors. These contractors recruit primarily immigrant workers, most of whom are Hispanic.

Processors that have adopted steam-shucking (i.e., using steam to release the adductor muscle from the shell before a mechanized process separates the meat from the shell) are able to substantially reduce their labor requirements. Moreover, the jobs in these processing plants are relatively attractive to local residents, being mostly inspection work, such as picking out debris from product on conveyor belts, rather than repetitive work that leads to injuries so common in food processing (Mid-Atlantic Fishery Management Council 2003). However, surfclams that are processed into clam strips require hand-shucking because it provides a more tender, flavorful clam (LaMonica Fine Foods 2018). In addition, the machinery involved in steam-shucking is expensive. An interviewed industry representative estimated that at least 40 percent of harvested surfclams are currently hand-shucked.

Some plants only involved in processing meats supplied by off-site, often distant shucking facilities are able to rely on residents of nearby communities for their workforce. Most of these plants have relatively small numbers of skilled and semi-skilled personnel because they have highly automated processing lines, a development that industry representatives report started in the early 1990s.

7.3.7 Safety of Human Life at Sea

Pre-SCOQ ITQ Program Period

Under the pre-SCOQ ITQ program management regime, occupational health and safety issues loomed large in the surfclam and ocean quahog fisheries; vessels frequently sank and men's lives were often lost each year in the waters of the New Jersey and Delmarva regions by the late 1980s. A study of mortality rates in New Jersey showed that fishing was one of the most dangerous occupations in the state, and these rates resulted almost entirely from the surfclam and ocean quahog fisheries. For example, five surfclam and ocean quahog vessels capsized off New Jersey in 1989 (National Research Council 1999).

Part of the danger in the surfclam and ocean quahog fisheries was attributable to physical characteristics of the vessels. Both fisheries land large volumes of raw shell stock which dictate large fish holds, easily as much as 50 percent of a vessel's hull volume (Woodley 2002). Because the vessels load the heavy shell stock directly into large cages that cannot be readily moved by the ship's crew when fully loaded, the top of the fish holds must be able to be completely opened during fishing operations. A 2002 report by a U.S. Coast Guard Fishing Vessel Safety Coordinator noted that the majority of the hatch covers on surfclam and ocean quahog vessels could not be dogged watertight or even held closed (Woodley 2002). The greatest danger would arise when vessels return to port fully loaded and had minimal aft freeboard. The hatch covers would gradually leak water into the holds, which resulted in a progressive degradation of the vessel's stability. Because this would occur over a long period of time, it was likely to be undetected by a crew that was tired after a fishing trip or distracted by other problems. Generally, by the time the crew realized there was a problem, the vessel's stability had been reduced to the point of being ready to capsize on any boarding wave (Woodley 2002).

In addition, vessel design may not allow a crew to adequately respond to flooding during bad weather. During the pre-SCOQ ITQ program period, many surfclam and ocean quahog vessels were converted from gulf shrimpers by modifying the fish hold and adding a large pump and engine in the lazarette. This pump primarily supplies high-pressure water to the harvesting dredge, but it is also used to flood and pump dry the fish holds. The problem occurs when flooding through the non-tight fish hold hatches discussed above occurs in rough seas. The only access to the fish hold pump is outside across the deck and through a relatively exposed hatchway. Several vessels were lost when the crew could not access the critical pumps because by the time the problem was discovered, the seas boarding the vessel prevented access aft across the deck (Woodley 2002). The dangers surfclam and ocean quahog vessels processors faced is captured in comments recorded in reports published shortly after SCOQ ITQ program implementation (Callout 11).

Callout 11. Vessel Safety: Perspectives from the Early Program Years

The hatch covers were only to protect the clams from the sun and heat; after all, many boats have no hatches at all (Vessel captain quoted in Spitzer (1999))

This [clamming] is the most dangerous fishing there is, and I've done a lot of different kinds—Gulf of Alaska dragging, etc. The weight of clams is just phenomenal (Vessel captain quoted in McCay (1992)).

It's dangerous because of days you have to work, if scheduled in rough weather, 30 miles per hour wind, with dredges swinging around, and slippery in ice and snow (Vessel captain quoted in McCay (1992)).

Clamming is dangerous because of the regulations. You go out no matter what to pay the bills. Keeping cages on deck makes the boat top heavy (Vessel captain quoted in McCay (1992)).

…there are too many rust buckets out there. You can have problems when the boat hasn't been maintained over the years (Vessel captain quoted in McCay (1992)).

You were given your day to go out, and if there was bad weather, you could make it up the next day, but not the day after that. So, you had a lot of boats going out in bad weather. And, with only six hours to fish, you had boats loading themselves up so much that they went down if the weather got rough (Vessel owner quoted in Kent (1992)).

Days that you have to fish are designated by the government in surfclamming, so people are forced for [ocean] quahogs and are going out [too far] in small boats (Vessel captain quoted in McCay (1992)).

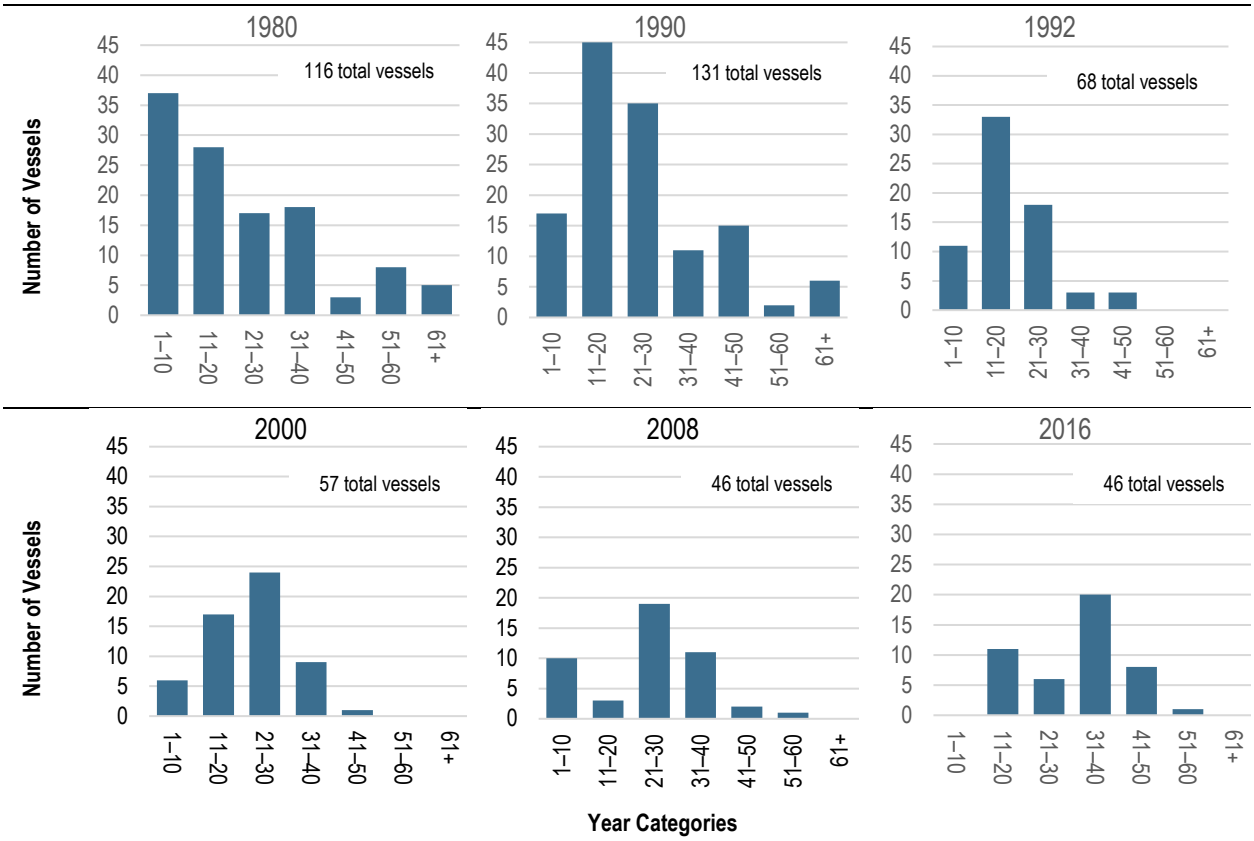
The dangers related to vessel loading and stability and fishing in bad weather were exacerbated by pre-SCOQ ITQ program management regulations that created pressures to harvest and bring in as much as possible in a very short period of time. Under the effort limitations system, vessels had to make their entire surfclam catch during the narrow window in which they were allowed to fish (McCay 1992). The situation was so dangerous most surfclam vessel were forced by their insurers to impose limits on the number of cages carried by each vessel in (McCay 1992).

Moreover, vessel owners had to choose the day or days he or she wished to fish, notify NMFS, and then had to "use or lose" the days. Under Amendment 2, prepared in 1979, a provision was made for an alternate fishing day in the event of unsafe weather conditions on a specified day. This bad weather "makeup day" provision was in effect only from November through April. A vessel could claim a makeup day if it notified NMFS within four hours of its official starting time for fishing and if it landed no surfclams on that day. The makeup day was required to be the next fishing day and amount to the same number of hours as the vessel normally had on a fishing day. A vessel was not permitted to claim an additional makeup day if weather conditions prohibited fishing on a makeup day (Mid-Atlantic Fishery Management Council 1988). While the makeup day provision was intended to reduce the safety problems created by the effort limitation system, given the foregone revenue if a makeup day was missed, vessel owners and captains often chose to fish in bad weather rather than lose the fishing opportunity (Phillips 1985; National Research Council 1999).

Additional factors had a negative effect on the safety of participants in the surfclam fishery during the pre-SCOQ ITQ program period. As discussed in Section 6.3.2., during the 1980s, as the Council was considering some form of individual allocation system in the surfclam fishery based on landings history, vessel owners' expectation of a future per-vessel allocation of the annual catch limit created the incentive to harvest with vessels that qualified for a moratorium permit but had previously been largely inactive. The result was that many vessels that were old and not well maintained participated in the surfclam fishery (McCay 1992; McCay and Brandt 2001). The vessel replacement policy during the moratorium on new entrants

compounded these safety problems, as existing boats could not be replaced unless they sank, were destroyed by fire, or became inoperable. When the moratorium was implemented in 1979, there already was a large number of older and less safe vessels operating in the surfclam fishery (Mannina 1997). By 1990, the average vessel age in the fishery was 25 years, and safety concerns were voiced about the aging of the fleet (Mid-Atlantic Fishery Management Council 1988). Figure 14 shows the age distribution of active vessels in the surfclam and ocean quahog fisheries before SCOQ ITQ program implementation. In 1990, the largest group of vessels were 20 years old or less, as during the preceding decade, several vessels had entered the fisheries that were relatively new (1–10 years old). However, there was also a substantial number of vessels aged 41 years or older.

Figure 38. Age Distribution of Active Vessels in the Surfclam and Ocean Quahog Fisheries, Selected Years[1]



Source: Developed using data provided by Greater Atlantic Regional Fisheries Office, National Marine Fisheries Service.

[1]Some active vessels could not be included in the 1980 chart because their ages are unknown.

Post-SCOQ ITQ Program Period

Improved safety was a major selling point for the SCOQ ITQ program, given the frequent loss of boats and lives under the pre-program management regime (McCay 1992). The program eliminated the effort limitation system, thereby removing an incentive for harvesters to overload their vessels and allowing vessel owners to schedule fishing trips at times of the year when the weather is more favorable. Further, the ability to transfer allocations to other vessels removed impediments to modernizing the fleet and retiring deteriorating, unsafe vessels (Mid-Atlantic Fishery Management Council 1988). As shown in Figure 14, within two years of the start of the SCOQ ITQ program most of the older vessels had departed the surfclam

and ocean quahog fisheries. In the ensuing years, the number of newly-built vessels entering the fisheries has been low.

Despite the removal of older vessels, the two fisheries maintained relatively high accident and fatality rates after program implementation (Woodley 2002). Between 1990 and early 1999, nine surfclam/ocean quahog boats and at least fourteen lives were lost, a rate of loss comparable to that of the 1980s (National Research Council 1999). Many of these disasters were caused by the same factors that affected vessel safety during the pre-SCOQ ITQ program period. For example, according to the U.S. Coast Guard, the three surfclam/ocean quahog boats that sank in the early 1990s had been carrying heavy loads, and instability of the loads was believed to be a factor in the accidents (Stevens 1992). Similarly, the *Cape Fear*, a surfclam/ocean quahog vessel that sank in 1999, was laden with 130 cages of clams—10 more cages than specified in its stability manual, and its fish hold hatches were not maintained in a watertight condition (Spitzer 1999).

Four surfclam/ocean quahog boats (*Predator*, *Beth Dee Bob*, *Cape Fear*, and *Adriatic*) and eleven lives were lost in January of 1999 alone, and this spate of vessel tragedies was a major impetus for the convening of a Commercial Fishing Industry Vessel Casualty Task Force later that the same year. In March 1999, the Task Force issued a report containing 59 safety recommendations in seven different categories. In direct response to the Task Force report and evaluation reports, the U.S. Coast Guard implemented immediate action measures that focused attention on three improvement areas: at-sea boardings; voluntary dockside exams and education/outreach efforts; and commercial fishing vessel safety training of U.S. Coast Guard personnel (Roberts 2002).

The continuing high rate of marine accidents and safety incidents in the surfclam and ocean quahog fisheries after SCOQ ITQ program implementation suggest that market conditions and the agreements made with processors are overriding factors that impel vessel operators to go out in dangerous conditions or to overload (McCay 1992). After the program began, processors still required that vessels fish when the product was needed, much as they did before the program began (Beal 1992; McCay and Brandt 2001). In addition, processors have additional leverage over harvesters because they control much of the ITQ quota share. Boats may be forced to fish in bad weather to maintain their link with the processor who holds the quota (Hall-Arber 1992; Woodley 2002).

An analysis by Windle et al. (2008) supports the notion that continuing safety problems in the surfclam and ocean quahog fisheries may be linked to patterns of ITQ quota share ownership. The authors suggest that the maximum amount of quota that entities are permitted to control within a fishery managed under a LAPP may be an important factor influencing safety. They found that U.S. fisheries with a LAPP that restricts quota aggregation (e.g., the Alaska sablefish and halibut fisheries) experienced significant declines in fatality rates and vessel incidents following program implementation, while fisheries with no defined aggregation limit continued to have safety problems. Windle et al. note that in fisheries where small-scale fishing operations must lease quota from large corporations to remain economically viable, the expected safety benefits of a LAPP (e.g., reduced incentives to race for fish or operate in poor conditions) may be negated if pressures from quota holders supersede the independent decision-making of vessel owners.

However, some industry representatives argue that the SCOQ ITQ program succeeded in making the surfclam and ocean quahog fisheries safer. A former spokesman for the National Fisheries Institute stated: "This fishing is safer than it was, and that's the direct result of the new regulation system. There is no race for clams" (Kannapelljan 1999). Regarding the spate of vessel accidents that occurred in 1999, one dock manager for a processor maintained that, "It's just a run of bad luck. To speculate about what happened would be ignorant" (Kannapelljan 1999).

In any case, both the number and rate of vessel disasters began to decrease after the first decade of the program. As shown in Table 18, a recent report by the National Institute of Occupational Health and Safety (NIOSH) found that during the 2000–2009 period, the rate of vessel disasters in the surfclam and ocean

quahog fisheries decreased by 42 percent from the preceding ten-year period. The rate further declined by 60 percent during 2010–2017. During 2000–2009, the rate of crewmember fatalities was 90 percent lower than the previous decade. An increase in the rate was subsequently observed during 2010–2017, but it was still 82 percent lower than the 1990s. The complete NIOSH report containing additional fatality, injury, and vessel disaster data specific to the surfclam and ocean quahog fisheries is provided in Appendix 1 of this SCOQ ITQ Program Review.

Table 18. Number and Rate of Vessel Disasters and Fatalities in the Surfclam and Ocean Quahog Fisheries, 1990–2017

Period	Vessel Disasters		Crewmember Fatalities	
	Number	Rate (per 10,000 Days at Sea)	Number	Rate (per 100,000 FTEs)
1990–1999	10	1.97	19	780
2000–2009	6	1.14	2	79
2010–2017	2	0.46	3	143

Source: Case et al. (2019)

According to interviewed industry representatives, new U.S. Coast Guard regulations contributed to improved vessel safety in the surfclam and ocean quahog fisheries. Current regulations require training, or demonstration of knowledge and competency, for all individuals in charge of commercial surfclam and ocean quahog vessels operating in federal waters. In addition, the U.S. Coast Guard provided voluntary safety initiatives and good marine practices (Coast Guard Maritime Compliance 2017). Industry representatives report that underwriters providing commercial fishing vessel insurance have contributed to improvements in vessel safety by insisting that vessel owners comply with these U.S. Coast Guard regulations and recommendations.

In addition, industry representatives note that safety in the surfclam and ocean quahog fisheries improved after Amendment 15 to the FMP reinstituted the onboard observer program in 2015, although the level of observer coverage is low. Observers are required to review emergency instructions with the vessel operator and complete a pre-trip safety check of the vessel's emergency equipment prior to departing on a trip. Moreover, observers verify that the equipment, registrations, and certificates meet U.S. Coast Guard and other requirements (National Marine Fisheries Service Undated).

Lastly, the majority of new vessels designed specifically for the surfclam and ocean fisheries are constructed with features that make them less prone to safety incidents. For example, new vessels typically have what is referred to as wet holds. Vessels with these holds are considered safer than vessels with a single dry hold or that carry all of their cages on deck because they can carry most of their catch below deck in a hold separated into 4 or 6 compartments (Interstate Shellfish Sanitation Conference 2018).[12]

Despite the safety improvements of vessels operating in the surfclam and ocean quahog fisheries over the past couple of decades, the fatality rate in the fisheries continues to be high compared to other U.S. fisheries. The 2010–2017 crewmember fatality rate of 143 per 100,000 FTEs is substantially higher than the 2017 rate for all U.S. "fishers and related fishing workers" (99.8 per 100,000 FTEs) (U.S. Bureau of Labor Statistics 2018a). Among U.S. fisheries where crewmember fatality rates were calculated, only the Northeast multispecies trawl fishery had a higher fatality rate during the 2005–2014 period (National Institute for

[12] An industry representative noted that the problem of hatch covers that can not be dogged watertight or even held closed is mainly an issue for vessels that store raw shell stock in holds. Vessels with a "barge" design in which cages are stored on deck do not face this problem. Currently, vessels that store shell stock in a hold have hatch covers that are weatherproof (i.e., hatch can't be ripped off by waves), but they may not be completely watertight. However, most vessels now pump refrigerated seawater into the hold, and therefore must have a high-water alarm in the hold.

Occupational Safety and Health 2017). Moreover, the rate of injuries onboard surfclam and ocean quahog vessels has not shown a declining trend similar to that for fatalities (Case et al. 2019). It is likely that myriad factors, including market conditions, the offshore environment, weather conditions, and hazardous gear and equipment, contribute to the ongoing incidence of safety-related incidents in the surfclam and ocean quahog fisheries.

7.4 Summary of the Effects of the Program

Table 19 provides a listing of the program review questions and summary of the social effects of the program.

Table 19. Program Review Questions and Summary of Social Effects of the Program

Question Number	Element Number/ Letter	Questions to be Answered	Summarized Effects of the Program
Questions that derive from program goals and objectives (G&Os)			
--	--	None applicable.	--
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
SOC-1	KA: B	Are the program allocations between individuals or entities within the program fair and equitable with respect to community and regional indicators of engagement (consistent with NS 4)?	The task for the Council was to come up with a formula for the surfclam and ocean quahog fisheries that struck a balance between independent harvesters and processors as well as among those who 1) had recently entered the surfclam and ocean quahog fisheries; 2) suffered long breakdowns or loss of markets through no-fault of their own; 3) entered the fisheries for only part of a fishing year; 4) and/or turned a vessel's catch performance around in the past few years. At the same time, the Council did not want to adopt a formula that would unjustly enrich those who had not actively participated in the fishery but sought to capitalize on their moratorium permit. To address these issues, the Council elected to make the initial allocation based on vessel history, but with certain modifications. For vessels with permits to fish for surfclams in the Mid-Atlantic Area, which included the vast majority of vessels in the surfclam fishery, 80 percent of the surfclam allocation was based on a vessel's reported historic catch. To take into account historical fishing practices in, and dependence on, the surfclam fishery, catch data as far back as 1979 were used. However, average reported catch was modified to make allowance for vessel breakdowns, loss of markets, and recent entry into the fishery—the last four years were counted twice, and the two worst years were excluded. The resulting values were summed and divided by the total catch of all harvesters for the period. The remaining 20 percent of the allocation was based on a vessel's capacity (length x width x depth) as a proxy for investment. This so-called "cost factor" was a key element in coming to agreement, as it addressed concerns of newer participants in the surfclam fishery who had invested in larger (replacement) vessels that did not have strong historical landings, and/or had large vessel mortgages. By considering both vessel catch history and vessel size, the final allocation formula took into account, to the degree it could, the benefits that vessel owners whose catch histories included substantial illegal catch derived from a history-only allocation scheme, and the windfall that owners of large dormant vessels would receive under a dimensions-only allocation scheme. Factors determining the allocation formula for the New England Area surfclam fishery and the ocean quahog fishery were the open access nature of the fisheries, the lack of effort restrictions, and the fact that the fisheries started years later than the Mid-Atlantic Area surfclam fishery. In both fisheries the initial allocation was based solely on average catch during the qualifying years. Following implementation of the SCOQ ITQ program, court cases ruled that the program is consistent with National Standard 4. In 2015, however, NMFS determined that the FMP is out of compliance with that national standard because it did not include an excessive share cap. Consequently, the Council is currently developing an FMP amendment to adopt an excessive share regulation.

Question Number	Element Number/ Letter	Questions to be Answered	Summarized Effects of the Program
SOC-2	KA: C	What have been the effects of the program on "historical" participants who were previously but are no longer involved in the fishery or program?	Vessel Owners The number of active independent vessel owners declined dramatically after the SCOQ ITQ program began. However, many of these owners who stopped harvesting and sold their vessel continued to participate in the surfclam and ocean quahog fisheries by leasing their ITQ quota share. Starting in the late 2000s, some small independent firms that opted to remain in the fisheries as ITQ quota share lessors have found it increasingly difficult to find lessees and/or have been forced to reduce quota lease prices. Substantial portions of the surfclam and ocean quahog annual catch limits have been left unharvested due to weak or stagnant demand for clam products. The resulting surplus of ITQ quota share has undermined the quota market. The distribution of harvests across firm types also changed after the program began. Small independent firms increased their share of harvests under the SCOQ ITQ program. By the 1996–1998 period, the relative position between large and small independent harvesting firms had reversed. During this period, it is estimated that more than two-thirds of all surfclams harvested were taken by vessels that were contracted to catch the ITQ quota share for a fee. The typical ITQ quota share trade was from the allocation owner to a processor, to an independent vessel owner. More recently, the reduced harvest of surfclam and ocean quahog resources has placed active small independent vessel owners at a disadvantage—processors are more likely to be able to meet their supply requirements using their own vessels. After program implementation a number of factors mitigated the possibility of a "spillover effect" in which competition and congestion would occur in non-surfclam and ocean quahog fisheries as a result of the enhanced ability of surfclam and ocean quahog to increase their participation in those fisheries. Many of the older boats were unfit to be converted to other fisheries or even sold, and the specialized nature of clamming gear makes outfitting a vessel for the surfclam and ocean quahog fisheries a complex and expensive undertaking. However, there is evidence that some surfclam vessels increased their participation in state inshore surfclam fisheries, particularly the surfclam fishery managed by New York. The increase in effort and catch likely had a negative economic impact on fishing operations that traditionally fished in the New York fishery. Crewmembers After the downsizing of the surfclam and ocean quahog fleets following program implementation, the number of crew positions fell from around 600 to about 250. On the other hand, vessel owners began to more fully utilize the vessels remaining in the fisheries, and the crewmembers who retained their jobs were more fully employed. Another major social effect of the program was the changes in the share system of returns to vessel owners and crew. A common practice adopted with the introduction of the program was for the vessel owners to deduct the cost of leasing ITQ quota share from the amount that would be shared out. This deduction of the cost of leasing ITQ quota share might be done even if the vessel owner actually owned the quota. For example, vessel owners may lease out their own quota and base their operations on shares leased from others to legitimize the deduction of leasing costs. The reduction of vessels and concomitant decrease in the demand for labor also led to a decline in the bargaining power of crewmembers, which in turn led to a decline in crew compensation. Processors After the program began, the number of processors of surfclams and ocean quahogs declined. Some small, independently-owned processors that did not receive substantial initial allocations of ITQ quota share (because they had few or no vessels) had difficulty getting financing to purchase additional quota and left the industry. In contrast, processors owned by large national or multinational corporations with strong financial backing were able to buy or lease ITQ quota share and contract with independent vessels to harvest the quota, giving them greater access to the surfclam and ocean quahog resources. Small independent vessel owners who were unable to fish their limited ITQ quota share economically were forced to

Question Number	Element Number/ Letter	Questions to be Answered	Summarized Effects of the Program
			switch and fish for these processors, as they could offer them additional ITQ quota share. Large processors also acquired greater control of supply of raw product for their plants by becoming more vertically integrated. As a result of this increased vertical integration of processors into harvesting, together with the proliferation of long-term contracts among ITQ quota share owners, processing firms, and vessel owners, processors now have direct or indirect control over the use of the majority of all ITQ quota share.
SOC-3	KA: D	What are the impacts of the program's QS or QP transferability provisions on equity, including changes in local and regional patterns of fishery engagement, and the sustained participation of fishing communities in the fishery?	While the available data clearly show that the level of engagement in the surfclam and ocean quahog fisheries of many communities changed after the SCOQ ITQ program was implemented, it is difficult to disentangle the effects of the program from the effects of co-occurring factors. These other factors included changes in resource availability, wastewater discharge regulations, demographics and economic development, markets for surfclam and ocean quahog products, and economic conditions in other fisheries. The social and economic impacts of each of these factors may have exacerbated or mitigated the negative effects of the program on fishing communities over both the short- and long-terms.
SOC-4	KA: F	What has been the equity/distributional impact of the program's limited access privileges caps (or absence of caps)?	The SCOQ ITQ program allows individual allocations of both surfclams and ocean quahogs to be traded freely and placed no limits on the amount of ITQ quota share an individual, partnership, or corporation could hold. Immediately following program implementation, some industry members continued to express concern that a few major firms would be able to acquire a controlling percentage of the surfclam and/or ocean quahog allocations. These industry concerns appear to have been well-founded, although perhaps overstated to some extent. An analysis conducted by NMFS of concentration in the harvesting sector after SCOQ ITQ program implementation found that the ownership of ITQ quota share is mildly concentrated for surfclam ITQ quota share and unconcentrated for ocean quahog ITQ quota share. However, the NMFS analysis concluded that the use of ITQ quota share in both the surfclam and ocean quahog fisheries is highly concentrated. As a result of the backward integration of processors into harvesting, together with the proliferation of long-term contracts among ITQ quota share owners, processing firms, and vessel owners, processors now have direct or indirect control over the use of the majority of ITQ quota share in the two fisheries. In 2015, NMFS determined that the FMP is out of compliance with National Standard 4 because it did not include an excessive share cap, and the Council is currently developing an FMP amendment to adopt an excessive share regulation.
SOC-5	KA: J	Does the program have a QS or QP set-aside for new entrants?	The industrial scale of the fisheries has long posed an economic barrier to entry for new entrants to the surfclam and ocean quahog fisheries. Vessels and fishing gear are expensive, and it can be difficult to find buyers, especially when the product market is tight. The cost of acquiring ITQ quota share after implementation of the SCOQ ITQ program created an additional obstacle. An early criticism of the program was that it increased the costs for new entrants without initial allocations, thereby decreasing opportunities for young people, crewmembers (including hired captains), and others to become vessel owners. In recent years an effort was made to facilitate the entry of individuals who lack the assets to purchase quota in the open market. However, that effort was implemented by the private sector and was limited in scope and duration.

Question Number	Element Number/ Letter	Questions to be Answered	Summarized Effects of the Program
SOC-6	KA: J	Do the transferability rules make it more or less difficult for new entities to participate in the program?	The ITQ quota share transferability rules of the SCOQ ITQ program facilitate the entry of new entities into the surfclam and ocean quahog fisheries. There are few restrictions on the transfer of ownership of either ITQ allocation permits or the annual allocations of ITQ quota share. The original owners of ITQ allocation permits and ITQ quota share were owners of permitted vessels in the surfclam and/or ocean quahog fisheries. Thereafter, any entity that meets requirements for owning a U.S. Coast Guard documented fishing vessel is eligible to own ITQ quota share. Initially, an allocation could not be transferred in amounts less than 160 bushels (i.e., 5 cages), but Amendment 13 to the FMP eliminated this restriction in 2004. There is no maximum amount that can be transferred, nor is there any limit on the percentage of the total ITQ quota share that can be held by one person. All transfers, whether permanent sales of ITQ quota share or temporary transfers of the annual allocations (i.e., leasing of ITQ quota share), must be approved by NMFS for monitoring and enforcement purposes. Under the new ITQ allocation permit application process that became effective on January 1, 2016, a transfer is not complete until the new owner receives an ITQ allocation permit from NMFS. The ITQ quota share transfer form is designed to be simple and easy to complete, thus saving time for both industry and NMFS.
SOC-7	KA: J	Have loan programs been established to help new entities participate in the program, consistent with Section 303A(g) of the MSA?	See SOC-5
Questions that derive from national standards (NSs) not encompassed by KA questions:			
SOC-8	NS: 8	Has the program provided for the sustained participation of fishing communities?	The level of engagement in the surfclam and ocean quahog fisheries of many communities changed after the SCOQ ITQ program was implemented. The available literature suggests that the socioeconomic effects of the program account for at least some of these community-level changes. However, it is difficult to disentangle the effects of the program from the effects of co-occurring factors. These other factors include changes in resource availability, wastewater discharge regulations, demographics and economic development, markets for surfclam and ocean quahog products, and economic conditions in other fisheries. The social and economic impacts of each of these factors may have exacerbated or mitigated the negative effects of the program on fishing communities over both the short- and long-terms.
SOC-9	NS: 10	Has the program promoted safety of human life at sea?	The SCOQ ITQ program eliminated the effort limitation system, thereby removing an incentive for harvesters to overload their vessels and allowing vessel owners to schedule fishing trips at times of the year when the weather is more favorable. Further, the ability to transfer allocations to other vessels removed impediments to modernizing the fleet and retiring deteriorating, unsafe vessels. However, the surfclam and ocean quahog fisheries maintained relatively high accident and fatality rates after program implementation. Many of these disasters were caused by the same factors that affected vessel safety during the pre-program period. For example, according to the U.S. Coast Guard, the three surfclam/ocean quahog boats that sank in the early 1990s had been carrying heavy loads, and instability of the loads was believed to be a factor in the accidents. Similarly, a surfclam/ocean quahog vessel that sank in 1999, was laden with more cages than specified in its stability manual, and its fish hold hatches were not maintained in a watertight condition. The continuing high rate of safety incidents in the surfclam and ocean quahog fisheries after program implementation suggest that market conditions and the agreements made with processors are overriding factors that impel vessel operators to go out in dangerous conditions or to overload. After the program began, processors still demanded that vessels fish when the product was needed, much as they did before the program began. In addition,

Question Number	Element Number/ Letter	Questions to be Answered	Summarized Effects of the Program
			processors have additional leverage over harvesters because they control much of the ITQ quota share. In recent years, a number of factors have improved vessel safety in the surfclam and ocean quahog fisheries. New U.S. Coast Guard regulations require training, or demonstration of knowledge and competency, for all individuals in charge of commercial surfclam and ocean quahog vessels. Underwriters providing commercial fishing vessel insurance have contributed to improvements in vessel safety by insisting that vessel owners comply with these U.S. Coast Guard regulations and recommendations. Finally, the majority of new vessels designed specifically for the surfclam and ocean fisheries are constructed with features that make them less prone to safety incidents.

8 Administrative Context and Effects Analysis

8.1 Questions to be Answered

Table 20 provides a summary of program review questions used to guide the administrative context and effects analysis. These questions are based on the SCOQ ITQ program goals and objectives and the key areas of the NMFS Catch Share Review Guidelines. The MSA national standards pertaining to this topic area are encompassed by the provisions of the NMFS Catch Share Review Guidelines. The methodological approach used to answer these questions is presented in Section 8.2.

Table 20. Program Review Questions for the Administrative Analysis

Question Number	Element Number	Question to be Answered	Section Number
Questions that derive from program goals and objectives (G&Os)			
ADM-1	G&O: 2	Has the program simplified regulatory requirements to minimize public and private management costs administering and complying with regulatory, reporting, enforcement, and research requirements of clam and quahog management?	8.3.1
ADM-2	G&O: 4	Has the program created a management approach that is flexible and adaptive to short-term events or circumstances and consistent with overall plan objectives?	8.3.1 and 8.3.2
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
ADM-3	KA: C	Are eligibility requirements regarding who is allowed to hold QS or QP (e.g., owner on board provisions, etc.) inhibiting or precluding the achievement of certain program goals and objectives? Are additional restrictions necessary to achieve particular goals and objectives?	8.3.3
ADM-4	KA: F	If applicable, are existing data collection and monitoring programs sufficient to accurately determine each entity's ownership level and thus whether entities are exceeding limited access privileges caps?	8.3.4
ADM-5	KA: F	If applicable, are limited access privileges caps being applied at the appropriate levels to ensure they are serving their intended purpose? Are "persons" being identified in the program in a manner consistent with the Council's intent and other agency practices and guidance?	8.3.4
ADM-6	KA: G	Does the program include a cost recovery program per Section 303A(e) of the MSA? If so, what is the cost recovery fee percentage, any changes to the fee, and the amount of fees collected on an annual basis?	8.3.5
ADM-7	KA: G	Is the program is assessing fees in a manner such that all incremental costs are included in the assessment, whether the collected fees cover all incremental costs (i.e., does the 3 percent cap imposed by MSA preclude collecting fees to cover all incremental costs?)?	8.3.5
ADM-8	KA: G	Have there been any compliance or enforcement issues related to cost recovery?	8.3.5
ADM-9	KA: A	Are the program goals and objectives clear, measurable (at least qualitatively), achievable (i.e., are two or more objectives mutually exclusive?), and still appropriate under the current circumstances?	8.3.6
ADM-10	KA: H	Are the existing data collection and monitoring programs sufficient to assess the program's performance relative to the various goals and objectives?	8.3.6 and 8.3.7
ADM-11	KA: H	What is the reporting burden on program participants?	8.3.7
ADM-12	KA: H	Has the program assessed the use of electronic technologies versus paper-based and other more labor-intensive methods, particularly with respect to their effect on the accuracy of the collected data and resulting statistical estimates but also with respect to their effect on the ability to engage in real-time reporting?	8.3.8

Question Number	Element Number	Question to be Answered	Section Number
ADM-13	KA: H	Are current enforcement provisions and activities, including resources for conducting the latter, sufficient to ensure a high rate of compliance with program requirements?	8.3.9
Questions that derive from national standards (NSs) not encompassed by KA questions			
--	--	None applicable.	--

8.2 Methodological Approach

The discussion of administrative effects of the SCOQ ITQ program includes a qualitative discussion regarding how efficiencies in managing the SCOQ fisheries has changed over time with the implementation of the program. A primary source of information on administrative impacts was the extensive array of journal publications that have investigated various SCOQ ITQ program outcomes. Other primary sources were the environmental reviews prepared for amendments to the surfclam and ocean quahog fisheries FMP, including Amendment 17 which establishes a cost recovery program for the fisheries. These published information sources were supplemented with information obtained from personal communications with the Council, NMFS Northeast Fisheries Science Center, and NOAA Office of Law Enforcement staff. In general, the methodological approach for the administrative analysis section was to summarize the appropriate fishery information for the pre- and post-implementation periods, and then to use those summaries to develop answers to the program review questions.

8.3 Environment Before and After Program Implementation

Nine issue categories and, where available, associated annual time series data spanning the pre- and post-SCOQ ITQ program periods were used to organize and summarize the information needed to address the thirteen administrative analytic questions to be answered as listed in Table 20. These issue categories, each addressed in separate subsections below, are:

- Private and Public Management Costs
- Flexibility and Adaptiveness of Management Approach
- Eligibility Requirements to Participate in the Fisheries
- Excessive Share of Fishing Privileges
- Cost Recovery
- Management System and Review of SCOQ ITQ Program Goals and Objectives
- Reporting Burden
- Electronic Technologies
- Enforcement Provisions

8.3.1 Private and Public Management Costs

Pre-SCOQ ITQ Program Period

From 1979 through 1989, the annual catch limit in the surfclam fishery during the stock-rebuilding phase of management was supported by a host of other measures designed to keep harvests within the limit and

to mitigate potential adverse economic impacts of the planned reduction in catch. To spread out the catch and spread out product input to processors, the annual catch limit was divided in unequal quarterly limits reflecting the expectation that greater fishing activity and harvest would occur from the late spring through early fall (Nicholls 1985). To keep the surfclam harvest within its prescribed catch limit, NMFS restricted fishing time for all vessels to whatever number of hours per week or trips per quarter the agency determined would be needed for the entire fleet to harvest the quarterly allocation. Progress toward harvest of the quotas was monitored on a weekly basis, and allowable fishing time during each quarter was increased or reduced to ensure that the quota would be taken, but not exceeded, and that the quota would last through the entire quarter.

In addition, to protect the growth of surfclams, the surfclam fishery was managed through minimum size limits and closed areas, where the harvest of surfclams was prohibited. The minimum size regulation was in effect from 1982 through 1990, while the area closure provision was applied during the 1980s, with area closures off Atlantic City, New Jersey, Ocean City, Maryland, and Chincoteague, Virginia (Mid-Atlantic Fishery Management Council 2017c).

The pre-SCOQ ITQ program regulatory regime under the FMP was widely considered a success in terms of reducing the overharvest of surfclams and ocean quahogs, but many provisions in the evolving FMP were seen by industry, the Council, and NMFS as burdensome and inflexible (National Research Council 1999). As the number and complexity of regulations increased, the public and private management costs of administering and complying with the regulations grew (Mid-Atlantic Fishery Management Council 1988). Eventually the management regime became what one observer called a "bureaucratic nightmare" (McCay 2004).

An example of these management problems was the complex regulatory web which the effort limitation system created in the surfclam fishery. For example, NMFS would notify each owner or operator of a fishing vessel engaged in the fishery concerning the allowable combinations of fishing periods for varying levels of allowable fishing time. Each vessel in turn would choose which actual day or days it would fish, notified NMFS, and then had to "use or lose" the days. In the winter, a vessel could obtain a bad weather "makeup day," but if this day also was missed, the fishing opportunity was lost. To facilitate enforcement, a relatively long lead time of ten days was required for choosing fishing days so that NMFS enforcement agents and the Coast Guard could be aware of when a vessel was allowed to fish; this requirement severely restricted short-term planning by vessel owners (Mid-Atlantic Fishery Management Council 1988). When combined with the inability to consolidate allowable fishing time from one vessel onto another, the restrictions imposed by the effort limitation system became highly problematic for industry (Marvin 1992; National Research Council 1999). Furthermore, the system was very labor-intensive and costly for NMFS to administer, as the agency was required to set and monitor an allowable fishing time for each vessel in the surfclam fishery (Wang 1995; U.S. General Accounting Office 2005).

In addition, any significant change in fishing operations or the condition of the surfclam resource required an adjustment in the regulations to keep the effort limitation system working as intended. For example, by the early to mid-1980s, surfclam vessels began landing more than one boat load of clams in one day in what was classified as one fishing trip on the theory that harvests took place during the vessel's permitted fishing time. In response, Amendment 6, prepared in 1986, modified the regulations to limit a vessel to land clams one time on any one fishing trip (Mid-Atlantic Fishery Management Council 1986a; Marvin 1992). The recurrent need to make detailed adjustments to the regulations explains why the pre-SCOQ ITQ program period was characterized by numerous amendments to the FMP (seven amendments between 1978 and 1987) (U.S. Congress 1994; Wallace 1994). The frequent changes in policy required NMFS to spend significant staff time monitoring the status of the fishery, as well as drafting revisions to fishery regulations (U.S. General Accounting Office 2005).

Table 21 illustrates the time and cost burden on industry, the Council, and NMFS during the first decade of management under the FMP. Most public and private management costs were associated with regulating the surfclam fishery. Similar effort restrictions were provided for the ocean quahog fishery in the event that the catch was likely to exceed the annual catch limit, or if overfishing required a closure before the end of the year. However, NMFS used these provisions only once, in the fall of 1985, when allowable fishing days were reduced from seven to five days per week (Marvin 1992).

Table 21. Public and Private Management Costs Before and After SCOQ ITQ Program Implementation[1]

Actions Associated with Surfclam and Ocean Quahog Fishery Management	Pre-SCOQ ITQ Program	Post-SCOQ ITQ Program
Federal Register actions	28 per year (1988)	4 per year (2005)
Council staff	3 or 4 staff-years annually (1988)	1/2 a staff-year (2003)
Council time	50 percent of time or more	5 percent of time
Industry time	Every Council meeting, last Friday of every month	A few representatives at about 2 Council meetings/year
Enforcement actions	60 per year	3 in the past decade

Source: U.S. General Accounting Office (2005); Hoff (2006)
[1] Years in parentheses are those provided in source document.

Post-SCOQ ITQ Program Period

The Council was considering some form of annual individual transferable allocation system as a substitute for the effort limitation system in the surfclam fishery from the time the FMP was first developed (Mid-Atlantic Fishery Management Council 1988). By the mid-1980s, rapid growth in harvesting capacity and resulting inefficiencies in the surfclam fishery accelerated the debate over establishing tradable fishing privileges (Brandt 2003b). The formal negotiations over an individual allocation system began with a discussion paper written and circulated by the Council in 1986 (Mid-Atlantic Fishery Management Council 1986b).

By the late 1980s, deciding on a type of individual allocation system to replace the effort limitation system had become one of the most time and labor-intensive tasks of the Council. A major cost was the staff time devoted to running alternative scenarios for determining the initial allocation and rules of the SCOQ ITQ program (McCay and Brandt 2001). According to MAFMC staff, it took the equivalent of about one full-time Council staff member between 2 and 3 years to develop the FMP amendment that created the SCOQ ITQ program (U.S. General Accounting Office 2005). A NOAA Office of General Counsel Northeast Section attorney estimated that providing legal input on the development of program required 30 to 50 percent of one attorney's time because the program raised legal issues that NMFS had not previously addressed since it had no prior experience approving individual catch allocations under the MSA (U.S. General Accounting Office 2005).

While NMFS does not systematically track the costs of managing LAPPs after they are implemented, fishery managers reported that management costs for the SCOQ ITQ program were higher during its first years as NMFS and industry adjusted to the new program (U.S. General Accounting Office 2005). For instance, NMFS reported that learning to manage ITQ quota share allocations, including transfers and leases, was very time-consuming for agency staff, particularly because there were no precedents in federal fisheries management. A NMFS official estimated that during the program's first years, these activities required the time of two Sustainable Fisheries' staff during the first month of each year and 25 percent of their time for the remainder of the year. However, while some NMFS offices incurred additional costs during initial program implementation, NOAA Office of General Counsel Northeast Section staff reported that they spent

considerably less time on the surfclam and ocean quahog fisheries once the SCOQ ITQ program was implemented. There were few appeals of the initial ITQ quota share allocation because it was based on historical landings data that were readily available from vessel logbooks because of the logbook requirements which applied to both the surfclam and ocean quahog fisheries. As a result of this detailed record of the fishing history of individual vessels, it was difficult for vessel owners to contest the validity of these data (U.S. General Accounting Office 2005).

As shown in Table 21, administrative cost savings due SCOQ ITQ program implementation were realized over time. By 2003, for example, Council staff estimated that the amount of time they spent on the surfclam and ocean quahog fisheries had decreased from three or four staff-years annually during the pre-SCOQ ITQ program period to less than half a staff-year. The number of Federal Register actions related to surfclam/ocean quahog fishery management fell from 28 in 1988 to four in 2005. These decreases occurred, in part, because the condition of the surfclam and ocean quahog stocks had stabilized, but also because fishery managers no longer had to "micromanage" the fisheries (U.S. General Accounting Office 2005). The replacement of the effort limitation system with the SCOQ ITQ program significantly reduced administrative costs through elimination of the need to assign and monitor individual vessel fishing days, the bad weather makeup day provision, and related measures. In addition, the costs associated with administering complex, ambiguous vessel replacement regulations were eliminated since the process of certifying that a vessel was retiring involuntarily from the fishery and was being replaced by one of similar harvesting capacity was no longer necessary (Mid-Atlantic Fishery Management Council 1988). While the issuance of annual permits for vessels participating in the surfclam and ocean quahog fisheries did not change under the SCOQ ITQ program, administrative cost savings occurred over time as vessel consolidation under the program reduced the number of permits processed (Mid-Atlantic Fishery Management Council 1988)

In addition, NMFS officials reported that enforcement costs were substantially lower after implementation of the SCOQ ITQ program (U.S. General Accounting Office 2005). Before program implementation, enforcement under the effort limitation system required the use of Coast Guard cutters and aircraft to monitor fishing vessels for compliance with their respective fishing time restrictions. Enforcement also required monitoring offloads to ensure that minimum surfclam sizes were being met. With the implementation of the SCOQ ITQ program and its reliance on individual catch allocations, NMFS changed its enforcement efforts from costly at-sea monitoring of fishing vessels to an emphasis on monitoring the amount of surfclams and ocean quahogs coming ashore and ensuring that all landings were reported accurately (U.S. General Accounting Office 2005). This reliance on shoreside monitoring and enforcement was facilitated by characteristics of the surfclam and ocean quahog fisheries, including a small number of vessels—the number of vessels is now less than 50 due to consolidation under the program—and limited landing sites, as vessels can offload their cages only at docks with industrial cranes because of the size and weight of the cages and shell stock (National Research Council 1999; U.S. General Accounting Office 2005).

Other features of the surfclam and ocean quahog fisheries also simplified management under a LAPP, thereby reducing public management costs: the fisheries operate in a relatively small area (e.g., industry has come to depend heavily on the same thirty or so ten minute squares in the New Jersey region in recent years); the number of vessel owners is even smaller than the number of vessels; and there is no recreational competition for the resources (National Research Council 1999; U.S. General Accounting Office 2005; Rountree 2016).

While overall public management costs decreased following SCOQ ITQ program implementation, the program created new types of costs. For example, there are on-going costs associated with the issuance of ITQ allocation permits and in keeping track of their subsequent sale and resale by industry (Mid-Atlantic Fishery Management Council 1988). However, these costs have decreased over time as ITQ quota share allocations were combined and older vessels were retired from the fisheries. Moreover, the cost recovery provisions for the SCOQ ITQ program, which became effective July 15, 2016, cover most, if not all, these incremental public management costs.

The fishing industry also experienced a reduction in management costs under the SCOQ ITQ program, as the program has a relatively simple set of rules designed, in part, to minimize government regulation (U.S. General Accounting Office 2005). However, some industry members assumed that more control of the surfclam and ocean quahog fisheries would be returned to them under the SCOQ ITQ program than was the case (Wallace 1994). For example, a vessel is allowed to shuck at sea under the SCOQ ITQ program only if it carries a NMFS-approved observer. Industry saw shucking at sea as a possible way of addressing the difficulty of meeting environmental pollution standards when disposing clam shells and wastewater during shoreside processing. On the other hand, NMFS expressed concern about its ability to ensure that accurate records are kept on the quantity of harvests unless an observer is onboard to certify the amount, in bushels, of unshucked product that the vessel has processed at sea (55 Fed. Reg. 24184 (June 14, 1990); Mid-Atlantic Fishery Management Council 1988).

Nevertheless, in comparison to the pre-SCOQ ITQ program management regime, vessel owners and operators are allowed to make far more adjustments to their day-to-day operations without involving the government (U.S. General Accounting Office 2005). In addition, the program places no limits on the amount of ITQ quota share a person can hold, and restrictions on who can receive ITQ quota share transfers are minimal. The elimination of vessel replacement regulations removed government interference in decisions about how large a vessel could be employed in the surfclam fishery (Mid-Atlantic Fishery Management Council 1988).

The SCOQ ITQ program did not change all of the regulatory requirements that existed in the surfclam and ocean quahog fisheries before the program began. The surfclam minimum size limit was retained, but the Council has maintained an exemption from the limit since implementation of the SCOQ ITQ program. Under the program, the desire of vessel operators to maximize their revenue from a given ITQ quota share led them to take additional measures to harvest the large-size, high-yield surfclams that are desired by buyers and command a higher price. With unlimited fishing time, for instance, vessels could search for and concentrate their fising effort on aggregations of the larger clams (Ross 1992).

Areas can continue to be closed to surfclam fishing if the abundance of small clams in an area meets certain threshold criteria. However, all of the closed areas created during the 1980s to protect the growth of surfclams were reopened by 1991. On the other hand, fishing areas for surfclams and ocean quahogs have closed for public health related issues due to the toxins that cause PSP. The Georges Bank region was closed to the harvest of surfclam and ocean quahog from 1990 to 2008 due to the risk of PSP. NMFS reopened a portion of the region in 2013, but harvesting vessels must adhere to the testing protocol from the National Shellfish Sanitation Program (Mid-Atlantic Fishery Management Council 2017c). In addition, in 2015, industry implemented two voluntary area closures to protect small surfclams and enhance production in portions of the stock. One closure is off Ocean City, Maryland, and the other is off Point Pleasant, New Jersey. The Science Center for Marine Fisheries, a research center supported by industry, universities, and the National Science Foundation, is surveying and sampling the closed areas annually. Compliance with the closures is being monitored by industry using the existing vessel monitoring system (VMS) for the surfclam and ocean quahog fisheries, and there is an agreed penalty schedule for fishing in the areas (Surfclam and Ocean Quahog Advisory Panel 2016; Kuykendall et al. 2017).

The cost recovery provisions for the SCOQ ITQ program, which became effective July 15, 2016, are a source on increased costs to the industry. In 2017, the actual total amount billed to industry was $21,942 ($0.32 per cage tag) in the surfclam fishery and $19,397 ($0.20 per cage tag) in the ocean fishery; these assessed charges are based on 2016 estimated management, data collection, and enforcement costs incurred by NMFS. Additional information on the cost recovery program is provided in Sections 6.3.7 and 8.3.5.

In addition, industry representatives has stated that since the SCOQ ITQ program began, the private costs of complying with regulatory function have generally increased (Surfclam and Ocean Quahog Advisory

Panel 2017). However, the majority of incremental costs are due to factors (e.g., wastewater treatment regulations, habitat protection requirements, bycatch mitigation mandates, onboard PSP protocols) unrelated to the SCOQ ITQ program.

8.3.2 Flexibility and Adaptiveness of Management Approach

Pre-SCOQ ITQ Program Period

Although participants in the surfclam and ocean quahog fisheries are geographically dispersed, the number of participants has been fairly limited since the fisheries first began, As a result, a kind of community arose out of the industry itself that was small and very competitive but tightly networked, with considerable vertical integration between harvesters and processors (McCay et al. 2011b). As a result, the transaction costs and conflicts likely to make collective agreements difficult in the fisheries were reduced, and industry has long been able to organize itself to become directly involved in management decisions for the fisheries (McCay et al. 2011b).

Before passage of the MSA, for example, industry members tried to find ways to voluntarily manage the surfclam fishery, and some NMFS analysts declared the fishery to be a model of near self-governance (McCay and Creed 1994b). At the time, there was even an exploration of the possibility of giving the entire resource over to the industry to manage. Once the MSA created the system of regional fishery management councils, industry did not hesitate to use the Council as a vehicle for establishing a formal regulatory framework for both the surfclam and ocean quahog fisheries, working closely with Council staff and NMFS officials (McCay and Creed 1994b). For example, before the MSA was passed, self-regulation contracting was used by industry to establish trip limits for vessels, and in 1984, a provision to introduce trip limits if the NMFS believes such limits are necessary was adopted by the Council through Amendment 4 (Turgeon 1985). In addition, at times the industry was able to translate its concern about limited markets into Council decisions to impose lower annual catch limits than what was biologically recommended (McCay et al. 2011b).

Moreover, the surfclam and ocean quahog fisheries are distinctive because of their extended history of close interaction among fishery managers, scientists, and industry personnel (McCay et al. 2011a). An early example of the capacity of industry and government to respond collectively to significant change in the fisheries occurred in the 1960s, when vessel owners suspected that the surfclam beds off New Jersey were being depleted. A joint research program, supported financially by industry and federal government, was initiated to determine the overall extent of the resource available for future exploitation. Exploratory surveys in 1965 discovered significant new beds in the regions off the Delmarva Peninsula, and the surfclam fishery expanded offshore and to the south (Mid-Atlantic Fishery Management Council 1977).

Post-SCOQ ITQ Program Period

The decision to move to the SCOQ ITQ program and the harder decision about the basis for allocating annual catch limits among fishery participants were made by the Council, but only after over 10 years of industry involvement largely through the Council's industry advisory committees (McCay and Creed 1994b). After the defeat of several lawsuits filed by industry groups challenging various features of the SCOQ ITQ program, the general approach of industry appears to be acceptance and desire for consistency and predictability, as opposed to frequent change (National Research Council 1999).

As discussed in Section 8.3.1, the SCOQ ITQ program was designed, in part, to minimize government regulation, thereby providing industry the flexibility to make more adjustments to their day-to-day operations without involving the government. In addition, over the years, the SCOQ ITQ program has increased the propensity of industry to not only comply with management measures but to also actively

engage in the management process. The sense of community in the industry has been reinforced by the myriad relationships engendered by ITQ quota share trading within the SCOQ ITQ program (McCay et al. 2011b). In addition, with far fewer key actors in the surfclam and ocean quahog fisheries following the fleet consolidation that occurred under the program, it has been possible for industry to organize better than in the past to influence decisions at the Council (McCay and Brandt 2001). For example, it has been able to present a more united front in fisheries management by meeting early to decide on what they will ask of the Council (McCay et al. 2011b).

Moreover, industry has repeatedly been able to generate both collective action and financing to address problems and opportunities, and the capacity to do this may be attributed at least partially to incentives created by the SCOQ ITQ program. Scholarship as well as direct experience in various ITQ programs suggest that the secure and exclusive harvesting rights granted to private entities by individual catch allocations creates incentives to care enough for the future that these entities will act both individually and collectively to protect the resources involved (McCay et al. 2011b)

Section 8.3.1 discussed a recent example of industry becoming proactive advocates of measures that will help ensure the long-term sustainability of the resource: voluntary area closures implemented off Ocean City, Maryland and Point Pleasant, New Jersey. The crowding and intensified pressure on the dense clam beds in these areas has resulted in sharply declining LPUE, which raises the costs of harvest and interacts with declining market demand to reduce profitability at the harvest end of the chain (McCay et al. 2011a). After forming a committee to explore various remedial measures, industry decided on a self-governed system of rotating closures, following the example of the sea scallop fishery (McCay et al. 2011b). As noted in Section 8.3.1, industry is monitoring compliance with the area closures using the existing VMS, and there is an agreed penalty schedule for fishing in the areas. The industry has indicated that they are not willing to disclose the specific locations of these areas closures to the Council.

Following SCOQ ITQ program implementation, industry was also at the forefront of a surge in cooperative or joint research efforts, contributing money, vessel and crew time, and expertise to at-sea research in order to improve the accuracy of NMFS stock assessment surveys (McCay and Brandt 2001). This collaborative research was initially precipitated by a 1995 lawsuit some industry members filed against NMFS that challenged the 1995 reduction in the annual catch limits for surfclams and ocean quahogs (*J.H. Miles & Co., Inc. v. Brown*, 910 F. Supp. 1138, 1157-59 (E.D. Va. 1995)). The plaintiffs contended that the NMFS stock assessment survey indicated that the surfclam and ocean quahog stocks were more abundant than previously believed, and that a reduction in the annual catch limits was a violation of the MSA. The court dismissed the plaintiffs' argument, noting that the 1995 annual catch limits for surfclams and ocean quahogs conformed to National Standard 1. Industry subsequently chose to take steps to improve the stock assessment survey. For example, in collaboration with scientists at Rutgers University's Haskin Shellfish Research Laboratory, industry funded improvements in NMFS survey technology (Griffith 2008). According to NMFS (2003), these improvements allowed for more accurate estimates of surfclam biomass. In 2016, a new selectivity dredge was designed and built by members of industry for use in NMFS stock assessment surveys. Since 2012, these surveys have been conducted on an industry vessel contracted by NMFS. In addition, from 1997 through 2012, depletion experiments that contributed information to the stock assessment were conducted in collaboration with NMFS, academia, and industry. During these experiments an industry vessel fishes repetitively to "deplete" a site where the survey vessel has already made a small number of non-overlapping tows (National Marine Fisheries Service 2013b). Another example of recent collaborative research was a joint effort by industry, NMFS, the U.S. Food and Drug Administration, and the Interstate Shellfish Sanitation Conference to determine the extent of potential PSP problems in the Georges Bank region, and to develop protocols for testing of clams both onboard and dockside for PSP toxins. This research was instrumental in the reopening by NMFS of a 6,000 nm^2 area in the Georges Bank region in January 2013 under the protocols (Rowley 2013).

These and several other instances of collaborative research since the SCOQ ITQ program began led a group of observers to declare that "one of the most successful examples of industry-science cooperative research in the Northeast U.S. occurs in the surfclam and ocean quahog fisher[ies]" (Murray et al. 2010).[13]

However, industry response to reductions in the range and productivity of the surfclam stock caused by climate change suggests that the capacity of industry to respond adaptively to significant environmental changes may have limits even though the SCOQ ITQ program has realigned incentives so that industry now has a greater financial stake in the long-term health of the resource. Thus far, coordination for addressing climate-related issues in the surfclam fishery has taken place mainly through industry meetings to discuss the potential for spatial management, building upon the social capital created over the previous decade for industry cooperation in supporting cooperative research with academic and government scientists. However, with the exception of the aforementioned voluntary area closures, little follow-up has happened. The dominant industry strategy, on the level of major companies, is "wait and see", trying to keep businesses going, while making minor adjustments in how business is done and exploring alternatives (McCay et al. 2011a).

The Council has voted to maintain the status quo for surfclam management, despite concerns about depletion of some surfclam beds and the die-offs to the south. This decision came about partly because of the legislative constraints, but also likely because of strong pressures from the more powerful members of the industry to avoid change and reluctance to act given uncertainties (McCay et al. 2011a). It appears that climate change issues have intersected with other issues. Given the reopening of parts of the Georges Bank region in 2013, issues such as overcrowding and overworking of the surfclam beds off the coast of New Jersey due to the shift in the surfclam stock's range are less of a priority, at least for the northern processors and large, offshore-capable vessels prepared to exploit Georges Bank beds (McCay et al. 2011a). In addition, the current situation is marked by economic uncertainty and distress because of declining demand for surfclam meat (McCay et al. 2011a). A potential industry response to this economic pressure is further consolidation, but this response may be stalled by uncertainty about how "excessive shares" will be defined in the SCOQ ITQ program (McCay et al. 2011a).

It also possible that industry inertia to adapting to and mitigating the effects of observed and anticipated climate-related changes in the surfclam stock may be partly due to unbalanced participation in the management process across industry members. While industry has long been directly involved in management decisions for the surfclam and ocean quahog fisheries, it has not necessarily been the case that the members most involved are representative of the entire industry or even the majority of members. Public stakeholder meetings often have high costs of participation, thus economic theory predicts they will be dominated by extreme views and often lead to decisions that do not represent the majority viewpoint (Lynham et al. 2017).

This potential for imbalanced industry participation in the management process for the surfclam and ocean quahog fisheries was studied by Turner and Weninger (2005). The researchers obtained logbook data on harvest in the fisheries. They then combined that data with public records of tradable ITQ quota share ownership and the minutes of regulatory meetings where annual catch limits were discussed to create a unique dataset on the universe of firms affected by regulatory outcomes and their participation in stakeholder meetings. Using this information, Turner and Weninger were able to show that firms with a preference for extreme, rather than moderate, policies were much more likely to participate in these public stakeholder meetings where regulation was determined. They also found that participation rates were higher for larger firms and for firms located geographically close to the meeting location. These results suggest that fishery managers will come under disproportionate pressure from firms whose preferred policies are extreme relative to the industry as a whole. However, it is likely that this imbalance occurred as much before

[13] A complete list of research projects industry has conducted in collaboration with the Science Center for Marine Fisheries is provided in Surfclam and Ocean Quahog Advisory Panel (2018).

the SCOQ ITQ program began as after. On the eve of program implementation the surfclam and ocean quahog fisheries were already highly industrialized and dominated by a few vertically integrated firms (McCay and Brandt 2001).

8.3.3 Eligibility Requirements to Participate in the Fisheries

Pre-SCOQ ITQ Program Period

During the pre-SCOQ ITQ program period, a vessel was required to be documented by the U.S. Coast Guard to harvest surfclams or ocean quahogs. It was necessary for an individual, partnership, or corporation to meet U.S. citizen requirements for ownership of a documented vessel.

With the establishment of the moratorium on new entry into the surfclam fishery in 1977, access to the fishery was contingent on owning one of the original permitted vessels or its replacement. Specifically, a vessel was eligible for a moratorium permit to harvest surfclams in the Mid-Atlantic Area if it met any of the following criteria: a) the vessel landed surfclams in the course of conducting a directed fishery for surfclams between 18 November 1976 and 17 November 1977; or b) the vessel was under construction for, or was being rerigged for, use in the directed fishery for surfclams on 17 November 1977; or c) the vessel was replacing a vessel of substantially similar harvesting capacity which involuntarily left the surfclam fishery during the moratorium, and both the entering and replaced vessels were owned by the same person (Mid-Atlantic Fishery Management Council 1988). A moratorium permit could not be sold independent of a vessel. No such eligibility restrictions existed for vessels fishing for surfclams in the New England Area or for vessels harvesting ocean quahogs.

Any processor or dealer of surfclams or ocean quahogs was required to have a federal permit issued by NMFS.

Post-SCOQ ITQ Program Period

Under the SCOQ ITQ program, two permits are needed to fish for and land surfclams and ocean quahogs. One permit is the same vessel permit required before program implementation. The vessel permit was required for any vessel that fished for surfclams or ocean quahogs. The second permit is an ITQ allocation permit issued by NMFS. This latter permit takes the form of 1) an individual allocation certificate specifying the share of the annual surfclam and/or ocean quahog catch limit the allocation is worth; 2) surfclam and/or ocean quahog cage tags equivalent to the cages resulting from applying the individual allocation to the annual catch limit; and 3) any documentation issued by NMFS concerning the transfer of individual allocations and cage tags (Mid-Atlantic Fishery Management Council 1988). The ITQ allocation permit specifies the cage tag numbers the permit holder is required to use during the harvest of their allocation. Any person (i.e., individual, partnership, or corporation) who meets U.S. citizen requirements for ownership of a U.S. Coast Guard documented vessel is eligible to own an ITQ allocation permit.

The annual ITQ allocation permit is valid only for the person to whom it is issued. A critical aspect of the initial allocation mechanism was that ITQ quota share would be distributed on a vessel basis, not directly to vessel owners. Thus, the fishing privilege asset was embedded in the vessel asset. However, at the point the program was implemented, the fishing privilege was disaggregated from the vessel and could be traded as a separate asset (Brandt 2003b). The program permits persons to retain ownership of their ITQ quota share even if they terminate harvesting and sell their vessel, thereby allowing them to lease their quota. Amendment 13, which was approved by NMFS in 2013, clarified the Council's intent not to restrict the holding of ITQ quota share to only those entities that own a permitted vessel.

Subject to the approval of NMFS, all or part of the ITQ quota share (i.e., cage tag allocation) specified in the ITQ allocation permit may be transferred to any person with an ITQ allocation permit (50 CFR §648.74(b)). Any entity who meets the requirements for owning a U.S. Coast Guard documented fishing

vessel can purchase or lease ITQ quota share, whether or not that person owns a fishing vessel. An ITQ allocation permit does not need to have associated ITQ quota share to be used for leasing ITQ quota share.

Until January 1, 2016, an ITQ allocation permit never expired. After that date, ITQ allocation permits became subject to a "renew or lose" provision. An existing ITQ allocation permit holder must renew his/her permit(s) on an annual basis by submitting to NMFS an ITQ allocation permit application and an ITQ ownership form for such permit before the end of the fishing year for which the permit is required. Failure to renew a surfclam or ocean quahog ITQ allocation permit in any fishing year will result in any surfclam or ocean quahog ITQ quota share held by that ITQ allocation permit holder to be considered abandoned and relinquished (50 CFR §648.74(a)(1)(ii)(B)).

As was the case during the pre-SCOQ ITQ program period, any processor or dealer of surfclams or ocean quahogs must have a permit issued by NMFS.

8.3.4 Excessive Share of Fishing Privileges

Two sections of the MSA address the need to prevent an individual, partnership, or corporation from acquiring an excessive share of fishing privileges, National Standard 4 and Section 303A(c)(5)(D). National Standard 4 requires "that no particular individual, corporation, or other entity acquires an excessive share of [fishing] privileges" (Sec. 301(a)(4)). Section 303A(c)(5)(D), which was added to the MSA by the MSA Reauthorization Act of 2006, does not apply to the SCOQ ITQ program. The note at the end of MSA Section 303A states that "nothing in this Act [P.L. 104-297] or the amendments made by this Act shall be construed to require a reallocation of individual fishing quotas under any individual fishing quota program approved by the Secretary before January 4, 1995."

As described in Section 7.3.1, during the Council's decade-long debate leading up to SCOQ ITQ program implementation, the issue of ownership concentration was central. Industry had long had one or more large players with concentrated harvesting or market power, and the future relationship of these large players to the smaller players, particularly the small independent vessel owners (one or two vessels), was a major question framing negotiations over initial allocations, transfer rules, and other SCOQ ITQ program-related issues. The debate about regulations concerning industry consolidation continued after the Council prepared a hearing draft of Amendment 8 in July 1988. For example, the draft amendment included a "phase-in period" of three years, during which ITQ allocation permits and ITQ quota share for the surfclam fishery could be combined at no more than the rate of two for one, for each of the three years. However, these provisions were eliminated in the amendment adopted by the Council in October 1989 (National Research Council 1999). The approved SCOQ ITQ program allowed individual allocations of both surfclams and ocean quahogs to be traded freely (in quantities no smaller than 5 cages) and placed no limits on the amount of ITQ quota share a person could hold.

The environmental review for Amendment 8 to the Atlantic Surfclam and Ocean Quahog FMP cited existing federal antitrust laws as being sufficient for the program to meet the requirements of National Standard 4 (Mid-Atlantic Fishery Management Council 1988). However, both the applicability as well as the effectiveness of federal antitrust law in meeting National Standard 4 was a source of controversy during the development of Amendment 8, as evidenced by public comments included in the amendment (Mid-Atlantic Fishery Management Council 1988). Comments attached to the final rule for Amendment 8 show that NMFS believed that the likelihood that an individual could acquire an excessive share of fishing privileges was slight for two reasons: the high prices of ITQ quota share, and the oversight by the government, including NMFS, the Council and the U.S. Department of Justice. NMFS also suggested that the MSA did not require that the SCOQ ITQ program prevent an excess accumulation of fishing privileges after the initial distribution had been made, but left open the question as to whether a court might find an aftermarket concentration in violation of the Sherman Act (55 Fed. Reg. 24184 (June 14, 1990); Milliken 1994).

Soon after SCOQ ITQ program implementation, industry raised the issue of excessive share of fishing privileges in an early legal challenge to the SCOQ ITQ program (*Sea Watch Int'l v. Mosbacher*, 762 F. Supp. 370 (D.D.C. 1991)). As discussed in Section 7.3.1, plaintiffs alleged that the plan would concentrate a substantial portion of the annual catch limit for ocean quahogs in the hands of a couple of harvesters. The court dismissed the plaintiffs' argument, noting that the MSA has no definition of the term "excessive shares" and that the judgment of NMFS of what is excessive "deserves weight."

Currently, there appears to be consensus that U.S. antitrust law prohibits anticompetitive conduct that would create significant monopoly power by buyers or sellers in the surfclam and ocean quahog fisheries. For example, according to Mitchell et al. (2011) antitrust law provides safeguards to "protect against any general exercise of market power through such means as collusion on prices and output, or concerted foreclosure strategies." However, as early as 1994, the NMFS National Director of Marine Fisheries cautioned that antitrust regulations would not be helpful in preventing monopolies from developing in the surfclam and ocean quahog fisheries except in the most extreme case, and it would be a very lengthy process (Schmitten 1994). Furthermore, in specific regard to complying with National Standard 4, the National Research Council (1999) noted that the likelihood that antitrust law would be used to prosecute holders of excessive fishing privileges is small. Similarly, the U.S. General Accounting Office (2002) reported that "NMFS officials explained that the Department of Justice would most likely base a decision for taking an antitrust action on whether or not an individual or entity could fix the price of fish, rather than the amount of quota an individual or entity held."

In the end, the debate over the role of U.S. antitrust law became moot when NMFS determined that the Atlantic Surfclam and Ocean Quahog FMP was out of compliance with National Standard 4 because it does not currently include an excessive share cap expressed as a percentage of the total ITQ quota share (80 Fed. Reg. 42747 (July 20, 2015)). As a result, the Council was required to develop measures which specifically define what constitutes an excessive share in the SCOQ ITQ program (Mid-Atlantic Fishery Management Council 2018c).

However, the development of an excessive share amendment to the FMP was impeded by a lack of ownership information that prevented NMFS from appropriately characterizing the amount of consolidation in the surfclam and ocean quahog fisheries under the SCOQ ITQ program (U.S. General Accounting Office 2002). NMFS collected only basic information about the individuals, partnerships, or corporations that held surfclam and ocean quahog ITQ allocations. This information was collected at the time that an entity first acquired ITQ quota share and was not routinely verified or updated (80 Fed. Reg. 42747 (July 20, 2015)). A further complication is that control of ITQ quota share in the surfclam and ocean quahog fisheries often involves a series of complex corporate and business relationships (80 Fed. Reg. 42747 (July 20, 2015)). A single person may potentially own or control many individual ITQ quota share allocations. In addition, as described in Section 6.3.8, in many cases, a financial institution holds ITQ quota share as collateral on a loan to purchase the quota over a long term. A number of financial institutions listed as owners of ITQ quota share may have a single borrower under multiple loans (Mid-Atlantic Fishery Management Council 2016b).

In 2011, in anticipation of the need to develop an excessive share amendment, NMFS and the Council contracted an economic consulting firm to examine and report on potential excessive share caps in the surfclam and ocean quahog fisheries (Mitchell et al. 2011), and they subsequently convened a panel of independent reviewers to evaluate the report (Walden 2011). In a series of public meetings, a special Council workgroup met and considered the recommendations of the consulting firm and panel, reviewed how ownership information is collected in other fisheries around the country, reviewed the information currently collected in this fishery, and then devised a suite of data elements that would provide the information the Council would need when developing an excessive shares cap. These recommendations were detailed in a white paper that was considered and approved by the Council (80 Fed. Reg. 42747 (July 20, 2015)). The specific components of the requested information collection detailed in the white paper

were incorporated in new applications for ITQ allocation permits and ITQ quota share transfers that became effective on January 1, 2016.

As discussed in Section 8.3.7, the newly revised applications for allocation permits and quota transfers were designed by NMFS to routinely collect information that would enable the agency to determine the identity of ITQ quota share owners. The revised application process helps ensure that the Council has the information needed to develop a future management action intended to establish an excessive share regulation for the surfclam and ocean quahog fisheries (80 Fed. Reg. 42747 (July 20, 2015)).

In 2015, the Council incorporated the goal of preparing an excessive share amendment into its 2014–2018 Strategic Plan (Mid-Atlantic Fishery Management Council 2015), and it has been actively developing the amendment since then. Some industry representatives have expressed concern that an excessive share regulation that establishes a percent cap on individual ITQ quota ownership could interfere with the efficient operation of processing plants and fleets and create issues related to possible divestment (Surfclam and Ocean Quahog Advisory Panel 2018). Transcripts of public scoping hearings held by the Council and accepted written comments on the excessive share amendment are available at Mid-Atlantic Fishery Management Council (2018c).

8.3.5 Cost Recovery

Section 304(d)(2)(A) of the MSA requires NMFS to collect fees to recover the costs directly related to management, data collection, and enforcement of a LAPP. However, according to the U.S. General Accounting Office (2005), NMFS officials believed that the costs of collecting these fees should be taken into account when determining whether cost recovery is required in a particular LAPP, and that cost recovery for the SCOQ ITQ program was a low priority. Further, the Sustainable Fisheries Act of 1996 prohibited NMFS from collecting such fees in the surfclam and ocean quahog fisheries until after January 1, 2000 (Pub. L. No. 104-297, Section 109(d)).

Nevertheless, according to the General Accounting Office (2005), NMFS stated that it would work with the Council on adding cost recovery to the SCOQ ITQ program. The absence of cost recovery not only raised concerns regarding noncompliance with the MSA, but also concerns about fairness because owners of surfclam and ocean quahog ITQ quota share were receiving exclusive access to a public resource without compensation to the public. Also, harvesters in other U.S. fisheries managed by LAPPs were paying fees, while harvesters in the surfclam and ocean quahog fisheries were not (U.S. General Accounting Office 2005).

Amendment 17 to the FMP added measures for collecting fees and recovering costs associated with the management of the SCOQ ITQ program to ensure that the FMP was in compliance with requirements of the MSA (Mid-Atlantic Fishery Management Council 2016b). The cost recovery provisions for the SCOQ ITQ program became effective July 15, 2016 (81 Fed. Reg. 38969 (June 15, 2016)).

Under the cost recovery program, any ITQ allocation permit holder who has surfclam or ocean quahog ITQ quota share is responsible for paying a fee at the end of the year (81 Fed. Reg. 38969 (June 15, 2016)). The fee is based on the permit holder's surfclam or ocean quahog ITQ quota share (i.e., cage tag allocation) that year. The fee percentage is based on the total recoverable costs from the prior fiscal year, adjusted for any prior over- or under-collection, divided by the total ex-vessel value of the fishery. As specified by section 304(d)(2)(B) of the MSA, the resulting percentage cannot exceed 3 percent of the ex-vessel value of the surfclams and ocean quahogs harvested. NMFS calculates a per-cage tag fee based on the total number of cage tags used to land surfclams or ocean quahogs in the previous year. This tag fee is separate from, and in addition to, the price ITQ allocation permit holders currently pay to the tag vendor to obtain the physical cage tags each year. If an ITQ allocation permit holder transfers some or all of his or her ITQ quota share after the start of the fishing year, they are still liable for any cost recovery fee based on landings of the initial

allocation of cage tags. This process includes an inherent assumption that a similar number of cage tags will be used each year. In some years, NMFS may collect more or less money than is necessary to recover its costs. NMFS applies any over- or under-collection to its calculation of recoverable costs and per-tag fees for the following year (81 Fed. Reg. 38969 (June 15, 2016)).

Table 22 shows the cost recovery cage tag fee in 2017 and 2018 in the surfclam and ocean quahog fisheries, together with the total recoverable costs estimated by NMFS for 2016 and 2017. Most of the recoverable costs are associated with labor, and a small amount recovered for supplies. Recoverable costs increased between 2016 and 2017 due to an increase in agency tasks associated with cost recovery itself, as well as increased compliance within NMFS divisions with fully tracking staff time spent on recoverable tasks (Potts 2018). The table also shows the actual total amount billed for 2017; the cost recovery program was not in effect in 2016, and the billed amount for 2018 was unavailable for this review. The amount billed in 2017 effectively recovered the 2016 management, data collection, and enforcement costs. The total amount billed differed from the total recoverable costs because of the number of tags actually used in 2017 and a cutoff for bills under $25. Future recoverable costs will be adjusted to account for any over- or under-collection (Potts 2018).

Table 22. Number of Cage Tags Used, Total Recoverable Costs, Cost Recovery Cage Tag Fee, and Total Amount Billed in the Surfclam and Ocean Quahog Fisheries, 2016–2018

	Surfclam Fishery				Ocean Quahog Fishery			
	Total Number of Cage Tags Used	Total Recoverable Costs	Cost Recovery Cage Tag Fee	Total Amount Billed	Total Number of Cage Tags Used	Total Recoverable Costs	Cost Recovery Cage Tag Fee	Total Amount Billed
2016	73,085	$23,410	Not Applicable	Not Applicable	94,885	$18,837	Not Applicable	Not Applicable
2017	68,762	$58,723	$0.32	$21,942	97,331	$24,549	$0.20	$19,397
2018	Not Available	Not Available	$0.85	Not Available	Not Available	Not Available	$0.25	Not Available

Source: National Marine Fisheries Service (2017c; 2018a); Potts (2018)

The fees collected by the cost recovery program are deposited in the Limited Access System Administrative Fund (LASAF) established in the U.S. Treasury. A separate account has been created within the LASAF to ensure that the funds from the cost recovery program are used only to pay for the actual costs directly related to management, data collection, and enforcement costs of the SCOQ ITQ program. An annual ITQ report is generated by NMFS that includes annual information regarding the amount and value of surfclams and ocean quahogs landed during the year, the associated cost recovery fees, and the status of those fees. This report also details the costs incurred by NMFS, including the calculation of the recoverable costs for the management, data collection, and enforcement incurred by NMFS during the year (Mid-Atlantic Fishery Management Council 2016b).

Since the cost recovery provisions for the program became effective, all ITQ allocation permit holders who have surfclam or ocean quahog ITQ quota share have paid the amount due, and there have not been any enforcement issues related to cost recovery (Potts 2018).

8.3.6 Management System and Review of SCOQ ITQ Program Goals and Objectives

Since 1965, surveys have been conducted by NMFS (or its predecessor, the U.S. Bureau of Commercial Fisheries) to estimate the condition of the surfclam resource in the Middle Atlantic Bight (Section 5.3.2). A formal scientific peer-review process for evaluating and presenting stock assessment results for surfclams and ocean quahogs to fishery managers began in 1985. Starting in 2015, surfclam and ocean quahog vessels have been required to carry onboard observers who document catch composition and discards.

With the development of the FMP for the surfclam and ocean quahog fisheries in 1977, NMFS began enacting reporting and recordkeeping requirements for surfclam and ocean quahog harvesters and processors to monitor fishery progress and gain additional information about the distribution of fishing pressure on the surfclam and ocean quahog resources and about the economic character of the fisheries (Section 8.3.7). The majority of these requirements were enacted during the pre-SCOQ ITQ program period.

Drawing on the above biological and socioeconomic data collected for the surfclam and ocean quahog fisheries, the management system for the surfclam and ocean quahog fisheries is regularly reviewed and amended, if necessary, through the council process to ensure that the SCOQ ITQ program goals and objectives are being achieved and still appropriate. The Council seeks input through its scientific, technical, and industry/stakeholder groups to ensure these fisheries are managed based on sound scientific advice, and management measures are initiated, evaluated, and adopted in a fully transparent and public process (Coakley 2018).

The following list provided by Coakley (2018) describes entities that are part of the management system for surfclams and ocean quahogs:

- Council – the entity with jurisdiction under the MSA for operational management of the surfclam and quahog fisheries, including review/approval of all amendments to the FMP, as well as the setting of annual catch limits for both species.
- Scientific and Statistical Committee (SSC) of the Council – the Council's primary scientific/technical advisory body. The SSC provides ongoing scientific advice for fishery management decisions, including recommendations for acceptable biological catch, preventing overfishing, maximum sustainable yield, and achieving rebuilding targets, and reports on stock status and health, bycatch, habitat status, social and economic impacts of management measures, and sustainability of fishing practices. The SSC also plays a role in the stock assessment process for Northeast regional fisheries.
- Surfclam and Ocean Quahog Committee of the Council – comprised of a subset of Council members, the Committee meets to address issues specific to management of the species, or other Council issues. Council committees generally meet prior to full Council meetings to review and discuss proposed management plans, amendments, and other information pertaining to issues at hand. The committees typically provide recommendations to the full Council for consideration.
- Surfclam and Ocean Quahog Advisory Panel (AP) of the Council – APs provide information and recommendations to the Council during the development of fishery management plans, amendments, specifications, and management measures. One of the chief responsibilities of advisory panels is the annual development of Fishery Performance Reports. These reports provide the Council and SSC with information about the factors that influenced fishing effort and catch within each fishery during the previous year. Advisory panels are composed of individuals with diverse experience and interest in Mid-Atlantic fisheries. Members include commercial fishermen, recreational anglers, for-hire operators, dealers, scientists, environmentalists, and other members of the interested public.
- NMFS Northeast Fishery Science Center – conducts ecosystem-based research and assessments of living marine resources, with a focus on the Northeast U.S. Shelf Ecosystem. The Science Center conducts resource assessment surveys and periodic stock assessments for surfclam and ocean quahogs. It also implements broad scale data collections systems that are used to characterize and monitor aspects of the fishery, habitat and the marine environment, and the human communities for these species.

Meetings of the Council and its committees and advisory panels also provide an opportunity to determine if SCOQ ITQ program goals and objectives, as stated in Amendment 8 to the FMP (Mid-Atlantic Fishery Management Council 1988), are clear, measurable, achievable, and still appropriate under the current circumstances.

In 2017, the Council incorporated the goal of reviewing and revising the goals and objectives of the FMP into its 2014–2018 Strategic Plan (Mid-Atlantic Fishery Management Council 2017d). This initiative will allow the Council to revisit and possibly "refresh" FMP goals and objectives to ensure that they are consistent with today's fishery and management issues. According to some industry representatives, a revision of the goals and objectives is unwarranted given the current stability of the surfclam and ocean quahog fisheries. However, other industry members are amenable to revising at least some of the wording of the goals and objectives. Transcripts of public scoping hearings held by the Council and accepted written comments on the goals and objectives revisions are available at Mid-Atlantic Fishery Management Council (2018c).

8.3.7 Reporting Burden

Pre-SCOQ ITQ Program Period

Before SCOQ ITQ program implementation, any vessel that fished for surfclams or ocean quahogs must have been issued a valid surfclam or ocean quahog permit, respectively. These fishery-specific vessel permits had to be renewed annually, and the application forms required information about the physical characteristics of vessels. In addition, the owner or operator of any vessel with a permit for the surfclam or ocean quahog fisheries was required to maintain on a daily basis on board the vessel an accurate log for each fishing trip. The logbooks were required to be made available for inspection by authorized officers or designated NMFS employees at any time during or after a trip. The owner or operator submitted copies of logbook forms weekly to NMFS. Processors had to record how much product they accepted and from whom and submit this information in a weekly report to NMFS. In addition, processors were required to submit additional information to NMFS on an annual basis. The information collected from each of these reporting and recordkeeping requirements is summarized below.

- **Vessel permit** – Names, addresses, and telephone numbers of the owner and operator; the name of the vessel; the vessel's U.S. Coast Guard documentation number or state license number; engine and pump horsepower; home port of the vessel; directed fishery or fisheries; fish hold capacity (in cages or bushels); dredge size; and number of dredges. The vessel owner or operator is required to notify NMFS of any changes of address or physical characteristics of vessels.
- **Vessel logbook** – Name and permit number of the vessel; total amount in bushels of each species taken; date(s) caught; time at sea; duration of fishing; time; locality fished; crew size; crew share by percentage; landing port date sold; price per bushel; buyer; and size distribution of surfclams and ocean quahogs sold, by species, on a percentage basis.
- **Processor weekly report** – Dates of purchases or receipt; name, permit number, and mailing address; number of bushels purchased or received, by species; cage tag numbers; name and permit number of the vessel from which surfclams or ocean quahogs are landed or received; price per bushel, by species; mailing address of dealer or processing plant; size distribution; and meat yield per bushel by species.
- **Processor annual report** – Number of processing plant employees during each month of the year just ended; number of employees processing surfclams and ocean quahogs, by species, by month; total payroll for surfclam and ocean quahog processing, by month; plant capacity to process surfclam and ocean quahog shell stock, or to process surfclam and ocean quahog meats into finished products, by species; and projected capacity to process surfclams and ocean quahogs, by species, for the following

year. Surfclam and ocean quahog processors and dealers whose plant processing capacities change more than 10 percent during any year must notify NMFS in writing within 10 days after the change.

The reporting and recordkeeping requirements for harvesters and processors were used by the Council and NMFS to monitor fishery progress and gain additional information about the distribution of fishing pressure on the resource and about the economic character of the fisheries (Nicholls 1985). In addition, cross-checking vessel records with processor records enabled enforcement authorities to verify whether the declared landings match the declared purchases by processors. The requirement for an annual report from processors and dealers had been in place since the original FMP was implemented.

To further strengthen the control over landed product and facilitate enforcement of the surfclam minimum size limit, Amendment 5, approved in 1985, instituted a requirement that all cages be tagged. Each year NMFS issued coded, sequentially numbered cage tags to moratorium permit owners which were required to attach the tags to cages before the cages left the vessel, and the tags could not be removed until the cages were emptied at the processing plant (Mid-Atlantic Fishery Management Council 1984a). The processor was required to retain the cage tags for collection by NMFS.

The mechanics of the reporting and recordkeeping and tagging requirements were not viewed as a major problem for most harvesters and processors. However, small processors with minimal clerical staff or generally poor recordkeeping procedures voiced complaints over the time and effort it took to complete reports. These small processors often received supplies from several sources which increased reporting and recordkeeping requirements since many different vessels could be involved and cage tags were often not in numerical series (Ross 1992).

In addition to the general reporting and recordkeeping requirements described above, vessels participating in the surfclam fishery were required to comply with the reporting requirements of the effort limitation system, including notifying NMFS of their planned fishing days and scheduling bad weather makeup days. Further, at the start of each fishing trip, surfclam and ocean quahog vessels were required to provide the nearest NMFS Office of Law Enforcement office with the permit number assigned to the vessel, port of landing, expected date and time of departure from port, target species, and expected time and location of landing. During the pre-SCOQ ITQ program period, this vessel call-in system was a critical component of NMFS enforcement activities.[14] Under the effort limitation system, each vessel was competing with the others and against time to catch as much as possible (Section 6.3.2), and underreporting of catches was a potential problem (Mid-Atlantic Fishery Management Council 2003). The dockside inspections necessary to help monitor catches were aided by the knowledge of when and where surfclam and ocean quahog vessels would be arriving in or leaving from any given port, thereby allowing scarce enforcement resources to be used as efficiently as possible (Mid-Atlantic Fishery Management Council 2003). Some industry members complained that the call-in requirement was costly and burdensome (Wallace 1994), but NMFS maintained that the requirement was a relatively minor inconvenience for most vessels since it corresponded to a time when they were contacting their buyers with the same information (Mid-Atlantic Fishery Management Council 1997).

Initially, the Council related that industry compliance with the various reporting and recordkeeping requirements was excellent, with information needed for management always provided by industry on a timely basis (Mid-Atlantic Fishery Management Council 1981). However, as effort limitations tightened through the 1980s to keep harvests below the annual catch limit, occurrences of non-compliance with reporting and recordkeeping and other requirements in the surfclam and ocean quahog fisheries became more common (Section 8.3.9).

[14] A telephone based call-in notification system was first employed as part of the bad weather makeup day provision included in Amendment 2 to the FMP (56 Fed. Reg. 61182 (December 2, 1991)).

Post-SCOQ ITQ Program Period

Under the SCOQ ITQ program, previous reporting and recordkeeping requirements were modified as follow: 1) dealers must file weekly reports similar to those that processors must file; 2) dealers and processors must make their weekly reports available for inspection by authorized officers or designated NMFS employees (the same requirement that was in effect for vessel logbooks); and 3) the ITQ allocation permit number must be reported on both the vessel logbook reports and the dealer/processor reports (Mid-Atlantic Fishery Management Council 1988). In 2004, as part of the electronic reporting program (Section 8.3.8), surfclam and ocean quahog dealers and processors were no longer required to report the ITQ allocation permit number of the vessel(s) from which they purchase surfclams or ocean quahogs, and processors were not required to report the size distribution and meat yield per bushel by species.

As during the pre- SCOQ ITQ program, vessel logbooks and dealer/processor reports can be cross-checked against each other to ensure compliance. Available information indicates a high level of correspondence between logbooks and reports (Hoff 2006).

New reporting and record keeping requirements under the SCOQ ITQ program include the reporting of ITQ quota share/cage tag transfers and the submittal of annual ITQ allocation permit renewal applications. When an ITQ allocation permit holder wishes to sell or lease ITQ quota share, he or she must submit an application to NMFS for transfer. The application procedure is essential to shoreside enforcement, since the NMFS must track cage tags from vessels to processors (Litz 1993). In addition, the information collection program that became effective on January 1, 2016 modified the ITQ quota share transfer form to collect more detailed financial information about each transfer (80 Fed. Reg. 42747 (July 20, 2015)). The form clarifies whether or not a permanent transfer of ITQ quota share includes all of the cage tags for the current fishing year. Further, the form collects information about the nature of the transfer, including the total price paid for the transfer, including any fees; broker fees paid, if applicable; whether the transfer is part of a long-term (more than 1 year) contract; if so, the duration of the contract and whether the price is fixed or flexible; and any other conditions on the transfer. This information can provide valuable insight into the market for ITQ quota share or long-term contracts and agreements that would not otherwise be apparent. These additional details about transfers can illuminate situations where individuals or companies exert effective control over ITQ quota share allocation, even if they do not directly hold the quota share (80 Fed. Reg. 42747 (July 20, 2015)). In general, the reporting and recordkeeping requirements associated with transfers of ITQ quota share do not represent a substantial burden. The ITQ quota share transfer form is designed to be simple and easy to complete, thus, saving time for both industry respondents and NMFS managers of the system (National Marine Fisheries Service 2005).

After SCOQ ITQ program implementation, there were complaints from some industry members that some reporting and recordkeeping requirements carried over from the pre-program period no longer had enforcement value and should be discontinued (Wallace 1994). For example, industry argued that the vessel call-in provision was not warranted or necessary after implementation of the program since most of the dockside enforcement necessity disappeared, and enforcement could focus on monitoring cage tag requirements at processing plants and auditing vessel logbooks and processor/dealer reports (Mid-Atlantic Fishery Management Council 1988). According to NMFS, however, the call-in system provided the agency with enhanced enforcement capability (56 Fed. Reg. 61182 (December 2, 1991)).[15] Notwithstanding the continuing burden of the call-in requirement, violations of the requirement decreased substantially after program implementation (Mid-Atlantic Fishery Management Council 2003). The enactment of a mandatory VMS in 2008 allowed the discontinuation of the telephone-based vessel call-in system. Vessels are required to declare their intended fishing activity via VMS before leaving port (50 CFR § 648.15(b)(1)). In addition to

[15] The vessel call-in requirement was suspended during the first year of the SCOQ program, but NMFS Office of Law Enforcement argued that it was a critical enforcement component of the program, and the requirement was reinstated in 1991 (McCarthy 1992).

reducing the burden on industry, the VMS-based call-in system relieved the federal government of the expenses of a telephone-based system, which included both hardware, phone service, and personnel costs to monitor the calls received (Mid-Atlantic Fishery Management Council 2003).

Concurrent with the implementation of information collection program, a "renew or lose'' provision for ITQ allocation permits was enacted. As discussed in Section 8.3.4, until January 1, 2016, NMFS gathered only basic information about the individuals, partnerships, or corporations that held surfclam and ocean quahog ITQ allocation permits. This information was collected at the time that an entity first acquired a permit and was not routinely verified or updated. Moreover, an ITQ allocation permit never expired. Consequently, from the onset of the SCOQ ITQ program, NMFS officials charged with administering the program found it difficult, given the nature of reporting, to determine the identity of the individuals, partnerships, or corporations owning ITQ quota share (National Research Council 1999).

With the implementation of the new annual ITQ allocation permit application process in 2016, permit applicants are required to provide detailed ownership information, such as information on financial institution-held ITQ quota share and identification of corporate officers, major shareholders, and partners as well as any immediate family members who also hold ITQ quota share. Corporations or other business entities are required to identify their corporate officers and all shareholders who have a 10-percent or larger stake in the company. A financial institution that holds ITQ quota share as collateral on a loan may be allowed to provide less detailed information under certain specified conditions (80 Fed. Reg. 42747 (July 20, 2015)).

Since SCOQ ITQ program implementation, a number of reporting and recordkeeping requirements have been enacted in the surfclam and ocean quahog fisheries that unrelated to the program. In particular, vessels fishing for surfclams or ocean quahogs in the reopened area of the Georges Bank region must comply with the reporting and recordkeeping requirements of the National Shellfish Sanitation Program (NSSP), which include a tagging system to ensure traceability of molluscan shellfish back to the source. The NSSP-required tags are separate and distinct from the cage tags required for federal reporting. The NSSP compliant tags are "shippers' tags" and these are attached before the containers are sent into the stream of commerce. The tags provide pertinent information concerning harvest location, shucking date, shipping date, and quantity. NSSP requirements are enforced through the applicable state agencies, on delegation from the federal government (National Marine Fisheries Service 2013c).

In addition, Amendment 15 to the FMP reinstituted the onboard observer program in 2015. The surfclam and ocean quahog fisheries have historically had very low bycatch and have been a low priority for observer coverage. Prior to Amendment 15, NMFS used its discretion to prioritize observer coverage to fishing fleets. Amendment 15 removed this discretion and implemented a formulaic process for assigning observer coverage across fisheries. This resulted in observer coverage being assigned to the surfclam and ocean quahog fisheries (81 Fed. Reg. 14072 (March 16, 2016)). Surfclam and ocean quahog vessels are not responsible for covering the cost of observers (National Marine Fisheries Service Undated).

According to Council staff, current reporting and recordkeeping requirements have left a number of data gaps (Coakley 2018). Information on the actual prices of surfclam and ocean quahog product as it moves from vessels to processors is difficult to obtain. Because of vertical integration, most processors are buying product from their own vessels; therefore, the prices reported in vessel logbooks and processor/dealer weekly reports may not represent a "true" market transaction. In addition, information on the operating and fixed costs of surfclam and ocean quahog vessels and processors is very limited, and there is no systematic collection of vessel crew and processor worker data, such as employment, remuneration, and job satisfaction.

However, attempts to solicit additional economic information from surfclam and ocean quahog fishery participants are likely to encounter resistance from industry. A potential indication of the level of resistance is the near zero percent response rate received in a voluntary survey that NMFS recently administered to

commercial fishing vessel owners in the New England and Mid-Atlantic states to collect economic data—only one survey response was received from vessel owners who reported landings in the surfclam or ocean quahog fisheries in 2015 or 2016 (Walden 2018).

The outcomes of a recent series of reviews conducted by NMFS may offer guidance in ways to enhance the effectiveness of future economic and social data collection efforts, including boosting industry cooperation and participation, and thereby help fill data gaps and fulfill economic and sociocultural science research needs for managing the surfclam and ocean quahog fisheries. These reviews evaluated the direction and quality of economics and human dimensions programs at each of the six NMFS Fisheries Science Centers and headquarters' Office of Science and Technology. Section 11.3 presents recommendations for improving economic and social data collection in the surfclam and ocean quahog fisheries based on information presented in online review reports compiled at National Marine Fisheries Service (2018c).

8.3.8 Electronic Technologies

Both during the pre-SCOQ ITQ program period and the initial years of the program, there were only a few reported instances of reporting and recordkeeping in the surfclam and ocean quahog fisheries that involved electronic technologies versus paper-based and other more labor-intensive methods. For example, Ross (1992) noted that some processors have cage tag numbers entered onto personal computers as cages are unloaded at the plant, often as part of an inventory or meat yield analysis process.

Over time, new information and monitoring technologies in fisheries were developed and integrated into the surfclam and ocean quahog fishery management regime. The two fisheries became the first federally-managed fisheries engaging in electronic reporting on a per vessel and trip basis ("e-Clams") and this voluntary program is being used by nearly all vessels. It is still being evaluated and tested by NMFS, so both paper and electronic logs are being used and matched. The information should be available in more real time once implemented (Surfclam and Ocean Quahog Advisory Panel 2017).

Currently, the ITQ allocation permit application, ITQ quota share ownership form, and ITQ quota share transfer forms are available online in a fillable and printable version through the NMFS forms portal. In the future, NMFS could consider allowing these forms to be completed and submitted electronically through Fish Online. This web-based application is currently used in the Greater Atlantic Region for similar leasing programs in other fisheries (National Marine Fisheries Service 2015b).

In 2004, all federally-permitted surfclam and ocean quahog processors as well as dealers were required to have the capability to transmit report data via the Internet. To ensure compatibility with the reporting system and database, dealers and processors are required to utilize a personal computer, in working condition, that meets the minimum specifications identified by NMFS. The purpose of this action was to improve monitoring of commercial landings by collecting more timely and accurate data, enhance enforceability of the existing regulations, promote compliance with existing regulations, and ensure consistency in reporting requirements among fisheries (69 FR 13482, March 23, 2004).

Since 2014, all seafood dealers permitted by NMFS Greater Atlantic Region were required to report all purchases and receipt of fish or shellfish electronically. The rules for surfclam and ocean quahog dealers and processors are consistent with those for all other federally permitted dealers; however, they must use the system designed for surfclams and ocean quahogs.

In 2008, the enactment of a mandatory VMS in the surfclam and ocean quahog fisheries allowed the discontinuation of the burdensome and costly telephone-based vessel call-in system. Vessels are required to declare their intended fishing activity via VMS before leaving port, and the transponder provides the location of fishing. The automatic data collection provides more accurate fishing location data than are being collected through vessel logbooks. Accurate location data are important both for the enforcement of closed areas and in the stock assessment (Mid-Atlantic Fishery Management Council 2003).

For vessels fishing for surfclams or ocean quahogs in the reopened area of the Georges Bank region, due to the nature of the protocol for onboard screening and dockside testing, the majority of the protocol requirements need to be completed in writing and submitted as such. However, the reporting requirements of the protocol need not be handwritten but can be completed and submitted through a computer. The notification requirement only requires that a notification be made, and, therefore, it is likely electronic means will be used such as cellular phone or via shipboard electronic equipment such as VHF radio, email, or the vessel's VMS (National Marine Fisheries Service 2015b).

8.3.9 Enforcement Provisions

Pre-SCOQ ITQ Program Period

In principle, enforcement of the surfclam quarterly catch limits could be handled through dockside inspection, facilitated by the vessel call-in provision, vessel and processor reporting and recordkeeping requirements, and cage tag system (Nicholls 1985). Once a limit had been landed, the surfclam fishery would be closed. Since surfclam vessels working at sea are readily identified by their location and vessel and gear configuration, any vessel operating after a closure could be cited for a violation. However, other provisions of the effort limitation system designed to spread harvests out over the course of the year complicated enforcement. For example, restrictions on allowable fishing hours required that each vessel be monitored at sea to determine if it was fishing on its designated fishing days and was not fishing beyond the designated daily hours (Nicholls 1985; Buck 1995). Monitoring the time of departure and arrival at the dock was not effective because some vessels had to leave the dock many hours before they started fishing, both to allow for steaming time to distant and diverse fishing grounds and to allow the larger vessels to clear shoal waters and navigational impediments at high water or with favorable tides. At-sea enforcement platforms (cutters and aircraft) could determine if a vessel's dredge and other fishing gear were out of the water and the vessel was heading for port, but these enforcement resources and were limited and their operational costs were high, so only a portion of the fishery could be monitored regularly (Nicholls 1985; Mid-Atlantic Fishery Management Council 1988).

Compounding the enforcement problem in the surfclam fishery was the high incentive for non-compliance. As described in Section 6.3.2, under the effort limitation system, vessels were racing to harvest as much as they could in the shortest time possible). Violations took several forms, including underreporting catch to delay a fishery closure, overreporting catch to enhance a vessel's position under an anticipated allocation system based on catch history, fishing in closed areas, fishing a longer time than allowed, reporting inactive vessels as fishing to maintain the vessel permit, and taking undersized surfclams (Ross 1992; National Research Council 1999; 55 Fed. Reg. 24184 (June 14, 1990)).

Despite the imposition of severe punishments for violations, including sanctioning of vessel and processor/dealer permits (55 Fed. Reg. 24184 (June 14, 1990)), there were unchallenged allegations that everyone in the surfclam fishery cheated at one time or another (Mid-Atlantic Fishery Management Council 1988; Marvin 1992). The executive director of the Council at the time noted: "I wouldn't say there's an innocent fisherman left in the surfclam industry. The fishermen are looking at each other and saying, 'He's cheating, why shouldn't I?' I've had people who were damned honest fishermen three years ago tell me, 'I've followed the rules, but everybody is cheating now, and I've got to cheat, too'" (Phillips 1985). The executive director also noted that the ability to avoid detection contributed to the high level of noncompliance. The Mid-Atlantic region had few NMFS enforcement personnel, with only two enforcement agents overseeing the surfclam fleet fishing off the Delmarva Peninsula (Phillips 1985; National Research Council 1999). Moreover, industry members were often better organized than NMFS enforcement agents. In New Jersey, for example, some vessel owners and operators hired private investigators to tail enforcement agents so that they knew where and when to cheat safely (Phillips 1985).

Post-SCOQ ITQ Program Period

Much of the impetus for major changes in the pre-SCOQ ITQ program management regime came from concern about enforcement difficulties (National Research Council 1999). The SCOQ ITQ program eliminated the need to enforce the time restrictions at sea, the bad weather makeup day, and the vessel moratorium. Additionally, under the program, the desire of vessel operators to maximize their revenue from a given ITQ quota share led them to take additional measures to harvest the large-size, high-yield surfclams that are desired by buyers and command a higher price (Ross 1992). With the minimum size for surfclams no longer an issue, the Council suspended the size limit.

Enforcement under the SCOQ ITQ program can be accomplished through monitoring of the cage tag requirements at processing plants and auditing of vessel logbooks and processor/dealer reports (Mid-Atlantic Fishery Management Council 1988). As a result, at-sea enforcement was largely replaced by less costly shoreside and reporting-based enforcement (Schmitten 1994). In addition, enforcement under the SCOQ ITQ program is facilitated by the reduction in the vessel population following program implementation as well as by the reduction in regulatory complexity and industry pressure that occurred once the effort limitation system was eliminated (Mid-Atlantic Fishery Management Council 1988).

During seasons when state fisheries are open, at-sea and air surveillance may be required to reduce the possibility that vessels with state permits or cage tags fish in federal waters (National Research Council 1999). In addition, NMFS enforcement agents must still check vessels at the wharf for the presence of the vessel permit and other regulations. However, agents do not always have to make their presence known when performing port inspections. They might, for example, observe a vessel offloading from a distance with a pair of binoculars, and count the number of cages that are taken off the ship. Later that number could be compared with the number of cages the vessel reported landing on its trip report form submitted to NMFS. If more cages were landed than were reported in the vessel's report, a violation might result (Mid-Atlantic Fishery Management Council 2007). These port inspections continue to be aided by a vessel call-in system that gives notice to NMFS enforcement officials the time and place vessels would be leaving from or arriving back in port (Mid-Atlantic Fishery Management Council 2007).

Although the SCOQ ITQ program mitigated many of the enforcement problems that had occurred before program implementation, enforcement continued to be problematic at the beginning of the program (National Research Council 1999). NMFS enforcement resources remained extremely scarce (McCarthy 1992), and while ITQ allocation permit numbers were reported on both vessel logbook reports and dealer/processor reports, enforcement officers were not given real-time information regarding who had which cage tags or ITQ quota share. In addition, the SCOQ ITQ program was reportedly designed without adequate input from NMFS enforcement officers, such that standard provisions were left out (i.e., the illegality of giving false statements to authorized officers) (McCarthy 1992; National Research Council 1999). Some processors reported a number of violations, including increasing cage sizes deliberately to increase yield; only tagging the last four cages in a tractor-trailer truck capable of holding 14 to 16 cages per load to pass in-transit spot checks of loaded trucks by enforcement agents; using non-tagged cages, particularly if processor-owned vessels were landing directly at processing plants; and using state-issued surfclam cage tags to harvest surfclams in waters under federal jurisdiction (Beal 1992; Ross 1992).

Over time, however, enforcement agents systematically examined every situation in which a violation of the SCOQ ITQ program might occur and began taking measures to ensure compliance. These measures included stopping company-owned trucks in-transit to verify all accessible cages are tagged; watching trucks unload at the plant receiving dock with tagged cages; verifying tag numbers are properly assigned to the owner or record; verifying that a specific days plant receipts are in order and agree with vessel records for the same day; and checking storage procedures for the used tags (Ross 1992).

Initially, the penalty schedule for violations in the surfclam or ocean quahog fisheries was limited to civil monetary penalties and vessel and dealer/processor permit sanctions. However, fines in most instances were an insufficient deterrent due to the relatively low probability of detecting a violation. Harvesters fishing in violation of the regulations were able to recoup the amount of any penalty paid by continuing to fish illegally. Moreover, the transferability of ITQ quota share under the SCOQ ITQ program rendered vessel permit sanctions relatively useless. An owner of ITQ quota share does not have to own a vessel to harvest his or her allocation. For example, they can contract with a vessel owner to harvest part or all of their ITQ quota share (Schmitten 1994).

In 1994, to impress on industry that violations under the SCOQ ITQ program would not be tolerated, NOAA General Counsel advised industry that it had administratively included ITQ allocation permit sanctions in the penalty schedule of the FMP. Due to the gravity of such a sanction, however, it is reserved only for those violations that go to the core of the SCOQ ITQ program. These violations include landing surfclams or ocean quahogs in excess of an ITQ quota share; manufacturing, altering, duplicating, or stealing a cage tag; and tagging a cage with a used or void tag; and submitting with intent false information in required reports. All of these violations involve an active intent to increase the share that a holder of ITQ quota share is authorized to remove from the surfclam or ocean quahog fisheries. The structure of the penalty schedule is such that no one can lose an ITQ quota share permanently for any first-time violation of the regulations. A first-time violation of a regulation for which an ITQ allocation permit sanction is warranted results in a loss of 50 percent of the ITQ quota share for a year. It is not until the third successive violation of certain regulations that an ITQ allocation permit is lost permanently (Schmitten 1994).

Industry members expressed concern that ITQ allocation permit sanctions could have a negative effect on processors who contract with independent vessels to harvest their ITQ quota share and could cause financial institutions to stop extending credit for the purchase of ITQ quota share. They argued that ITQ allocation permit owners could lose their quota through the actions of a contractor or subcontractor. However, NMFS noted that permit owners can protect themselves from a permit sanction by contracting with reputable individuals. In addition, contracts for the harvest of ITQ quota share can provide for reimbursement by the harvester for any liability imposed on the ITQ quota share owner for any violation committed by the harvester (Schmitten 1994).

More recently, the Council included accountability measures in the surfclam and ocean quahog fisheries in Amendment 16 to the FMP, which was approved in 2011. If the annual catch limit for the surfclam or ocean quahog fishery is exceeded, and that overage can be attributed to one or more holders of ITQ quota share, then accountability for that overage occurs at the individual level. Specifically, individual ITQ quota share is reduced in the following year by 100 percent of the overage (i.e., bushel-for-bushel repayment), as a single-year adjustment. Any amount of an annual catch limit overage that cannot be otherwise attributed to an ITQ quota share holder is deducted from the appropriate annual catch limit in the following fishing year (50 CFR § 648.73(a)).

Incentives for cheating were drastically reduced once ITQ allocation permit holders were faced with the prospect of forfeiting all or part of their ITQ quota share for violations, although liability for a violation continued to be reduced by creating limited liability corporations to hold quota or having family members hold quota. Additionally, the improved efficiency derived from SCOQ ITQ program improved the profitability of the surfclam and ocean quahog industry as a whole. Consequently, is it less likely that industry members feel compelled to break the law due to financial stress in their business operations (Mid-Atlantic Fishery Management Council 2012). Council and NMFS staff have reported that the surfclam and ocean quahog fisheries have not had any serious compliance issues in recent years, and currently there is no evidence of systematic non-compliance (SCS Global Services 2016).

8.4 Summary of the Effects of the Program

Table 23 provides a listing of the program review questions and summary of the administrative effects of the program.

Table 23. Program Review Questions and Summary of Administrative Effects of the Program

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
Questions that derive from program goals and objectives (G&Os)			
ADM-1	G&O: 2	Has the program simplified regulatory requirements to minimize public and private management costs of administering and complying with regulatory, reporting, enforcement, and research requirements of clam and quahog management?	During the development phase of the SCOQ ITQ program deciding on a type of individual allocation system to replace the effort limitation system became one of the most time and labor-intensive tasks of the Council. Once the program was implemented, NMFS reported that learning to manage ITQ quota share allocations, including transfers and leases, was time-consuming for agency staff, particularly because there were no precedents in federal fisheries management. However, NOAA Office of General Counsel Northeast Section staff reported that they spent considerably less time on the surfclam and ocean quahog fisheries once the SCOQ ITQ program was implemented. There were few appeals of the initial ITQ quota share allocation because it was based on historical landings data that were readily available from vessel logbooks. Council staff also spent less time on the surfclam and ocean quahog fisheries due to a drop in the number of regulatory actions related to the two fisheries. The replacement of the effort limitation system with the SCOQ ITQ program significantly reduced NMFS administrative costs through elimination of the need to assign and monitor individual vessel fishing days, the bad weather makeup day provision, and related measures. In addition, the costs associated with administering complex, ambiguous vessel replacement regulations were eliminated since the process of certifying that a vessel was retiring involuntarily from the fishery and was being replaced by one of similar harvesting capacity was no longer necessary. While the issuance of annual permits for vessels participating in the surfclam and ocean quahog fisheries did not change under the program, administrative cost savings occurred over time as vessel consolidation under the program reduced the number of permits processed. Enforcement costs were substantially lower after implementation of the program, as NMFS changed its enforcement efforts from costly at-sea monitoring of fishing vessels to an emphasis on monitoring the amount of surfclams and ocean quahogs coming ashore and ensuring that all landings were reported accurately. While overall public management costs decreased following program implementation, the program created new types of costs. For example, there are ongoing costs associated with the issuance of ITQ allocation permits and in keeping track of their subsequent sale and resale by industry. However, these costs have decreased over time as ITQ quota share

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
			allocations were combined and older vessels were retired from the fisheries. Moreover, the cost recovery provisions for the SCOQ ITQ program, which became effective on July 15, 2016, cover most, if not all, these incremental public management costs. Industry also experienced a reduction in management costs under the SCOQ ITQ program, as the program has a relatively simple set of rules designed, in part, to minimize government regulation. While, some industry members assumed that more control of the surfclam and ocean quahog fisheries would be returned to them under the program than was the case, in comparison to the pre-SCOQ ITQ program management regime, vessel owners and operators are allowed to make far more adjustments to their day-to-day operations without involving the government. In addition, the program places no limits on the amount of ITQ quota share a person can hold, and restrictions on who can receive ITQ quota share transfers are minimal. The elimination of vessel replacement regulations removed government interference in decisions about how large a vessel could be employed in the surfclam fishery.
ADM-2	G&O: 4	Has the program created a management approach that is flexible and adaptive to short-term events or circumstances and consistent with overall plan objectives?	As discussed above, the SCOQ ITQ program was designed, in part, to minimize government regulation, thereby providing industry the flexibility to make more adjustments to their day-to-day operations without involving the government. In addition, over the years, the program has increased the propensity of industry to not only comply with management measures but to also actively engage in the management process. The sense of community in the industry has been reinforced by the myriad relationships engendered by ITQ quota share trading within the program. In addition, with far fewer key actors in the surfclam and ocean quahog fisheries following the fleet consolidation that occurred under the program, it has been possible for industry to organize better than in the past to influence decisions at the Council. Industry has repeatedly been able to generate both collective action and financing to address problems and opportunities, and the capacity to do this may be attributed at least partially to incentives created by the program. Following program implementation, industry was also at the forefront of a surge in cooperative or joint research efforts, contributing money, vessel and crew time, and expertise to at-sea research in order to improve the accuracy of NMFS stock assessment survey
Questions that derive from NMFS Catch Share Review Guidelines key areas (KAs)			
ADM-3	KA: C	Are eligibility requirements regarding who is allowed to hold QS or QP (e.g., owner on board provisions, etc.) inhibiting or precluding the achievement of certain program goals and objectives? Are additional restrictions necessary to achieve particular goals and objectives?	Under the SCOQ ITQ program, two permits are needed to fish for and land surfclams and ocean quahogs. One permit is the same vessel permit required before program implementation. The vessel permit was required for any vessel that fished for surfclams or ocean quahogs. The second permit is an ITQ allocation permit issued by NMFS. The ITQ allocation permit specifies the cage tag numbers the permit holder is required to use during the harvest of their

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
			allocation. Any person (i.e., individual, partnership, or corporation) who meets U.S. citizen requirements for ownership of a U.S. Coast Guard documented vessel is eligible to own an ITQ allocation permit. The initial allocation mechanism of the program specified that ITQ quota share would be distributed on a vessel basis, not directly to vessel owners. Thus, the fishing privilege asset was embedded in the vessel asset. However, at the point the program was implemented, the fishing privilege was disaggregated from the vessel. The program permits persons to retain ownership of their ITQ quota share even if they terminate harvesting and sell their vessel, thereby allowing them to lease their quota. Subject to the approval of NMFS, all or part of the ITQ quota share specified in a person's ITQ allocation permit may be transferred to any other person with an ITQ allocation permit. An ITQ allocation permit does not need to have associated ITQ quota share to be used for leasing ITQ quota share. Until January 1, 2016, an ITQ allocation permit never expired. After that date, an existing ITQ allocation permit holder must renew his/her permit(s) on an annual basis by submitting to NMFS an ITQ allocation permit application and an ITQ ownership form for such permit before the end of the fishing year for which the permit is required.
ADM-4	KA: F	If applicable, are existing data collection and monitoring programs sufficient to accurately determine each entity's ownership level and thus whether entities are exceeding limited access privileges caps?	Under the initial ITQ allocation permit application process, NMFS did not gather sufficient ownership information to determine the identity of the individuals, partnerships, or corporations owning ITQ quota share. A single person may potentially own or control many individual ITQ quota share allocations. Similarly, a number of financial institutions listed as owners of ITQ quota share may have a single borrower under multiple loans. The lack of ownership information prevented NMFS from appropriately characterizing the amount of consolidation in the surfclam and ocean quahog fisheries under the SCOQ ITQ program. The revised applications for ITQ allocation permits and ITQ quota share transfers implemented on January 1, 2016 were designed by NMFS to routinely collect information that would enable the agency to determine the identity of ITQ quota share owners. The revised applications help ensure that the Council has the information needed to develop a future management action intended to establish an excessive share regulation for the surfclam and ocean quahog fisheries.
ADM-5	KA: F	If applicable, are limited access privileges caps being applied at the appropriate levels to ensure they are serving their intended purpose? Are "persons" being identified in the program in a manner consistent with the Council's intent and other agency practices and guidance?	The environmental review for the FMP amendment creating the SCOQ ITQ program cited existing federal antitrust laws as being sufficient for the program to meet the requirements of National Standard 4, which requires that no particular individual, corporation, or other entity acquires an excessive share of fishing privileges. Therefore, no limits were placed on the amount of ITQ quota share a person could acquire. Most recently, NMFS has determined that the FMP is out of

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
			compliance with National Standard 4 because it does not currently include an excessive share cap expressed as a percentage of the total ITQ quota share. The Council is currently developing an FMP amendment to adopt an excessive share regulation.
ADM-6	KA: G	Does the program include a cost recovery program per Section 303A(e) of the MSA? If so, what is the cost recovery fee percentage, any changes to the fee, and the amount of fees collected on an annual basis?	NMFS has maintained that the costs of collecting fees should be taken into account when determining whether cost recovery is required in a particular LAPP, and that cost recovery for the SCOQ ITQ program was a low priority. Further, the Sustainable Fisheries Act of 1996 prohibited NMFS from collecting such fees in the surfclam and ocean quahog fisheries until after January 1, 2000. Nevertheless, NMFS stated that it would work with the Council on adding cost recovery to the program. The absence of cost recovery not only raised concerns regarding noncompliance with the MSA, but also concerns about fairness because owners of surfclam and ocean quahog ITQ quota share were receiving exclusive access to a public resource without compensation to the public. Also, harvesters in other U.S. fisheries managed by LAPPs were paying fees, while harvesters in the surfclam and ocean quahog fisheries were not. Amendment 17 to the FMP added measures for collecting fees and recovering costs associated with the management of the program to ensure that the FMP was in compliance with requirements of the MSA. The cost recovery provisions for the program became effective July 15, 2016.
ADM-7	KA: G	Is the program is assessing fees in a manner such that all incremental costs are included in the assessment, whether the collected fees cover all incremental costs (i.e., does the 3 percent cap imposed by MSA preclude collecting fees to cover all incremental costs?)?	Under the cost recovery program, any ITQ allocation permit holder who has surfclam or ocean quahog ITQ quota share is responsible for paying a fee at the end of the year. The fee is based on the permit holder's surfclam or ocean quahog ITQ quota share that year. The fee percentage is based on the total recoverable costs from the prior fiscal year, adjusted for any prior over- or under-collection, divided by the total ex-vessel value of the fishery. NMFS calculates a per-cage tag fee based on the total number of cage tags used to land surfclams or ocean quahogs in the previous year. If an ITQ allocation permit holder transfers some or all of his or her ITQ quota share after the start of the fishing year, they are still liable for any cost recovery fee based on landings of the initial allocation of cage tags. This process includes an inherent assumption that a similar number of cage tags will be used each year. In some years, NMFS may collect more or less money than is necessary to recover its costs. NMFS applies any over- or under-collection to its calculation of recoverable costs and per-tag fees for the following year.
ADM-8	KA: G	Have there been any compliance or enforcement issues related to cost recovery?	Since the cost recovery provisions for the program became effective, all ITQ allocation permit holders who have surfclam or ocean quahog ITQ quota share have paid the amount due, and there have not been any enforcement issues related to cost recovery.

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
ADM-9	KA: A	Are the program goals and objectives clear, measurable (at least qualitatively), achievable (i.e., are two or more objectives mutually exclusive?), and still appropriate under the current circumstances?	The management system for the surfclam and ocean quahog fisheries is regularly reviewed and amended, if necessary, through the council process to ensure that the SCOQ ITQ program goals and objectives are being achieved and still appropriate. The Council seeks input through its scientific, technical, and industry/stakeholder groups to ensure the two fisheries are managed based on sound scientific advice, and management measures are initiated, evaluated, and adopted in a fully transparent and public process. In 2017, the Council incorporated the goal of reviewing and revising the goals and objectives of the FMP into its 2014–2018 Strategic Plan. According to some industry representatives, a revision of the goals and objectives is unwarranted given the current stability of the surfclam and ocean quahog fisheries. However, other industry members are amenable to revising at least some of the wording of the goals and objectives.
ADM-10	KA: H	Are the existing data collection and monitoring programs sufficient to assess the program's performance relative to the various goals and objectives?	With the development of the FMP for the surfclam and ocean quahog fisheries in 1977, NMFS began enacting reporting and recordkeeping requirements for surfclam and ocean quahog harvesters and processors to monitor fishery progress and gain additional information about the distribution of fishing pressure on the surfclam and ocean quahog resources and about the economic character of the fisheries. Drawing on this biological and socioeconomic data collected for the two fisheries, the management system is regularly reviewed and amended, if necessary, through the council process.
ADM-11	KA: H	What is the reporting burden on program participants?	The majority of current reporting and recordkeeping requirements in the surfclam and ocean quahog fisheries were enacted before the SCOQ ITQ program was implemented. However, some new requirements were enacted under the program, including the reporting of ITQ quota share/cage tag transfers and the submittal of annual ITQ allocation permit renewal applications. With the implementation of the new annual ITQ allocation permit application process in 2016, permit applicants are required to provide detailed ownership information, such as information on financial institution-held ITQ quota share and identification of corporate officers, major shareholders, and partners as well as any immediate family members who also hold ITQ quota share. In 2004, as part of the electronic reporting program, surfclam and ocean quahog dealers and processors were no longer required to report the ITQ allocation permit number of the vessel(s) from which they purchase surfclams or ocean quahogs, and processors were not required to report the size distribution and meat yield per bushel by species. The enactment of a mandatory VMS in 2008 allowed the discontinuation of the telephone-based vessel call-in system. Vessels fishing for surfclams or ocean quahogs in the reopened area of the Georges Bank region must comply with

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
			the reporting and recordkeeping requirements of the NSSP, which include a separate tagging system to ensure traceability of shellfish back to the source. These NSSP requirements are enforced through the applicable state agencies, on delegation from the federal government.
ADM-12	KA: H	Has the program assessed the use of electronic technologies versus paper-based and other more labor-intensive methods, particularly with respect to their effect on the accuracy of the collected data and resulting statistical estimates but also with respect to their effect on the ability to engage in real-time reporting?	Both during the pre-SCOQ ITQ program period and the initial years of the program, there were only a few reported instances of reporting and recordkeeping in the surfclam and ocean quahog fisheries that involved electronic technologies versus paper-based and other more labor-intensive methods. Over time, however, new information and monitoring technologies in fisheries were developed and integrated into the management regime. The two fisheries became the first federally-managed fisheries engaging in electronic reporting on a per vessel and trip basis ("e-Clams"), and this voluntary program is currently being used by nearly all vessels. Currently, the ITQ allocation permit application, ITQ quota share ownership form, and ITQ quota share transfer form are available online in a fillable and printable version through the NMFS forms portal. In 2004, all federally-permitted surfclam and ocean quahog processors as well dealers were required to have the capability to transmit report data via the Internet. The requirement improves monitoring of commercial landings by collecting more timely and accurate data, enhances enforceability of the existing regulations, promotes compliance with existing regulations, and ensures consistency in reporting requirements among fisheries. In 2008, the enactment of a mandatory VMS in the surfclam and ocean quahog fisheries allowed the discontinuation of the burdensome and costly telephone-based vessel call-in system. Vessels are required to declare their intended fishing activity via VMS before leaving port, and the transponder provides the location of fishing. The automatic data collection provides more accurate fishing location data than are being collected through vessel logbooks. For vessels fishing for surfclams or ocean quahogs in the reopened area of the Georges Bank region, due to the nature of the protocol for onboard screening and dockside testing, the majority of the protocol requirements need to be completed in writing and submitted as such. However, the reporting requirements of the protocol need not be handwritten but can be completed and submitted through a computer. The notification requirement only requires that a notification be made, and, therefore, electronic means can be used such as cellular phone or via shipboard electronic equipment such as VHF radio, email, or the vessel's VMS.
ADM-13	KA: H	Are current enforcement provisions and activities, including resources for conducting the latter, sufficient to ensure a high rate of compliance with program requirements?	The SCOQ ITQ program eliminated the need to enforce the time restrictions at sea, the bad weather makeup day, and the vessel moratorium. Additionally, under the program, the desire of vessel operators to maximize their revenue from a

Question Number	Element Number	Questions to be Answered	Summarized Effects of the Program
			given ITQ quota share led them to take additional measures to harvest the large-size, high-yield surfclams desired by buyers. With the minimum size for surfclams no longer an issue, the Council suspended the size limit. Enforcement under the program can be accomplished through monitoring of the cage tag requirements at processing plants and auditing of vessel logbooks and processor/dealer reports. As a result, at-sea enforcement was largely replaced by less costly shoreside and reporting-based enforcement. In addition, enforcement under the program is facilitated by the reduction in the vessel population following program implementation as well as by the reduction in regulatory complexity that occurred once the effort limitation system was eliminated. In 1994, to impress on industry that violations under the program would not be tolerated, NOAA General Counsel advised industry that it had administratively included ITQ allocation permit sanctions in the penalty schedule of the FMP. More recently, the Council included accountability measures in the surfclam and ocean quahog fisheries in Amendment 16 to the FMP, which was approved in 2011. If the annual catch limit for the surfclam or ocean quahog fishery is exceeded, and that overage can be attributed to one or more holders of ITQ quota share, then accountability for that overage occurs at the individual level. Specifically, individual ITQ quota share is reduced in the following year by 100 percent of the overage (i.e., bushel-for-bushel repayment), as a single-year adjustment. Any amount of an annual catch limit overage that cannot be otherwise attributed to an ITQ quota share holder is deducted from the appropriate annual catch limit in the following fishing year.
Questions that derive from national standards (NSs) not encompassed by KA questions			
--	--	None applicable.	--

9 Net Benefits to the Nation

This section summarizes how net benefits to the Nation derived from the surfclam and ocean quahog fisheries changed after the SCOQ ITQ program began. The net benefits arising out of SCOQ ITQ program implementation accrued from several different sources, including increased economic efficiency in the harvesting and processing sectors of the two fisheries, reduced public and private management costs, and improved management of stocks. However, the program also led to costs to the Nation in the form of economic and social dislocations. Both the economic benefits and costs are discussed in the sections below.

9.1 Efficiency of Harvesting and Processing Sectors

The dominant change in the net benefits arose from improvements in production efficiencies of both the harvesting and processing sectors. The elimination of the fishing time restrictions the harvesting sector had greater ability to focus input choices to minimize operational costs, and to improve and increase product output.

In the surfclam fishery, productivity adjusted for changes in biomass remained above that of the pre-SCOQ ITQ program base time period (1987-1989) in every year between 1990 and 2012, and it was at least twice that of the base in every year between 1999 and 2012. Under the program, each harvester is able to use the least cost combination of fishing inputs since they are allocated an exclusive share of the annual catch limit. Vessel owners transferred their ITQ quota share onto fewer vessels, and some less-efficient vessels exited the fishery. Vessel owners with the lowest harvesting costs expanded their catch by buying or leasing ITQ quota share from owners with higher-cost vessels, leading to lower overall harvest costs and more efficient outcomes for industry. Because there were fewer vessels and no restrictions on fishing time, average catch per vessel of both surfclams and ocean quahogs increased markedly after the program began.

Unadjusted productivity for the surfclam fishery was above the pre-program base from 1990 to 2007 before dropping below the base during 2009–2012. As exploitable biomass has declined, vessels have had to use more inputs to produce the same output. In addition, an allocation of an exclusive share of the annual catch limit allows vessels to become more profitable by changing their output mix.

Similar trends were evident in the ocean quahog fishery, although they were not as pronounced. From 1990 through 1995, unadjusted productivity was nearly identical to that biomass-adjusted productivity because the biomass index was unchanged. Since 1995, the ocean quahog biomass has been declining resulting in an increasing biomass index and a positive trend in biomass-adjusted productivity relative to the pre-program base. Consequently, the divergence between unadjusted and biomass-adjusted productivity has increased. After adjusting the productivity index by the biomass index, there were only four years during the entire time period where productivity was less than the base (1990-1994). The value of 1.82 in year 2012 showed that the fishery was 82 percent more productive in 2012 than in the base time period.

In addition, the SCOQ ITQ program likely yielded improvements in processing efficiency, although there is insufficient information available to estimate these gains. For example, the program allows processors to plan out supplies and work with ITQ quota shareholders to schedule fishing effort when needed. The result is that processors can better control inventory to match market demand.

9.2 Communities

Within seven years of SCQ ITQ program implementation the surfclam fleet shrank from 135 to 34 vessels, and the ocean quahog fleet decreased from 69 to 36 vessels. While this fleet consolidation removed excess harvesting capacity and led to more labor becoming available for employment in other industries, it also led

to substantial economic and social dislocation. The decreases in the size of the fishing fleets negatively affected the communities from which the fleets operated by reducing the local demand for shoreside support services. Quantitative measures of the reduction in these services and the resulting socioeconomic impacts on communities are not available. In addition, the number of crew positions in the surfclam and ocean quahog fisheries fell from 612 to 254 during the first seven years of the program. On the other hand, the number of crewmembers employed was at least partially balanced by an increase in the number of days of employment for those remaining.

After the program began, the number of processors of surfclams and ocean quahogs also declined. Some small, independently-owned processors that did not receive substantial initial allocations of ITQ quota share (because they had few or no vessels) had difficulty getting financing to purchase additional quota and left the industry. As with consolidation in the harvesting sector, the decrease in the number of processors led to economic and social dislocation in the communities in which the processors operated, although these socioeconomic impacts on communities cannot be quantified.

While the available data clearly shows that the level of engagement in the surfclam and ocean quahog fisheries of many communities changed after the SCOQ ITQ program was implemented, it is difficult to disentangle the effects of the program from the effects of co-occurring factors. These other factors included changes in resource availability, wastewater discharge regulations, demographics and economic development, markets for surfclam and ocean quahog products, and economic conditions in other fisheries. The social and economic impacts of each of these factors may have exacerbated or mitigated the negative effects of the program on fishing communities over both the short- and long-terms.

9.3 Management Costs

The replacement of the effort limitation system with the SCOQ ITQ program significantly reduced NMFS administrative costs through elimination of the need to assign and monitor individual vessel fishing days, the bad weather makeup day provision, and related measures. In addition, the costs associated with administering complex, ambiguous vessel replacement regulations were eliminated since the process of certifying that a vessel was retiring involuntarily from the fishery and was being replaced by one of similar harvesting capacity was no longer necessary. While the issuance of annual permits for vessels participating in the surfclam and ocean quahog fisheries did not change under the program, administrative cost savings occurred over time as vessel consolidation under the program reduced the number of permits processed.

Enforcement costs were substantially lower after implementation of the program, as NMFS changed its enforcement efforts from costly at-sea monitoring of fishing vessels to an emphasis on monitoring the amount of surfclams and ocean quahogs coming ashore and ensuring that all landings were reported accurately.

While overall public management costs decreased following program implementation, the program created new types of costs. For example, there are ongoing costs associated with the issuance of ITQ allocation permits and in keeping track of their subsequent sale and resale by industry. However, these costs have decreased over time as ITQ quota share allocations were combined and older vessels were retired from the fisheries.

Industry also experienced a reduction in management costs under the SCOQ ITQ program, as the program has a relatively simple set of rules designed, in part, to minimize government regulation. While, some industry members assumed that more control of the surfclam and ocean quahog fisheries would be returned to them under the program than was the case, in comparison to the pre-SCOQ ITQ program management regime, vessel owners and operators are allowed to make far more adjustments to their day-to-day operations without involving the government. In addition, the program places no limits on the amount of ITQ quota share a person can hold, and restrictions on who can receive ITQ quota share transfers are

minimal. The elimination of vessel replacement regulations removed government involvement in decisions about how large a vessel could be employed in the surfclam fishery.

9.4 Conservation Benefits

Since the SCOQ ITQ program was implementated, no significant annual catch limit overage in the surfclam and ocean quahog fisheries has occurred. With the allocation of ITQ quota share, vessel operators are no longer fishing under time pressure that would increase the probability of exceeding the catch limit. Furthermore, market conditions in the surfclam and ocean quahog fisheries are such that there is little incentive to increase landings, which are substantially less than the annual catch limits. Under the SCOQ ITQ program, the desire of vessel operators to maximize their revenue from a given ITQ quota share has led them to take additional measures to harvest the large-size, high-yield surfclams desired by buyers. Consequently, the surfclam discard rate has dropped to zero. Reporting and recordkeeping violations decreased after the program eliminated fishing time restrictions, and both landings and effort data from vessel logbooks are considered by NMFS to be accurate.

In addition, the program has increased the propensity of industry to not only comply with management measures but to also actively engage in the management process, including becoming proactive advocates of measures that will help ensure the long-term sustainability of the resource and supporting cooperative or joint research efforts in order to improve the accuracy of NMFS stock assessment surveys.

10 Summary of Program Performance Evaluation

Previous sections provided summaries of the program's biological and ecological/ environmental effects (Section 5.4), economic effects (Section 6.4), social effects (Section 7.4), and administrative effects (Section 8.4), along with a summary of the program's net benefits to the Nation (Section 9). This section provides an evaluation of those effects with respect to meeting the goals and objectives of the program (i.e., program performance), including a goal-by-goal summary of the conclusions arising from the evaluation.

Section 3.2 provides a full listing of the four goals and objectives of the FMP, as revised by Amendment 8 (Mid-Atlantic Fishery Management Council 1988), which coincide with the goals and objectives of the SCOQ ITQ program. Table 24 provides a cross-walk correspondence between (1) the key areas for review, as specified in the NMFS Catch Share Review Guidelines, those national standards not already addressed by a key area, and the required net benefit to the Nation analysis, (2) the questions asked in each of the topical analytic areas covered in Chapters 4 through 8, and (3) the specific subsections of the SCOQ ITQ Program Review where the analysis of the questions by topic may be found. As shown in the table, program performance with respect to program goals and objectives (listed under key area for review A [KA-A]) was evaluated in multiple sections the program review, as the different goals and objectives touched on a range of biological and ecological/environmental, economic, and administrative aspects of the fishery. The following discussions, organized by the four goals and objectives, summarize the evaluation conclusions reached in those component analyses. The sections containing the analyses that led to these conclusions are noted in the table.

10.1 Conserve and Rebuild Resources

Available data suggest that the goal of conserving and rebuilding SCOQ resources by stabilizing annual harvest rates throughout the management unit has largely been met. Stock surveys and assessments performed by NMFS since the SCOQ ITQ program was implemented indicate that neither the surfclam stock nor the ocean quahog stock has been overfished and overfishing has not occurred.

Overall surfclam stock size has declined only slightly since the program was implemented, but there is evidence that a substantial decline in surfclam biomass has occurred in some regions due to environmental factors and fishing pressure. Although harvest locations have shifted over time, surfclam landings have been relatively stable since program implementation; a recent downturn in landings may be due to market constraints.

There has been no substantial decline in the ocean quahog stock as a whole since program implementation, but there is evidence of substantial biomass decline in heavily fished regions. Ocean quahog landings have shown a decreasing trend. As with surfclams, catches of ocean quahogs are likely constrained by market limitations.

10.2 Simplify Regulatory Requirements and Minimize Management Costs

The available information suggests that the goal of simplifying regulatory requirements and minimizing public and private management costs of administering and complying with regulatory, reporting, enforcement, and research requirements has been achieved under the SCOQ ITQ Program. Development of the program was one of the most time and labor-intensive tasks of the Council has undertaken, and learning to manage ITQ quota share allocations, including transfers and leases, was time-consuming for NMFS staff, particularly because there were no precedents in federal fisheries management. However, NOAA Office of General Counsel Northeast Section staff reported that they spent considerably less time on

the surfclam and ocean quahog fisheries once the program was implemented. Council staff also spent less time on these fisheries due to a drop in the number of new regulatory actions.

NMFS administrative costs were reduced through elimination of the need to assign and monitor individual vessel fishing days, the bad weather makeup day provision, and related measures. Similarly, the costs associated with administering vessel replacement regulations were eliminated and vessel consolidation reduced the number of permits processed. Enforcement costs declined as efforts shifted from costly at-sea monitoring of vessels to less expensive on-shore monitoring of landings.

While overall public management costs decreased, the program created new types of costs, including ongoing costs associated with the issuance of ITQ allocation permits and keeping track of their subsequent sale and resale by industry. However, these new costs have also decreased over time as ITQ quota share allocations were consolidated, older vessels were retired, and cost recovery provisions were implemented.

Industry also experienced a reduction in management costs, as the program has a relatively simple set of rules. Vessel owners and operators have more latitude to make adjustments to their day-to-day operations; the program places no limits on the amount of ITQ quota share a person can hold; and restrictions on who can receive ITQ quota share transfers are minimal. In addition, the elimination of vessel replacement regulations removed government involvement in vessel size decision-making.

10.3 Provide Opportunities for Efficiency

The goal of promoting economic efficiency by bringing harvest capacity in line with processing and biological capacity has been realized. With few restraints on ownership or transfer of ITQ quota share, the program was effective in rapidly eliminating economically excessive capacity. Harvesters could consolidate their catch onto fewer vessels that could then operate at or near full capacity. In addition, some vessel owners divested themselves of older vessels they had accumulated during the moratorium, while others chose to lease their ITQ quota share to others or to leave the surfclam fishery entirely. A major decrease in fleet size occurred at the onset of the program, and within seven years of program implementation the surfclam and ocean quahog fleets were reduced by 75 and 48 percent, respectively. Average catch per vessel has increased markedly under the program, and an allocation of an exclusive share of the annual catch limit allows vessels to optimize their output mix.

The program goal of allowing industry to efficiently use capital and labor has also been achieved to a considerable extent. In the surfclam fishery, productivity adjusted for changes in biomass remained above that of the pre-SCOQ ITQ program base time period (1987-1989) in every year between 1990 and 2012. ITQ quota share was transferred onto fewer vessels and some less-efficient vessels exited the fishery. Vessel owners with the lowest harvesting costs expanded their catch by buying or leasing ITQ quota share from owners with higher-cost vessels, leading to lower overall harvest costs and more efficient outcomes. Unadjusted productivity for the surfclam fishery was above the pre-program base from 1990 to 2007 before dropping below the base during 2009–2012. As exploitable biomass has declined, vessels have had to use more inputs to produce the same output.

Similar trends were evident, if not as pronounced, in the ocean quahog fishery. From 1990 through 1995, unadjusted productivity was nearly identical to that biomass-adjusted productivity as the biomass index was unchanged. Since 1995, the ocean quahog biomass has been declining, resulting in an increasing biomass index and a positive trend in biomass-adjusted productivity relative to the pre-program base. Consequently, the divergence between unadjusted and biomass-adjusted productivity has increased. After adjusting the productivity index by the biomass index, there were only four years during the entire time period where productivity was less than the base (1990-1994).

10.4 Provide Management and Regulatory Framework that is Flexible and Adaptive and Consistent with Long-term Industry Planning and Investment Needs

Considerable progress has also been made toward achieving the program goal of creating a management approach that is flexible and adaptive to short-term events or circumstances and consistent with overall plan objectives has also been largely achieved. Over the years, the program has increased the propensity of industry to not only comply with management measures but to also actively engage in the management process. The sense of community in the industry has been reinforced by the myriad relationships engendered by ITQ quota share trading within the program. In addition, with far fewer key actors in the surfclam and ocean quahog fisheries following the fleet consolidation, it has been possible for industry to better organize to influence decisions at the Council. Industry has repeatedly been able to generate both collective action and financing to address problems and opportunities, and the capacity to do this may be attributed at least partially to incentives created by the program. Following program implementation, industry was also at the forefront of a surge in cooperative or joint research efforts, contributing money, vessel and crew time, and expertise to at-sea research in order to improve the accuracy of NMFS stock assessment survey.

In turn, the flexible and adaptive management approach has helped promote long-term industry planning and investment. The SCOQ ITQ program eliminated the tightly structured regulations of the effort limitation system, thereby providing vessel owners more flexibility in operating their businesses. ITQ quota share can only be used during the year for which it was issued, but otherwise shareholders have the ability to harvest their quota when weather and market conditions are favorable. An owner of ITQ quota share may use their own vessels to harvest their quota, or they may contract for the quota to be caught by someone else's vessels. In addition, fishery participants can adopt a business model whereby they no longer harvest or process but instead generate revenue by leasing ITQ quota share. An ITQ quota shareholder interested in getting out of the surfclam or ocean quahog fishery entirely does not have to find a buyer for their vessel; they can simply sell their quota. Further, the program allows processors to plan out supplies and work with ITQ quota shareholders to schedule fishing effort when needed. The result is that processors can better control inventory to match market demand

Table 24. Correspondence Between NMFS Catch Share Review Guidelines Key Area, National Standard, or Net National Benefit Analysis, Program Review Question Number, and Component Evaluation by Document Section Number

KA/NS/NBN	Topic	Program Review Question Number	Section(s) Where Component Evaluation Can Be Found
KA-A	Program Goals and Objectives Clear, Measurable, and Still Appropriate	ADM-9	8.3.6
	G&O 1: Conserve and Rebuild Resources	BE/E-1, ECON-1	5.3.2, 6.3.1
	G&O 2: Simplify Regulatory Requirements and Minimize Management Costs	ADM-1	8.3.1
	G&O 3: Provide Opportunities for Efficiency	ECON-2, ECON-3	6.3.2, 6.3.3
	G&O 4: Provide Management and Regulatory Framework that is Flexible and Adaptive and Consistent with Long-term Industry Planning and Investment Needs	ECON-4, ADM-2	6.3.4, 8.3.1, 8.3.2
KA-B	Allocations	SOC-1	7.3.1
KA-C	Eligibility	SOC-2, ADM-3	8.3.3
KA-D	Transferability	ECON-5, SOC-3	6.3.3, 7.3.6
KA-E	Catch and Sustainability	BE/E-2, BE/E-3, ECON-6	5.3.2, 5.3.3, 6.3.5
KA-F	Accumulation Limits/Caps[1]	ECON-7, ECON-8, ECON-9, SOC-4, ADM-4, ADM-5	6.3.2, 6.3.6, 7.3.4, 8.3.4
KA-G	Cost Recovery	ECON-10, ADM-6, ADM-7	6.3.7, 8.3.5
KA-H	Data Collection/Reporting, Monitoring, and Enforcement	ADM-10, ADM-11, ADM-12, ADM-13	8.3.6, 8.3.7, 8.3.8, 8.3.9
KA-I	Duration	ECON-11	6.3.8
KA-J	New Entrants	ECON-12, SOC-5, SOC-6, SOC-7	6.3.9, 7.3.3, 7.3.5
KA-K	Auctions and Royalties[2]	Not Applicable	Not applicable.
NS-2	Contribute to Conservation and Management Measures with Best Scientific Information Available	BE/E-4	5.3.4
NS-3	Manage Stocks as a Unit	BE/E-5	5.3.1
NS-8	Sustained Participation of Fishing Communities	SOC-8	7.3.2, 7.3.6
NS-10	Safety of Human Life at Sea	SOC-9	7.3.7
NBN	Net Benefits to the Nation	Not applicable	9.1 through 9.4

[1] The MAFMC is currently (2019) addressing a potential excessive shares FMP amendment under a separate action. This specific in-process issue is not evaluated in the program review.

[2] For LAPPs implemented after January 12, 2007, section 303A(d) of the MSA requires Councils and NMFS to consider the use of auctions or royalties for the initial or any subsequent distribution of limited access privileges. Because the SCOQ ITQ program was implemented before January 12, 2007, auctions and royalties are not considered in the review.

11 Other Considerations

In addition to the topical areas included in the preceding sections, the NMFS Catch Share Review Guidelines specifies that program reviews should contain the following elements: 1) a summary of any unexpected effects (positive or negative) which do not fall under the program's goals and objectives; 2) identification of issues associated with the program's structure or function; 3) and the potential need for additional data collection and/or research. Drawing on information obtained from consultations with Council staff (Coakley 2018), the following three subsections address these elements.

11.1 Summary of Unexpected Effects

The unexpected effects of the SCOQ ITQ program, together with the sections of the program review where additional information on these effects can be found, are summarized below.

- The size of the surfclam and ocean quahog fleets decreased dramatically at the onset of the SCOQ ITQ program. The surfclam fleet shrank from 135 vessels to 34 vessels within seven years of program implementation. This represented a 75 percent reduction in fleet size. Less consolidation occurred in the ocean quahog fleet—a 48 percent decrease occurred during that period (Section 6.3.2).
- A large number of vessel owners who received the initial allocations of ITQ quota share opted to remain in the surfclam and ocean quahog fisheries solely as quota lessors (Section 7.3.2).
- While the ownership of ITQ quota share is mildly concentrated for surfclam ITQ quota share and unconcentrated for ocean quahog ITQ quota share, the use of quota in the two fisheries is highly concentrated (Section 6.3.6).
- The surfclam and ocean quahog harvest attributable to independent vessels (versus processor-owned vessels) has steadily declined (Section 6.3.6). Although the SCOQ ITQ program goals and objectives do not clearly define what the surfclam and ocean quahog "industry" is, the goals and objectives were oriented toward harvesting, with the initial ITQ quota share allocations going solely to vessel owners. However, the industry has become increasingly oriented toward the processing sector.
- The loss of small, independently-owned processing plants was significant after SCOQ ITQ program implementation (Section 7.3.2). As a result of the overall decrease in processing facilities, the trucking of shell stock from the port of landing to distant processing facilities increased (Section 7.3.6).
- A large amount of surfclam and ocean quahog ITQ quota share is transferred each year. These transactions include myriad types of transfers between entities, including transfers 1) between industry entities through short- and long-term contracts; 2) between financial institutions holding ITQ quota share as collateral and industry entities; and 3) between related industry entities (e.g., transfers within a company or between different entities owned by the same company) (Section 7.3.3).
- Within a few years of the start of the SCOQ ITQ program, financial institutions became some of the largest holders of ITQ quota share (Section 6.3.8). Early on these institutions demonstrated a willingness to hold ITQ quota share as collateral on loans to purchase quota and other harvesting and processing assets over a long term.
- Determining SCOQ ITQ program effects on local and regional patterns of engagement in the surfclam and ocean quahog fisheries (e.g., the apparent northward movement of processing plants and fishing effort) is made complicated by the influence of concurrent factors unrelated to the program (Section 7.3.6). These factors include changes in resource availability, wastewater discharge regulations,

demographics and economic development, markets for surfclam and ocean quahog products, and economic conditions in other fisheries.

- Improved safety was a much-anticipated positive impact the SCOQ ITQ program, but the surfclam and ocean quahog fisheries continued to experience relatively high vessel disaster and fatality rates after program implementation. It is only recently that a combination of factors, most of which were external to the program, have contributed to lowering these rates in the fisheries, including new U.S. Coast Guard regulations, reestablishment of the onboard observer program, and the inclusion of various safety features in new vessel design. Less serious accident injury rates have not shown a similar declining trend (Section 7.3.7).

11.2 Identification of Issues Associated with Program Structure or Function

Two issues associated with SCOQ ITQ program structure or function, imbalance between annual catch limits and harvest and barrier to new entry, were identified and are discussed below. Each discussion notes the section of the program review where additional information about the issue can be found.

11.2.1 Imbalance between Annual Catch Limits and Harvest

Starting in the late 2000s, substantial portions of the surfclam and ocean quahog annual catch limits have been left unharvested due to weak or stagnant demand for clam products. While the resulting surplus of ITQ quota share has reduced the leasing burden, it has caused an economic hardship for some firms that opted to remain in the fisheries as quota lessors, as they have found it increasingly difficult to find lessees and/or have been forced to reduce quota lease prices (Section 7.3.2).

In addition, the reduced harvest of surfclam and ocean quahog resources has placed active small independent vessel owners at a disadvantage—processors are more likely to be able to meet their supply requirements using their own vessels. This difficulty of finding buyers, together with the increasing costs of fuel, insurance, and other fishing inputs, has forced out more of the small independent firms and accelerated vertical integration (Section 7.3.2).

On the other hand, some lessees of ITQ quota share welcome the devaluation of quota (Section 7.3.2). Moreover, a number of industry representatives have expressed concern that financial institutions would not renew loans if changes in the annual catch limits led to a signification reduction of ITQ quota share that could be used as collateral.

11.2.2 Barriers to New Entry

The ITQ quota share transferability rules of the SCOQ IT program facilitate, in theory, the entry of new entities into the surfclam and ocean quahog fisheries. There are few restrictions on the transfer of ownership of either ITQ allocation permits or the annual allocations of ITQ quota share. The original owners of ITQ allocation permits and ITQ quota share were owners of permitted vessels in the surfclam and/or ocean quahog fisheries. Thereafter, any entity that meets requirements for owning a U.S. Coast Guard documented fishing vessel is eligible to own ITQ quota share. Initially, an allocation could not be transferred in amounts less than 160 bushels (i.e., 5 cages), but Amendment 13 to the FMP eliminated this restriction in 2004. There is no maximum amount that can be transferred, nor is there any limit on the percentage of the total ITQ quota share that can be held by one person.

However, according to interviewed industry representatives, the industrial scale of the fisheries has long posed an economic barrier to entry for new entrants to the surfclam and ocean quahog fisheries. Vessels and fishing gear are expensive, and it can be difficult to find buyers, especially when the product market is

tight. The cost of acquiring ITQ quota share after implementation of the SCOQ ITQ program created an additional obstacle. In the ensuing years, there have been few programs to assist new entrants into the harvesting sector, and those programs have been limited in scope and duration. The number of new processors entering the surfclam and ocean quahog fisheries since the program began has also been limited. One long standing member of the industry has recently pursued a niche market for specialty clam products rather than attempting to compete with larger processors producing traditional products.

11.3 Potential Need for Additional Data Collection and/or Research

The following discussion on the potential need for additional data collection and/or research is based on information provided in Section 8.3.7.

Both before and after the SCOQ ITQ program began, reporting and recordkeeping requirements for harvesters and processors in the surfclam and ocean quahog fisheries were used by the Council and NMFS to monitor fishery progress and gain additional information about the distribution of fishing pressure on the resource and about the economic character of the fisheries. However, these requirements left a number of data gaps. Information on the actual prices of surfclam and ocean quahog product as it moves from vessels to processors is difficult to obtain. Because of vertical integration, most processors are buying product from their own vessels; therefore, the prices reported in vessel logbooks and processor/dealer weekly reports may not represent a "true" market transaction. In addition, information on the operating and fixed costs of surfclam and ocean quahog vessels and processors is very limited, and there is no systematic collection of vessel crew and processor worker data, such as employment, remuneration, and job satisfaction.

Implementation of a mandatory, on-going economic data collection system would be one way of bridging the data gaps. Some LAPPs have comprehensive economic data collection requirement to help the Councils and NMFS assess the success of the programs and develop amendments to the programs. For example, both the Bering Sea and Aleutian Islands Crab Rationalization Program and that Pacific Groundfish Trawl Rationalization Program included requirements to provide employment, cost, and sales data necessary to understand the economic performance of harvesters and, in the case of the Bering Sea and Aleutian Islands Crab Rationalization Program, processors participating in the respective fisheries. Annual forms that collect quantitative financial information about industry operations were specifically developed for each fishery. Completion and submission of the forms are required as a condition of continued participation in the fisheries (National Marine Fisheries Service 2018e; National Marine Fisheries Service 2018d).

However, both of the above LAPPs had the advantage of including the economic data collection requirements when the programs were first implemented. Industry participants in the programs viewed the requirements as one of many other program requirements, and they became accustomed to providing detailed, proprietary financial data on a regular basis. Given the many years that have elapsed since the SCOQ ITQ program began, an attempt to solicit similar economic information from surfclam and ocean quahog fishery participants is likely to encounter resistance from industry, as it would be outside of the long-held status quo. A potential indication of the level of resistance is the near zero percent response rate received in a voluntary survey that NMFS recently administered to commercial fishing vessel owners in the New England and Mid-Atlantic states to collect economic data—only one survey response was received from vessel owners who reported landings in the surfclam or ocean quahog fisheries in 2015 or 2016 (Walden 2018).

The outcomes of a recent series of reviews conducted by NMFS may offer guidance in ways to enhance the effectiveness of future economic and social data collection efforts, including boosting industry cooperation and participation, and thereby help fill data gaps and fulfill economic and sociocultural science research needs for managing the surfclam and ocean quahog fisheries. These reviews evaluated the direction and quality of economics and human dimensions programs at each of the six NMFS Fisheries Science Centers

and headquarters' Office of Science and Technology. The following recommendations for improving economic and social data collection in the surfclam and ocean quahog fisheries are based on information presented in online review reports compiled at National Marine Fisheries Service (2018c).

- Resource Evaluation: Evaluate the capacity of Council and NMFS Northeast Fisheries Science Center resources (staff time/technical capabilities, funds) to undertake additional social and economic data collection and management.
- Collaboration: Investigate potential collaborations in social and economic data collection and analysis with academic researchers who could both elevate science rigor and broaden technical capabilities. For example, use of post-doctorate and other fellowships could be a way to build and expand capacity among Council and NMFS Northeast Fisheries Science Center staff. Collaborations could also be sought with Council and NMFS Fisheries Science Center staff outside the region.
- Temporary Funding: Assess the role of temporary funds from outside sources and non-permanent staff in supporting social and economic data collection and research activities. Identify any inherent vulnerabilities in such an approach, such as: 1) Council and NMFS Northeast Fisheries Science Center staff may spend a considerable amount of time each year developing research proposals; 2) social science is particularly sensitive to temporary funding, as successful research is often predicated on community support, trust, and cultural awareness, which is fostered by consistent staff who can build relationships; and 3) cost data for commercial fisheries collected on an intermittent basis is likely to limit the ability to develop indicators such as profitability/efficiency.
- Public Communication: Embrace new technologies to facilitate social and economic data dissemination. For example, the creation of a user-friendly internet data interface with visualization and data download tools for the public can improve the efficiency of data availability and help to show the fishing industry that its data is being used and appreciated (which could increase participation in future data collection efforts).
- Industry Involvement: Involve industry stakeholders in the development and implementation of any new social and economic data collection system since they can provide valuable feedback that will foster acceptance and compliance with data requirements. Early industry involvement can also help ensure that social and economic data collection is less burdensome for industry while still providing the Council with the information it needs to make decisions.
- Prioritization: Explicitly link social and economic data collection and research activities to specific high priority analytical needs related to the MSA, Executive Order 12866, and other regulatory requirements. Agreement on social and economic data collection and research directions may make it easier to realign Council and NMFS staff with priorities should funding not allow the full desired portfolio of activities continue.
- Innovation: Do "out of the box" thinking about social and economic data collection. For example, wholesaler and retail price data could possibly be obtained using cost effective solutions such as crowdsourcing, web scraping, or NMFS port agent collaboration. In addition, possible "add-ons" to existing on-going data collection systems could be explored.
- Planning. Develop a multi-year plan for the collection and analysis of social and economic data. The plan should set forth clear goals and objectives for an economic and social science research program and could be developed in coordination with broader Council- and NMFS Northeast Fisheries Science Center-level strategic planning. The plan could address many of the recommendations listed above, including 1) reviewing current and emerging needs for social and economic research and data, assessing how well existing activities meet those needs, and identifying where changes to existing efforts or new ones are necessary; 2) identifying opportunities to reorganize, grow, or revamp data collection programs

to improve the data collected and efficiency of collecting it; and 3) assessing whether the Council and NMFS Northeast Fisheries Science Center have the appropriate resources to address current and emerging research and data collection needs.

Section 8.3.7 presents recommendations for data collection and research in the surfclam and ocean quahog fisheries based on information presented in the review reports compiled by NMFS.

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Appendix 1: NIOSH Assessment of Occupational Hazards in the Atlantic Surfclam and Ocean Quahog Fisheries

Assessment of Occupational Hazards in the Atlantic Surfclam and Ocean Quahog Fisheries

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Disclaimer
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Introduction

The National Institute for Occupational Safety and Health (NIOSH) is the federal government agency responsible for conducting research and making recommendations to prevent work-related injury and illness. NIOSH researchers have examined fatalities and injuries in the commercial fishing industry since 1991 to better understand and control workplace hazards. While much progress has been made throughout the years to prevent loss of life at sea, commercial fishing remains one of the most dangerous occupations in the United States (US) [BLS 2018].

NIOSH periodically publishes fatality, injury, and vessel disaster data specific to regions and fisheries across the US. However, this is the first analysis focused solely on the Atlantic surfclam and ocean quahog fisheries. This report provides an overview of crewmember and vessel safety issues in the fleet, which is needed to examine trends, characterize leading hazards, and identify relevant recommendations for further safety improvements. The findings included herein are especially relevant to the Mid-Atlantic Fishery Management Council (MAFMC), the United States Coast Guard (USCG), and vessel owners and operators.

Surfclams and ocean quahogs span the waters from Maine to North Carolina, primarily in the Exclusive Economic Zone (3 to 200 miles from shore) [MAFMC 2018a, 2018b]. Commercial fishing vessels that participate in these fisheries are typically large (>100 gross registered tons), carry 3-5 crew onboard, and use hydraulic dredges to dislodge and harvest the surfclams and quahogs from the ocean floor [MAFMC 2018A, 2018b; McCay and Brandt 2001; NOAA fisheries, no date]. Fishing operations are conducted year-round, with concentrated efforts off the coasts of Maine, Massachusetts, Rhode Island, New York, New Jersey, and Delaware [NOAA fisheries, no date; Mid-Atlantic Ocean Data Portal, no date].

Atlantic surfclam and ocean quahog fisheries have operated under a fishery management plan since 1977 [MAFMC 1977]. In 1990, final approval of Amendment #8 to the fishery management plan established the individual transferable quota (ITQ) system, the first of its kind in the US. Implementation of ITQs meant that vessels would no longer compete with each other for the resource; instead, permit holders received their own allocation. In analyzing the potential effects of an ITQ system, several safety-related benefits were posited [MAFMC 1988]. Because the quota allocations could be transferred, barriers to replacing older, potentially unsafe vessels could be reduced. Having additional time to harvest the catch may better allow for decisions to stay in port during foul weather conditions, without that decision resulting in loss of fishing days and income. Further, without constrained fishing hours, operators may not feel pressures to overload the vessels to maximize their catch in a limited amount of time [MAFMC 1988].

Quota-based management systems have long been hypothesized to improve safety in the fisheries in which they are implemented. Evidence suggests that quota-based management systems may reduce incentives for operators to take risks associated with short and highly competitive fisheries [Knapp 2016]. Other pressures may not be alleviated, such as demands to meet delivery timeframes to processors [Knapp 2016]. For example, a study of the Alaskan halibut and sablefish fishery showed immediate decreases in the rates of search-and-rescue cases and fatalities after individual fishing quotas (IFQs) were employed in the 1990s [Lincoln et al. 2007]. However, a more recent analysis showed that fatalities and vessel disasters have persisted over time in this fishery, demonstrating that not all operational hazards were resolved by a change in this management policy [Case et al. 2016].

The availability of detailed information about safety issues in the surfclam and ocean quahog fisheries is limited, particularly after the 1990s. This report summarizes marine casualty data in the fleet since the implementation of ITQs in 1990.

Hazard Assessment Methods

Case Definition

For this report, two types of casualties that occurred during 1990–2017 were included as measures of safety: vessel disasters and crewmember traumatic injuries. These events were only included in the analysis if they occurred while the vessel was participating in the surfclam or ocean quahog fisheries. Events were excluded if the vessel was participating in a state fishery.

Vessel disasters were defined as catastrophic vessel events that resulted in: a) one or more crewmember fatalities; and/or b) the crew abandoning the vessel due to safety concerns. Typically, vessel disasters involve sinkings and capsizings. However, this definition excludes sinkings that occurred at the dock with no crew onboard. Variables of interest for vessel disasters included the following: vessel characteristics (year built, hull material, length); incident date; sequence of events; number of persons at risk; number of fatalities; and weather-relatedness (as determined by USCG investigators).

Work-related traumatic injuries to the crew from any cause, both fatal and nonfatal, were also analyzed. Included in the analysis were injuries to any worker on a vessel, including captains, deckhands, and fishery observers. A traumatic injury was defined as "any wound or damage to the body resulting from acute exposure to energy… caused by a specific event or incident within a single workday or shift" [BLS 2016]. This definition includes effects from acute exposures to chemicals and environmental conditions. Not included in this analysis were disorders resulting from cumulative trauma (e.g., carpal tunnel syndrome, repetitive motion strains, and noise-induced hearing loss) or illnesses and chronic conditions (e.g., infections, heart attacks, and diabetes-related complications). For crewmember injuries, the following variables were of interest: incident date; work activity at the time of the incident; nature of injury; body part affected; event and source causing the injury; injury response; and injury treatment. Severity of each injury was also analyzed. Injuries that resulted in death or presumption of death were considered Fatal. Severity of nonfatal injuries was based on a USCG modification of the Abbreviated Injury Scale [USCG 2018]. Injury severity classifications are listed below, with definitions and examples:

- Minor: The injury is minor or superficial. No medical treatment was required. Includes scrapes/abrasions, first-degree burns, minor head trauma with headache, minor sprain/strain.
- Moderate: The injury exceeds the minor level; professional medical treatment may have been required. If so, the person was not hospitalized for more than 48 hours within 5 days of the injury. Includes broken fingers/toes/nose, amputated fingers/toes, dislocated joints, herniated disc.
- Serious: The injury exceeds the moderate level and requires significant medical/surgical management. The person was not hospitalized for more than 48 hours within 5 days of the injury. Includes broken bones, partial loss of limb, degloving of entire hand/arm or foot/leg, bruised organs.
- Severe: The injury exceeds the moderate level and requires significant medical/surgical management. The person was hospitalized for more than 48 hours within 5 days of the injury. Includes internal hemorrhage, punctured organs, loss of entire limb.

- Critical: The injury exceeds the moderate level and requires significant medical/surgical management. The person was hospitalized and in intensive care for more than 48 hours within 5 days of the injury. Includes spinal cord injury, extensive second- or third-degree burns, severe/multiple organ damage.

Data Sources

The MAFMC, through Northern Economics Inc., provided to NIOSH and the USCG a list of vessels that were active in the federal surfclam and ocean quahog fisheries since 1980. In total, there were 396 unique vessels active in these fisheries, as determined by the number associated with each vessel's state registration or federal documentation.

According to 46 CFR 4.05, commercial vessel owners or operators are required to report marine casualties to the USCG, including vessel disasters, injuries resulting in loss of life, and injuries requiring treatment beyond first aid and resulting in the crewmember being unable to perform routine duties. Instances of vessel disasters and crewmember injuries were identified from the USCG's electronic Marine Information for Safety and Law Enforcement (MISLE) system. The MISLE system documents various USCG activities, including vessel boardings, search and rescue cases, and marine casualty investigations. Personnel from the USCG's Fifth District searched each vessel's activity history in MISLE to identify vessel disasters and crewmember injury events in which those vessels were involved from 1990 through 2017. Although vessel data were provided since 1980, casualty data for the 1980s were not available in MISLE and therefore not included in the analysis. NIOSH researchers collected additional information for analysis as described in the case definition above.

Effort data (number of vessels operating in the fishery per year, and average time at sea per vessel per year) were derived from the National Marine Fisheries Service to calculate rates of vessel disasters and crewmember injuries. These denominator data were provided through 2016, with the final year extended as estimates for 2017.

Analysis

A descriptive analysis was conducted to examine the causes and characteristics of vessel disasters and crewmember injuries. Because the number of events fluctuated over time with low annual frequencies, conducting a statistical test for annual trend was not possible. However, results over the 28-year period are broken down by decade for comparison: 1990–1999, 2000–2009, and the first eight years of the final decade, 2010–2017.

In addition to describing the raw number of vessel disasters and crewmember injuries, rates were also calculated. The exposure estimate used to calculate rates of vessel disasters was days at sea, which is the product of number of vessels and average days at sea per vessel. Risk was expressed as the number of vessel disasters per 10,000 days at sea. For crewmember injuries, the exposure estimate was full-time equivalent workers (FTEs), an adjusted estimate of crew size of the fleet based on a standard 2,000-hour work year. Because 3-5 crewmembers work onboard these vessels, an average of four crew per vessel was assumed while calculating FTE estimates. Fatal injuries were expressed per 100,000 FTEs, and nonfatal injuries expressed per 1,000 FTEs.

Results

Vessel Disasters

Eighteen vessel disasters (8 fatal, 10 nonfatal) occurred while participating in the clam and quahog fisheries over the 28-year period, 1990–2017. Of the 63 total crewmembers onboard and therefore at risk during these events, 21 (33%) died. This loss of life primarily occurred in the 1990s, with six fatal vessel disasters resulting in 18 crewmember deaths. The number of vessel disasters and associated fatalities have generally decreased over time, as shown in Table 1.

Table 1. Vessel disasters and associated fatalities in the Atlantic Surfclam/Ocean Quahog fleet, 1990–2017.

Period	Number of Vessel Disasters	Number of Persons Onboard	Number of Fatalities	Case Fatality Rate
1990–1999	10	36	18	50%
2000–2009	6	20	1	5%
2010–2017	2	7	2	29%

These were relatively rare events, with less than one vessel disaster occurring annually on average (mean = 0.64). As shown in Table 2, both the number and rate of these events have decreased over time. During 2000–2009, the rate of vessel disasters decreased by 42% from the preceding ten-year period. The rate further declined by 60% during 2010–2017.

Table 2. Rates of vessel disasters in the Atlantic Surfclam/Ocean Quahog fleet, 1990–2017.

Period	Number of Vessel Disasters	Total Days at Sea	Rate (per 10,000 Days at Sea)
1990–1999	10	50,722	1.97
2000–2009	6	52,719	1.14
2010–2017	2	43,799	0.46

Vessel disaster events were most frequently caused by flooding (7, 39%). Instances of flooding included downflooding from open doors and hatches (2 events), internal flooding from malfunctioning valves and pipes (2 events), and flooding below the waterline from unspecified hull breaches (2 events). The cause of flooding was unknown in one disaster.

The loss of vessel stability resulted in five vessel disasters (28%). In two of these events, clam cages had been loaded unevenly or shifted on the vessels while underway. In two additional cases, equipment failures caused sudden changes in weight distribution on the vessels, causing them to roll. One further instability-related vessel sinking was suspected to have been caused by icing conditions.

Fires resulted in three vessel sinkings (17%). All three fires began in the engine room; however, specific causes of the fires could not be definitively determined.

Two vessel disasters had unique causes: in one, the dredge gear was caught on the ocean floor and caused the vessel to capsize; in another, the vessel had taken on water and sank after it ran aground. The cause of one vessel disaster remains unknown.

Overall, weather conditions contributed to nearly half of all vessel disasters (8, 44%). This proportion was higher in fatal disasters (5/8, 63%) than in nonfatal disasters (3/10, 30%). The month of January had the highest frequency of vessel disasters (7, 39%), with the remaining vessel losses distributed throughout the year, and no other month experiencing more than two disasters.

Vessels involved in these events were a mean 81' in length (range = 42' – 140') and most often steel (14, 78%). The average vessel age was 24 years at the time of the incident (range = <1 year – 43 years).

Crewmember Injuries

Table 3. Injuries in the Atlantic Surfclam/Ocean Quahog fleet by severity, 1990–2017.

Severity Classification	Number of Injuries	Percent
Fatal	24	31
Severe	3	4
Serious	12	16
Moderate	27	35
Minor	7	9
Unknown	4	5
Total	**77**	**100**

During 1990–2017, 77 injuries in the fleet were reported to the USCG, of which 24 (31%) were fatal (Table 3). The severity of the remaining nonfatal injuries varied, with most classified as either moderate (27, 35%) or serious (12, 16%).

Table 4. Rates of fatal injuries in the Atlantic Surfclam/Ocean Quahog fleet, 1990–2017.

Period	Number of Fatalities	Total FTEs	Rate (per 100,000 FTEs)
1990–1999	19	2,435	780
2000–2009	2	2,530	79
2010–2017	3	2,102	143

Twenty-four crewmembers died in the fleet, less than one fatality per year on average (mean = 0.86). Table 4 shows the distribution of fatalities over time. While the high incidence of crewmember deaths persisted in the 1990s, both the number and rate of fatalities has since remained much lower. During 2000–2009, the rate of fatalities was 90% lower than the previous decade. An increase in the rate was subsequently observed during 2010–2017, but it was still 82% lower than the 1990s.

Nearly all deaths were due to drowning. Most fatalities (21, 88%) occurred during vessel disasters as described previously. Vessel abandonment information was limited in these events, but none of the victims were confirmed to have been able to don an immersion suit.

The remaining three deaths resulted from falls overboard, including one victim who died after entering the water during a rescue attempt of another who had fallen in the water. While this crewmember served as a rescue swimmer and wore an immersion suit during the rescue, the two unintentional fall overboard victims were not wearing a personal flotation device (PFD).

An additional 53 crewmembers suffered nonfatal injuries while working in the fleet. Nearly two nonfatal injuries were reported to the USCG per year throughout the duration of the study period (mean = 1.9). The number of reported injuries fluctuated annually, ranging from a high of nine in 1992 to a low of zero in multiple years. The number of injuries varied by month with no discernable trend. The number of reported nonfatal injuries remained stable over time (Table 5). During 2000–2009, the rate had decreased by 9% compared to 1990–1999, but then increased by 27% during 2010–2017.

Table 5. Rates of nonfatal injuries in the Atlantic Surfclam/Ocean Quahog fleet, 1990–2017.

Period	Number of Nonfatal Injuries	Total FTEs	Rate (per 1,000 FTEs)
1990–1999	18	2,435	7.39
2000–2009	17	2,530	6.72
2010–2017	18	2,102	8.56

Eleven crewmembers were nonfatally injured during vessel disasters. Injured survivors of these incidents most frequently experienced hypothermia from immersion in water and extended exposure to the elements (6, 55%), but also experienced other trauma, including fractures, lacerations, and burns, during vessel abandonment.

The remaining 42 crewmembers experienced injuries while working on deck. By work activity, crewmembers were most frequently injured while directly handling gear and equipment such as the dredge and clam cages (7, 17%), repairing and maintaining equipment including conveyors (6, 14%), and sorting clams (6, 14%). Additional information on the circumstances surrounding these 42 injuries are described below and shown in Table 6.

Table 6. Nonfatal on-deck injuries in the Atlantic Surfclam and Ocean Quahog fleet by nature and event, 1990–2017.

	Caught In or Compressed By Objects, Equipment	Other Contact with Objects, Equipment	Slips, Trips, Falls	Exposure to Harmful Substance, Environment	Violence	Total
Fractures	5	4	2	0	0	**11**
Amputations	5	3	0	0	0	**8**
Crushing injuries	5	0	0	0	0	**5**
Chemical Burns	0	0	0	3	0	**3**
Internal Injuries	0	3	0	0	0	**3**
Unspecified Injuries	0	1	1	0	1	**3**
Cuts, Lacerations	0	1	1	0	0	**2**
Bruises, Contusions	1	0	1	0	0	**2**
Sprains, Strains, Tears	0	0	2	0	0	**2**
Dislocations	0	0	1	0	0	**1**
Dehydration	0	0	0	1	0	**1**
Respiratory Symptoms	0	0	0	1	0	**1**
Total	**16**	**12**	**8**	**5**	**1**	**42**

Injuries most often occurred after crewmembers were caught in or compressed by gear or equipment (16, 38%). Most commonly, crewmembers were caught between the dredge and vessel exterior (4, 25%) or caught in running winches (3, 19%). Other sources of injuries included conveyors, hydraulic doors, and clam cages. Injuries caused by being caught in/compressed by gear or equipment were often finger amputations (5, 31%), fractures (5, 31%), and crushing injuries of the extremities (5, 31%). Of these injuries, the majority were classified as moderate (7, 44%) or serious (7, 44%) severity.

An additional 12 crewmembers (29%) were injured from other types of contact with objects or equipment, including being struck by or against equipment. Similarly, crewmembers experienced fractures (4, 33%) and finger amputations (3, 25%) from these events. Three crewmembers (25%) also suffered internal injuries from these events, representing the most severe nonfatal injuries in the fleet. The equipment most often implicated in these cases were cables and lines (3, 25%), the dredge (3, 25%), and pulleys (2, 17%).

Slips, trips, and falls contributed to eight injuries (19%) while crewmembers were walking on deck, as well as climbing or descending ladders and stairs. Injuries ranged from minor (4, 50%) to serious (2, 25%), with the serious injuries resulting from falls from height.

On three separate occasions, unexploded ordnances were hauled up with the catch. Four crewmembers were exposed to sulfur mustard while throwing the munitions overboard. They experienced chemical burns, blisters, and respiratory symptoms that developed several hours after exposure, and required professional medical treatment.

The remaining two injuries had unique causes. In one instance, a crewmember suffered effects of dehydration. In the other, workplace violence resulted in an unspecified head injury to one crewmember.

Because vessels were primarily at sea when the injuries occurred, the most typical response for the 42 on-deck injuries was for the vessel to immediately transit to shore for treatment (15, 36%) or for the injured crewmember to be rescued by a USCG helicopter or boat while offshore (14, 33%). All injured crewmembers were transferred to a hospital for evaluation and, if applicable, professional medical treatment.

Discussion

In the 1980s, the clam and quahog fleet lost an average of one vessel per year [National Research Council 1999]. Even with ITQs in place, this trend continued into the 1990s with the loss of 10 vessels and an overall case-fatality rate of 50%. While ITQs may have reduced pressures to fish in inclement weather, interviews from crewmembers in the 1990s suggested that strict processor delivery dates required fishing at certain times regardless of weather conditions [as cited in McCay and Brandt 2001; National Research Council 1999]. Fortunately, both the number of vessel disasters and associated fatalities have since decreased. Since 2000, the overall case-fatality rate from vessel disasters was 11%, indicating increasing survivability during these events. The rate at which vessel disasters occur in the fleet has also declined since the 1990s.

Many vessel disasters were caused, at least in part, by specific vessel conditions (e.g., open doors and hatches, equipment malfunctions). These conditions, along with heavy weather, resulted in catastrophic

events that put crews at risk of immersion in water and subsequent injury or death. Preventing vessel disasters begins with ensuring vessels are seaworthy. At a minimum, vessel owners should follow guidelines for flooding prevention, stability standards, and fire safety equipment and practices outlined in the USCG "Voluntary Safety Initiatives and Good Marine Practices for Commercial Fishing Industry Vessels" document [USCG 2017].

Although survivability of vessel disasters has increased, these events were the primary contributors to loss of life in the fleet during 1990–2017, mirroring the national commercial fishing industry [Lucas and Case 2018]. It is imperative that vessels in the fleet are in compliance with federal fishing vessel safety regulations as outlined in 46 CFR 28 by carrying the appropriate survival craft onboard, maintained in serviceable condition. A study of cold water survival after fishing vessel sinkings in Alaska has shown that the use of this lifesaving equipment improves crewmembers' chances of survival after immersion in cold water [Lucas et al. 2018]. In addition, all crewmembers should be extremely familiar with each piece of lifesaving equipment and its proper use. This knowledge can be attained through marine safety training classes, with participation recommended at least once every five years, and routine emergency drills onboard, conducted monthly [NIOSH 2010, 2017].

Fall overboard events also resulted in fatalities, showing a risk of working on vessels at sea. However, these incidents are preventable. In order to prevent future fatalities, it is vital to keep crewmembers out of the water altogether [Case et al. 2018]. On vessels where the deck gear and equipment, such as the clam cages and conveyors, extend out to the rails of the vessel, additional protection to workers may be gained by keeping them from atop the cages at the rail or tethered when working [Case et al. 2018; Dameron 2018]. Exposure to fall hazards is greatest when working at height and near the stern, performing activities such as throwing and retrieving the clam hose and working on the dredge [Dameron 2018]. One of the simplest and most affordable ways to prevent future drowning deaths should a fall occur is to ensure all crewmembers are wearing PFDs while on deck, particularly when conducting these work tasks, and utilize man-overboard alarms to facilitate a swift recovery effort [Case et al. 2018].

Nonfatal injuries can be quite severe and may result in long-term consequences for crewmembers, including unemployment and lost wages, disability, chronic pain, and psychological distress [van der Sluis et al. 1998]. Crewmember injuries also result in operational interruptions and medical costs. Although fatalities decreased over time, nonfatal injuries remained fairly constant throughout the study period, highlighting an area for renewed focus. Of the 53 nonfatal injuries reported to the USCG, 79% required professional medical treatment, with 28% classified as serious or severe and requiring significant medical/surgical management. This report's analysis of the uncontrolled hazards that resulted in traumatic injuries can help inform prevention efforts and directly improve the well-being of the fleet. Most of the injuries observed in the fleet were directly related to dredging operations, such as coming into contact with dredges, clam cages, winches, and conveyors. Priority areas for injury prevention include shifting gear and equipment from vessel motion, winch entanglement hazards, cable and line failures, and slip/trip/fall hazards on deck. Additional research is needed to determine the incidence and determinants of repetitive motion injuries, illnesses, and chronic health conditions in the fleet.

Dredging in the Atlantic poses other unique hazards to crewmembers, including the potential for exposure to sulfur mustard agent. Through investigations of these incidents, crewmembers note that they routinely haul up munitions that had been disposed of at sea [CDC 2013]. Informational brochures and posters have been developed for the fishing industry to help operators develop a munitions

response plan [CDC 2018]. Guidance is provided on munition recognition, proper handling techniques, reporting procedures, and approaches to reduce crewmembers' exposures. These tools should be widely distributed among the fleet to increase awareness and reduce severity of the adverse health effects of such exposures.

This assessment is subject to several limitations. First, pre-ITQ casualty data were unavailable for analysis, rendering us unable to evaluate the effects of ITQs. Further, the safety measures included in this report are not exhaustive. Additional measures could be evaluated in future analyses, including the causes and frequency of less severe vessel casualties (e.g., loss of power, loss of propulsion, groundings). Lastly, it is possible that nonfatal injuries in this fleet are underreported to the USCG, with the injuries captured in this analysis likely representing the most severe injuries that required more immediate professional medical treatment and USCG assistance. Underreporting of work-related injuries has been shown to occur across many industries [Pransky et al. 1999].

Although ITQs may have reduced some risks in the Atlantic surfclam and ocean quahog fisheries, hazards still exist that were not eliminated by changes in this fishery management policy. Other factors, such as market conditions, the offshore environment, weather conditions, and hazardous gear and equipment, contribute to safety-related decision-making and the ongoing incidence of vessel disasters and crewmember injuries [Knapp 2016]. By applying prevention strategies at all levels, from vessel owners and operators to policy makers, these risks can be further mitigated.

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