unknown or potentially detrimental consequences. The scallop industry has recognized the seriousness of this issue and has taken steps to educate themselves on turtle identification, recognition, and proper care to maximize survival of sea turtles. The industry has also begun efforts to work with NMFS to identify procedural and other changes that could reduce sea turtle interactions and improve survival.

Turtles are known to inhabit and aggregate in areas within the geographic vicinity of the proposed controlled access program. While the impacts of the controlled access program may be beneficial as compared to the no action (open access to the Virginia Beach and Hudson Canyon Areas to both scallop dredge and trawl gear) the actual impacts of the program itself are uncertain at this writing. NMFS is preparing a Biological Opinion for the Sea Scallop FMP which should provide insight into this issue and guidance to the Council.

6.3.4.4 Economic Impacts

6.3.4.4.1 Introduction

This section evaluates the economic impacts of proposed days-at-sea adjustments and access to the Hudson Canyon and Virginia Beach Closed Areas for each management alternative. The increase in the allocated days-at-sea per vessel above the Amendment 7 allocations and the access to the closed areas in Mid-Atlantic is estimated to have positive economic impacts for the scallop industry and the nation for all options that were considered by the Council. The economic impacts analyzed here refer to the impacts of the proposed measures on landings, revenues, ex-vessel prices, and on consumer and producer surpluses. The impacts on regional revenues are also discussed in Section 6.3.4.4.5. The estimates indicate that net benefits in 2003 (the sum of consumer and producer surpluses net of no action levels) from the proposed action (120 DAS, high TAC) will reach $61 million in 2003, and that of the other alternatives will increase by $38 to $73 million relative to the no action levels (45 DAS, Amendment 7 schedule) (Table 47). The economic impacts on the vessels are also expected to be positive.

The analysis includes the three alternatives that propose to increase allocations to 100, 120, or 140 days-at-sea for the full-time vessels. To avoid repetition, the alternatives are identified by the DAS allocations per full-time vessel although they also include an increase in the allocations for the part-time vessel days (to 40, 48, or 58 DAS, respectively) and for occasional vessel days (to 8, 10 or 12 DAS, respectively) 40. The analysis compares the results of the proposed measures with that of *no action*, which is a continuation of Amendment 7 days-at-sea schedule with 45 DAS for full-time vessels (18 for part-time and 4 DAS for occasional vessels) in year 2003 as well as with the results of the *status quo* 120-DAS option41. For purposes of analysis, the following alternatives represent the likely combinations of measures described in Section **5.1** and described in Section **6.3.4.1.1**:

- No action – 45 full-time days-at-sea
- 100 full-time days-at sea with F=0.2
- 100 full-time days-at sea with high F in access areas
- 120 full-time days-at sea with F=0.2
- 120 full-time days-at sea with high F in access areas (proposed action)

40 Current law and restrictions on measures that can be introduced in a framework prevent some other management mechanisms such as individual transferable vessel quotas or transferable DAS.
41 New management policies for groundfish and EFH are likely to affect the baseline (no action or status quo) definition for the scallop fishery in the near future, but these policies are formative at this time and not clear enough to be integrated in Framework 15.

- 140 full-time days-at sea with F=0.2

The economic impacts of these options on net national benefits and scallop vessels were analyzed using the biological projections reported in Sections **6.3.4.1.1**. The results of this analysis could be useful in showing the direction of change from the no action levels, and the comparative net benefits of the proposed action, rather than in predicting the absolute values of the landings, revenues and economic benefits in future years.

The analysis was conducted both for the very short-term, i.e., for 2003 fishing year during which Framework 15 will be in effect, and for the future 10 years following the implementation. A further discussion of the long-term impacts is provided in 6.3.4.4.8.

6.3.4.4.2 Overview of economic impacts

The short-term economic impacts shown in Table 47 include the impacts of proposed days-at-sea adjustments and access to the Hudson Canyon (HC) and Virginia Beach Areas (VB). Status quo is defined as the 120 DAS option with a low TAC option and F=0.2. No action refers to continuation of Amendment 7 days-at-sea schedule with 45 DAS for full-time vessels. The results of the alternative options are compared both with status quo, but also with the no action alternative in accordance with the regulatory impact requirements. Although Framework 15 proposals include one fishing year, 2003, the economic analysis takes into account the long-term impacts on the scallop biomass and future landings of alternative short-term policies, assuming that these policies will be in effect from 2003 to 2012. Table 48 summarizes these impacts.

Impacts on landings and scallop prices

Sea scallop prices change when the level of domestic landings, import prices, size of landed scallops, and the income of consumers change. The management options considered in this framework will affect prices by changing the level of landings and the meat count.

- If no action is taken, allocations for full-time vessels will decline to 45 days as mandated by Amendment 7, reducing the estimated landings to 31 million pounds in 2003, and increasing the ex-vessel price to above $4.30 per pound.
- The price of scallops is estimated to be about $3.35 to $3.68 per pound for the 120-DAS and the 100-DAS options, and about $3.12 for the 140-DAS option.
- The decline in prices relative to the no action result primarily from the estimated increase in scallop landings to 46 to 49 million pounds respectively for the 100-DAS and the 120-DAS options, and to 54 million pounds for the 140-DAS option from 31 million pounds for no action.
- The average meat count is estimated to be 17 meats per pound for the no action alternative and about 21 meats per pound for the proposed DAS options.

Impacts on fleet revenues, costs and producer surplus

- **Short-term (**Table 47**, 2003):** The operational costs (non-labor variable costs) are expected to be lower with the no action (57% less) and the 100 DAS (14% less) and 120 DAS, high TAC (1% less) alternatives and higher with the 140 DAS option (18% more) relative to the status quo. The scallop revenues of the fleet are expected to decline by $25 million (15%) relative to status quo if no action is taken and the allocations are reduced to 45 DAS as scheduled by Amendment 7. The 100 DAS option slightly reduces fleet

revenue (2%) if a low TAC is assigned to HC areas, but the level of revenues stay almost at the same level with the high TAC, the 100 DAS option compared to status quo. In year 2003, the greatest increase in revenue would be observed with the 120 DAS, high TAC (2%), and 140 DAS option (4%). However, revenues net of operational expenses, that is, the producer surplus, would increase more for the high TAC alternatives combined with either the 100 DAS or with 120 DAS allocation (by 3% in each case) compared to the levels for the status quo and the 140 DAS option. The impact of all DAS alternatives on revenues and producer surplus are expected to be positive relative to no action (45 DAS) levels.

- **Long-term (**Table 48**):** The producer surplus will increase by 2% with the proposed action (120 DAS, high TAC) relative to the status quo in 2003-2006. Because the operational expenses are lower with the 100 DAS option, the producer surplus will increase by 2% and 4% respectively for the low and high TAC options during the four-year period from 2003 to 2006. Over a 10-year period, the100 DAS options would increase revenues net of operational expenses (producer surplus) by 5% relative to the proposed action (120 DAS, high TAC) and status quo. Because of the continued increase in costs and declining scallop biomass and revenue over time, 140 DAS options would reduce the producer surplus by 9% in a 10-year period. During the same period, no action alternative would reduce total revenue (by 6%), but would increase producer surplus (by 9%) due to the decline in operational expenses (by 55%). Because the operational expenses would be less with the no action (45 DAS) alternative, the producer surplus, that is total revenue minus costs, for the proposed action and the non-preferred alternatives is estimated to fall below the producer surplus for no action. Another reason for this is that after the first five years landings for the no action alternative exceed the landings, therefore the revenues, for the proposed action and the non-preferred alternatives (see Table 51 in Section 6.3.4.4.4). This is because of the faster rebuilding of the scallop stock biomass in future years with less DAS and fishing mortality.

Impacts on consumers

- **Short-term:** The consumer benefits, as measured by consumer surplus, are expected to increase with all DAS options relative to the no action alternative because of the increase in landings and the decline in prices. No action would reduce consumer surplus by $40 million in year 2003 relative to the status quo. The 120 and 140 DAS options would maximize the increase in consumer surplus compared to the 100 DAS with the low and high TAC options.

- **Long-term:** The impacts on the consumer surplus follow the same trend in the near term from 2003 to 2006, with the high DAS options producing the largest positive effects. Over a 10-year period, however, both the100 DAS and 120 DAS with high TAC options would result in largest positive impacts on consumer surplus relative to the status quo, while with the 140 DAS option, the magnitude of the impacts would approach the same levels as with the status quo.

Impacts on net national benefits

- **Short-term:** The proposed increase in DAS allocations in 2003 is estimated to have positive economic impacts on the sea scallop industry and net national benefits under all options relative to the no action (45 DAS) alternative. The net national benefits

(cumulative discounted value of the consumer surplus and producer surplus) are estimated to increase by $38 to $73 million compared to the no action levels if the DAS allocations were reduced to 45 DAS for full-time vessels in accordance with original Amendment 7 schedule (Table 47). Among the proposed alternatives, the140 DAS option would result in the largest economic benefits ($73 million) relative to no action in 2003, followed by high TAC options with the120 DAS ($61 million), and 100 DAS (50 million).

- **Long-term:** The proposed action (high TAC, 120 DAS) is estimated to increase net benefits by $32 million during the period 2003-2012. Over this 10-year period, the 100 DAS options either with low or high TACs would produce the largest net economic benefits, $66 million for low TAC and $74 million for high TAC alternatives, relative to the no action benefits. The net benefits would decline by $49 million with the 140 DAS option compared to the no action (45 DAS). This is because the magnitude of reduction in scallop biomass and landings is greater at the higher fishing mortality levels corresponding to the 140 DAS alternative. The status quo (120 DAS, F=0.2) alternative would increase net benefits by $28 million.

Table 47. Short-term impacts and economic benefits: 2003.

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
Landings (million pounds)	31	43	46	46	49	54
Ex-vessel price per pound	4.39	3.68	3.53	3.51	3.35	3.12
LPUE (pounds per DAS)	2007	1715	1787	1628	1746	1687
Total Fleet DAS	13,641	25,263	24,827	28,428	28,005	32,969
	Economic benefits and costs (million $, in 1996 prices)					
Total fleet revenue	137	158	162	162	165	169
Operational costs	14	28	27	32	31	38
Producer surplus	123	130	135	130	134	131
Consumer surplus	43	74	82	83	93	108
Total economic benefits	166	204	216	213	227	239
Total benefits net of no action	0	38	50	47	61	73
	Percentage change relative to status quo (120 DAS), 2003					
Total fleet revenue	-15%	-2%	0%	0%	2%	4%
Operational costs	-57%	-13%	-14%	0%	-1%	18%
Producer surplus	-5%	0%	3%	0%	3%	1%
Consumer surplus	-49%	-11%	-1%	0%	12%	30%
Net economic benefits	-22%	-4%	2%	0%	6%	12%
Employment (Crew*days-at-sea)	-52%	-11%	-13%	0%	-1%	16%

Table 48. Long-term costs and benefits net of status quo levels

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
	Percentage change in cumulative discounted values relative to					

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
	Status quo (120 DAS), 2003 – 2006					
Total fleet revenue	-21%	-1%	1%	0%	2%	2%
Operational costs	-63%	-13%	-14%	0%	-1%	18%
Producer surplus	-10%	2%	4%	0%	2%	-2%
Consumer surplus	-57%	-6%	-0%	0%	6%	13%
Net economic benefits	-28%	-1%	3%	0%	4%	4%
Employment (crew*days-at-sea)	-59%	-11%	-12%	0%	-1%	16%
	Percentage change in cumulative discounted values relative to Status quo (120 DAS), 2003-2012					
Total Revenue	-6%	1%	1%	0%	0%	-3%
Operational Costs	-55%	-13%	-13%	0%	0%	19%
Consumer Surplus	-23%	-1%	1%	0%	1%	0%
Producer Surplus	9%	5%	5%	0%	0%	-9%
Net Economic Benefits	-2%	3%	4%	0%	0%	-6%
Percentage change in employment (crew*days-at-sea)	-49%	-11%	-12%	0%	0%	17%
	Economic Benefits Net of No Action, 2003-2012					
Consumer Surplus	0	97	103	101	106	102
Producer Surplus	0	-31	-30	-73	-74	-151
Net Economic Benefits	0	66	74	28	32	-49

Impacts on vessels

The DAS adjustment alternatives will have positive impacts on vessels' financial viability, revenues and profits. The impacts on crew shares will be positive as well. The days-at-sea allocations will be in excess of the break-even DAS points and the vessels will be able to cover their fixed and variable costs (Section 6.3.4.4.10, Table 58). From the perspective of the vessel economics, adjustment of the allocations to 120 days-at-sea would contribute to the stability of the operations by keeping the effort at the present levels. As a result, the industry can increase its efficiency by reducing its production and marketing costs, improving its competition with imports and increasing its economic returns (profits).

Impacts on employment

The employment in the sea scallop fishery as measured by total number of crew days (CREW*DAS) will increase in proportion to the increase in total fleet days-at-sea. The proposed action would keep the employment at about the same levels with that of status quo both in the short- and the long-term. The no action alternative (45 DAS) is estimated to reduce employment by over 50% in the short-term, and close to 50% in the long-term compared to the status quo 120 DAS alternative. 100 DAS options would also reduce employment approximately by 10% both in the short and the long term relative to status quo (120 DAS, F=0.2). Because of the higher DAS levels, 140 DAS option would have the largest positive impacts and would increase employment by about 16% to 17% both in the short- and the long-term compared to status quo alternative.

Impacts of trip limits

At the proposed 21,000 pounds trip limit, the average net revenues per day in the Hudson Canyon and VA/NC Areas, evaluated at mid-year, are estimated to exceed net revenues per day from the open areas. As a result, the proposed increase in the trip limit (21,000 pounds for 2003) is expected to attract

effort from the open areas to the more productive Hudson Canyon and VA/NC Areas. For further analysis and additional cautions, please see the section below on the trip limit analysis (Section 6.3.4.4.9).

Impacts of a day-at-sea tradeoff exemption for broken trips

On an individual basis, an exemption from the automatic day-at-sea tradeoff for broken trips may increase mortality on scallops. The overall effect however is to encourage the use of authorized trips in the Hudson Canyon and VA/NC Area access program, improving the performance of the program and shifting mortality from scallops in open fishing areas where smaller scallops generally are present. If the day-at-sea exemption is ineffective (i.e. few vessels with broken trips are granted exemptions), it would discourage fishing in the Hudson Canyon and VA/NC Areas and cause the fleet to use the majority of the 120 day-at-sea allocation in the open fishing areas without a day-at-sea tradeoff or reductions in bottom contact time that are associated with the proposed area access program.

Some vessels may gain economic benefit from receiving an exemption from the automatic 10 day-at-sea charge, to compensate for their loss if they were charged the full 10 day-at-sea for a controlled area trip. If a vessel owner is granted an exemption from the tradeoff, that owner may elect to take a subsequent trip in the Hudson Canyon or VA/NC areas, or the owner may elect to use the re-instated days elsewhere. Regardless of where the subsequent trip is taken, the ability to use an additional days-at-sea may provide economic gain from an additional scallop trip. However, these gains are expected on an individual basis. The anticipated low number of exemptions would result in negligible impacts to the economy as a whole.

Since a controlled level of fishing in the Hudson Canyon and VA/NC Areas increases scallop landings, decreases fishing mortality in other fishing areas with smaller scallops, reduces bottom contact time and fishing costs, a day-at-sea tradeoff exemption will have positive economic benefits overall. A more liberal day-at-sea tradeoff exemption policy would encourage more fishing in the Hudson Canyon and VA/NC Areas by vessels that are authorized to take area access program trips by reducing the risk of loosing unused days on broken trips caused by circumstances beyond the captain's control. Since these areas contain larger scallops and higher scallop biomass, the landings per day-at-sea (LPUE) is expected to reach 2,500 pounds in 2003 as compared the average LPUE in the open areas which is estimated to be slightly less than 1,500 pounds per day-at-sea. For this reason, fishing in Hudson Canyon and VA/NC Areas will increase landings and revenues and reduce costs of fishing per pound of scallops landed. As a result, both the producer and consumer surpluses and the net benefits would be higher compared to a scenario if no fishing or little fishing took place in the Hudson Canyon and VA/NC Areas.

Cautions

The economic benefits and costs were estimated based on the assumption that total landings from the Hudson Canyon and VA/NC areas will be equivalent to the estimated TACs. If, however, the vessels prefer to fish in the open areas rather than in the access areas at the selected days-at-sea trade-offs and trip limits, thus landing less in these areas than the corresponding TAC levels, the economic benefits will probably be less than estimated in Table 47 Also, some vessels may not benefit from fishing in the access areas in the same extent if their capacity to catch and shuck scallops were limited to take full advantage of the high abundance in the Hudson Canyon and VA/NB areas. With less access to the Hudson Canyon and VA/NC Areas, the relative differences in economic benefits of the high and low TAC options would decrease (see Sections 6.3.4.4.7, 6.3.4.4.8 and 6.3.4.4.13 for further discussion, uncertainties and cautions).

6.3.4.4.3 Assumptions and methodology: Economic Model

The economic model includes an ex-vessel price equation, a cost function and a set of equations describing the consumer and producer surpluses. The ex-vessel price equation is used in the simulation of the ex-vessel prices, revenues and consumer surplus along with the landings and average meat count from biological projections. The cost function is used for projecting harvest costs and thereby for estimating the producer benefits as measured by the producer surplus. The set of equations also include the definition of the consumer surplus, producer surplus, rent to vessels and total economic benefits.

Next section provides a historical review of the factors that affect the price of the domestic sea scallops during the last two decades along with a description of the total supply including the imports. In the following sections, the equations of the economic model are described.

Historical Background: Scallop landings and prices, meat count, and imports

Table 49 summarizes scallop landings, imports, meat count, ex-vessel and import price for four different periods corresponding to periods of low and high level of US sea scallop landings. Both Periods 1 (1982-1986) and 3 (1993-1998) include the years during which landings of sea scallops in the Northeast were below 20 million pounds. Periods 2 (1987-1992) and 4 (1999-2001) correspond, however, to years of high landings mostly exceeding 30 million pounds. Comparison of these periods provide some insights about the change in ex-vessel prices, quantity of imports, import prices and total supply of scallops as follows:

- Ex-vessel prices move in opposite direction to the domestic landings of sea scallops. Specifically, they were higher in periods (periods 1 and 3) of lower landings and lower in periods of high (periods 2 and 4) landings.

- In general, however, both ex-vessel and import prices of scallops exhibited a declining trend in the last two decades, especially since 1983. Table 49 shows that average annual domestic price of scallops corrected for inflation at the 1996 cost of living (i.e., expressed in terms of 1996 constant prices) declined from over $7.35 per pound in early 1980's (period 1) to less than $5 per pound since year 2000. Similarly, the import prices per pound of scallops declined from over $6 per in the early 1980's to less than $4 since year 2000 (Figure 19).

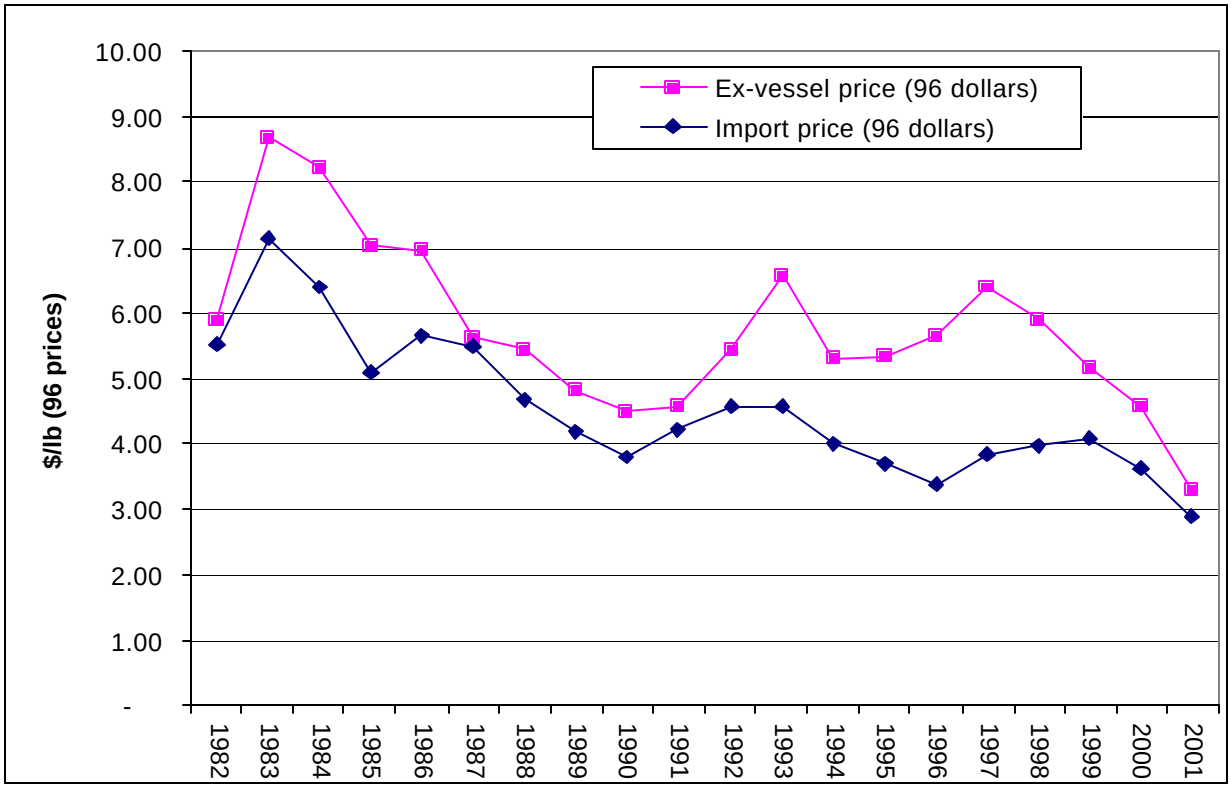
- Total supply, as measured by the sum total of landings and imports, has been increasing since 1982. Average annual supply increased 79 million pounds during the period 1999 to 2001 from an average of 52 million pounds during 1982-1986. The increase in the overall seafood consumption as the consumers became aware of the beneficial health impacts of fish, the decrease in the price of scallops both domestic and foreign and the increase in the disposable income of consumers were the main factors that contributed to the increase in demand for scallops.

- Imports increased substantially after 1982, from 20 million pounds to more than 40 million pounds after 1984. It is also evident from Figure 20 that imports as a substitute for domestic scallops fluctuated to fill the gap between domestic landings and the total demand for scallops, especially after 1990. Quantity of imports of scallops increased significantly during the period 1993-1998 (Period 3) in response to the rapid decline in domestic landings of scallops to less than 20 million. This trend seems to be reversed in the recent years, however, due to the recovery of the scallop resource. For example, level of imports declined to 40 million pounds in 2001 as domestic landings reached 44 million pounds in the same year.

Table 49. Landings, Imports, Prices and Meat Count

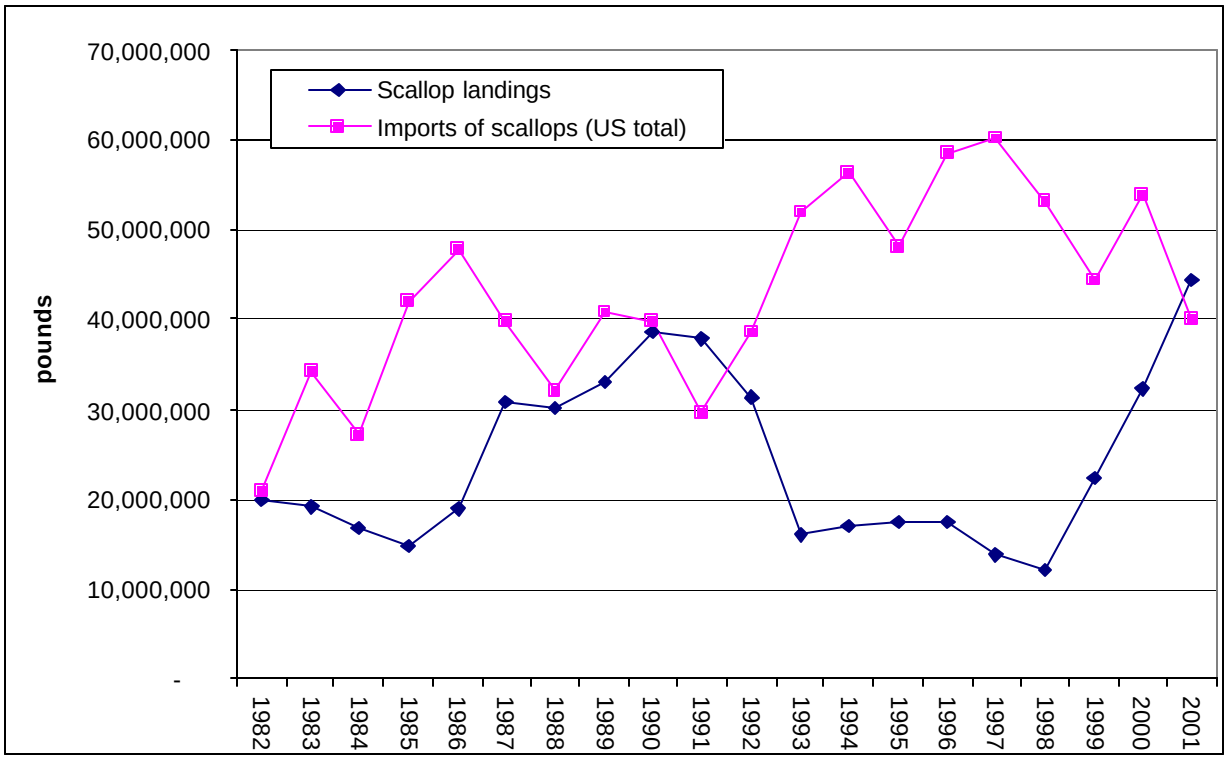
	Supply (million lbs)			Price ($/lb)		Count
	Domestic landings	Imports	Total	Ex-vessel	Import	Meats per pound
1. 1982-1986	18	34	52	7.35	5.96	28
2. 1987-1992	34	37	71	5.06	4.48	37
3. 1993-1998	16	55	70	5.86	3.91	36
4. 1999-2001	33	46	79	4.34	3.52	27[42]

Figure 19 – Ex-vessel and average price of scallops (in 1996 constant dollars)



[42] Years 1999 and 2000 only.

Figure 20 – Sea scallop landings and imports (pounds)



- Table 49 shows meat count of the scallop resource available to fishing during the first two decades since 1982. Average meat count per year increased from 28 meats per pound during 1982-1986 (Period 1) to over 35 meats per pound during the next two periods ending with year 1998. The size of landed scallops were restricted by a meat count standard that first went into effect in 1982 with the implementation of the first FMP to Atlantic sea scallops. The meat count was restricted at 30 meats per pound. In June 1983, the Regional Director set the meat count at 35 meats per pound. Amendment 4 to the Sea Scallop FMP eliminated the meat count standard in 1994 to replace the primary management regulation with limited access, day-at-sea restrictions, crew limits, and new gear restrictions. With the recovery of the scallop resource in the recent years, the meat count declined to 27 meats per pound during the period 1998 to 2000, indicating that the size of the exploitable scallops available for fishing increased.

- The monthly price data collected from dealers database from January 1998 to December 2001 indicated the presence of price premium for larger scallops (Figure 21). Although price differentials between meat count categories fluctuated from month to month, In general U-10 (under 10 count) scallops earned the highest price premium, except during June to August 1999, when Closed Area II was open to scallop fishing. The high landings of U-10 scallops from Closed Area II swamped the market with large scallops and the price premium temporarily disappeared. This event did not reoccur in 2000 when the groundfish closed areas reopened to scallop fishing, however. The differences in price were larger between the 30/40 count scallops and the 20/30 count scallops until the last quarter of 2000. It seems, however, that the price premium for relatively larger scallops except U-10's almost disappeared after October 2000.

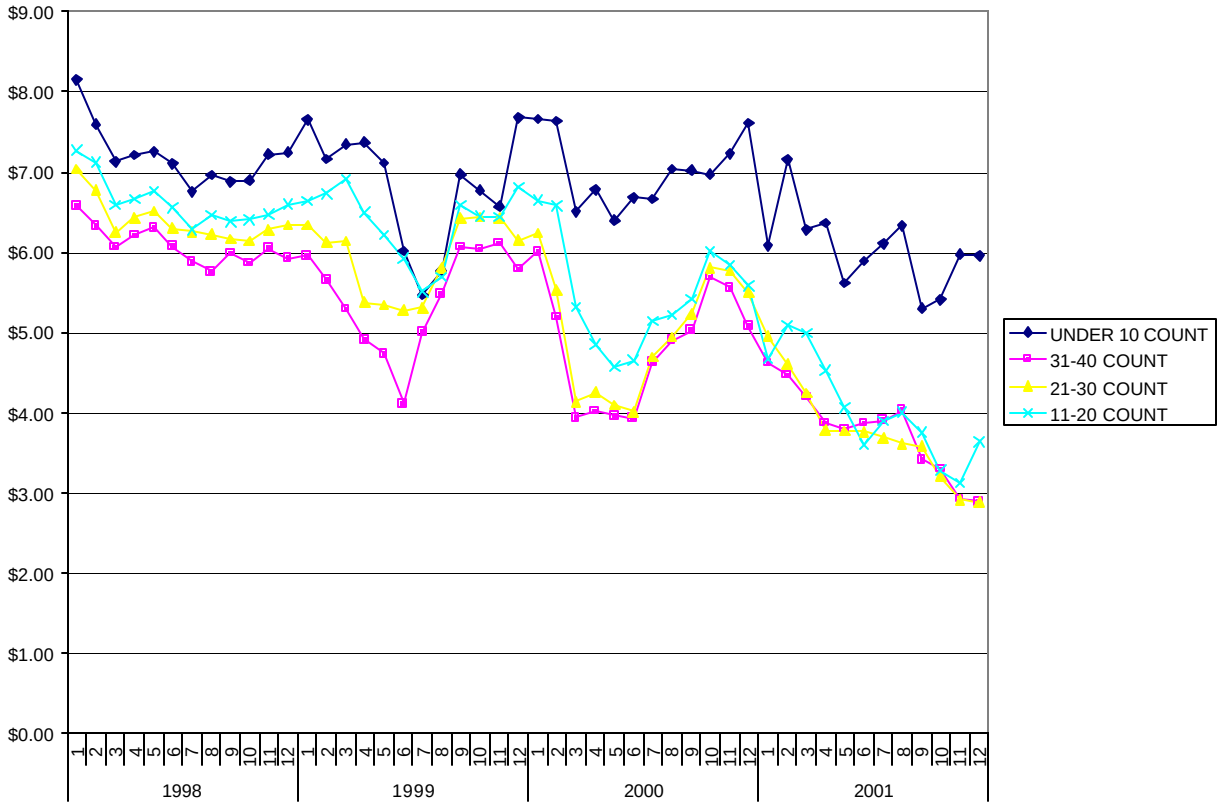


Figure 21 – Price premium: Average monthly price of scallops by count .

- This is because composition of landings has changed dramatically since year 2000. The share of 11-20 count scallops in total landings increased to almost 25% and the share 21-30 scallops increased to almost 50% in year 2001 from around an average 15% and 25% respectively from 1998 and 1999 (Table 50). As the supply of 21-30 count scallops increased, their prices came closer in value to the prices of 31-40 count scallops. It seems that the price of 11-20 count scallops is following the same trend as their supply keeps increasing because of the recovery of the scallop resource and availability of larger scallops especially in the formerly closed areas.

- The U-10 scallops commanded a large price differential ranging from $1 to $2 per pound in 2001. The percentage share of U-10's in total landings was still small, however, about 7.3% in 2000 and 3.2% in 2001 (Table 50). The continuity of the price premium for U-10's in the future is uncertain because of the expected increase in the average size of the landed scallops. In fact, analyses based on a regression of the price for U-10's and their relative supply indicated strongly that such price differentials would decrease in the future as more U-10 scallops are landed in the future years.

Table 50. Composition of sea scallop landings by count category

Count/Year	1998	1999	2000	2001
11-20 COUNT	17.34%	11.74%	18.42%	24.61%
21-30 COUNT	22.06%	25.23%	43.70%	49.82%
31-40 COUNT	13.34%	20.37%	18.31%	11.15%
41-50 COUNT	9.16%	12.58%	1.71%	0.18%
51-60 COUNT	7.44%	1.60%	0.07%	0.00%
61+ COUNT	2.60%	0.14%	0.01%	0.00%
UNDER 10 COUNT	1.66%	16.57%	7.32%	3.20%
Unclassified	26.39%	11.77%	10.48%	11.05%

Ex-vessel price equation

Ex-vessel price of sea scallops (PEXVES) is postulated to be a function of:

- domestic landings (DOMLAN, million pounds),
- disposable income per capita (PCDPI),
- average price of all scallop imports to the Northeast region (PIMPAL),
- average meat count (MCOUNT). It is estimated as the weighted average of meat count by area, weighted by the numbers and size of the areas open to fishing.
- A dummy variable, D94, as a proxy of management changes, such as the abolition of the meat count standard, since 1994.

Other things being equal, higher landings would lead to a lower price for scallops. Higher income would result in a higher price because sea scallop is considered a normal good. Higher price of scallop imports as a substitute would lead to a higher price for domestic scallops as well. Normally, larger scallops command a higher price because they are preferred in restaurant markets. Since the size of scallops is measured in meat counts per pound, smaller meat count implies that the scallops are larger compared to a pound of scallops with a higher meat count. Therefore, smaller meat count representing larger scallops would be associated with a higher ex-vessel price, implying an inverse relation between average meat count (MCOUNT) and the ex-vessel price (PEXVES).

All the price variables are corrected for inflation and expressed in 1996 prices by deflating current levels by consumer price index (CPI) for food. Per capita disposable income is also expressed in 1996 dollars by deflating nominal values with the GDP implicit deflator. The semi-log form was chosen to restrict estimated price to positive values only. The empirical estimation is as follows:

Equation 1.

Log(PEXVES) =	1.1606 –	0.0146 * DOMLAN +	0.00002*PCDPI+	0.1228*PIMPAL –	0.0013*MCOUNT –	0.1458*D94
	(2.42)	(-6.49)	(1.30)	(3.94)	(-0.46)	(-1.73)

n=18, from 1982 to 2000, adj R-sq = 0.90, D-W = 1.67, t-value in parentheses.

Operating cost equation

Fishery management measures not only affect the level of landings and prices of scallops, but also have an impact on the trip and operating cost of vessels. Since cost data are needed for estimating

producer surplus and thus net national benefits (consumer and producer surpluses), specification and estimation of cost equations are necessary for analyzing policy options. The operating cost of scallop fishing (OPC) is postulated to be a function of vessel crew size (CREW), vessel size in gross tons (GRT) and vessel days at sea (DAS).

This cost equation was assumed to take a double-logarithm form and estimated with data collected by the Economic and Social Science Branch of Northeast Fisheries Science Center. The operating cost includes food, ice, water, fuel, gear, supplies and half of the annual repairs. The detailed information on the cost/earnings data are available in two studies: Gautam and Kitts (1996) and Edwards (1997). The empirical equation presented below verifies the postulated hypothesis and has proper statistical properties.

Equation 2.

$$\underset{}{\text{Log(OPC)}} = \underset{(6.31)}{4.6130} + \underset{(3.34)}{0.2531} * \text{Log(CREW)} + \underset{(3.46)}{0.2743} * \text{Log(GRT)} + \underset{(8.79)}{1.1134} * \text{Log(DAS)}$$

n=69, adj R-sq = 0.58, D-W = 1.97, t-value in parentheses.

Consumer surplus

Consumer surplus measures the area below the demand curve and above the equilibrium price. For simplicity, consumer surplus is estimated here by approximating the demand curve between the intercept and the estimated price with a linear line as follows:

CS=(PINT*DLNP-EXPP*DLNP)/2
EXPP= Ex-vessel price corresponding to landings for each policy option.
PINT=Price intercept i.e., estimated price when domestic landings are zero

DLNP= Sea scallop landings for each policy option.

Although this method may overestimate consumer surplus slightly, it does not affect the ranking of alternatives in terms of highest consumer benefits or net economic benefits.

Producer surplus

The producer surplus (PS) is defined as the area above the supply curve and the below the price line of the corresponding firm and industry (Just, Hueth & Schmitz (JHS)-1982). The supply curve in the short-run coincides with the short-run MC above the minimum average variable cost (for a competitive industry). This area between price and the supply curve can then be approximated by various methods depending on the shapes of the MC and AVC cost curves. The economic analysis presented in this section used the most straightforward approximation and estimated PS as the excess of total revenue (TR) over the total variable costs (TVC). It was assumed that the number of vessels and the fixed inputs would stay constant over the time period of analysis. In other words, the fixed costs were not deducted from the producer surplus since the producer surplus is equal to profits plus the rent to the fixed inputs. Here fixed costs include various costs associated with a vessel such as depreciation, interest, insurance, half of the repairs (other half was included in the variable costs), office expenses and so on. It is assumed that these costs will not change from one scenario to another.

$$PS = EXP * DLN - \Sigma OPC$$

ΣOPC = Sum of operating costs for the fleet.

Producer Surplus also equals to sum of rent to vessels and rent to labor. Therefore, rent to vessels can be estimated as:

RENTVES = PS – CREWSH[43]

Rentves = Quasi rent to vessels
Crewsh = Crew Shares

Total economic benefits (TOTBEN)

Total economic benefits is estimated as a sum of producer and consumer surpluses and its value net of status quo is employed to measure the impact of the management alternatives on the national economy.

TOTBEN = PS + CS

Other assumptions

- The vessel costs are estimated for an average scallop vessel that has a GRT, HP, and crew size equivalent to the fleet average. All the costs are estimated in 1996 constant prices.
- The scallop revenues are estimated from projected landings and the annual price model in 1996 real prices.
- Import prices, and the disposable income are held constant at the 2001 level, but in 1996 constant prices when estimating ex-vessel prices.
- The maximum crew size is restricted at seven men.
- Crew shares are estimated using a 40/60 lay-system according to which crew receives 60% of the gross stock and pays for the trip expenses.
- A discount rate of 7% is applied to annual values in deriving present cumulative value of the revenues, costs, producer and consumer surpluses and total economic benefits.
  The consequences of using a 3% discount rate (social rate of time preference) were discussed below, however, in comparing the short-term versus long-term benefits (Section 6.3.4.4.8).
- The results are based on the assumption that there will be sufficient effort to land the scallops predicted by the biological model and there would be no reduction in total effort. This implies that even if there were some business failures DAS would be redistributed among the remaining vessels either with regulation and/or some consolidation (see below Section 6.3.4.4.10 for vessel impacts).

6.3.4.4.4 Landings and effort projections

The landings and total fleet DAS for no action (45 DAS) and proposed alternatives are estimated from the biological projection model presented in Section 6.3.4.1.1. The following Table 51 shows that although the140 DAS option results in highest increase in landings and total fleet DAS in the short-term, it reduces landings in the long-term by 4% compared to the status quo (120-DAS). This is due to the fact that at high fishing mortality levels stock biomass declines faster relative to options with a lower fishing

[43] CREWSH is estimated as follows: CREWSH=.60*gross revenues-trip costs. With this definition, crew shares are equivalent to crew income, i.e., their revenue net of trip expenses.

mortality (lower total fleet DAS) alternatives, reducing landings per day-at-sea (LPUE). In 2003, landings for the 100-DAS option with high TAC in the access areas and with the status quo (120 DAS) option are estimated to reach 46 million pounds. Over the long-term, however, both LPUE and landings will be larger for the 100-DAS options compared to status quo (120-DAS).

Table 51. Landings and effort

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
Landings: 2003 (million pounds)	31	43	46	46	49	54
Percentage change in landings net of Status quo: 2003	-32%	-7%	-1%	0%	7%	17%
Average Landings: 2003-2007 (million pounds)	27.2	41.1	41.8	42.2	42.9	43.6
Average Landings: 2008-2012 (million pounds)	38.4	30.7	29.9	28.8	27.8	24.7
Average Landings: 2003-2012 (million pounds)	32.8	35.9	35.9	35.5	35.4	34.2
Percentage change in landings net of Status quo: 2003 - 2012	-8%	1%	1%	0%	0%	-4%
Total Fleet DAS: 2003	13,641	25,263	24,827	28,428	28,005	32,969
Total Fleet DAS: 2003-2012	14,826	25,585	25,498	28,821	28,714	33,698
LPUE: 2003	2007	1715	1787	1628	1746	1687
LPUE: 2003-2012	2205	1450	1456	1253	1295	1095

6.3.4.4.5 Ex-vessel price and revenue projections

The price per pound of scallops and scallop revenues are estimated for the no action management (45 - DAS) and proposed alternatives, using the annual price model presented in Section 6.3.4.4.3. The results are shown in Table 52 and figures Figure 22 and Figure 23 below.

Sea scallop prices change when the level of domestic landings, import prices, size of landed scallops, and income of consumers change. The management options considered in this framework will affect prices by changing the level of landings and the meat count. If no action is taken, allocations for full-time vessels will decline to 45 days as mandated by Amendment 7, reducing the estimated landings to 31 million pounds in 2003, and increasing the ex-vessel price to above $4.30 per pound in 2003. The price of scallops is estimated to be about $3.35 to $3.68 per pound for 120-DAS and 100-DAS options, and about $3.12 for 140-DAS option during the same year. The decline in prices relative to the no action result primarily from the estimated increase in scallop landings to 46 to 49 million pounds respectively for 100-DAS and 120-DAS options, and to 54 million pounds for the 140-DAS option from 31 million pounds for no action. The average meat count is estimated to be 17 meats per pound for the no action alternative and about 21 meats per pound for the proposed DAS options.

Over the long-term ex-vessel prices are estimated to increase reaching about $5 per pound (Figure 22). This is because the landings are estimated to decline from over 40 million in 2003 with the proposed options to below 30 million in 2012 (with the exception of the no action alternative). In fact, landings are not sustainable over the long-term at the fishing mortality rates corresponding to the DAS options proposed by this framework if the Georges Bank groundfish areas stay closed during 2003-2102.

Table 52. Average Meat count, Ex-vessel prices and Fleet Revenues (in 1996 real prices).

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
Average meat count: 2003	17	21	20	21	20	21
Ex-vessel price per pound: 2003	4.39	3.68	3.53	3.51	3.35	3.12
Total fleet revenue: 2003 (million $, 1996 prices)	137	158	162	162	165	169
Total fleet revenue: 2003 % change relative to status quo	-15%	-2%	0%	0%	2%	4%
Regional Impacts Net of No Action: 2003 ($ million) (Increase in total regional revenue including the multiplier impacts)	0.0	37.8	45.0	45.0	50.4	57.6
Total fleet revenue: 2003-2012 % change relative to status quo	-6%	1%	1%	0%	0%	-3%

The impacts of the proposed DAS alternatives on revenues will be different in the short-and the long-term. The scallop revenues of the fleet are expected to decline by $25 million (15%) in 2003 relative to status quo if no action is taken and the allocations are reduced to 45 DAS as scheduled by Amendment 7. The 100 DAS option will reduce fleet revenue (by 2%) if a low TAC is assigned to Hudson Canyon areas, but the level of revenues stay almost at the same level with the high TAC, 100 DAS option compared to status quo (Table 52). In year 2003, the greatest increase in revenue (4%) would be observed with the 140 DAS option. The impact of all DAS alternatives on revenues is expected to be positive relative to the no action (45 DAS) levels.

In the long-term, however, the fleet revenues would be slightly larger with the 100-DAS options compared to status quo and other options, whereas 140-DAS option would reduce overall revenues by 3% for the period 2003-2012 (Figure 23).

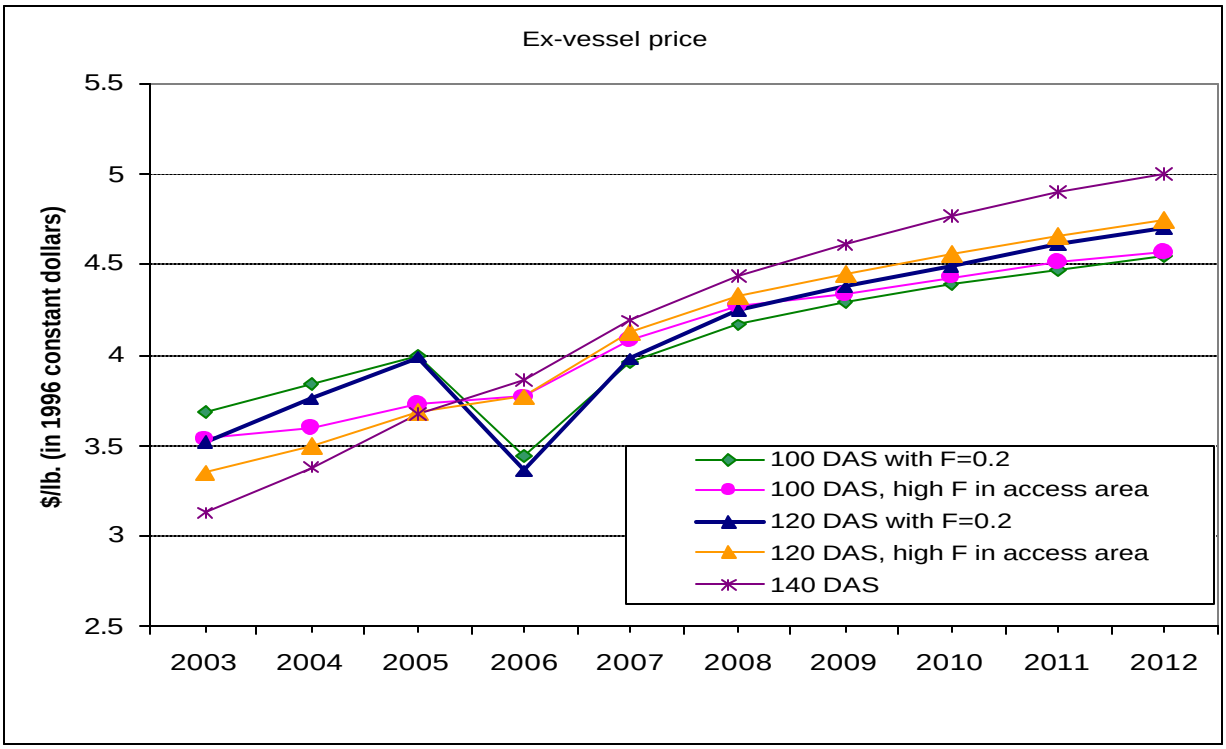


Figure 22 - Ex-vessel price estimates for 2003-2012.

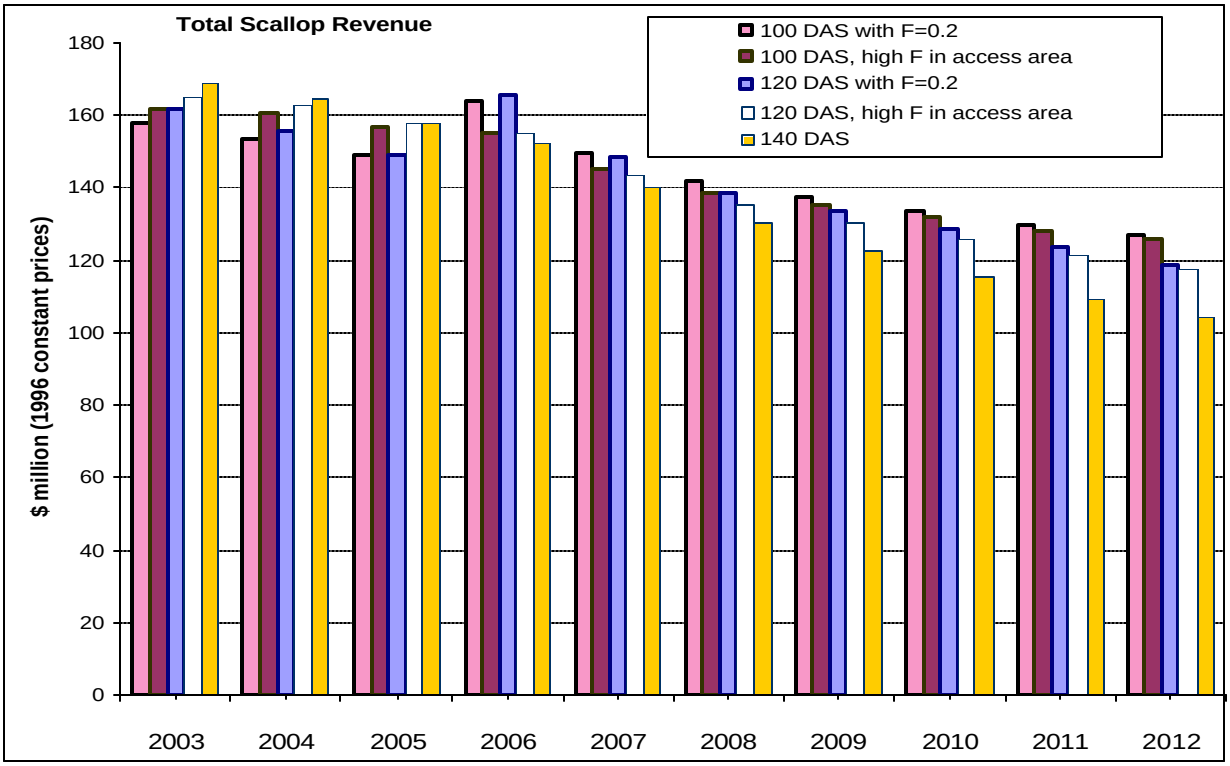


Figure 23 – Revenue estimates for 2003-2012

The overall impacts on regional revenues and incomes, however, will be greater than these estimates because of the indirect and induced multiplier impacts. Indirect impacts include the impacts on sales, income, employment and value-added of industries that supply commercial harvesters, such as the impacts on marine service stations that sell gasoline and oil to scallop vessels. The induced impacts represent the sales, income and employment resulting from expenditures by crew and employees of the indirect sectors. An input/output analysis conducted by NMFS (1998) estimated that sales, income and employment multipliers for the sea scallop fishery in the Northeast Region. The sales multiplier for the coastal counties in Northeast was estimated to be approximately 1.8 in 1996 for the scallop dredge and trawls. If this multiplier is applied to determine overall impacts, the increase in overall sales in the Northeast region will be $50.4 million for the proposed action (120 DAS, high TAC) in 2003 and range from $37 to $57 million for the other options (see Appendix 6, volume II of the Amendment 7 document for the input/output analysis).

These numerical estimates should be interpreted with caution, however, for the following reasons:

- In estimating ex-vessel prices it was assumed that the average import prices and disposable income would stay constant in the future years. The ex-vessel prices and revenues would be lower (higher) than predicted in Table 53, if import prices and disposable income declined (increased) compared to their 2001 levels.
- The sales and income multipliers were estimated including only the backward linkages associated with the harvest of sea scallops.

6.3.4.4.6 Variable cost projections

The variable costs are defined here to include non-labor trip expenses such as food, fuel, oil, water and ice, as well as half of repair expenses, which generally are considered as semi-variable costs. The costs per vessel are estimated in 1996 real prices for an average scallop vessel that has a GRT, HP, and crew size equivalent to the fleet average.

Since trip expenses and other variable costs increase as the time spent for steaming and fishing increase, the options with lower DAS allocation per vessel will result in smaller costs relative to options with larger DAS allocations. For this reason, the operational costs (non-labor variable costs) are expected to be lower with the no action (57% less) and 100 DAS (14% less) alternatives and higher with the 140 DAS option (18% more) relative to the status quo both in the short and the long-term (Table 53).

Table 53. Variable cost projections (in 1996 real prices).

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
Operational costs: 2003 $ million	14	28	27	32	31	38
Operational costs: 2003 % change from status quo	-57%	-13%	-14%	0%	-1%	18%
Operational costs: 2003-2012 % change from status quo	-55%	-13%	-13%	0%	0%	19%

The level of the operational costs will also vary with the prices of various inputs, such as the price of fuel, oil and food. These costs were estimated in 1996 prices and the latest statistics (for July

2002) indicated that the fuel costs were 9 percent higher as compared to year 1996. If the variable costs were adjusted with this percentage, the operating costs would increase by about $2.8 million for the status quo (120 DAS) and by $2.5 to $3 million for the days-at-sea adjustment scenarios in 2003 from the levels shown in Table 53 (and only by 1.3 million for no action, i.e., 45 DAS option). The actual increase will be less than these will since variable costs also include non-fuel costs such as water, ice, oil, food, and half-of repair expenses. Since the net benefits were estimated by comparing the days-at-sea adjustment options with the status quo, the impacts of any such adjustment would therefore be very small. It is also possible, however, for the fuel costs to decrease in the future from their present levels. Because the fuel prices could not be predicted for the coming years at this time, no adjustments were made to the estimated variable costs in the cost/benefit analysis presented in this section.

6.3.4.4.7 Producer and consumer surpluses, net national benefits and employment in the short term (2003)

The net national benefits are estimated as a sum of the producer and consumer surpluses, net of status quo levels. The producer surplus is measured by the difference in revenues and variable costs, and it includes profits and crew shares[44]. As Table 54 shows the increase in producer surplus would be larger for the high TAC alternatives with either 100 DAS or with 120 DAS option (a 3% increase in each case) compared to the levels for status quo and 140 DAS options. The impact of all DAS alternatives on revenues and producer surplus are expected to be positive relative to no action (45 DAS) levels, however.

The proposed DAS options are estimated to have positive impacts on the consumers, by increasing the scallop landings and by reducing their prices. The consumer surplus, which is measured as the difference of what consumers are willing to spend and what they actually pay, is expected to range between $74 to $108 million with the DAS adjustment scenarios included in this framework (respectively 100, 120 and 140 DAS), as compared to $43 million for no action (45 DAS: Amendment 7 schedule) in year 2003. In other words, no action would reduce consumer surplus by $40 million in year 2003 relative to status quo. 120 and 140 DAS options would maximize the increase in consumer surplus compared to the 100 DAS with low and high TAC options.

Table 54. Short-term economic benefits and employment: 2003

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
	Economic benefits and costs (million $, in 1996 prices)					
Producer surplus	123	130	135	130	134	131
Consumer surplus	43	74	82	83	93	108
Total economic benefits	166	204	216	213	227	239
Total benefits net of no action	0	38	50	47	61	73
	Percentage change relative to status quo(120 DAS), 2003					
Producer surplus	-5%	0%	3%	0%	3%	1%

[44] The producer surplus is defined as the area above the supply curve and the below the price line of the corresponding industry. The supply curve in the short-run coincides with the short-run marginal cost curve above the minimum average variable cost for a competitive industry. This area between price and the supply curve can then be approximated by various methods depending on the shapes of the marginal and average variable cost curves. The economic analysis presented here used the most straightforward approximation and estimated producer surplus as the excess of total revenue over the total variable costs. It was assumed that the number of vessels and the fixed inputs would stay constant under each option. In other words, the fixed costs were not deducted from the producer surplus since producer surplus is equal to the profits plus the rents to the fixed inputs.

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
Consumer surplus	-49%	-11%	-1%	0%	12%	30%
Net economic benefits	-22%	-4%	2%	0%	6%	12%
Employment (crew*days-at-sea)	-52%	-11%	-13%	0%	-1%	16%

The proposed increase in DAS allocations is estimated to have positive economic impacts on the sea scallop industry and net national benefits under all options relative to the no action (45 DAS) alternative. The net national benefits (cumulative discounted value of the consumer surplus and producer surplus) are estimated to increase by $38 million (for the 100 DAS, low TAC option) to $73 million (for the 140 DAS option) in 2003. Among the proposed alternatives, 140 DAS option would result in the greatest economic benefits relative to the 120 DAS status quo option, followed by the high TAC options with 120 DAS, and with 100 DAS. Although the enforcement, observer and the reporting costs for the public was not included at this time, these costs are not expected to be significant compared to the level of net benefits of the proposed DAS allocations.

The employment in the sea scallop fishery as measured by total number of crew days (CREW*DAS) will increase in proportion to the increase in total fleet days-at-sea. As Table 54 shows, the no action alternative (45 DAS) is estimated to reduce employment by over 50% in the short-term, and close to 50% in the long-term compared to the status quo (120 DAS) alternative. The 100 DAS options would also reduce employment approximately by 10% both in the short and the long term relative to status quo (120 DAS, F=0.2).

The economic benefits and costs were estimated based on the assumption that total landings from the Hudson Canyon and Virginia Beach areas would be equivalent to the estimated TACs. If, however, the vessels prefer to fish in the open areas rather than in these restricted access areas at the selected days-at-sea trade-offs and trip limits, thus landing less in these areas than the corresponding TAC levels, the results will be different than shown in Table 47 and Table 54. This could be a possibility if the trips limits were set in the restricted access areas at levels such that the vessel can gain more net revenues per day-at-sea by fishing in the open areas (see Section 6.3.4.4.9 below for further discussion). For example, only 80 vessels participated in the Georges Bank Closed Area II fishery during 2000, and only 26 percent of the scallop TAC was landed (see weekly quota reports on the Northeast Regional Office website, http://www.nero.nmfs.gov).

At the proposed 21,000 pounds trip limit, however, the average net revenues per day in the HC and VA/NC areas, evaluated at mid-year, are estimated to exceed net revenues per day from the open areas (See Section 6.3.4.4.9 below). For this reason, the proposed increase in the trip limits to 21,000 pounds for 2003 is expected to attract effort from the open areas to the controlled access areas of HC and VA/NC. If the scallop fishermen do not choose to fish in the Hudson Canyon and VA/NC Areas at the proposed trip limits, however, it is reasonable to expect that overall revenues to be lower, costs to be higher and net benefits to be lower than estimated in Table 47 and Table 55. With less access to the Hudson Canyon and VA/NC Areas, the relative differences in economic benefits of the high and low TAC options would decrease.

Finally, these results are based on the assumption that the number of vessels will stay the same, and there would be no reduction in total effort because of business failures in the short-term even if the allocations were reduced to 45 DAS per full-time vessel under the no action scenario (see below Section

6.3.4.4.10 for vessel impacts). If some vessels exit the fishery, under the 45 DAS scenario for example, the benefits of all options in 2003 relative to the no action would be higher than predicted in Table 54.

6.3.4.4.8 Short-term versus long-term economic benefits

The actual and/or the long-term economic net benefits of the DAS options included in this framework can differ from these short-term impacts. Although the 100, 120 and 140 DAS allocation options are expected to have positive economic benefits relative to the no action (45 DAS), their long-term impacts relative to each other will be different from their short-term impacts. This is because, the management options that maximize landings in the short-term usually result in higher economic benefits, but in the long-term, they may reduce the scallop biomass, and therefore, the sustainable level of landings.

The present values of the real revenues, costs, producer and consumer surpluses, and net benefits are estimated using a discount rate of 7 percent[45]. Table 55 compares the cumulative present value of benefits and costs of various options over a 10-year period relative to the no action levels assuming that the DAS schedule proposed by each option is implemented for 10 years. Even though Framework 15 implementation period covers one year, i.e., 2003, the impacts of each option on stock biomass, and therefore on potential yield, will continue for many years although at a diminishing rate even if a different policy was applied after 2003.

Because the operational expenses would be less with the no action (45 DAS) alternative, the producer surplus, that is total revenue minus costs, is estimated to exceed the producer surplus for the other options. In addition, after the first years landings for the no action alternative exceed the landings for the proposed action and the non-preferred alternatives. For example, in 2008, the landings with the proposed action is estimated to be 31 million pounds, but with the no action it is estimated to be 39 million pounds because of the faster stock rebuilding resulting in higher LPUEs. Over a 10-year period, the proposed action (120 DAS, high TAC) would increase cumulative present value of the revenues by 6% and the operational expenses by 123% relative to the no action alternative. As a result, the cumulative value of the producer surplus would be 8% less than the producer surplus for the no action over a 10-year period from 2003 to 2012. The 100-DAS options would increase revenues by 7%, and costs by about 94% to 95% and reduce the producer surplus by 3% relative to the no action option. Because of the continued increase in costs and declining scallop biomass and revenue over time, 140 DAS options would reduce the producer surplus by 9% in a 10-year period (Table 55).

The impacts on the consumer surplus will be positive for all options. The cumulative present value of the consumer surplus is expected to be 31% higher with the proposed action (120 DAS, rotational management TAC), and about 29% to 30% higher with the 100 DAS and 140 DAS options relative to the no action levels.

Table 55. Long-term costs and benefits net of no action levels, 2003-2012

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
	Change relative to No Action Levels (Cumulative discounted values in 1996 prices for period 2003 to 2012) Million $					

[45] OMB Circular Number A-94 specifies a real discount rate of 7 percent for computing net present value (NPV) when doing constant-dollar, benefit-cost analyses of proposed investments and regulations. The OMB circular also encourages the analyst to present sensitivity analyses using other discount rates if the use of such alternative rates can be justified. See below for the discussion of results if a lower discount rate were used.

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
Total Revenue	0	71	72	61	58	29
Operational Costs	0	103	102	134	133	180
Consumer Surplus	0	97	103	101	106	102
Producer Surplus	0	-31	-30	-73	-74	-151
Net Economic Benefits	0	66	74	28	32	-49
	Percentage change in cumulative discounted values relative to No Action (45 DAS) , 2003 – 2012					
Total Revenue	0%	7%	7%	6%	6%	3%
Operational Costs	0%	95%	94%	124%	123%	166%
Consumer Surplus	0%	29%	30%	30%	31%	30%
Producer Surplus	0%	-3%	-3%	-8%	-8%	-16%
Net Economic Benefits	0%	5%	6%	2%	3%	-4%
Percentage change in employment (crew*days-at-sea)	0%	72%	94%	94%	127%	73%
	Percentage change in cumulative discounted values relative to Status quo (120 DAS) , 2003-2012					
Total Revenue	-6%	1%	1%	0%	0%	-3%
Operational Costs	-55%	-13%	-13%	0%	0%	19%
Consumer Surplus	-23%	-1%	1%	0%	1%	0%
Producer Surplus	9%	5%	5%	0%	0%	-9%
Net Economic Benefits	-2%	3%	4%	0%	0%	-6%
Percentage change in employment (crew*days-at-sea)	-49%	-11%	-12%	0%	0%	17%

Over a 10-year period, the preferred option (120 DAS, high TAC) is estimated to increase total economic benefits by $32 million, the 100 DAS options by $66 million for low TAC and by $74 million for high TAC alternative relative to the no action benefits. However, it should be noted that the proposed action will be for one year only. The net benefits are expected to decline by $49 million with the 140 DAS option compared to the no action (45 DAS). This is because the magnitude of reduction in scallop biomass and landings is greater at the higher fishing mortality levels corresponding to the140 DAS alternative. The employment is also estimated to increase significantly both with the proposed action (127%) and also with the non-preferred alternatives (72% to 94%).

The revenues, costs and economic benefits were estimated assuming that the number of vessels will stay the same, and that there would be no reduction in total effort even if there were some business failures because DAS would be redistributed in future years among the remaining vessels either with regulation and/or consolidation. If some vessels exit the fishery, under the 45 DAS scenario for example, and there is no redistribution of DAS among the remaining vessels, the benefits of all options relative to the no action will be higher than predicted in Table 55.

The numerical estimates shown in Table 47 through Table 55 should be used in comparing one option with another rather than for predicting the future values of the economic variables. The absolute values of the net economic benefits and their components would change if a different discount rate was applied and/or different assumptions were used regarding the trends in disposable income, import prices and costs. In addition, the estimates for landings and prices are subject to statistical errors and variability. If the standard deviations in various variables and coefficients are taken into account, the range of values for revenues, consumer and producer surpluses and net economic benefits will fall within a confidence interval around the mean values reported in Table 55. The ranking of the options in terms of their net economic benefits relative to each other would stay the same, however, as discussed below.

<u>Sensitivity of the results to the assumptions about area access:</u>

The economic benefits and costs were estimated assuming that the total landings from the Hudson Canyon and Virginia Beach areas will be equivalent to the estimated TACs. If, however, the vessels prefer to fish in the open areas rather than in these restricted access areas at the selected days-at-sea trade-offs and trip limits, thus landing less in these areas than the corresponding TAC levels, the results will be different than shown. If for example, LPUEs in the Hudson Canyon and VA/NC Areas fall short of the estimated LPUEs from the biological model or the LPUE in other fishing areas is higher than expected, some scallop fishermen may choose not to take controlled access area trips. In that case, the actual landings may fall short of the TACs for the access, and the total landings, revenues and economic benefits would be less than predicted. The relative differences in economic benefits of the rotational management and Amendment 7 TAC options would also decrease under such a scenario.

Sensitivity of results to the value of the discount rate:

If a lower discount rate was used for estimating the cumulative present value of the benefits, the economic benefits of options with lower DAS allocations will increase relative to the options with higher DAS allocations. For example, if a 3% rather than a 7% discount rate were applied in estimating the present value of the net benefits, the economic benefits associated with no action and 100 DAS options would increase relative to the 120 or 140 DAS options. This is because the benefits on scallop stock biomass and yield from lower fishing mortalities will be realized later in the future years and the future years would be discounted less with the lower discount rate[46].

Sensitivity of the results to future values of disposable income and import prices:

The long-term impacts of all options were analyzed by asking the following question: What would be the impact of changing the DAS allocations on long-term economic benefits and its components holding other variables, such as disposable income and import prices constant. For this reason, the ex-vessel price was estimated for the future years assuming the disposable income and import prices will stay constant at their 2001 value. Although the absolute value of the net benefits would change if a different set of assumptions were used, the ranking of the alternatives in terms of their economic benefits would still stay the same, however, for the following reasons:

- If it was assumed, as an example, the disposable income per capita (DPIPC) will increase at an average of 3% rate per year as it did in the last 10 years, the ex-vessel prices would increase under all options, increasing the value of the scallop resource and therefore total net benefits. Because those options with lower DAS allocations result in higher yield compared to others, the economic benefits associated with no action and 100 DAS options would increase slightly relative to the 120 or 140 DAS options. The reverse would happen if there was a change in historical trends and disposable income declined by 3% over the same period. Even under this unlikely scenario, however, more conservative options (i.e. 45 and 100 DAS options) would result in larger net economic benefits compared to the other alternatives (140 and 120 DAS options). In general, however, the differences in net benefits

[46] An alternative discount rate, which is often used in cost benefit analyses, is social discount rate. OMB circular defines this rate as follows: "The social rate of time preference reflects the discount rate at which society is indifferent between a payment now and a correspondingly larger payment in a future year. It may be lower than the average real return on investment because, as a result of taxes and other distortions, individuals do not receive the full return on their investments. Most analysts use the average real rate on long-term Treasury bonds to represent the social rate of time preference. For the last 15 years, this rate has been in the range of 3 to 5 percent (http://www.whitehouse.gov/OMB/memoranda/m00-06.html)."

one option versus another is not very sensitive to changes in disposable income within the range of its historical trend[47].

- The average import price of scallops from all countries declined at an average annual rate of 3 percent during the last 10 years from 1991 to 2001, although in some years there was an increase in import prices. The continuation of a declining trend in import prices would accelerate (dampen) the decline (increase) in domestic scallop prices as the landings increase (decline) in response to changes in stock biomass. If the cost/benefit analysis was conducted assuming import prices will decline by 3 percent in the next 10 years, results would be similar to that of a declining disposable income per capita (DPIPC). Specifically, the difference in the net benefits of the more conservative options, such as 45 DAS and/or 100 DAS options relative to the 120 DAS and 140 DAS options, would slightly decrease although their net benefits would still exceed the benefits of the later options.

- An increasing trend in import prices would have the reverse effect, increasing the net benefits of the more conservative options relative to the others slightly. As with the changes in the disposable income, however, the sensitivity of the relative differences in net benefits (of one option versus another) to changes in import prices are small within the range of historical trends[48].

Sensitivity of the results to variances in landings and price estimates:

The landings and price estimates and their variability determine to a large extent the absolute values and variability of the revenue, producer and consumer surplus, and net benefit estimates for each option. The ranking of the options in terms of their economic benefits are not expected to change, however, when the variability and the standard errors in the estimates are taken into account:

Table 56. Mean and standard deviation of the projected landings (Average of values from 2003 to 2012)

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	140 DAS F=0.32 in access area
Mean Landings (Mill. lb. , 2003-2012)	32.83	35.91	35.89	35.52	35.37	34.18
Standard Deviation (Mill. lb. , 2003-2012)	4.19	10.63	10.31	11.37	11.32	12.24

- The prices were estimated using the price model (Equation 1.) discussed in Section 6.3.4.4.2. If the elasticity (i.e., responsiveness) of prices to change in landings is lower than the mean values, the absolute values of economic benefits would be less for each option. The sensitivity analyses are conducted using the lower and upper bounds of a 95% confidence interval of the landings coefficient of the price model. The results show that the differences in net economic benefits of

[47] In general, the results are not very sensitive to the changes in the disposable income (DPI) as could be inferred from the coefficient of this variable in the price equation. For example, total economic benefits of a 100 DAS, high TAC option would exceed the benefits from the status quo option (i.e., 120 DAS, F=0.2) by $46 million if DPI stayed constant, by $48 million if it increased by 3% a year, and by $45 million if DPI declined by 3 percent a year over the 10-year period from 2003 to 2012.

[48] Total economic benefits of a 100 DAS, high TAC option would exceed the benefits from the status quo option (i.e., 120 DAS, F=0.2) by $46 million if import prices stayed constant, by $47 million if they increased by 3% a year, and by $45 million if they declined by 3 percent a year over the 10-year period from 2003 to 2012.

one option versus another would change slightly and the relative benefits of the more conservative options (100 DAS) would still exceed the benefits of the other options (120 DAS and 140 DAS)[49].

- The landings from the biological model estimates have variability due to the possible changes in recruitment over the next 10 years. The results show that the variability increase as the DAS allocations increases. In addition, options with lower TAC has a lower variability (i.e., standard deviation) then the options with higher TAC for the HC and VA/NB areas. If variability is taken as a measure of risk, the risk of landings falling below the mean values is higher at the higher DAS options relative to the others (Table 56).

- In general, no action (45 DAS) alternative has the least and 140 DAS alternative has the largest variability, whereas other alternatives have variability within a close range. If the economic impacts were evaluated at the lower and upper bounds of a 95% confidence interval (as an example), the absolute value of the benefits would decrease for all options if landings are assumed to approach lower bounds and increase if landings are assumed to reach upper bounds. But no significant changes are expected in the relative differences of net benefits from one option to another because they will be estimated using the landings stream at either the lower or the upper limits of the confidence interval for all options.

6.3.4.4.9 Trip Limit Analysis

The proposed access to the Hudson Canyon and VA/NC areas will be managed by trip limits and days-at-sea trade-offs. The proposed increase in the trip limits to 21,000 pounds for 2003 is expected to attract effort from the open areas to the controlled access areas of HC and VA/NC. The average net revenues per day in the HC and VA/NC areas, evaluated at mid-year, are estimated to exceed net revenues per day from the open areas at a 21,000-pound trip limit in 2003. The extent of the fishing effort that would be directed to the HC and VA/NC areas could not be quantified, however. Because of the decline in the catch rates after an area is opened, the fluctuations in the LPUEs in the open and in the restricted access areas, and the changes in the price premium for larger scallops during the course of the fishing year, it is not possible to predict with certainty the times when fishing in the HC and VA/NC will be more profitable compared to fishing in the open areas at the proposed trip limits.

Table 57 provides a comparative analysis of the gross and net revenues per day-at-sea in the open versus the Hudson Canyon and VA/NC areas in Mid-Atlantic. The revenues per day-at-sea in these areas are obtained by multiplying the estimated prices by area with the landings per day-at-sea (LPUE). The LPUEs in each area are estimated from the biological model and takes into account the steaming time and the shucking capacity at various meat size for scallops. It is also assumed that 10 days will be deducted from the days-at-sea allocations of vessels for each trip they take to Hudson Canyon and VA/NC areas. The net revenues per days-at-sea show gross revenues minus the operating costs per DAS.

The results of this analysis indicate that the LPUE point estimate for the mid-2003 fishing year ranges from 1,388 (140 DAS) to 1,565 (100 DAS – high TAC) pounds in the open areas, and about 2,550 pounds per DAS in the Hudson Canyon and VA/NC Areas. Since these are averages corresponding to the middle of the fishing year, the actual LPUEs will differ from these values at any given point in time depending on the intensity of effort and the level and growth of exploitable biomass in each area. On the

[49] Cumulative net economic benefits of a 100 DAS, high TAC option would exceed the benefits from the status quo option (i.e., 120 DAS, F=0.2) by $47 million if price coefficient is evaluated at the upper 95% of the confidence interval, and by $45 million if evaluated at the lower bound of the 95% confident interval over the 10-year period from 2003 to 2012.

average, however, the results indicate that a trip limit of 21,000 pounds in 2003 will probably exceed the amount a vessel can land by fishing 10 DAS in the open areas.

For the proposed DAS options included in this framework, the net revenues per day-at-sea for an average vessel in the HC and VA/NC areas *are* expected *to exceed* the net revenues per day-at-sea from *the open areas* at the 21,000 pound trip limit in 2003 at 10 days-at-sea trade-off (Table 57). This is due to the lower LPUEs in the open areas compared to the levels in Hudson canyon (HC) and VA/NC areas. Since a vessel can land an average of approximately 1400 to 1550 pounds per day, or about 14,000 to 15,500 pounds in 10 days-at-sea in the open areas, but 21,000 pounds in the HC and VA/NC areas in 2003 due to the proposed possession limit, gross revenues from the open areas will fall short of the corresponding amounts in the restricted access areas. Also the trip expenses per pound of scallops landed will be lower in HC and VA/NC because of higher LPUEs in these areas. As a result, the revenues net of trip expenses, i.e. net revenues per day-at-sea, will be higher for these areas, ($5,200 to $6,400) compared to the net revenues for open areas ($3,185 to $4,414).

The risk of the automatic 10 day-at-sea charge, however, can reduce this economic incentive to fish in the Hudson Canyon and VA/NC Areas, even though the average landings per charged day-at-sea is higher than in the open areas. Vessels that return to port early, due to weather, equipment failure, medical emergencies or other events beyond their control, pay a heavy price (i.e. essentially a 10 day-at-sea reduction in their allocated days) for that broken trip. The proposed action includes the provision for a case-by-case review by the Regional Administrator and a potential exemption from this automatic charge, but some fishermen may choose not to participate in the controlled access program if they will not meet the criteria for this review. This risk, if not sufficiently compensated by the higher catch per charged day, could reduce fishing in the Hudson Canyon and VA/NC Areas (where there are larger scallops and fishing time is lower) and increase fishing elsewhere (where the scallops are generally smaller and fishing time per day-at-sea is often higher).

If it is assumed that these mid-year net revenue estimates will prevail throughout the year, the proposed trip limits for the Hudson Canyon and VA/NC areas may provide sufficient economic incentive for an average full-time limited access vessel to fish in those areas. For some small vessels that have a limit on their capacity to catch more than 1,500 per DAS, for example, fishing in the closed versus the open areas may not provide any extra economic return. In such cases, the decision to fish in the closed versus open areas will be determined by other factors such as the proximity to the fishing grounds.

Gross and net revenue estimates are sensitive to the various biological and economic factors including LPUEs, the relative price of large versus small scallops, and the fuel prices that affect trip costs. Although the biological model estimates that LPUE in the HC and VA/NC areas will reach over 2500 pounds per day, some vessels may be unable to land this amount due to the constraints on the shucking capacity with a 7-men crew. In general, an increase in the relative price of large scallops and/or fuel prices will make restricted access areas economically more attractive relative to fishing in open areas. Similarly, the fluctuations in the LPUEs in the open and the restricted areas during the course of the fishing year will affect the relative profitability of fishing in these areas. Therefore, at certain times of the year, fishing in the Hudson Canyon and VA/NC areas may become economically less profitable for some vessels depending on the changes in relative LPUEs, scallop and fuel prices at that point in time.

Table 57. Trip limit analysis at 10-days-at-sea trade-off for the Hudson Canyon (HC) and VA/NC areas.

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area
	Open Areas				
LPUE (pounds per DAS)	1,500	1,565	1,435	1493	1388
Ex-vessel price per pound	3.67	3.52	3.50	3.34	3.12
Gross revenues per DAS	5,509	5,511	5,029	4,990	4,325
Net revenues per DAS (net of operational expenses per DAS)	4,412	4,414	3,909	3,870	3,185
	Hudson Canyon and VA/NC areas				
LPUE (pounds per DAS)	2,553	2,527	2,553	2,527	2,553
Ex-vessel price per pound	3.71	3.55	3.54	3.37	3.15
Gross revenues per DAS at 21,000 pound trip limit and 10 DAS trade-off	7,785	7,463	7,432	7,086	6,608
Net revenues per DAS (net of operational expenses per DAS)	6,452	6,143	6,070	5,739	5,223

The analysis presented so far focused on an average vessel and average gross and net revenues per days-at-sea, not on the impacts of the proposed access on individual vessels. The trip limits may also have a differential impact on vessels with different productivity indicated by their LPUEs. Higher productivity vessels will be constrained more by the trip limits compared to the vessels that have a lower LPUE rate, and only the vessels with a capacity of more than 2100 pounds per day will need to give-up some DAS because of the 10-DAS trade-off. On the other hand, the actual trip length will be less than 10 days for the high productivity vessels; thus, their trip costs will be less compared to some smaller vessels that have to fish 10 days or more to land the trip limit. In other words, higher productivity vessels may loose some allocated DAS from the trips they take to the regulated areas if the possession limits were set too low, but they would still gain if the reduction in their operating costs from the closed area trips offsets the lost revenues from the open area trips. In addition, the DAS-tradeoff incurred by a higher productivity vessel does not necessarily imply that that vessel will have less DAS to fish in the open areas relative to the smaller vessels for which a 21,000 pounds trip limit is not binding. For example, if vessel A could land 3500 pounds per day-at-sea in the access areas, it would take only 6 days for that vessel to land 21000 pounds of possession limit. As a result, vessel A would loose 4 days of fishing opportunity in the open areas due to the 10-DAS trade-off. It would still be economically beneficial for vessel A to access HC and VA/NB areas, however, if in the open areas it could land less than 2100 per day because by fishing in the closed areas it would earn more revenues at less cost[50]. For a vessel that has a LPUE lower than 2100 pounds per day-at-sea, however, it will take more than 10 days to land the trip limit of 21000 pounds. For example, if vessel B could land at most 1500 pounds per day, it will take more than 14 days-at-sea to land a possession limit of 21000 pounds, which could be equivalent to the number of days it would take this vessel to land the same amount in the open areas. In such a case, vessel B may not have much to gain from fishing in the HC/VA areas as compared to fishing in the open areas, and may access these areas for other reasons such as proximity to the home port. For these reasons, it is not clear if the imposed trip limits will have less advantageous impacts on higher productivity vessels compared to the smaller, less productive vessels (For more discussion on this subject please see Framework 14, Section 5.2.4.4.9).

[50] This is a likely outcome for most vessels given that the estimated average LPUE in the open areas is at most equals 1,500 pounds per day-at-sea.

Although higher productivity vessels are estimated to gain from access to the HC and VA/NB areas at the proposed trip limits, it is also true that the trip limit requires the more productive vessels to take more trips than their ability necessitates. Their trip costs are lower than their unconstrained counterparts but higher than necessary to harvest their effective allocation. This cost also increases with vessel productivity. An allocation of individual vessel quotas for the closed and the open areas would prevent unnecessary trip costs, but would also increase enforcement costs significantly. At the present, there is no enforcement system in place to determine, administer and enforce individual vessel landings.

The constraints on landings per trip and days-at-sea trade-offs are necessary, however, to allow access to the closed areas without reducing the overall days-at-sea allocations and/or number of closed area trips for all vessels. The TACs, trip limits and DAS trade-offs are proposed by the Council to continue high catches from highly productive areas of Hudson canyon and VA/NC areas until other resource areas are rebuild. If the trip limits were increased at the given 10 days-at-sea trade-off, the overall landings from closed areas would increase, resulting in higher overall fishing mortality for the scallop resource. If there were no DAS-trade-offs, however, high productivity vessels (such as vessel A in the example given above) would not forego any days to fish in the open areas. Consequently, effort available to fish in the open areas would increase, again resulting in higher overall fishing mortality for the scallop resource. Increase in the overall fishing mortality would, in turn, necessitate further reductions in the allocation levels and/or number of trips for all vessels. For these reasons, it is important to establish a trip limit and days-at-sea trade-off combination in a way to ensure that the fishing mortality remains below the Amendment 7 thresholds and overfishing of the resource is prevented.

These results should be interpreted by caution, however, for the following reasons:

- The results depend on the relative LPUE of the open and of the HC and VA/NC areas at any given point in time. The LPUE in any given area is unlikely to stay constant, but will probably change over time according to the intensity of effort directed to that area and also according to the growth rate of the exploitable biomass in that area. The analysis in Table 57, however, was derived from the average LPUE in the middle of the fishing year, just one point in time.

- The gross and net revenue estimates are sensitive to the various factors, including the price of large versus small scallops, and fuel prices. An increase in the relative price of large scallops and/or fuel prices will make restricted access areas economically more attractive relative to fishing in the open areas.

- Therefore, the gross and net revenues per day-at-sea from the open areas and the HC and VA/NC areas will change throughout the year -- again depending on the level and intensity of effort and the growth rate of biomass in each area. These factors may also equalize the LPUEs in different areas at some points in time.

6.3.4.4.10 The impacts of the proposed alternatives on small business entities and on an average vessel

The Framework 15 proposed action is estimated to have positive impacts on the business activities of sea scallop fishermen. The Small Business Administration defines a small business entity as an enterprise that grosses less than $3 million a year, including its affiliates. The majority of the vessels in the scallop fishery are small business entities according to this definition.

The financial viability of the scallop vessels is examined by break-even concept, which estimates the number of DAS necessary to cover total variable and fixed costs of a vessel. The results indicate that

at the given days-at-sea allocations, an average vessel in the sea scallop fishery will be able to break-even and make some profits both under the no action and the proposed DAS adjustments. The revenue estimates do not include revenues from monkfish and other fisheries. Almost all full-time vessels earned, however, some portion of their income from other species as an incidental catch, which averaged about $37,000 annually in 2001 fishing year. Including these revenues will improve the break-even points shown in Table 58.

The results show that the increase in the days-at-sea allocations to 100, 120 or 140 DAS from the 45 DAS set by Amendment 7 schedule and the access to the Hudson Canyon and VA/NC areas will have positive economic impacts on the vessels. Although the analysis in this section is conducted for an average full-time vessel in the scallop fishery, the results are expected to be positive for the part-time and occasional vessels as well since their days-at-sea allocations will be adjusted upwards and they will be able to access to the HC and VA/NC areas. The following analysis examines the impacts of the days-at-sea adjustments and controlled access to the HC and VA/NC areas.

Profits could be calculated in various ways depending on the accounting conventions applied to gross receipts and costs. The profit estimates given in Table 58, rather than corresponding to a specific accounting procedure, simply shows the difference of gross revenue over variable and fixed expenses based on the available data. It is in some ways similar to the conventional cash flow from operations since depreciation charges are not subtracted from income (because they are not out-of-pocket expenses).

Specifically, it was estimated that the fixed costs for an average scallop vessel amounted to $159,900 in 1996 constant dollars. These costs included insurance, license, half of repairs, office expenses, professional fees (for accounting etc.), dues, utilities, interest, dock expenses, rent, employee benefits and bank, store, auto, travel expenses. Overall, estimated repairs averaged $69,900 a year in 1996 constant dollars and half of this, $34,965 was included in fixed costs. The other half of repairs was included in variable costs because part of repair expenses is related to the level of fishing activity. For example, a vessel that fishes full-time will likely need more repairs than a vessel that fishes only part-time. Interest payments on vessels are estimated to be around $40,280, which could be close to total payments on mortgage for some vessels. Including interest payments, however, would overestimate fixed costs for some vessels that are already paid-off.

Annual revenues per vessel are estimated as follows:

- Total fleet revenue are divided by fleet DAS in order to estimate average revenue per day-at-sea.
- Revenue per day-at-sea was multiplied with the corresponding full-time DAS allocation.

The results are based on the assumption that the vessels will use 100% of their allocations i.e., DAS-used will equal the allocation for each option. In reality, many vessels do not use their allocations in entirety, and may fish 97 DAS, for example, if 100 DAS were allocated, but 112 DAS if 120 DAS were allocated. The results presented in Table 58 would be different if the revenues, cost and profits were estimated for a vessel that generally uses less DAS than its allocation51.

Since fixed costs are not related to the level of activity of the vessel, it was assumed that an average vessel would have to spend the same amount, $159,900, in fixed expenses whether it fished only 45 days or as much as 140 days. The estimated revenues, costs, crew shares, and profits per vessel for the status quo schedule and the proposed DAS adjustments are shown in Table 58. Although annual operational and trip costs per vessel will be higher for the 100-DAS, 120-DAS and 140-DAS options

51 This fact was taken into account in estimates of total DAS as inputs to the biological simulations. For example, if total fleet DAS were divided between 256 full-time equivalent vessels, average DAS-use per vessel would be 99 DAS if 100 DAS was allocated, but 111 DAS is 120 DAS allocated.

relative to the 45-DAS option, the increase in revenues more than offsets higher annual costs of fishing (due to the higher effort and DAS allocations). As a result, the proposed DAS adjustments will have positive impacts on vessels since both the revenues and the profits per vessel and also the crew shares are estimated to exceed the no action (45 DAS, Amendment 7) levels significantly in 2003 (Table 58).

These results were also based on the assumption that all vessels will fish in the controlled access areas. If, however, vessels prefer to fish in the open areas, their revenues, costs, and profits will be different than estimated in Table 58. Also, some vessels may not benefit from fishing in the access areas in the same degree if their capacity to catch and land scallops were too limited to take full advantage of the high abundance and LPUEs in the Hudson Canyon and VA/NB areas. As a result, their revenues may not be as high as reported under the high TAC options compared to the options with low TAC options for the controlled access areas of Mid-Atlantic.

The profits and short-term break-even levels will also change with the future fuel costs. The variable costs were estimated in 1996 prices. The latest statistics (for July 2002) indicated that the fuel costs were 9 percent higher as compared to year 1996. If the variable costs were adjusted with this percentage, the break-even DAS estimates would increase by one or two days for most options. The actual increase will be less than these will since variable costs also include non-fuel costs such as water, ice, oil, food, and half-of repair expenses. It is also possible, however, for the fuel costs to decrease in the future from their present levels. Because the fuel prices could not be predicted for the coming years at this time, no adjustments were made to the estimated break-even-even levels and profits in this section.

Although, the no action 45 DAS allocation exceeds the break-even level, it is not certain that the fleet would be financially sound at this level of operation. Break-even DAS includes fixed and variable costs, including repairs, and but not vessel replacement or depreciation costs. In addition, at the break-even point, there are hardly any returns on the owner's investment, let alone a rate of return that reflects the level of risk for scallop fishing.

Adjustment of the allocations to 120 days-at-sea will contribute to the stability of the operations by keeping the effort at the present levels. A more stable production over years would benefit the primary industry and the sea scallop fishing firms, wholesalers and retailers in planning of production and marketing activities in a more orderly fashion (versus a boom-bust cycle). As a result, the industry can increase its efficiency by reducing production and marketing costs, improving its competition with imports and increasing its economic returns (profits). A more stable production would also benefit the related industries in the same way as it benefits the primary industry. The profits with the proposed action (the 120-DAS and high TAC) and with the non-preferred 100-DAS, high TAC option are expected to be larger, however, than the profits for the status quo 120 DAS option, 45 and 140 DAS options[52].

The revenues, costs, profits and crew shares as well as the break-even DAS in Table 58 were estimated for an average full-time vessel in the scallop fleet, and they will vary according to the vessel size both in terms of gross tons, horsepower, vessels' age (older vessels will have more repair costs) and also because of the differences in the skills of the captains and the crew. Therefore, some vessels may not be able to break-even at the proposed DAS levels, and that some vessels could make more profits than estimated in Table 58. The impacts of the lower DAS allocations would also vary among vessels also according to the level of DAS they fish presently. For 167 vessels that fish more than 100 days-at-sea,

[52] Since the level of future DAS per vessel could change either because of a regulatory redistribution of DAS among the vessels that continue to fish in the scallop fishery or due to transfer of DAS or consolidation, the vessel impacts analysis was not carried out for 10-years. Cost/benefit analysis was conducted for a 10-year period, however, assuming that there the total effort in the fishery will be sufficient to land the pounds of scallops estimated by the biological model.

the lower DAS allocation could have a larger impact in revenue compared to the vessels that are already fishing less than 100 DAS. In addition, the impacts could be larger on the New England vessels, especially those that usually fish in the Gulf of Maine and Georges Bank, if they are not able to participate in the Hudson Canyon and VA/NC Area access program without incurring substantial cost. The vessels and others that are currently near their break-even with a 120 days-at-sea allocation may not be able to operate profitably with a lower day-at-sea allocation.

Table 58. Economic impacts on vessels for 2003 fishing year

	45 DAS No Action	100 DAS F=0.2	100 DAS F=0.32 in access area	120 DAS F=0.2 Status Quo	120 DAS F=0.32 in access area	45 DAS No Action
2003						
Revenue per vessel	452,287	625,293	651,588	683,156	708,558	717,470
Percent increase in revenue net of no action	0%	38%	44%	51%	56%	58%
Operating costs per vessel	45,077	109,665	109,665	134,348	134,348	159,503
Crew Shares	226,622	286,249	302,027	305,871	321,113	311,714
*Fixed Costs	159,900	159,900	159,900	159,900	159,900	159,900
**Profits per vessel	24,808	73,324	83,842	86,783	96,944	89,999
***Break-even DAS	39	68	65	77	74	89

* Fixed costs include insurance, license, half of repairs, office expenses, professional fees (for accounting etc.), dues, utilities, interest, dock expenses, rent, employee benefits and bank, store, auto, travel expenses.

** Profits per vessel=Revenue per vessel-Crew shares-operating costs-fixed costs.

*** Break-even-DAS= Fixed costs/(Gross revenue per DAS - Operating costs per DAS - Crew shares per DAS).

The operational costs are assumed to change with vessel's effort, and therefore, were assumed to decline as DAS decreased. Operational costs consist of trip costs, such as food, fuel, oil and ice which vary with DAS, as well as half of repairs assuming that more vessel activity will increase repair costs. For this reason, it was estimated that 120 DAS options will result in larger operational costs relative to the 100 DAS options. Other than these costs, the vessels will incur dockside expenses, and overhead costs (such as insurance, interest payments, professional fees, other repairs) no matter how many days they fish. These expenses were included in the fixed costs as explained above for all options. If, however, staying at the dock more increases some dockside expenses for the low DAS allocation options, the decline in the operational costs will be less than reported in Table 58[53]. Even then, it is unlikely for the operational costs of the lower DAS allocations to exceed the costs of the higher DAS allocations because a major portion of the operational costs consists of trip expenses that decline with fishing effort and DAS.

In conclusion, the short-term break-even DAS and profit estimates will be imperfect indicators of the financial viability of the vessels until more current and comprehensive data are obtained not only on vessel costs, but also on vessel owners' short- and long-term liabilities (such as mortgage on vessels), cost of capital, and other fishery related income and assets generated from previous years' profits from fishing. For these reasons, the numerical values of these estimates should be interpreted with caution and should be mainly used in comparing one alternative with the other. There is no doubt that including other items, such as opportunity costs of capital, would reduce the gross profit estimates for all options. Since this

[53] When scallop vessels are fishing at a full-time level, the crew often does routine repairs during their normal activities, in preparation for the trip. If the vessels are not at sea as much, then these routine repairs (engine maintenance, equipment lubrication, etc.) must be done by someone at port, often as an added expense.

reduction would be in an equal amount for each alternative, the profitability of each option relative to the others would not change.

6.3.4.4.11 General category vessels

The proposed alternative allows vessels with general category permits and not subject to days-at-sea restrictions to possess no more than 100 pounds of sea scallops while the vessel is in the Hudson Canyon and VA/NC Areas. The same vessels can land up to 400 pounds of scallops in the open areas. This action is expected to reduce the economic incentive for the large numbers of General category vessels to fish in Hudson Canyon and VA/NC Areas. Before the Hudson Canyon and VA/NC Area closures, scallop fishing by smaller vessels with General Category permits were not prevalent in the Mid-Atlantic. In other areas, however, vessels with General Category scallop permits commonly targeted scallops when they were abundant in areas of Southern New England and Georges Bank. The Council therefore decided to lower the scallop possession limit to prevent a new open-access fishery for scallops in the rebuilt areas where such a fishery has no history.

Under proposed alternatives, the proposed access to these areas the by the general category access vessels would have positive economic impacts on these vessels by increasing their scallop revenues. Since the participation in the closed area program is voluntary and a vessel will use this opportunity only if the net revenues they can obtain from these areas exceed the levels in the open areas. The economic impacts of any potential access by the general category vessels were already included in the net benefit estimates presented above since the analysis used total landings by all parties as an input. The set aside for this category of vessels would not reduce total economic benefits but only reduce the fishery TAC and the number of trips allocated to the limited access vessels. As a result, the revenues and profits of the limited access vessels would decrease proportionally. The reporting and VMS requirements for these vessels would, however, increase the total costs slightly above the levels estimated in this analysis. It is possible for the operational costs to be somewhat overestimated, however, to the extent that the general category vessels are smaller than the vessels in the full-time scallop fleet. The costs of reporting requirements for the General category access vessels and additional information requirements for limited access vessels were examined in the PRA notice for Framework Adjustment 14, and was estimated at $3,120 for the public. These costs do not include the costs of installing VMS for the general category vessels.

In addition, there will be observer costs associated with access to the closed areas, and these costs will increase in direct proportion to the number of trips. Under the non-preferred alternatives, the number of trips that would be allocated to the general category access vessels as a function of the number of applications for access, and the possession limits for General Category scallop vessels. An increase in the possession limits would reduce the number of closed area trips and the observer costs as examined in Section **6.3.4.1.3**. The proposed action will however result in the reduction of these potential observer costs by discouraging the many vessels in the General category from accessing Hudson Canyon and VA/NC areas.

6.3.4.4.12 Enforcement costs

The cost-benefit analysis assumes that there will be no significant change in the costs to administer, monitor and enforce DAS because of the proposed alternatives. The basis for this assumption is that for the proposed days-at-sea allocations, the costs associated with setting up a monitoring and enforcement system have already been covered under the mandates of Amendment 4 and Amendment 7 to the sea scallop plan. Therefore, increasing the DAS allocations is not expected to increase the enforcement costs.

The costs of trips to be sampled in the HC and VA/NC areas were examined for each option in Section **6.3.4.1.3**. These costs are a function of the number of trips that will be allocated and the trip limits. If the possession limits are set low, more trips will be allocated to these permit categories, increasing the observer requirements and the costs. For example, a 11,000 pounds possession limit for the access areas will result in over $404,450 for the Amendment 7 TAC alternative in observer costs for year 2003, since the total number of trips allocated with that possession limit will reach 1,120. Similarly, a 11,000 pounds possession limit for the access areas will result in over $606,740 for the high TAC option in observer costs in the same year, since the total number of trips allocated with that possession limit will reach 1,680. Increasing the possession limit to 21,000 pounds will reduce these costs to $340,063 for the low-TAC and to $510,105 for the high TAC option in 2003. Of course, it is very likely that many, if not most, vessels would not choose to access HC and VA/NC areas if the trip limits were set too low, such as at 11,000 pounds, making those trips uneconomical compared to the trips in the open areas. In such a case, the enforcement costs may approach to zero as well. Given that the average LPUEs at the open areas are estimated to range approximately from 1400 to 1500 pounds per day-at-sea, the possession limits should probably exceed 16,000 pounds in order to make HC and VA/NB areas economically attractive. The 11,000 pounds trip limit example was used merely to demonstrate the difference in enforcement costs if more trips occurred to these areas than the maximum number of trips that are estimated to occur with a 21,000 pounds trip limit. Because of the uncertainty regarding the estimated LPUE's, prices of large versus small scallops and future costs, it is not possible to predict accurately the number of trips that would occur at different trip limits. The results from the 11,000 pounds trip limit example show, however, that this difference would be close to $100,000 a year if TAC was landed by taking more trips than necessary at a 21,000 pounds trip limit.

Despite the fact that the proposed access to some areas and closures in other areas will increase the enforcement requirements and administrative burden, the monetary costs for the government may not change to a significant degree as long as the budgetary allocations for enforcement do not allow any such increase. Allocation of the existing resources for the enforcement of these resources may, however, result in reduced enforcement of other management actions. In other words, the enforcement of the new measures is likely to reduce the overall efficiency of the enforcement unless there is an increase in the budgetary allocations for these measures.

6.3.4.4.13 Sources of uncertainty in the analysis

The economic impacts of the no action versus the proposed DAS adjustments were analyzed based on the available information about the vessel costs and characteristics, crew shares, prices, and revenues of the scallop vessels. Therefore, the numerical results of this analysis should be interpreted with caution due to uncertainties about the likely changes in:

- Factors affecting scallop resource abundance and landings
- Fishing behavior
- Fixed costs
- Variable costs including the price of fuel
- Import prices
- Bycatch and revenues from other fisheries
- The share system
- The number of active vessels
- Structural changes in ownership
- The composition of fleet in terms of tonnage, HP and crew size of the active vessels
- Disposable income and preferences of consumers for scallops
- Price differences and premium on small versus large scallops.