Preliminary economic impacts for Framework 32

The following sections analyze the economic impacts of the management alternatives considered in Framework 32 and compare these with two baselines, No Action alternative and Status Quo scenario. The objective of the cost-benefit analysis is to evaluate the net economic benefits arising from changes in consumer and producer benefits that are expected to occur with implementation of a regulatory action. As the NMFS Guidelines for the Economic Analysis of the Fishery Management Action (NMFS, 2007) [1] state "the proper comparison is '*with the action' to 'without the action'* rather than to *'before and after the action*,' since certain changes may occur even without action and should not be attributed to the regulation." The guidelines also state that "No Action alternative does not necessarily mean a continuation of the present situation, but instead is the most likely scenario for the future, in the absence of other alternative actions"[2]. Even without action, the scallop stock abundance in open and access areas will be different, and as a result, landings, scallop prices, fishing costs, revenues and benefits from the fishery would change compared to the present levels. The Status Quo scenario as projected in this Framework action reflects this reality and, in addition to the No Action alternative, is used as one of the baselines to assess economic impacts of the proposed measures especially for the purposes of E.O.12866.

While NMFS 2007 guidelines indicate "The No Action alternative should be the basis of comparison for other alternatives", it very often uses the terms "No Action" and "Status Quo" interchangeably[3]. The economic analyses presented in this section make a distinction in the definition of those terms, however, with "No Action" referring to a "regulatory" baseline and "Status Quo" referring to a state with no changes from the present allocations for open area DAS and access area trips. The definition of "No Action" refers to the default measures that are specified in Framework 30 until the next Framework action is implemented.

However, default measures are temporary in nature and as such, allocations under those measures are usually set at considerably lower levels than the allocations either in the current (in 2019) or the projected allocations in the next fishing year (2020) to prevent fishing effort exceeding the sustainable levels due to the delays in the implementation of the proposed measures in next Framework Action. As a result, the projections for landings, revenues and economic benefits under the No Action alternative are considerably lower than the current levels and the levels that are expected under the proposed measures. Because of this, if economic benefits of the proposed alternatives were estimated using No Action as the baseline, the impacts on the economy would be overstated in the short-term compared to the present circumstances.

For these reasons, the economic analyses in this framework also include a Status Quo scenario *(SQ)* to provide an assessment of how landings, revenues and total economic benefits from the scallop fishery would change if the current regulations were continued in 2020 but taking into account the impacts of projected changes in the productivity and the spatial distribution of the scallop resource on landings, revenues and total economic benefits. From that perspective, SQ is a more realistic baseline to assess the impacts of the proposed measures on the economy from the perspective of E.O.12866.

As the Guidelines for Economic Analysis of Fishery Management Actions specify, "benefits and costs are measured from the perspective of the Nation, rather than from that of private firms or individuals. Benefits

[1] Guidelines for Economic Reviews of National Marine Fisheries Service Regulatory Actions, March 2007,

http://www.nmfs.noaa.gov/sfa/domes_fish/EconomicGuidelines.pdf

[2] Ibid, p.12

[3]For example, see p. 15 of 2007 NMFS guidelines: "For economic analysis of regulatory actions, changes in net benefits are measured by the difference in the present value of the discounted stream of net benefits of regulatory action, as compared to the status quo. In this context, a positive result means that the net present value of the regulatory action exceeds that of the status quo."

enjoyed by other nations are not included, although tax payments by foreign owners, and export revenues, are benefits to the Nation."

Because fishery management actions in general result in short-term costs for the industry in terms of foregone revenue, "choosing a period of analysis that is too short may bias the analysis toward costs, where costs are incurred in the short-term and benefits are realized later." Similarly, the Office of Management and Budget (OMB, 2003) indicated that the analyses should "present the annual time stream of benefits and costs expected to result from the rule," and state that "the beginning point for your stream of estimates should be the year in which the final rule will begin to have effects" and "the ending point should be far enough in the future to encompass all the significant benefits and costs likely to result from the rule."[4] For these reasons, guidelines indicate that "a reasonable attempt should be made to conduct the analysis over a sufficient period of time to allow a consideration of all expected effects."

Furthermore, the economic impacts of the proposed regulations over the long-term should be evaluated by the discounted cumulative present value of the stream of benefits since benefits or costs that occur sooner are generally more valuable (or have a positive time preference). Discount rate is the interest rate used in calculating the present value of expected yearly benefits and costs.

This section examines the economic impacts of the proposed regulations in Framework 32. Although Framework 32 is a one-year action, it will have impacts on the future yield from scallop resources, on scallop revenues and total economic benefits. The short- and the long-term economic impacts of the specification alternatives are analyzed in Section 4.3. The present value of long-term benefit and costs of the specification alternatives are estimated using both a 3% and a 7% discount rate. The higher discount rate (7%) provides a more conservative estimate and a lower bound for the economic benefits of alternatives compared with the benefits predicted using a lower discount rate (3%).

5.4.3 **Economic impacts of the proposed specification alternatives**

Open area DAS and access area trip allocations are updated based on the recent estimates for Overfishing Limit and Acceptable Biological Catch. Alternatives considered in Framework 32 is described below for a full-time limited access vessel. No Action corresponds to the default measures in Framework 30 and Status Quo "Status Quo" refers to a state with no changes from the present allocations in Framework 30 for open area DAS and access area trips.

[4] OMB Circular A-4 (September 17, 2003), http://www.whitehouse.gov/omb/circulars_a004_a-4/

Table 1. Summary of Specification alternatives under consideration in FW 32.

Section	Description of Alternatives	Run	FT LA DAS
4.3.1	**No Action**	NA	18
4.3.2.1	**CAII ext Open 20 DAS**	XOP20	20
4.3.2.2	**CAII ext Open 22 DAS**	XOP22	22
4.3.2.3	**CAII ext Open 24 DAS**	XOP24	24
4.3.3.1	**CAII ext Closed 20 DAS**	XC20	20
4.3.3.2	**CAII ext Closed 22 DAS**	XC22	22
4.3.3.3	**CAII ext Closed 24 DAS**	XC24	24
4.3.3.4	**CAII ext Closed 24 DAS with summer opening**	XC24_ALT	24
4.3.4.1	**SF & CAII ext Closed 20 DAS**	SFC20	20
4.3.4.2	**SF & CAII ext Closed 22 DAS**	SFC22	22
4.3.4.3	**SF & CAII ext Closed 24 DAS**	SFC24	24
4.3.4.4	**SF & CAII ext Closed 24 DAS with summer opening**	SFC24_ALT	24
4.3.5	**Status Quo**	SQ	18

Summary of economic impacts

Short-term impacts:

- In the short run, the specification alternative 4.3.2.3 (xop24) that allocates 24 DAS for full-time limited access vessels and gives access to CAII extension area has the highest landings, revenues and total economic benefits in 2020.
- Total revenues under the economically highest-ranking specification alternative 4.3.2.3 (xop24) is estimated to exceed the status quo (SQ) scenario by about $55 million in 2020. Except “No Action (NA)” alternative, revenues for all specification alternatives are higher compared to the SQ alternative. They range from a little over $436 mil under alternative 4.3.5 (SQ) to a little over $491 million for alternative 4.3.2.3 (xop24). Revenue difference from SQ range from about $13 million higher revenue under Alt.7 (sfc20) and by about $55 million higher under alternative 4.3.2.3 (xop24). The revenue differential with SQ in CAII Closed Extension (XCL SAMS runs) options are also noticeably higher ranging from around $26 million to $51 million (Table 2).
- Total economic benefits (a sum of producer and consumer surpluses) under all alternatives except NA are estimated to be over $374 million in 2020. It is highest for 4.3.2.3 (xop24) at about $432 mil and least for the SQ at $374 million. Total economic benefits net of SQ values are estimated to be about $58 million with the Alt 3 (xop24). It would be higher under other options as well compared to SQ levels (Table 3).
- It is important to note that actual values of prices, revenues and total economic benefits, however, will differ than those estimates depending on the actual landings, size composition of landings, and values of variables that effect prices including import prices, disposable income of consumers and imports of scallops from countries such as Canada and Japan that are a close substitute for the large domestic scallops. When estimating prices, it was assumed that the values of these variables will not change from the current levels and that actual landings will equal to the projected landings from the biological model. For these reasons, the numbers provided in the Tables should be mainly used to compare one alternative with another rather than to predict future values.

Short-term impacts – 2020

Table 4 - Economic Impacts for 2020: Estimated landings (Mill.lb.), revenue and economic benefits (Mill. $, in 2019 dollars), and price (in 2019$/lb)

	4.3.1	4.3.2.1	4.3.2.2	4.3.2.3	4.3.3.1	4.3.3.2	4.3.3.3	4.3.4.1	4.3.4.2	4.3.4.3	4.3.5
Values/ RUN	**NA**	**XOP20**	**XOP22**	**XOP24**	**XCL20**	**XCL22**	**XCL24**	**SFC20**	**SFC22**	**SFC24**	**SQ**
Landings mil lbs	27.6	48.6	50.4	52.0	48.3	50.0	51.6	46.7	48.2	49.7	44.9
Price	$10.15	$9.59	$9.51	$9.44	$9.59	$9.51	$9.44	$9.62	$9.56	$9.49	$9.73
Revenue	$280.1	$466.2	$479.0	$491.4	$463.1	$475.4	$487.4	$449.4	$460.7	$471.6	$436.7
Revenue Difference from SQ	**-$156.6**	**$29.5**	**$42.3**	**$54.7**	**$26.4**	**$38.7**	**$50.7**	**$12.7**	**$24.0**	**$34.8**	**$0.0**
Producer Surplus	$201.7	$368.1	$378.5	$388.5	$365.0	$374.9	$384.5	$351.3	$360.1	$368.6	$341.1
Consumer Surplus	$9.2	$38.7	$41.0	$43.3	$38.6	$40.8	$43.1	$36.8	$38.9	$40.9	$32.8
Total Benefits	$210.9	$406.8	$419.5	$431.8	$403.6	$415.7	$427.6	$388.1	$399.0	$409.5	$374.0
Total Benefits Difference from SQ	**-$163.1**	**$32.8**	**$45.5**	**$57.8**	**$29.6**	**$41.8**	**$53.7**	**$14.1**	**$25.0**	**$35.5**	**$0**

Table 5 - Long-term Economic Impacts (2020-2033): Cumulative present value of revenues, producer surplus and total economic benefits net of Status quo values (million $ in 2019 dollars, 7% Discount rate)

	4.3.1	4.3.2.1	4.3.2.2	4.3.2.3	4.3.3.1	4.3.3.2	4.3.3.3	4.3.4.1	4.3.4.2	4.3.4.3	4.3.5
Values/ RUN	**NA**	**XOP20**	**XOP22**	**XOP24**	**XCL20**	**XCL22**	**XCL24**	**SFC20**	**SFC22**	**SFC24**	**SQ**
Landings mil lbs	1011.89	1019.81	1020.12	1020.45	1019.10	1019.35	1019.60	1017.49	1017.69	1017.89	1016.54
Price $/lb	8.79	8.78	8.78	8.78	8.78	8.78	8.78	8.79	8.79	8.78	8.79
Revenue	5700.59	5825.73	5830.93	5835.80	5815.75	5820.41	5824.75	5795.43	5799.48	5803.14	5797.17
Revenue Difference from SQ	-96.58	28.56	33.76	38.63	18.58	23.24	27.58	-1.74	2.31	5.97	0.00
Producer Surplus	6997.71	7100.62	7103.75	7106.54	7093.55	7096.14	7098.44	7077.61	7079.69	7081.39	7075.45
Consumer Surplus	694.43	687.41	687.14	686.94	685.07	684.74	684.43	684.60	684.30	684.00	683.82
Total Benefits	5212.28	5318.85	5322.63	5326.15	5307.58	5310.79	5313.71	5288.30	5290.94	5293.19	5289.09
Total Benefits Difference from SQ	-76.81	29.76	33.54	37.06	18.49	21.70	24.62	-0.79	1.85	4.10	0.00
Rank	11	3	2	1	6	5	4	10	8	7	9

Table 6 – Long-term Economic Impacts (2020-2034): Cumulative present value of revenues, producer surplus and total economic benefits net of Status quo values (million $ in 2019 dollars, 3% Discount rate).

	4.3.1	4.3.2.1	4.3.2.2	4.3.2.3	4.3.3.1	4.3.3.2	4.3.3.3	4.3.4.1	4.3.4.2	4.3.4.3	4.3.5
Values/ RUN	**NA**	**XOP20**	**XOP22**	**XOP24**	**XCL20**	**XCL22**	**XCL24**	**SFC20**	**SFC22**	**SFC24**	**SQ**
Landings mil lbs	1,011.89	1,019.81	1,020.12	1,020.45	1,019.10	1,019.35	1,019.60	1,017.49	1,017.69	1,017.89	1,016.54
Price $/lb	$8.79	$8.78	$8.78	$8.78	$8.78	$8.78	$8.78	$8.79	$8.79	$8.78	$8.79
Revenue	7,217	7,336	7,340	7,345	7,327	7,331	7,335	7,308	7,312	7,315	7,308
Revenue Difference from SQ	-$90.67	$28.05	$32.64	$36.91	$19.22	$23.26	$26.98	$0.61	$4.09	$7.16	$0.00
Producer Surplus	$5,725	$5,833	$5,836	$5,839	$5,825	$5,828	$5,830	$5,807	$5,810	$5,812	$5,807
Consumer Surplus	$868.73	$858.17	$857.69	$857.29	$856.07	$855.52	$855.00	$856.49	$855.99	$855.49	$854.84
Total Benefits	$6,593	$6,691	$6,694	$6,697	$6,681	$6,683	$6,685	$6,664	$6,666	$6,667	$6,662
Total Benefits Difference from SQ	-$68.40	$29.05	$32.13	$34.95	$18.99	$21.47	$23.68	$2.08	$4.06	$5.65	$0.00
Rank	11	3	2	1	6	5	4	9	8	7	10

Long-term impacts– 2020 to 2034

- The results are expected to be similar over the long-term and the differences in economic benefits of various specification alternatives would be small both in the short- and long-term.

- Present value of the cumulative economic benefits net of SQ would be higher for all the specification alternatives except for alternative 4.3.4.1 (sfc20) and No Action whether the long-term benefits are discounted at 7% and 3% . The specification alternative 4.3.4.1 (sfc20) with 20 DAS results in slightly higher benefits than SQ at 3% discount rate but lower at 7% discount rate.

- Present value of the estimated total revenues net of SQ values would range from $0.61 million in 4.3.4.1 (sfc20) to $36.91 million in 4.3.2.3 (xop24).

- Present value of the cumulative net economic benefits would range from $2.08 in 4.3.4.1 (sfc20) million to $34.95 million in 4.3.2.3 (xop24) using a discount rate of 3%.

- A higher discount rate at 7%, do not alter the rank of alternatives except for the 4.3.4.1 (sfc20), although the cumulative present value of revenues and total economic benefits would be lower due to the discounting the long-term benefits at a higher rate.

- The higher revenues and economic benefits in the SAMS runs with the CAII-ext open (4.3.2.1 to 4.3.2.3) compared to alternatives with the CAII-ext closed (4.3.3.1 to 4.3.3.3) are attributed to opening of CAII extension at various DAS allocations.

- The numerical results of these analyses should be interpreted with caution and should be used solely to compare one alternative with another rather than to predict future values. The costs and the benefits of the alternatives were analyzed based on the biological projections of landings, DAS and LPUE and the available information about the vessel costs and characteristics and price model. Actual value of landings, size composition and other biological variables are likely to be different, at least to some extent, than the projected values due to scientific and management uncertainties. Price projections are derived from the price model that estimated the impact of landings and size composition on prices after taking into account the impact of exogenous variables including the import prices, per capita disposable income and scallop imports from Japan and Canada as a proxy of changes in international markets for large scallops. Future price projections hold all the exogenous explanatory variables constant in order to estimate the economic impacts of alternative management measures on landings, scallop size composition, LPUE and effort. Actual prices will be different than estimated depending on the differences in actual landings and in size composition from projected values as well as due to changes inflation, consumer demand, price, composition of imports, etc.

LAGC IFQ allocations

LAGC IFQ fishery is allocated 5.5% of the 5 annual projected landings (APL) those with IFQ permits receiving 5% and those with both IFQ and LA permits receiving 0.5% of the total APL. Under No Action, allocations would be equivalent to FW30 default measures for FY 2021 the LAGC IFQ allocation would be 631 mt. (or 1,391,069 pounds) for LAGC IFQ and LA with LAGC IFQ quota. LAGC IFQ vessels would also have access in the Mid-Atlantic Access Area and Nantucket Lightship West on April 1, 2020 under default measures, with a fleet wide maximum of 571 trips from the area.

Table 7. Impacts of the LAGC IFQ TAC for 2020 fishing year

Section	Description	Run	LAGC IFQ Share (pounds)	LAGC IFQ Share (mt)	Revenue (2019 $ mil)	Percent change in revenue relative to SQ
4.3.1	No Action	NA	1,391,069	631	$14.1	-37.13%
4.3.2.1	CAII ext Open 20 DAS	xop20	2,548,319	1,156	$24.4	8.81%
4.3.2.2	CAII ext Open 22 DAS	xop22	2,642,897	1,199	$25.1	11.91%
4.3.2.3	CAII ext Open 24 DAS	xop24	2,736,021	1,241	$25.8	15.00%
4.3.3.1	CAII ext Closed 20 DAS	xc20	2,530,374	1,148	$24.3	8.05%
4.3.3.2	CAII ext Closed 22 DAS	xc22	2,621,921	1,190	$24.9	11.02%
4.3.3.3	CAII ext Closed 24 DAS	xc24	2,712,497	1,231	$25.6	14.01%
4.3.4.1	SF & CAII ext Closed 20 DAS	sfc20	2,441,615	1,108	$23.5	4.58%
4.3.4.2	SF & CAII ext Closed 22 DAS	sfc22	2,524,917	1,146	$24.1	7.48%
4.3.4.3	SF & CAII ext Closed 24 DAS	sfc24	2,606,764	1,183	$24.7	10.15%
4.3.5	Status Quo	SQ	2,341,944	1,063	$22.5	0.00%

Table 8. presents the LAGC IFQ share (5% of APL) and estimated revenues for all specification alternatives including SQ and NA options. LGC IFQ share for the SQ alternative is 2.34 mil pounds. The share for the specification alternatives ranges from 2,441,615 pounds in alternative 4.3.4.1 (sfc20) to a high of 2,736,021 pounds in 4.3.2.3 (xop24). Alternative 4.3.5 is the Status Quo scenario for comparison purposes of the relative economic benefits. Under this scenario, allocations for the LAGC IFQ fishery would be set at the same level as in FRM 30, at 2,341,944 lbs. Alternative 4.3.2.3 (xop24) have the highest amount of LAGC IFQ share amount, i.e., 2,736,021 pounds or $25.8 million (in 2019$). The differences in revenue with SQ across alternatives range from $1 mil to $3.4 mil. The highest-ranking alterntive (xop24) has 15 percent more revenue from LAGC IFQ share relative to SQ.

Landings and size composition

Projected values of landings show that landings could vary from over 44 million to 50 million pounds in 2020 (except for no Action) but could reach about 80 million pounds. However, over the long-term the value of

landings is expected to be stabilize around 75 million pounds. The proportion of U10 scallops is estimated to vary from 16.83% to 18.93% in 2020 and a little bit over 14% in the long-term.

Table 9. Estimated landings (Million lb., Average per fishing year)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	27.59	48.63	50.35	52.05	48.31	49.97	51.62	46.69	48.21	49.70	44.88
2021	80.02	73.91	73.26	72.61	69.35	68.71	68.06	64.68	64.08	63.49	75.19
2022-24	79.14	77.55	77.34	77.13	78.93	78.72	78.51	80.32	80.12	79.92	77.05
2025-34	66.68	66.46	66.45	66.44	66.46	66.45	66.44	66.52	66.51	66.50	66.53

Table 10. Projected landings of U10 scallops per year (Mill.lb.)

FY	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	2.89	8.56	8.66	8.76	8.71	8.82	8.93	8.84	8.96	9.07	7.8
2021	17.24	14.07	13.99	13.91	14	13.91	13.82	13.49	13.41	13.33	15.1
2022-24	13.03	11.89	11.85	11.82	11.79	11.75	11.71	12.12	12.09	12.05	11.76
2025-34	9.66	9.54	9.54	9.53	9.53	9.53	9.53	9.56	9.56	9.56	9.57

Table 11. Historical landings of scallops by size category (in pounds)

FISHYEAR	'U10'_LANDING	'U1120'_LANDING	'U2130'_LANDING	U31+ Landing	'UNK'_LANDING	Grand Total
2009	8,426,450	35,799,075	12,193,737	172,283	1,327,049	57,918,594
2010	8,770,955	36,052,201	10,831,759	63,244	939,048	56,657,207
2011	8,543,436	45,260,311	3,256,836	306,256	1,339,491	58,706,330
2012	10,485,521	41,587,639	3,486,843	63,484	1,234,715	56,858,202
2013	8,666,779	24,780,078	5,564,030	125,631	1,076,312	40,212,830
2014	8,046,766	19,084,369	4,079,070	286,378	873,788	32,370,371
2015	6,115,533	21,138,141	7,719,681	170,252	772,211	35,915,818
2016	4,720,193	18,774,077	14,691,792	2,202,112	1,141,890	41,530,064
2017	10,186,798	29,399,041	12,655,069	388,708	979,780	53,609,396
2018	10,857,391	41,363,933	6,929,958	65,768	875,675	60,092,725

Table 12. Biological projections - Percentage share of U10 scallops in total landings

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24
2020	10.47%	17.60%	17.20%	16.83%	18.03%	17.65%	17.30%	18.93%	18.59%	18.25%
2021	21.54%	19.04%	19.10%	19.16%	20.19%	20.24%	20.31%	20.86%	20.93%	21.00%
2022-24	16.46%	15.33%	15.32%	15.32%	14.94%	14.93%	14.92%	15.09%	15.09%	15.08%
2025-34	14.49%	14.35%	14.36%	14.34%	14.34%	14.34%	14.34%	14.37%	14.37%	14.38%

Table 13. Historical data: Percentage composition of scallop landings by size categories

FISHYEAR	'U10'_LANDING	'U1120'_LANDING	'U2130'_LANDING	U31+ Landing	'UNK'_LANDING
2009	14.55%	61.81%	21.05%	0.30%	2.29%
2010	15.48%	63.63%	19.12%	0.11%	1.66%
2011	14.55%	77.10%	5.55%	0.52%	2.28%
2012	18.44%	73.14%	6.13%	0.11%	2.17%
2013	21.55%	61.62%	13.84%	0.31%	2.68%
2014	24.86%	58.96%	12.60%	0.88%	2.70%
2015	17.03%	58.85%	21.49%	0.47%	2.15%
2016	11.37%	45.21%	35.38%	5.30%	2.75%
2017	19.00%	54.84%	23.61%	0.73%	1.83%
2018	18.07%	68.83%	11.53%	0.11%	1.46%

Table 14. Landings per pound of scallops (LPUE)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	2659	3005	2980	2956	2984	2957	2931	2882	2850	2819	2906
2021	2867	2780	2774	2768	2771	2764	2758	2730	2727	2725	2798
2022-24	2940	2916	2916	2916	2917	2917	2918	2936	2937	2937	2912
2025-34	2945	2943	2943	2943	2943	2943	2944	2944	2944	2944	2944

Prices and Revenue

Prices are estimated using the ex-vessel price model that takes into account the impacts of changes in domestic landings, exports, import prices, income of consumers, composition of landings by market category (i.e., size of scallops), and changes in international markets for large scallops using imports of Japanese and Canadian scallops as proxy variables (Appendix I. Price Model).

The price estimates correspond to the price model outputs assuming that the import prices will be constant at their average value for 2017 to 2018 so far, at about $6 scallop exports will constitute about 22% of the domestic landings and the disposable income, ratio of Japanese and Canadian imports to total scallops import will be constant at the current levels in 2018, so that only the effects of the reduction in and changes in the size composition of landings could be identified. In addition, price estimates reflect real (as opposed to nominal) prices since they are expressed in 2018 constant prices assuming inflation will be zero in the future years. Therefore, actual real or nominal prices could be higher (lower) than the estimated prices depending on the import prices, exports and disposable income increase (decrease) in the future years. Nominal prices will probably higher in the future as well since it is unusual for the inflation to remain at zero. In addition, ex-vessel

prices could be underestimates of true values because the biological model underestimates the proportion of U10s in landings and it doesn't have a separate category for U12 scallops.

Although the absolute values for revenues, producer and consumer surpluses, and total economic benefits would change with the value of estimated prices, the differences of these values for all the alternatives to the No Action or Status Quo scenarios would not change in any substantial way. Higher prices than estimated prices would increase the short-term positive impact of all alternatives on revenues compared to No Action and SQ, while lower prices would reduce this impact. Increase in import prices leads to higher ex-vessel prices and revenues.

In short, absolute values of short- and long-term revenues and economic will be greater with higher prices and smaller with lower prices, but the ranking of alternatives are not expected to change.

Table 15. Estimated ex-vessel prices (in 2019 dollars)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	$10.15	$9.59	$9.51	$9.44	$9.59	$9.51	$9.44	$9.62	$9.56	$9.49	$9.73
2021	$8.35	$8.61	$8.63	$8.65	$8.74	$8.76	$8.78	$8.88	$8.90	$8.92	$8.55
2022-24	$8.45	$8.51	$8.51	$8.52	$8.47	$8.48	$8.48	$8.43	$8.44	$8.44	$8.52
2025-34	$8.80	$8.80	$8.80	$8.80	$8.80	$8.80	$8.80	$8.80	$8.80	$8.80	$8.80

Table 16. Scallop revenue per Fishyear (undiscounted, Million $, in 2019 dollars)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	$280	$466	$479	$491	$463	$475	$487	$449	$461	$472	$437
2021	$625	$595	$591	$587	$566	$562	$558	$537	$533	$529	$601
2022-24	$547	$540	$539	$538	$547	$546	$545	$554	$553	$552	$537
2025-34	$315	$314	$314	$314	$314	$314	$314	$315	$315	$315	$315

Estimated impacts on DAS, fishing costs and open area days and employment

Total effort measured in terms of DAS used as a sum total of all areas will be lower in the short-term in 2019 for all the alternatives compared to SQ scenario which allocates fewer DAS and access trips. Changes in employment level in the scallop fishery as measured by CREW*DAS will be proportional to total effort under all alternatives compared to No Action and SQ. Because overall annual DAS per FT vessel will increase under all alternatives compared to the levels under SQ in 2020, employment is expected to increase as well by about 5% (in xcl20 and sfc20) to 14% (in xop24, xcl24, and sfc24) except for No Action the DAS decrease by about 31%. However, over the long-term, total effort and employment is expected to be about same compared to SQ under all alternatives. Even though, employment in terms of CREW*DAS would be lower under some options and higher on others, it is uncertain to what extent this would lead to a reduction or increase in the actual numbers of crew employed.

Trip costs for all the alternatives are expected to be slightly higher by few million dollars than SQ levels in 2020, but have small differences in magnitude from one alternative to the other as well as compared to SQ. However, trip costs are expected to increase noticeably over the long-term.

Table 17. Projected DAS per FT vessel per year (including open and access areas)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	29.1	45.36	47.37	49.36	45.4	47.4	49.4	45.4	47.4	49.4	43.3
2021	78.2	74.53	74.03	73.53	70.2	69.7	69.2	66.4	65.9	65.3	75.3
2022-24	75.5	74.55	74.35	74.15	75.9	75.7	75.4	76.6	76.4	76.2	74.2
2025-34	63.5	63.31	63.3	63.29	63.3	63.3	63.3	63.4	63.3	63.3	63.4

Table 18. Percentage change in total DAS from SQ levels (open and access areas)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	-32.80%	4.78%	9.42%	14.02%	4.83%	9.42%	14.04%	4.90%	9.54%	14.16%	0.00%
2021	3.85%	-1.06%	-1.73%	-2.39%	-6.86%	-7.51%	-8.18%	-11.84%	-12.57%	-13.29%	0.00%
2022-24	1.70%	0.49%	0.22%	-0.05%	2.25%	1.97%	1.68%	3.30%	3.03%	2.75%	0.00%
2025-34	0.19%	-0.08%	-0.09%	-0.11%	-0.09%	-0.11%	-0.14%	-0.02%	-0.03%	-0.06%	0.00%

Table 19. Trip costs per year for the scallop fleet (Undiscounted, in million 2019 dollars)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	$22.26	$34.72	$36.25	$37.78	$34.73	$36.26	$37.79	$34.76	$36.29	$37.83	$33.13
2021	$59.87	$57.04	$56.66	$56.28	$53.70	$53.33	$52.94	$50.82	$50.41	$49.99	$57.66
2022-24	$57.75	$57.06	$56.90	$56.75	$58.06	$57.90	$57.74	$58.66	$58.50	$58.35	$56.78
2025-34	$48.58	$48.46	$48.45	$48.44	$48.45	$48.44	$48.43	$48.48	$48.48	$48.47	$48.50

Present Value of Producer Surplus, Consumer Surplus and Total Economic Benefits

Producer surplus (benefits) for a fishery shows the net benefits to harvesters, including vessel owners and crew, and is measured by the difference between total revenue and costs including operating costs and opportunity costs of labor and capital. In technical terms, 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 marginal cost above the minimum average variable cost. 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 in this section used the most straightforward approximation and estimated PS as the excess of total revenue (TR) over the total variable costs (TVC) minus the opportunity costs of labor and capital. 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. More information about the producer surplus estimates, an opportunity costs are provided in the Appendix for Economic Model.

It must also be emphasized that the empirical results of the economic analyses should be used to compare alternatives with each other and with No Action or Status Quo rather than to estimate the absolute values since the later will be change according to the several external variables that affect prices, revenues and costs including changes in import prices, exports of scallops, disposable income of consumers, size composition of scallop landings, oil prices and inflation.

Consumer surplus for a fishery is the net benefit that consumers gain from consuming fish based on the price they would be willing to pay for them. Consumer surplus will increase when fish prices decline, and/or the amount of fish harvested goes up. Present value of the consumer surplus (using a 7% discount rate), and the cumulative present values net of Status Quo levels are summarized in the table below.

Economic benefits include the benefits both to the consumers and to the fishing industry and equal the sum of benefits to the consumers and producers. The cumulative present value of the total benefits and economic benefits net of Status Quo (SQ) levels are shown in the tables below. The cumulative present value of economic benefits is also estimated at a 3% discount rate. Discounting future benefits at a lower level resulted in higher benefits for all options without changing the ranking of the alternatives in terms of magnitude of benefits.

Consumer and producer surpluses and total economic benefits would be largest under the specification alternative 4.3.2.3 (xop24) and lowest under alternative 4.3.4.1 (sfc20), but they are all higher compared to SQ in 2020 as well as in the long-term. The differences between those alternatives on different economic indicators are small within the broader group of alternative (i.e., xop, xcl, and sfc) but are noticeably different between them both in short- and the long-term.

Table 20. Present value of producer surplus (using 7% discount rate, Million $, in 2019 dollars)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	202	368	378	388	365	375	385	351	360	369	341
2021	496	470	467	464	447	443	440	421	418	415	475
2022-24	1311	1292	1290	1287	1310	1307	1305	1328	1326	1323	1286
2025-34	2509	2501	2500	2500	2501	2501	2500	2503	2503	2502	2503
Grand Total	**4518**	**4631**	**4635**	**4639**	**4623**	**4626**	**4629**	**4604**	**4607**	**4609**	**4605**

Producer Surplus net of SQ values (% Change)											
Fishing year	**NA**	**xop20**	**xop22**	**xop24**	**xcl20**	**xcl22**	**xcl24**	**sfc20**	**sfc22**	**sfc24**	**SQ**
2020	-40.76%	7.92%	10.85%	13.78%	7.04%	9.97%	12.90%	2.93%	5.57%	8.21%	0.00%
2021	4.42%	-1.05%	-1.68%	-2.32%	-5.89%	-6.74%	-7.37%	-11.37%	-12.00%	-12.63%	0.00%
2022-24	1.94%	0.47%	0.31%	0.08%	1.87%	1.63%	1.48%	3.27%	3.11%	2.88%	0.00%
2025-34	0.24%	-0.08%	-0.12%	-0.12%	-0.08%	-0.08%	-0.12%	0.00%	0.00%	-0.04%	0.00%
Grand Total	-1.89%	0.56%	0.65%	0.74%	0.39%	0.46%	0.52%	-0.02%	0.04%	0.09%	0.00%

Table 21. Present value of consumer surplus (CS) using 7% discount rate (in 2019 dollars, Million $)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	9	39	41	39	41	43	37	39	41	33	43
2021	100	83	81	75	74	73	67	66	65	87	80
2022-24	234	219	218	225	223	222	233	232	231	216	217
2025-34	351	347	347	347	347	347	348	348	348	348	347
Grand Total	694	687	687	685	685	684	685	684	684	684	687
Percent change from SQ											
Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	-79.07%	-9.30%	-4.65%	-9.30%	-4.65%	0.00%	-13.95%	-9.30%	-4.65%	-23.26%	0.00%
2021	25.00%	3.75%	1.25%	-6.25%	-7.50%	-8.75%	-16.25%	-17.50%	-18.75%	8.75%	0.00%
2022-24	7.83%	0.92%	0.46%	3.69%	2.76%	2.30%	7.37%	6.91%	6.45%	-0.46%	0.00%
2025-34	1.15%	0.00%	0.00%	0.00%	0.00%	0.00%	0.29%	0.29%	0.29%	0.29%	0.00%
Grand Total	1.02%	0.00%	0.00%	-0.29%	-0.29%	-0.44%	-0.29%	-0.44%	-0.44%	-0.44%	0.00%

Table 22. Present value of total economic benefits (TB) using 7% discount rate (in 2019 dollars, Mill. $)

Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	211	407	419	432	404	416	428	388	399	409	374
2021	596	553	548	544	522	517	512	488	484	479	562
2022-24	1545	1512	1508	1504	1534	1531	1527	1561	1558	1554	1502
2025-34	2860	2848	2847	2847	2848	2847	2847	2851	2851	2850	2851
Grand Total	5212	5319	5323	5326	5308	5311	5314	5288	5291	5293	5289
Percent change from SQ											
Fishing year	NA	xop20	xop22	xop24	xcl20	xcl22	xcl24	sfc20	sfc22	sfc24	SQ
2020	-43.58%	8.82%	12.03%	15.51%	8.02%	11.23%	14.44%	3.74%	6.68%	9.36%	0.00%
2021	6.05%	-1.60%	-2.49%	-3.20%	-7.12%	-8.01%	-8.90%	-13.17%	-13.88%	-14.77%	0.00%
2022-24	2.86%	0.67%	0.40%	0.13%	2.13%	1.93%	1.66%	3.93%	3.73%	3.46%	0.00%
2025-34	0.32%	-0.11%	-0.14%	-0.14%	-0.11%	-0.14%	-0.14%	0.00%	0.00%	-0.04%	0.00%
Grand Total	-1.46%	0.57%	0.64%	0.70%	0.36%	0.42%	0.47%	-0.02%	0.04%	0.08%	0.00%

Uncertainties and risks

The economic impacts presented in the above sections are analyzed using the price model, costs, revenues and total net benefits as described in the economic model provided in Economic Appendix I (forthcoming). The estimated fishing costs are used in calculating producer surplus for the proposed alternatives, which shows total revenue net of variable costs minus the opportunity costs of labor and capital. The costs and the benefits of the proposed alternatives were analyzed based on the biological projections of landings, DAS and LPUE and the available information about the vessel costs and characteristics, crew shares and prices. The numerical results of these analyses should be interpreted with caution due to uncertainties about the likely changes in:

- factors affecting scallop resource abundance
- fishing behavior
- fixed costs
- variable costs
- import prices and imports from Canada and Japan that are close substitutes for large domestic scallops.
- demand for scallop exports
- bycatch and revenues from other fisheries
- the crew share system
- change in the number of active vessels
- structural changes in ownership
- changes in the composition of fleet in terms of tonnage, HP and crew size of the active vessels
- disposable income and preferences of consumers for scallops.

The estimated values of the economic cost/benefit analysis should be used solely in comparing preferred action with the other alternatives since the uncertainties related to landings and prices are expected to affect all alternatives in the same direction.

The landings streams, DAS and LPUE were obtained from the biological model, which is based on fishing mortality by area and the inputs are not fishery-based in terms of DAS, etc. The biological simulations do not model individual vessels or trips; it models the fleet as a whole. The output of the biological model and the landings streams were used to estimate the costs and benefits of the preferred action and alternatives. The results for economic impacts would change if the actual landings, size composition of landings and LPUE are different than the forecasted values from the biological model.[5]

The prices are estimated using the ex-vessel price model described in Appendix I (forthcoming). This model takes into account the impacts of changes in meat count, domestic landings, exports, price of imports, income of consumers, and composition of landings by market category (i.e., size of scallops) including a price premium on under count 10 scallops.

The important changes in external factors, i.e., in exports, imports, value of dollar, export and import prices had some unpredictable impacts on scallop prices in the past, first resulting an increase to over $9.70 per pound (in terms of 2017 dollars) in 2005, then a consequent decline to about $7.86 per pound (in terms of 2017 dollars) in 2006 as import prices declined but without a significant increase in scallop landings in 2006 (about 56 million lb.) compared to 2005 (about 54 million lb.). During the fishing years from 2010 to 2016, however, the decline in the value of dollar, strong demand for scallops especially from the European countries and a

[5] Economic appendix will be supplemented during AP/CTE meeting.

diminished supply from Japan and other competing, scallop-producing nations resulted in much higher prices than anticipated in the previous frameworks. However, in 2017 as landings of scallops reached to nearly 50 million lb. and proportion of U10 and 11 to 20 count scallops increased, average annual ex-vessel price declined to $9.7 from over $12 in 2016. The decrease in import prices and increase in imports from Japan and Canada relative to total imports played a role in this decline as well (See Price Model section in the Economic Model provided in the Appendix I.). Thus, any change in the external factors that affect price, such as in import prices or in the differences between the actual and projected landings will result in differences in the actual and estimated prices.

In addition, the prices were estimated by holding the values of the all the variables that impact prices, such as import prices and disposable income, at the recent levels. For example, disposable income per capita and import prices are assumed to stay constant at the 2019 levels for the economic analyses of this Framework action. This is because it is not possible to predict accurately the changes in the future values of the explanatory variables and also because our goal is to determine the response in scallop prices to the change in landings and the composition in terms of market category given other things held constant. Therefore, future prices could be higher (or lower) than predicted depending on the values of the explanatory variables.

For these reasons, the empirical results of the economic analyses should be used to compare alternatives with each other and with No Action or Status Quo --rather than to estimate the absolute values--since a change in the variables listed above will change the numerical results in the same direction. For example, an increase in import prices would lead to a rise in ex-vessel prices and revenues for all alternatives above the levels estimated in the sections above. An increase in the price of oil, on the other hand, would increase the variable costs and reduce the cost savings under all options. While these changes would affect the absolute values of net economic benefits, the ranking of alternatives in terms of their impacts on revenues, costs, and net benefits are not expected to change.