NEMS Framework 55 Economic Impacts
Supplement to the NEMS Framework 55 Environmental Assessment
Groundfish Plan Development Team
December 1, 2015

Quota Change Model Inputs and Assumptions for FW55

The Quota Change Model (QCM) has been used to predict the effects of quota changes on the sector portion of the commercial groundfish fishery since FW47 (FY 2012). New inputs and assumptions for the QCM in predicting FY 2016 results are detailed here along with preliminary model results and a brief discussion of noteworthy findings. A more detailed description of the background and methods of the QCM are available in the FW55 economic impacts section. All previous model assumptions remain intact. To summarize, these are:

- Stock conditions, fishing practices and harvest technologies existing during the data period are representative;
- Trips are repeatable;
- Demand for groundfish is constant, noting that fish prices do vary between the reference population and the sample population, but this variability is consistent with the underlying price/quantity relationship observed during the reference period;
- Quota opportunity costs and operating costs are both constant; and,
- ACE flows seamlessly from lesser to lessee such that fishery-wide caps can be met without leaving ACE for constraining stocks stranded.

Notable Changes to Quota Change Model

- ***FYs 2014 and 2015 used as inputs***

In previous FWs, the QCM drew from the most recent fishing year for which a full year of data was available. For FW55, such an approach implies that FY 2014 would be the input dataset for FY 2016. Because the interim action for GOM cod influenced fishing behavior for portions of FY14, using that year as the only input data is not considered appropriate. Accordingly, trips from FY15 (through November) are added to supplement the FY14 trip data. Trips taken during FY14 and FY15 to areas that will be closed in FY16 are removed from the selection pool.

- ***At-sea monitoring***

Industry-funded at-sea monitoring (ASM) is explicitly modeled within the QCM for the first time in FW55. ASM affects the types of trips likely to be taken by, primarily, negatively impacting trip-level net revenues. A sub-set of trips that are profitable under previous conditions will no longer be profitable

with the addition of ASM costs (see Figure 1 for more details). This has second-order effects on the distribution of catch across stocks as well as port and size class level impacts.

To estimate the cost of ASM, a range of possibilities are simulated. ASM costs are estimated to fall between $675-725 per day initially and, to simulate decreasing marginal costs of coverage, declining exponentially with increases in coverage rates to, at 100% coverage, a range of between $410-445 per day. The number of whole-day (rounded) fishing days that the cost could be applied to was estimated to be between 17-22K days (see Figure 2). The full range of potential coverage rates is included in the simulation (0-100% ASM coverage, see Figure 3) and a target of **22% ASM coverage** is carried forward for inclusion in the QCM. The median cost estimate for a 22% ASM coverage rate is $2.92million for FY16 (Figure 4).

To apportion this total cost to individual trips, a per-groundfish-pound ASM fee is estimated. Total groundfish landings have been relatively stable from FY13 onward at around 50 million pounds of groundfish, and QCM simulations without ASM coverage indicate that this level of landings is likely to be maintained. A range of 45-55 million pounds was included in the simulation to estimate the per-pound ASM fee. The median per-pound fee to cover ASM costs for FY16 is estimated at $0.0586 (Figure 5, Figure 6).

The distribution of vessels enrolled in sectors and the common pool is assumed to be the same in FY16 as it is in FY15.

Figure 1 – Distribution of quasi-probabilities assigned to trips from FY14 and FY15 under no ASM cost (left panel) and with ASM cost (right panel). Slightly more trips (6%) are assigned a near-zero probability of being replicated with ASM, and about 10% fewer trips are assigned a 100% probability of being replicated

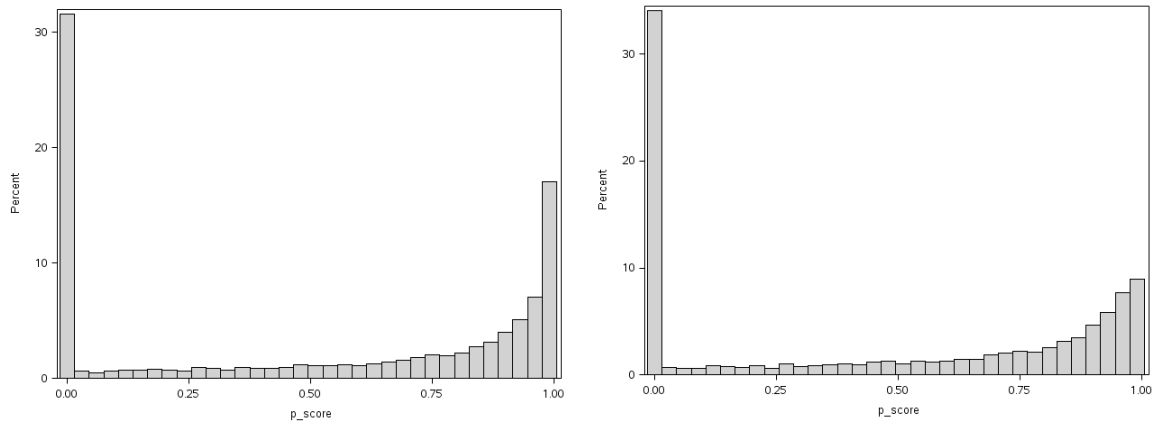


Figure 2 – Total whole days and realized ASM days, FY10-14

Fishing Year	TOTAL DAYS	ASM DAYS	*Percent ASM*	TOTAL TRIPS	ASM TRIPS	*Percent ASM*
2010	26,916	6,841	*25%*	13,831	3,638	*26%*
2011	31,018	6,928	*22%*	16,122	3,253	*20%*
2012	27,750	4,404	*16%*	14,321	2,220	*16%*
2013	22,295	2,819	*13%*	10,053	1,144	*11%*
2014*	20,179	3,859	*19%*	9,396	1,702	*18%*

Figure 3 – Total estimated cost of ASM across range of coverage rates, simulation results

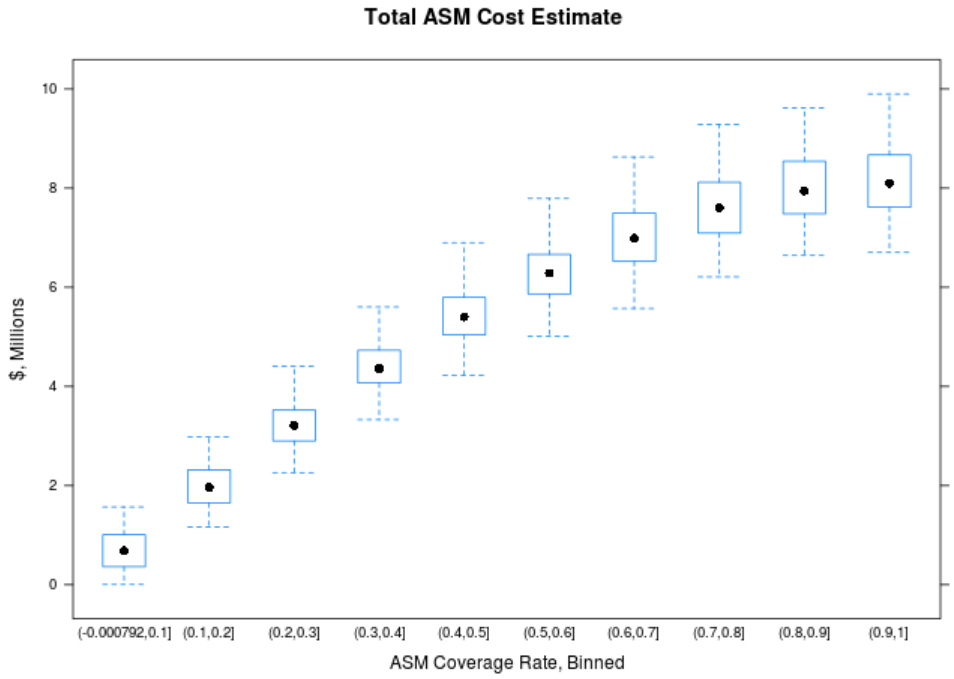


Figure 4 – Total cost estimates from simulation results for ASM coverage rates, expanded for the range between 0 and 40%

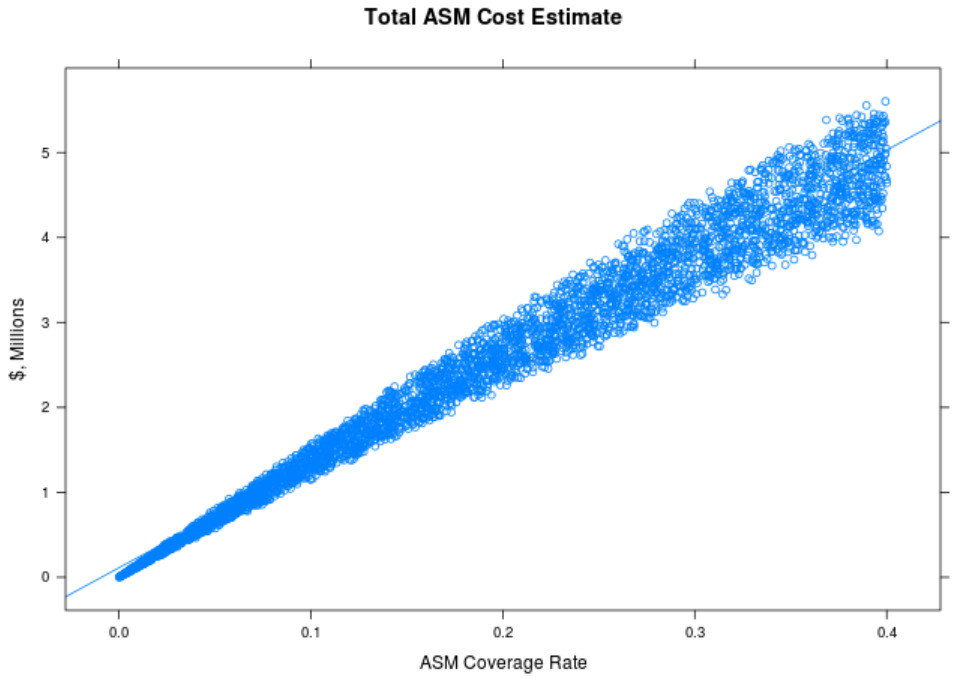


Figure 5 – Per-pound ASM 'fee' estimates from simulation results

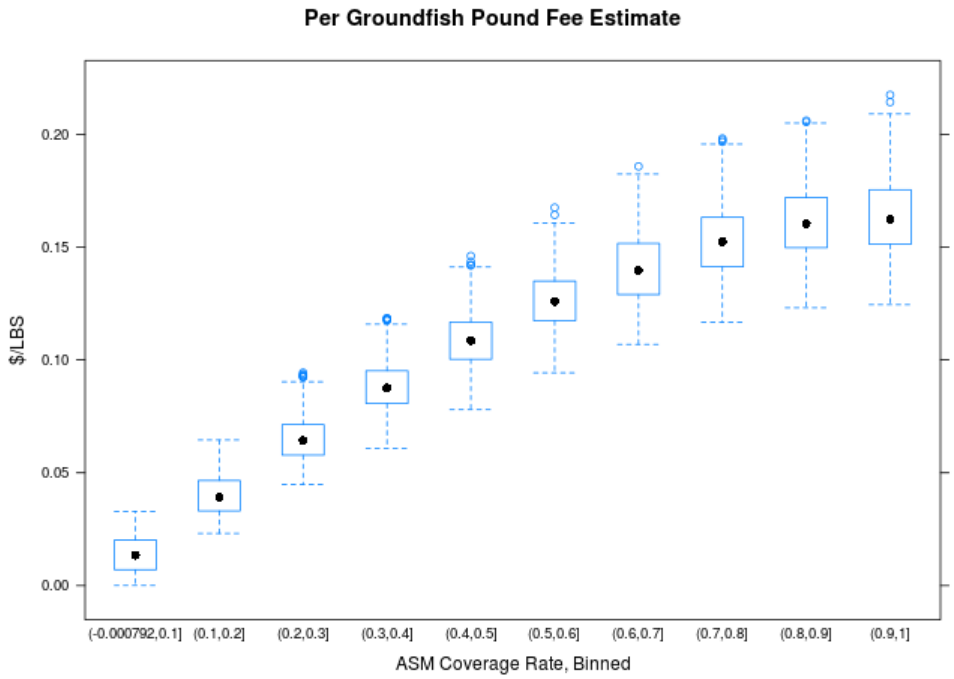
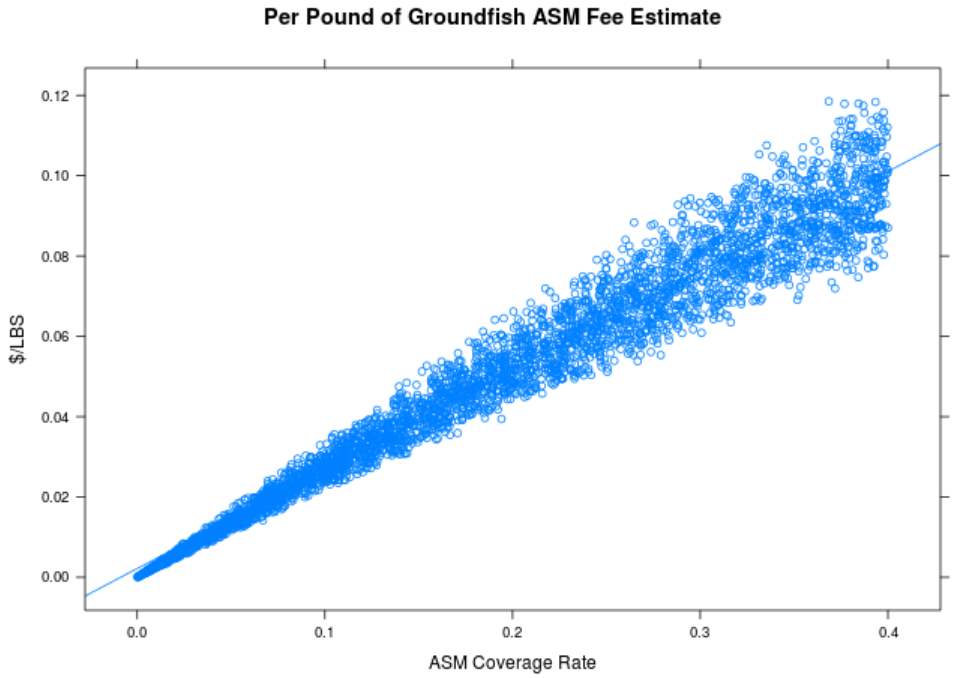


Figure 6 – Per-pound ASM 'fee' estimates from simulation results for ASM coverage rates, expanded for the range between 0 and 40%



Preliminary FY 2016 Results

- ***Overall results***

FY 2016 predictions for No Action ACLs, revised ACLs without industry-funded ASM, and revised ACLs with industry-funded ASM (at 22% coverage) are presented in Table 1. With industry-funded ASM and revised ACLs in FY16, total revenues on groundfish trips are predicted to drop from $76.3 million in FY15 to $71.9 million in FY16, a 7% decline. Revenues from groundfish on groundfish trips are predicted to drop from $59.2 million in FY15 to $54.2 million in FY16, a 10% decline. Similarly, in the absence of industry-funded ASM, total revenues on groundfish trips are predicted to drop to $70.8 million in FY16, a 7% decline from FY15 predictions. Revenue from groundfish only on groundfish trips are predicted to drop to $53.7 million in the absence of industry-funded ASM, a 10% decline from FY15 predictions. That gross revenues are predicted to be higher with industry-funded ASM than without is noteworthy. Net revenues with industry-funded ASM, however, are predicted to be lower. Once again, the QCM assumes the requirement for industry-funded ASM in FY16 for sectors will not result in a shift of vessels from sectors to the common pool.

When comparing FY16 stock-level predictions under industry-funded ASM (Table 2) with FY15 predictions (Table 3), the three stocks with the largest absolute increase in average revenue are redfish ($3.9 million), pollock ($1.4 million), and white hake ($0.6 million). The three stocks with the largest absolute decrease from FY15 to FY16 are GB winter flounder ($4.3 million), GB cod ($3.5 million), and witch flounder ($1.4 million). In terms of utilization rates, Table 4 shows the highest predicted utilization rates, assuming industry-funded ASM, to be GOM cod (98%), SNE/MA yellowtail flounder (96%), and witch flounder (91%). Table 2 shows that for FY15, the highest predicted utilization rates are for GB winter flounder, GOM cod, and SNE/MA yellowtail flounder, all at 100%.

Tables 3 through 5 give the full range of QCM results under No Action ACLs, revised ACLs without industry-funded ASM, and revised ACLs with industry-funded (at 26% coverage). Gross revenues from groundfish trips are predicted to be similar with or without industry-funded ASM; however net revenues are predicted to be around $2 million higher without ASM.

- ***Results by port and state level***

In terms of groundfish revenue at the port level (Table 6), Boston and Gloucester are predicted to see revenue increases ($4.3 million and $2.2 million, respectively) relative to FY15, assuming industry-funded ASM in FY16. Ports predicted to see groundfish revenue decreases relative to FY15 include New Bedford ($7.7 million), Point Judith ($1.1 million), and Portland ($1.1 million). At the state level, all states are predicted to see revenue decreases relative to FY15. In terms of absolute decreases, Massachusetts is predicted to see the largest decline in revenue at $2.1 million, followed by Rhode Island ($1.6 million), and Maine ($1.5 million). In terms of a percentage decline in groundfish revenues, Rhode Island (61.5%) exceeds both Maine (11.6%) and Massachusetts (5.1%). In the absence of industry-funded ASM,

distributional impacts to ports and states are predicted to be similar as when the ASM requirement is in place.

- ***Results by vessel length category***

In terms of groundfish revenue by vessel length (Table 7), vessels of 75'+ are predicted to see the largest revenue decreases both in terms of absolute value ($7.0 million) and percentage (24.3%) relative to FY15, assuming industry-funded ASM in FY16. Vessels in the 30-<50' category are also predicted to have decreases in revenue relative to FY15 with a decline of $1 million, representing 20% of predicted FY15 revenues. Vessels in the 50-75' category are predicted to see revenue increases of $4 million, representing a 23.5% increase from predicted FY 15 revenues. In the absence of industry-funded ASM, vessels in the 30-<50' range and those in the 75'+ range are predicted to have groundfish revenue increases of $1 million relative to when the ASM requirement is in place. For 30-<50' vessels, this $1 million jump would represent a 25% increase.

Discussion

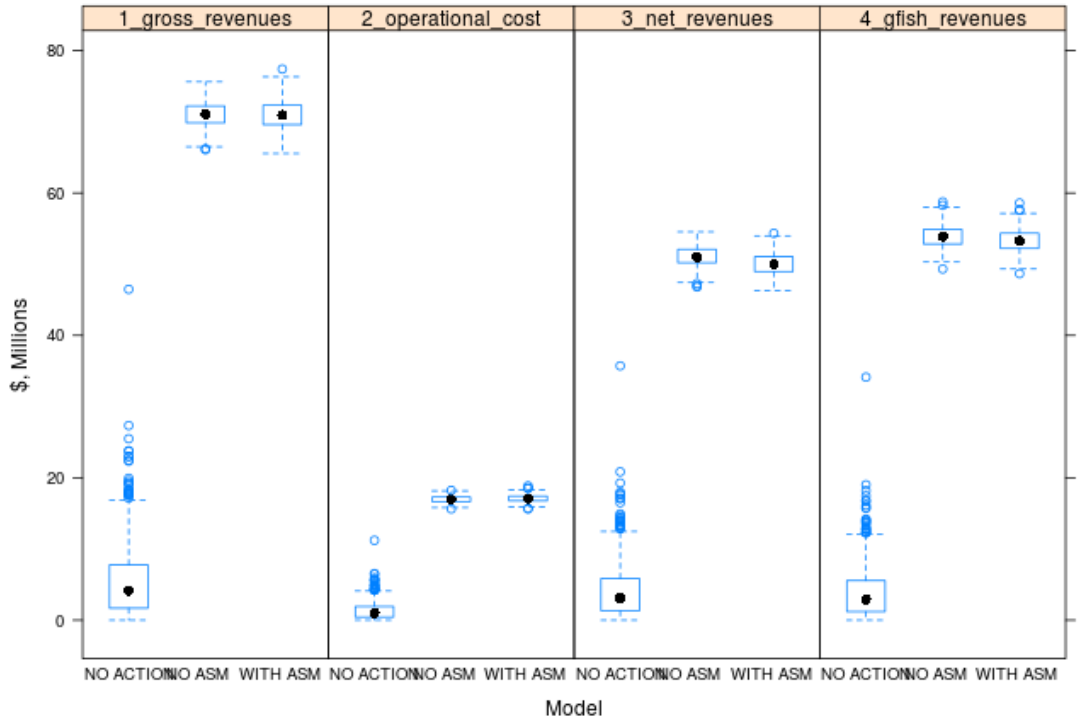
Several key findings stand out. The first is that the impacts of FW55 quota changes, GB cod and SNE/MA yellowtail flounder in particular, are predicted to have serious distributional impacts. Specifically, ports such as Point Judith, RI and New Bedford, MA, as well as more southern ports in New Jersey and New York, are predicted to see declines in gross revenues on the order of 45-100%. New Bedford alone is predicted to lose 46% of its FY15 revenues, or $7.7 million dollars. Rhode Island is predicted to 65% of its FY15 gross revenues from groundfish. Conversely, Boston and Gloucester are predicted to see large increases in gross revenues (33 and 35%, respectively). These large changes indicate a high degree of uncertainty for the fishery, as businesses strive to re-balance their catch with their allocations. Importantly, four stocks are predicted to be constraining: GOM cod, GB cod, SNE/MA yellowtail flounder, and witch flounder. The geographic breadth of these constraining stocks has no precedent over the past five years of the Sector system.

Redfish landings are predicted to increase by 75%, to roughly 7,500mt. Under the FW55 sector sub-ACLs, redfish trips are among the most profitable, with or without industry-funded ASM coverage. While the model assumes that trips are replicable, this level of redfish landings should be considered uncertain. Further, redfish prices from the sample dataset may not hold up to such high volumes, and aggregate fishery gross revenues may be underestimated.

The industry-funded ASM requirement for sectors in FY16 is not predicted to decrease total revenue, but will result in a decrease in net revenue (Figure 7, Figure 8), as ASM is predicted to cost sectors $2.6-2.9 million in FY16. One bright spot in an otherwise bleak landscape is the decline of fuel prices in recent months (Figure 9). Noting that the number of trips taken, and predicted, is roughly stable from 2013-2016, lower fuel prices contribute significantly to a predicted $5 million reduction in fleet-wide variable costs from FY14-FY16. If ASM costs materialize as modeled here, the roughly $2.5-$3 million cost will erode much of the savings generated by lower fuel costs

Tables and Figures

Figure 7 - FY16 QCM predictions with 500 simulated fishing years for each scenario



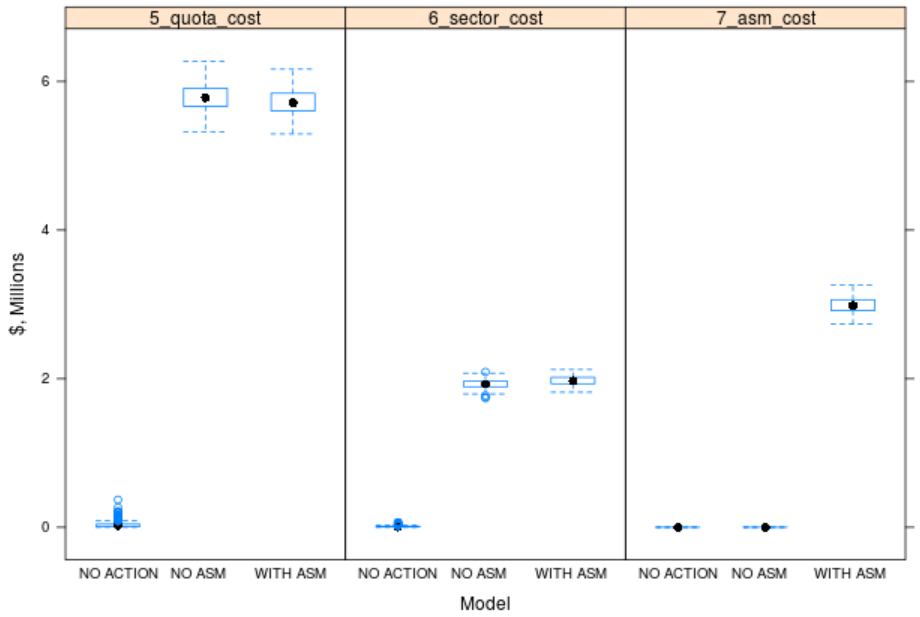


Table 1 – FY16 QCM predictions with 5% and 95% confidence intervals and changes from FY15 predictions

Model	All groundfish trips, gross Revenues	p5 Revenues	p95 Revenues	All groundfish, gross Revenues	p5 Revenues	p95 Revenues	% Change from FY15 - Groundfish trips	% Change from FY15 - Groundfish
FY15 (FW53)	76.3	69.3	83.3	59.2	53.2	65.1		
NO ACTION	6.4	0.2	28.5	4.6	0.1	20.5	-92%	-92%
NO ASM	70.8	64.1	78.3	53.7	48.4	59.7	-7%	-9%
WITH ASM	71.9	64.8	79.9	54.2	48.6	60.4	-6%	-8%

Table 2 – FW53 (FY15) QCM stock-level catch and revenue predictions with 5% and 95% confidence intervals

	FW53 (FY15)					
	Sub-ACL	**Catch**	**Utilization**	**Revenue**	p5 Revenue	p95 Revenue
Redfish	10,988	4,306	39%	4.8	4.2	5.3
GB Haddock West	16,206	4,597	28%	11.6	10.0	13.2
Pollock	13,632	3,880	28%	8.6	8.0	9.3
White Hake	4,313	1,757	41%	5.2	4.8	5.6
GB Haddock East	5,402	1,122	21%	2.7	2.2	3.3
Plaice	1,382	1,235	89%	4.2	3.9	4.5
GB Winter Flounder	1,875	1,867	100%	6.9	6.4	7.3
GB Cod West	1,629	1,550	95%	5.8	5.2	6.1
SNE Winter Flounder	1,147	839	73%	2.7	2.3	3.1
Witch Flounder	598	533	89%	2.7	2.5	2.9
GOM Cod	202	201	100%	1.0	1.0	1.0
GOM Haddock	948	128	13%	0.4	0.4	0.5
CC/GOM Yellowtail Flounder	443	147	33%	0.4	0.4	0.5
SNE/MA Yellowtail Flounder	457	457	100%	1.4	1.3	1.5
GOM Winter Flounder	375	82	22%	0.3	0.2	0.3
Halibut	0	47	0%	0.2	0.2	0.2
GB Yellowtail Flounder	192	52	27%	0.2	0.1	0.4
GB Cod East	124	30	24%	0.1	0.1	0.1
Northern Windowpane	0	245	0%	0.0	0.0	0.0
Ocean Pout	0	35	0%	0.0	0.0	0.0
Southern Windowpane	0	138	0%	0.0	0.0	0.0
Wolffish	0	14	0%	0.0	0.0	0.0
Non groundfish	0	9,369	0%	17.1	16.1	18.2
Total		32,631		76.3	69.3	83.3

Table 3 - FY16 QCM stock-level catch and revenue predictions with 5% and 95% confidence intervals for the No Action Alternative

	NO ACTION					
	Sub-ACL	**Catch**	**Utilization**	**Revenue**	p5 Revenue	p95 Revenue
Redfish	3,840	418	11%	0.5	0.0	2.2
GB Haddock West	7,548	464	6%	1.1	0.0	4.8
Pollock	13,628	362	3%	1.0	0.1	4.5
White Hake	4,250	157	4%	0.5	0.0	2.2
GB Haddock East	0	0	0%	0.0	0.0	0.0
Plaice	483	45	9%	0.2	0.0	0.8
GB Winter Flounder	1,967	109	6%	0.5	0.0	2.1
GB Cod West	612	44	7%	0.2	0.0	0.9
SNE Winter Flounder	402	41	10%	0.2	0.0	0.9
Witch Flounder	208	16	8%	0.1	0.0	0.4
GOM Cod	201	21	11%	0.1	0.0	0.5
GOM Haddock	1,155	27	2%	0.1	0.0	0.4
CC/GOM Yellowtail Flounder	153	11	7%	0.0	0.0	0.1
SNE/MA Yellowtail Flounder	155	20	13%	0.1	0.0	0.3
GOM Winter Flounder	375	6	2%	0.0	0.0	0.2
Halibut	0	4	0%	0.0	0.0	0.1
GB Yellowtail Flounder	274	3	1%	0.0	0.0	0.1
GB Cod East	0	0	0%	0.0	0.0	0.0
Northern Windowpane	0	9	0%	0.0	0.0	0.0
Ocean Pout	0	3	0%	0.0	0.0	0.0
Southern Windowpane	0	9	0%	0.0	0.0	0.0
Wolffish	0	1	0%	0.0	0.0	0.0
Non groundfish	0	1,222	0%	1.8	0.1	8.0
Total		2,992		6.4	0.2	28.5

Table 4 - FY16 QCM stock-level catch and revenue predictions with 5% and 95% confidence intervals for FY16 Sector sub-ACLs without industry-funded ASM coverage

	WITHOUT ASM					
	Sub-ACL	Catch	Utilization	Revenue	p5 Revenue	p95 Revenue
Redfish	9,471	7,509	79%	9.0	8.1	9.8
GB Haddock West	34,156	4,676	14%	10.0	8.8	11.6
Pollock	17,705	3,977	22%	10.2	9.6	10.9
White Hake	3,434	1,843	54%	5.9	5.5	6.3
GB Haddock East	17,053	1,617	9%	3.4	2.9	4.1
Plaice	1,160	857	74%	3.4	3.1	3.6
GB Winter Flounder	584	453	78%	2.4	2.0	3.0
GB Cod West	550	547	99%	2.3	2.2	2.4
SNE Winter Flounder	514	417	81%	1.9	1.5	2.3
Witch Flounder	271	245	90%	1.3	1.2	1.4
GOM Cod	273	268	98%	1.2	1.1	1.2
GOM Haddock	2,385	362	15%	1.1	1.0	1.2
CC/GOM Yellowtail Flounder	325	163	50%	0.4	0.4	0.5
SNE/MA Yellowtail Flounder	145	139	96%	0.4	0.4	0.4
GOM Winter Flounder	604	83	14%	0.3	0.2	0.4
Halibut	0	47	0%	0.3	0.3	0.3
GB Yellowtail Flounder	207	21	10%	0.1	0.0	0.1
GB Cod East	45	34	75%	0.1	0.1	0.2
Northern Windowpane	0	82	0%	0.0	0.0	0.0
Ocean Pout	0	29	0%	0.0	0.0	0.0
Southern Windowpane	0	70	0%	0.0	0.0	0.0
Wolffish	0	17	0%	0.0	0.0	0.0
Non groundfish	0	9,322	0%	17.1	15.7	18.6
Total		32,778		70.8	64.1	78.3

Table 5 – FY16 QCM stock-level catch and revenue predictions with 5% and 95% confidence intervals for FY16 Sector sub-ACLs with industry-funded ASM coverage

	WITH ASM					
	Sub-ACL	**Catch**	**Utilization**	**Revenue**	p5 Revenue	p95 Revenue
Redfish	9,471	7,555	80%	9.1	8.1	10.2
GB Haddock West	34,156	4,709	14%	10.2	9.0	11.7
Pollock	17,705	4,000	23%	10.4	9.7	11.1
White Hake	3,434	1,863	54%	6.0	5.5	6.4
GB Haddock East	17,053	1,668	10%	3.5	3.0	4.1
Plaice	1,160	870	75%	3.4	3.1	3.7
GB Winter Flounder	584	452	77%	2.5	2.0	3.0
GB Cod West	550	547	100%	2.3	2.3	2.4
SNE Winter Flounder	514	372	72%	1.6	1.3	2.0
Witch Flounder	271	247	91%	1.3	1.2	1.4
GOM Cod	273	268	98%	1.2	1.1	1.2
GOM Haddock	2,385	371	16%	1.1	1.0	1.3
CC/GOM Yellowtail Flounder	325	160	49%	0.4	0.4	0.5
SNE/MA Yellowtail Flounder	145	139	96%	0.4	0.3	0.4
GOM Winter Flounder	604	83	14%	0.3	0.2	0.4
Halibut	0	47	0%	0.3	0.3	0.3
GB Yellowtail Flounder	207	20	10%	0.1	0.0	0.1
GB Cod East	45	32	72%	0.1	0.1	0.2
Northern Windowpane	0	82	0%	0.0	0.0	0.0
Ocean Pout	0	29	0%	0.0	0.0	0.0
Southern Windowpane	0	68	0%	0.0	0.0	0.0
Wolffish	0	17	0%	0.0	0.0	0.0
Non groundfish	0	11,049	0%	17.7	16.2	19.5
Total		34,648		71.9	64.8	79.9

Table 6 – Port-level QCM gross revenue predictions, groundfish revenues only, with 5% and 95% confidence intervals

	FY15 (FW53)			No Action			WITH ASM			NO ASM		
	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev
Connecticut	0	0	0	0	0	0	0	0	0	0	0	0
Massachusetts	41.1	36.5	46	3.1	0.1	9.2	39.7	35.5	44.2	39.7	35.3	44.3
Boston	*12.9*	*11.3*	*14.7*	*1.3*	*0*	*3.7*	*17.2*	*15.7*	*18.9*	*17.2*	*15.5*	*18.9*
Gloucester	*8.2*	*7.2*	*9.3*	*0.7*	*0*	*2*	*11.1*	*10*	*12.2*	*10.8*	*9.8*	*12*
New Bedford	*16.9*	*15.5*	*18.2*	*1*	*0.1*	*2.8*	*9.2*	*8.2*	*10.4*	*9.3*	*8.2*	*10.4*
Maine	12.9	11	14.6	0.8	0.1	2.2	11.7	10.2	13.3	11.5	10.1	12.9
Portland	*11.4*	*9.8*	*13*	*0.7*	*0.1*	*1.9*	*10.5*	*9.2*	*11.9*	*10.3*	*9.1*	*11.6*
New Hampshire	1.3	1.1	1.5	0.2	0	0.5	1.6	1.3	1.9	1.5	1.3	1.8
New Jersey	0.2	0.1	0.3	0	0	0	0	0	0	0	0	0
New York	1	0.7	1.3	0	0	0.1	0.3	0.2	0.3	0.2	0.2	0.3
Rhode Island	2.6	2.1	3	0.1	0	0.4	0.9	0.7	1.2	1	0.7	1.2
Point Judith	*1.9*	*1.7*	*2.2*	*0.1*	*0*	*0.2*	*0.8*	*0.6*	*1*	*0.8*	*0.6*	*1*
Other Northeast	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	59.1	51.5	66.7	4.2	0.2	12.4	54.2	47.9	60.9	53.9	47.6	60.5

Table 7 – Port-level change, relative to FW53 baseline

		No Action	WITH ASM	NO ASM
Connecticut		n/a	n/a	n/a
Massachusetts		-92%	-3%	-3%
	Boston	-90%	33%	33%
	Gloucester	-91%	35%	32%
	New Bedford	-94%	-46%	-45%
Maine		-94%	-9%	-11%
	Portland	-94%	-8%	-10%
New Hampshire		-85%	23%	15%
New Jersey		-100%	-100%	-100%
New York		-100%	-70%	-80%
Rhode Island		-96%	-65%	-62%
	Point Judith	-95%	-58%	-58%
Other Northeast		n/a	n/a	n/a

Table 8 – Vessel size category-level QCM gross revenue predictions, groundfish revenues only, with 5% and 95% confidence intervals

	FY15 (FW53)			No Action			With ASM			No ASM		
Length class	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev	Rev	p5 rev	p95 rev
<30'	0	0	0	0	0	0	0	0	0	0	0	0
30'to<50'	4.5	4.1	4.9	0.7	0.0	2.1	4.7	4.2	5.1	4.6	4.2	5.0
50'to<75'	17.3	15.8	18.6	2.6	0.1	7.5	20.7	19.1	22.1	20.5	19.1	22.0
75'+	37.1	34.1	39.9	3.4	0.3	10.2	28.7	26.4	31.0	28.6	26.4	30.9
TOTAL	59.1	54.1	63.7	6.7	0.4	20.0	54.3	49.8	58.5	53.9	49.8	58.2

Figure 8 – Variable costs (fuel, food, ice, ASM) as percent of gross revenues, 2010-2016

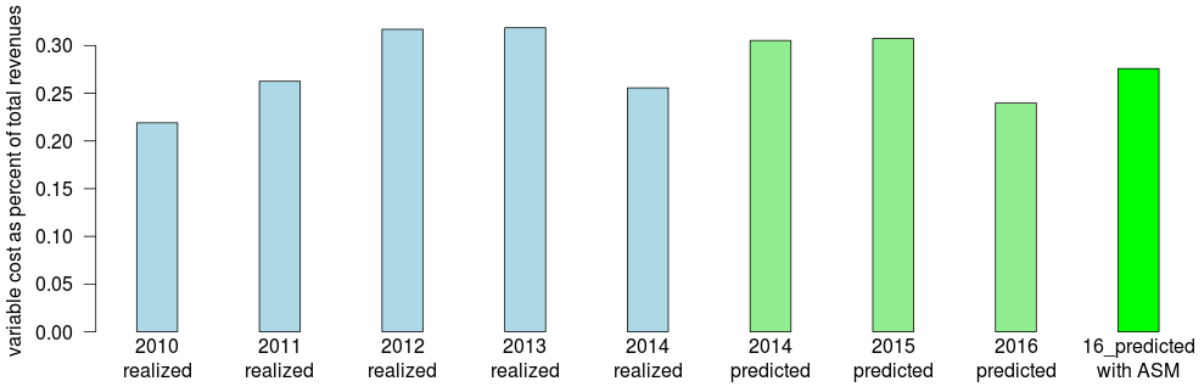


Table 9 – Variable costs (fuel, food, ice, ASM) as percent of gross revenues, 2010-2016

Year	Type	Gross Revenues	Variable Costs	Ratio
2010	realized	$105.0	$23.0	22%
2011	realized	$122.0	$32.0	26%
2012	realized	$95.4	$30.2	32%
2013	realized	$80.3	$25.6	32%
2014	realized	$87.7	$22.4	26%
2014	predicted	$70.8	$21.6	31%
2015	predicted	$73.6	$22.6	31%
2016	predicted	$72.1	$17.3	24%
2016	predicted with asm	$72.1	$19.9	28%

Figure 9 – Nominal monthly fuel prices, 2008-2015 (November)