New England Fishery Management Council
50 WATER STREET | NEWBURYPORT, MASSACHUSETTS 01950 | PHONE 978 465 0492 | FAX 978 465 3116
E.F. "Terry" Stockwell, III, *Chairman* | Thomas A. Nies, *Executive Director*

MEMORANDUM

DATE: **June 26, 2015**

TO: **Council Members**

FROM: Tom Nies, Executive Director

SUBJECT: **Updated At-Sea Monitoring report**

This is the updated version of the at-sea monitoring report presented by Mr. Chad Demarest of the Social Science Branch (NEFSC) at the June 2015 Council meeting. It includes an additional table of results summarized at the sector level.

Preliminary Evaluation of the Impact of Groundfish Sector-Funded At Sea Monitoring on Groundfish Fishery Profits

Draft
June 19, 2015

Chad Demarest
Social Sciences Branch
NOAA NEFSC

This information is distributed solely for the purpose of pre-dissemination review. It has not been formally disseminated by NOAA. It has no official status with the agency and does not represent final agency determination or policy.

Introduction

NOAA Fisheries (the Agency) has indicated that, beginning in FY2015, it will no longer fund the groundfish Sector fishery's portion of the At-Sea Monitoring (ASM) program. Consistent with the provisions of the Northeast Multispecies Fishery Management Plan, the Agency will require groundfish sectors to share in the costs associated with this program, a condition of fishing within the sector management system (NEFMC 2009).

The New England Fishery Management Council (Council) passed the following motion at its April meeting:

> 1. Request that (the Agency) prepare an estimate of the cost/revenue ratio for the at sea Sector monitoring based on the current approach (e.g., in terms of CVs and methodology) for fishing years 2015 (i.e., taking account of reduced ACLs for some species and likelihood a reduction in the number of trips);
>
> 2. Initiate a framework to address the perception (to be confirmed or rejected based on number 1) that the fishery will not be viable under the current approach for at sea monitoring.

This draft report examines aspects of the cost/revenue ratio for the groundfish sector fishery as it contemplates the transition to ASM cost-sharing for FY 2015, consistent with Part 1 of the Council motion.

Expressly, this report does not address other issues implied by Part 2 of the Council motion, such as increasing the cost-efficiency of ASM coverage or modifying existing monitoring requirements.

Anticipated costs to the groundfish sector fishery in FY 2015

Monitoring costs are estimated using a four step process:

1. calculate the number of days vessels carried an at-sea monitor under the ASM program in each year of the program;
2. assign an industry cost to each day;
3. estimate the number of anticipated change in days observed under the ASM program for FY2015; and
4. apportion the costs at the appropriate level (e.g. Sector, Homeport State, etc).

Dataset-The Data Management and Imputation System (DMIS) database is used for determining the population of trips and their associated attributes (input and output quantities). These data are joined directly with the ASM tables in the Observer Program Database (i.e., ASMTRP in OBDBS) to correctly assign for each trip the presence or absence of an at-sea monitor. The monitoring cost associated with each observed day is assumed to be **$710**(A. Martins, *pers comm.*). In this report, the cost is applied to any portion of an entire day by rounding up to a whole number any partial days, such that a 2 hour ASM trip has a cost of $710 and a 25 hour ASM trip has a cost of $1,420, etc. This method is consistent with advice received from the NEFSC's Fisheries Sampling Branch.

ASM Coverage Rates- The number of fishery and ASM days and trips are represented in Table 1, below. ASM coverage rates declined from FY 2010 to 2013 with an uptick in FY 2014 to nearly 4K ASM days, or 19% of the total days. Note that the days reported here are estimated using the "monitoring cost observed day" method of rounding up to the nearest whole day and are not equal to "days fished" in the groundfish fishery.

Table 1 - Summary of ASM coverage in the groundfish fishery, FY 2010 – 2014 (*2014 data are preliminary)

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%*

Using the Quota Change Model to Predict FY 2015 Effort-To estimate the number of ASM days likely to be required for FY 2015, we use the relative change in number of days fished predicted from the Quota Change Model (QCM). The QCM has a known bias toward underestimating future fishery effort levels due to its use of net revenue maximization in the optimization function—essentially, the model predicts that most unprofitable trips will not occur but, year after year, this prediction is confounded by the reality that fisherman's welfare functions are heterogeneous. To predict the change in effort between FY 2014 and 2015, we use the relative inter-annual changes in number of trips from the QCM, not the absolute values, as relative changes are more likely to be unbiased (see Table 2Error: Reference source not found).

Applying the relative change in fishing effort predicted in the QCM to the actual fishing trips implies that FY 2015 may see 18,570 total days available for ASM coverage on 8,645 trips. Given than the ASM coverage in FY 2014 is calculated here at 18%, and is forecasted for FY 2015 at 20% (a 24% target rate minus the 4% SBRM-mandated observer coverage level) we get an estimate of **3,714 ASM days on 1,730 ASM trips**. At the rate of $710/day, the cost of this monitoring to groundfish sectors would be approximately **$2.64 million** dollars. This estimate assumes that groundfish sectors are responsible for monitoring costs beginning on May 1, 2015—actual industry costs will be lower depending on the initial date of industry responsibility (anticipated to be some time in August of 2015). To project vessel level anticipated monitoring costs, the total cost is apportioned across each vessel predicted to land groundfish in FY 2015 (as per the QCM) proportional to their allocation of hypothetical costs in FY 2014. If a vessel carried ASM observers often enough to account for 0.1% of the FY 2014 cost ($2,729), that same vessel would incur predicted ASM costs of 1% of the FY 2015 total ($2,637). Note that this method makes no attempt to predict which trips or vessels will carry ASM's in FY15.

Table 2 - QCM effort predictions FY 2010 – 2014

Fishing Year	DAYS ABSENT	TRIPS	Predicted year-on-year change	Actual year-on-year change
2010	not estimated			
2011	21,055	13,894		
2012	16,983	8,717	-37%	-11%
2013	13,778	6,913	-21%	-20%
2014	13,180	6,593	-5%	-9%
2015	13,325	6,064	-8%	

Hypothetical monitoring costs as a percentage of groundfish fishery profits

Revenues from all species caught on groundfish trips are reported from the DMIS. Table 3shows that ASM costs have averaged between 2.5-4.5% of gross revenues on all groundfish trips.

Table 3 - Total groundfish fishery revenues and ASM costs (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

	2010	2011	2012	2013	2014*	2015**
Total revenues	114,759	124,942	96,942	80,813	79,348	72,081
ASM	5,190	4,933	3,081	1,990	2,729	2,637
ASM as pct total revenues	*4.5%*	*3.9%*	*3.2%*	*2.5%*	*3.4%*	*3.7%*

Industry profits are discussed here as "return to owner" and are estimated using the following calculations:

(1) Return to owner = gross revenue – (crew share + variable costs + fixed costs + sector costs),

where

(2) Fixed costs = (Repairs, Maintenance, Upgrades and Improvements) + (Business, Haul-out and Other costs)

Crew shares are a function of the number of crew, size of vessel and type of trip (single- or multi-day) and estimates of crew share fall between 25-35% of total revenues for most trips with a crew size greater than 2. Variable costs are estimated using models generated from the Northeast Observer Program data (Das 2014). Fixed costs are estimated using models generated from the 2011 and 2012 Owner's Fixed Cost Survey and range from 10-18% of annual gross revenues (DAS unpublished). Transfer payments between vessel owners for quota leases are not included.

Table 4 - Summary of 2011-2012 Fixed Cost Survey data (nominal dollars)

Cost Category	Length Groups	N	Mean ($)	SD ($)
Repair/Maintenance	Over 80ft	42	105,916	357,757
	40ft-80ft	280	29,583	139,277
	<40ft	373	9,209	27,771
Upgrade/Improvement (After depreciation)				
	Over 80ft	27	5,778	18,862
	40ft-80ft	172	3,798	15,251
	<40ft	236	1,669	7,385
Business	Over 80ft	43	208,650	452,332
	40ft-80ft	257	40,779	177,891
	<40ft	381	13,865	46,338
Haul-out cost	Over 80ft	20	10,619	49,806
	40ft-80ft	198	2,770	15,672
	<40ft	301	1,139	7,335

Table 5–Estimated crew share, RMUI, Business/Haul-out and Sector Costs by vessel size class, mean and std dev of FY10-15 per-vessel estimates (nominal dollars)

Length	Crew share		RMUI		Business and Haul-out		Sector costs	
cat	Mean ($)	SD ($)	Mean ($)	SD ($)	Mean ($)	SD ($)	Mean ($)	SD ($)
<30'	10,200	7,925	3,968	386	8,980	809	525	379
30'to<50'	36,809	6,989	14,790	337	20,516	561	1,408	296
50'to<75'	108,902	13,558	40,905	754	63,720	1,223	4,948	740
75'+	281,614	20,597	74,569	1,402	145,030	13,277	12,679	1,097

Vessels do not generate all of their revenues in the groundfish fishery and fixed costs (RMUI, Business/Haul-out) are applicable to all aspects of each vessel's fishing business. Consequently, these costs are calculated for each entity and for the purposes of estimating groundfish fishery returns to owner they are pro-rated by the percent of total revenues each vessel obtained on groundfish trips (the proration formula is simply all revenues on groundfish trips divided by all revenues). Table 6summarizes the distribution of groundfish fishery percentages across vessel size classes and years.

Table 6 - Percentage of all revenues generated on groundfish trips

Length cat	2010		2011		2012		2013		2014		2015	
	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev	mean	std dev
<30'	42%	41%	66%	40%	71%	41%	63%	42%	54%	45%	-	-
30'to<50'	62%	37%	64%	34%	63%	37%	66%	37%	62%	36%	59%	40%
50'to<75'	54%	37%	57%	38%	55%	40%	59%	40%	59%	39%	60%	39%
75'+	68%	39%	67%	41%	64%	43%	73%	39%	81%	30%	71%	38%

Variable costs are estimated as a function of fuel prices, trip duration, number of crew and vessel characteristics. They average between 27-38% of total fishery revenues (Table 7).

Table 7 - Summary of estimated variable cost by size class (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

		2010	2011	2012	2013	2014*	2015**
<30'	Total revenue	449	1,381	805	489	284	199
	Variable cost	49	298	216	180	71	51
30'to<50'	Total revenue	28,987	31,375	24,601	16,428	17,527	7,301
	Variable cost	3,411	4,254	3,922	2,816	2,430	1,470
50'to<75'	Total revenue	38,934	43,194	32,974	28,944	27,743	26,837
	Variable cost	10,326	13,490	12,008	10,347	8,077	7,735
75'+	Total revenue	46,389	48,992	38,561	34,952	33,794	37,743
	Variable cost	17,053	26,078	19,614	17,374	13,530	14,445
	Sum – Total revenue	114,759	124,942	96,942	80,813	79,348	72,081
	Sum – Variable cost	30,840	44,119	35,761	30,718	24,108	23,700
	Variable cost as pct of total revenue	*27%*	*35%*	*37%*	*38%*	*30%*	*33%*

Including crew share, fixed and variable costs provides a more complete picture of the potential impacts of industry-funded ASM on groundfish fishery profits. Table 8disaggregates the components of returns to owner (RTO), and shows that ASM costs would have ranged from a low of 22% in FY10 to a high of just over 40% of RTO in FY13. Figure 1 shows the distribution of RTO by year for all vessels, and Figure 2 - Figure 4 show the same for three different vessel size classes.

Table 8 - Estimated returns to owner and ASM costs (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

	2010	2011	2012	2013	2014*	2015**
Total revenues	114,759	124,942	96,942	80,813	79,348	72,081
Variable costs	30,840	39,868	35,761	30,718	24,108	23,700
Crew share	34,362	37,528	29,332	24,542	23,969	22,091
RMUI	8,736	8,245	8,069	7,290	7,112	6,178
Business/Haul-out	15,083	14,128	13,596	12,089	11,528	10,061
Sector fees	1,772	1,842	1,396	1,263	1,152	1,311
Return-to-owner	23,966	23,332	8,787	4,911	11,479	8,740
ASM	5,190	39,868	3,081	1,990	2,729	2,637
ASM as pct RTO	*22%*	*26%*	*35%*	*41%*	*24%*	*30%*
Number active ves-sels	440	384	379	319	298	221

Figure 1 – Return to Owner (RTO) by year for all vessels, vessel level histograms (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

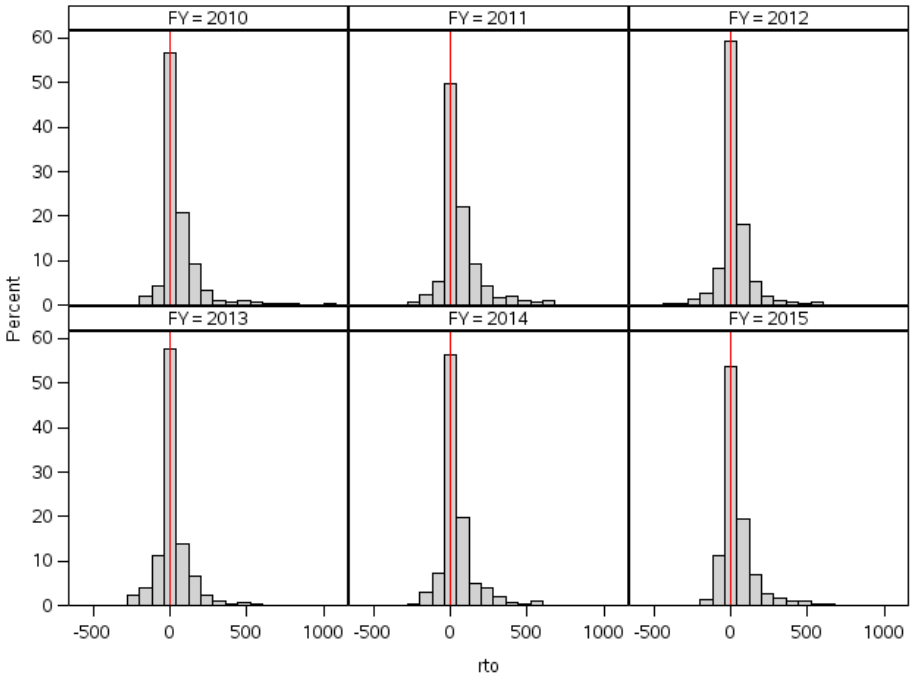

Figure 2 - Return to Owner (RTO) by year for vessels less than 50ft, vessel level histograms (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

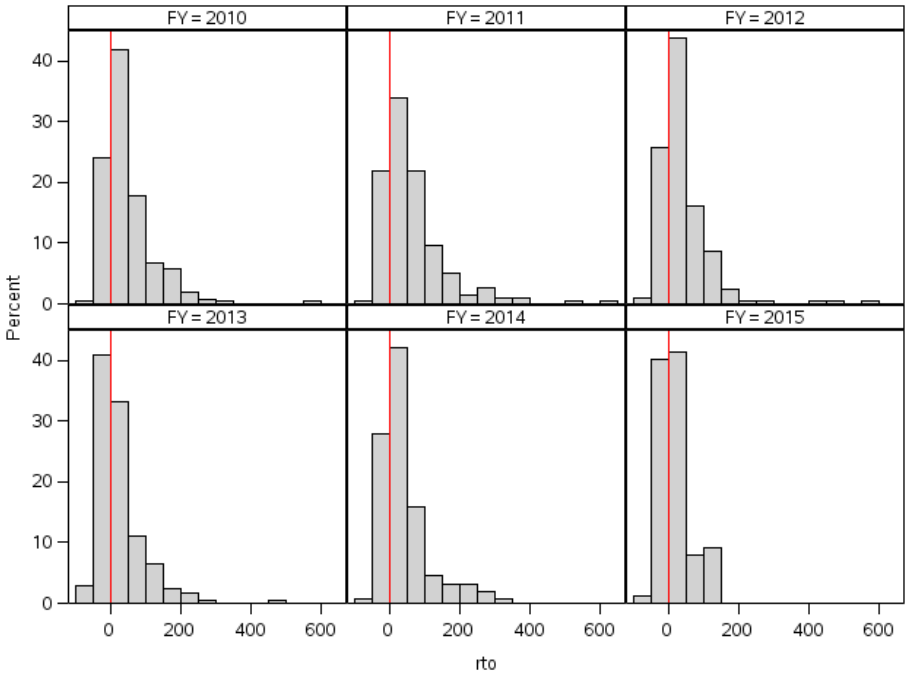

Figure 3 - Return to Owner (RTO) by year for vessels greater than or equal to 50ft and less than 75ft, vessel level histograms (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

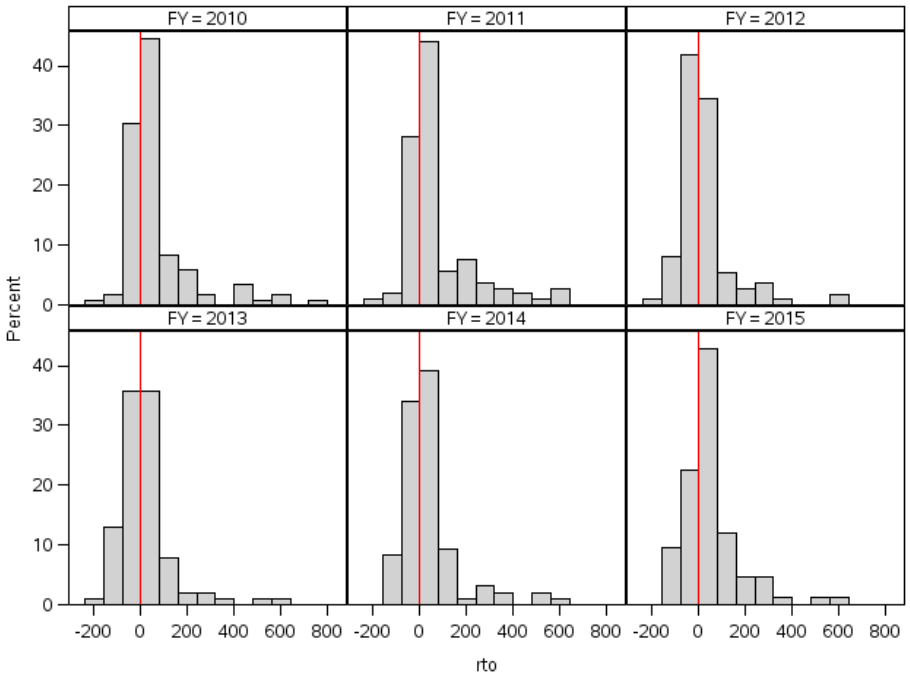

Figure 4 - Return to Owner (RTO) by year for vessels greater than or equal to 75ft, vessel level histograms (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

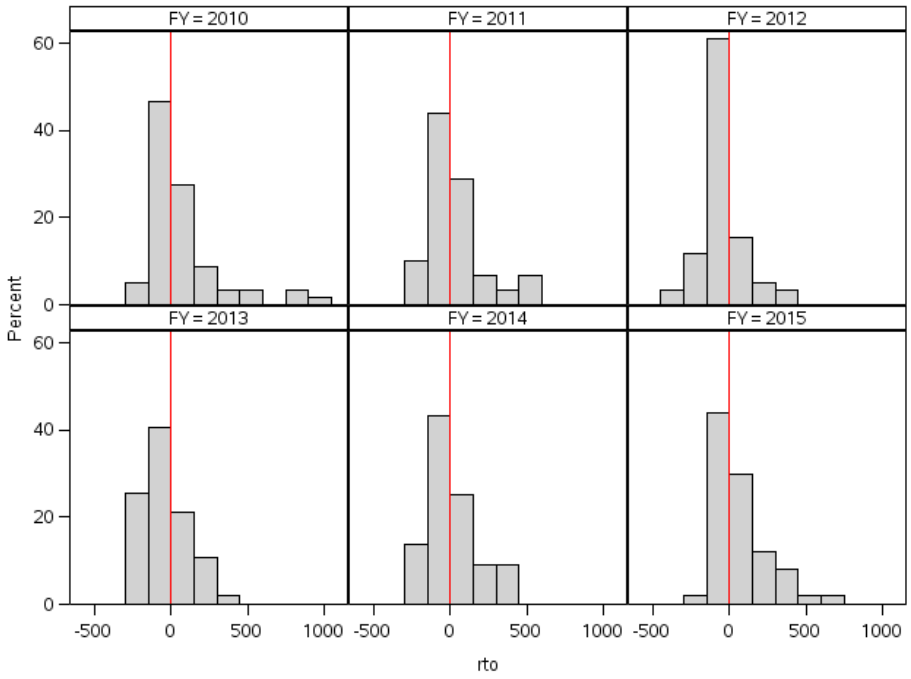

Table 9 shows that in all years since FY 2010 roughly 30% of groundfish vessels have operated with negative returns to owner and that in FY 2013 nearly half the vessels were in this situation. Error: Reference source not found extends this by showing the equivalent numbers *if ASM coverage had been industry-funded at $710/day*. The most significant detail in this table is the prediction that, with ASM coverage incorporated as a variable cost for the groundfish fishery, roughly 60% of vessels would be operative with negative returns to owner. This point

is addressed in the *Discussion* section (below) but we will note here that this is an overestimate, primarily because ASM will be industry-funded for only part of the fishing year and this estimate is based on full-year coverage. Nonetheless, the predicted 20% increase in the number of vessels operating with negative RTO ASM coverage included in FY 2015, relative to prior years where ASM costs caused only 2-5% more vessels to fall below the zero-RTO line, is indicative of a forecast for substantial reductions in profit margins due primarily to the reduction in GOM cod allocations hitting smaller inshore GOM vessels most directly. These vessels accounted for over 40% of total (hypothetical) ASM costs in FY 2014 while accounting for 28% of total gross revenues.

Table 9 – Estimated counts of vessels with positive and zero or negative returns to owner (ASM costs not included) by year (*2014 data are preliminary, **2015 data are predictions)

	2010	2011	2012	2013	2014	2015
# vessels RTO <=0	133	114	157	156	111	86
# vessels RTO >0	307	270	222	163	187	135
proportion fleet <=0	*30%*	*30%*	*41%*	*49%*	*37%*	*39%*
Total number of vessels	440	384	379	319	298	221

Table 10 – Estimated counts of vessels with positive and zero or negative returns to owner by year, including hypothetical ASM costs (*2014 data are preliminary, **2015 data are predictions)

	2010	2011	2012	2013	2014	2015
# vessels RTO <=0	159	136	173	164	120	130
# vessels RTO >0	281	248	206	155	178	91
proportion fleet <=0	*36%*	*35%*	*46%*	*51%*	*40%*	*59%*
Total number of vessels	440	384	379	319	298	221

A note about financing ASM coverage

The mechanism by which ASM coverage is financed may have important consequences for the function of the ASM program overall and the quality of the data it provides. Financing mechanisms should strive to decouple the relationship between taking a groundfish trip and the cost of ASM coverage for that trip.An obvious example of a coupled relationship would be direct funding by the vessel carrying the monitor. In this instance, a vessel would have a strong incentive to either avoid carrying the monitor or to modify their fishing practices such that they minimize their direct monitoring costs. A slightly decoupled version of this scenario may be a rolling sector level invoice, where the sector pays for ASM trips as they accrue, invoicing their members by whatever mechanism they deem most suitable but spreading the total cost across their membership. But even at this removed level the decision to carry a monitor and fishing practices once a monitor is onboard are not decoupled—both may influence sector-level ASM costs and by extension costs to owners/members. Vessels may still elect to minimize costs by cancelling trips outright or shortening trips relative to what would have occurred in the absence of monitoring. Second-order effects are important as well. ASM cost minimization strategies impart additional operating costs on vessels, which operators may attempt to recoup by fishing longer and/or differently when monitors are not present. This imparts further costs on the users of the valuable data that the ASM program provides.

One financing mechanism that may mitigate against strategic decisions on the part of operators, decoupling ASM costs from fishing trip decisions, would be to link aggregate industry ASM costs to PSC or ACE allocations, spreading the cost of ASM coverage as widely as possible and divorcing the sector's and member's costs from the incidence of carrying an observer. Here is a back-of-the-envelope calculation: assuming FY 2015 realized ASM costs are in the vicinity of $2.6 million and that the industry funds some 60% of that total (for trips occurring after August), a fee of $1,100 per 1% of PSC (or $1,200 per 100k lbs of ACE) may be sufficient to cover ASM costs. These are examples. Industry financing mechanisms should be subject to additional study, but it is critical to understand that the method by which ASM is industry-financed *will* affect the quality of data provided by the program. Only careful consideration will ensure that a government subsidized ASM program and one that is industry funded provide commensurate and high-quality data.

Discussion of ASM funding and Returns to Owner

The cost of ASM coverage was roughly 25% of net owner's share of fishing revenues (RTO) in 2014, down from just over 40% in 2013. Returns to owner are estimated to have declined by annually from 2010-13, with an uptick in 2014. This report is restricted to the groundfish fishery in isolation. As demonstrated in Table 6, vessels engaged in the groundfish fishery do generate the majority of their revenues from this fishery, but not all—10-40% of vessel-level revenues appear to be generated in other fisheries. Implied reductions in aggregate vessel level profits will be mitigated by participation in other fisheries which are exempt from ASM coverage requirements. In the future it may be more meaningful to examine the potential impact of industry-funded ASM in light of total enterprise profits, for example at the vessel or owner level. This will be the basis for future work on this issue. The fact remains that almost 40 percent of active vessels are estimated to have earned negative returns to owner from the groundfish fishery portion of their business in FY 2014, and this number has been since 2010. Predictions for FY 2015 are that nearly 60% of the fleet could see negative returns to owner when full 2015 ASM costs are factored in. This is an over-estimate, as the industry will only be responsible for ASM marginal costs from late summer onward, but it indicates that industry funded ASM could result in restructuring of the fleet, though changes are hard to predict since at least parts of the fishery have remained active despite estimated negative returns. Additionally, profit declines may have second-order effects such as the laying off of crew, reductions in maintenance and safety expenditures, etc, and these reductions in necessary inputs affect upstream shoreside markets. Reductions in profits due to industry-funded ASM may impede the ability for owners to make capital investments and may affect the ability of domestic producers to compete in the ever-more-globalized marketplace.

Table 11 -Table 12includedetailed disaggregated RTO estimates at the vessel size class, homeport state and sector level.

These estimates contain many uncertainties. Among the most important are:

- the Quota Change Model has a lengthy set of embedded assumptions not highlighted here and, while it has predicted within 5% accuracy from 2012-2014, previous performance is no guarantee of accuracy;
- the forecast for an 8% decline in trips may or may not prove accurate or average trip length may change, noting that FY2015 is an exceedingly difficult year to predict outcomes for, particularly for fishing in the Gulf of Maine stock area;
- the 20% target for ASM coverage may not be realized;
- FY2015 predictions assume that active fishing vessels will finance ASM and this may or may not prove accurate,
- the distribution of trips across states, size classes and sectors is may not be consistent with that observed in FY2014, making these disaggregated estimates more uncertain than the aggregate;
- financing mechanisms for industry-funded ASM are unclear and it seems possible that some owners may treat ASM as a variable cost payable from the crew's share; and
- the implementation of industry-funded ASM will, itself, affect the accuracy of predictions for FY2015 as those predictions were generated without consideration of ASM costs.

Table 11 - Estimated returns to owner by homeport state, with ASM costs (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

		2010	2011	2012	2013	2014*	2015**
CT	Total revenue	679	839	639	398	317	251
	Variable cost	160	185	125	116	54	59
	Crew share	208	252	188	125	98	80
	RMUI	82	74	63	51	47	11
	Bus/Haul	130	118	97	79	64	20
	Sector fee	2	2	1	2	0	2
	RTO	97	208	165	24	54	80
	ASM cost	30	8	7	6	4	9
	Numvsls	7	5	6	5	6	4
MA	Total revenue	78,474	84,349	63,508	53,188	53,921	52,762
	Variable cost	22,196	29,169	25,777	22,075	18,014	18,222
	Crew share	23,373	25,262	19,149	16,053	16,218	16,119
	RMUI	6,137	5,791	5,669	5,139	5,161	4,732
	Bus/Haul	10,024	9,279	8,945	8,082	8,032	7,359
	Sector fee	1,204	1,238	906	817	773	949
	RTO	15,540	13,610	3,061	1,023	5,723	5,382
	ASM cost	3,496	3,542	2,107	1,359	1,856	1,930
	Numvsls	234	204	196	168	155	131
ME	Total revenue	18,974	18,746	18,091	16,026	13,691	9,565
	Variable cost	4,471	5,369	6,040	5,636	3,646	3,152
	Crew share	5,800	5,651	5,485	4,897	4,181	2,907
	RMUI	979	949	1,159	1,154	896	719
	Bus/Haul	2,076	2,005	2,381	2,241	1,702	1,387
	Sector fee	366	367	344	314	259	240
	RTO	5,282	4,403	2,682	1,785	3,007	1,161
	ASM cost	808	656	547	305	432	350
	Numvsls	43	46	48	43	32	24
NC	Total revenue	718	611			178	
	Variable cost	188	223			51	
	Crew share	226	193			57	
	RMUI	80	60			21	
	Bus/Haul	157	107			26	
	Sector fee	4	6			1	
	RTO	62	21			23	
	ASM cost	18	9			11	
	Numvsls	6	6			4	
NH	Total revenue	4,508	6,458	4,764	2,882	2,658	1,410
	Variable cost	497	781	723	573	478	330
	Crew share	1,335	1,988	1,484	859	770	398
	RMUI	343	297	254	259	215	136
	Bus/Haul	542	518	411	416	339	221
	Sector fee	72	109	70	43	40	29
	RTO	1,719	2,764	1,824	732	816	296
	ASM cost	387	307	186	125	203	52
	Numvsls	31	25	20	21	18	14
NJ	Total revenue	941	1,168	333	354	251	
	Variable cost	234	334	121	107	53	
	Crew share	285	322	105	113	80	
	RMUI	92	92	66	34	27	
	Bus/Haul	170	175	150	63	46	
	Sector fee	10	8	3	3	1	
	RTO	150	236	-112	34	42	
	ASM cost	34	39	10	12	12	
	Numvsls	20	17	11	10	9	

NY	Total revenue	2,487	2,853	2,131	1,673	2,743	1,777
	Variable cost	545	803	670	509	539	397
	Crew share	724	826	630	531	840	568
	RMUI	221	207	201	146	242	154
	Bus/Haul	398	399	371	284	439	291
	Sector fee	26	29	13	16	21	21
	RTO	572	589	246	187	661	345
	ASM cost	64	51	37	53	62	65
	Numvsls	38	33	38	26	27	9
RI	Total revenue	7,764	9,698	7,104	6,130	5,527	6,004
	Variable cost	2,490	2,970	2,233	1,686	1,265	1,489
	Crew share	2,346	2,963	2,172	1,913	1,703	1,918
	RMUI	765	754	616	486	491	401
	Bus/Haul	1,545	1,508	1,194	900	871	747
	Sector fee	87	82	58	68	57	70
	RTO	530	1,420	832	1,078	1,140	1,379
	ASM cost	349	319	173	125	149	220
	Numvsls	56	46	54	44	45	35

Table 12 - Estimated returns to owner by vessel size class, with ASM costs (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

		2010	2011	2012	2013	2014	2015
<30'	Total revenue	449	1,381	805	489	284	
	Variable cost	49	298	216	180	71	
	Crew share	95	294	156	106	60	
	RMUI	38	61	52	52	35	
	Bus/Haul	90	135	115	122	81	
	Sector fee	3	20	9	8	4	
	RTO	175	574	258	21	34	
	ASM cost	18	90	41	19	46	
	Numvsls	28	26	18	18	16	
30'to<50'	Total revenue	28,987	31,375	24,601	16,428	17,527	7,301
	Variable cost	3,411	4,254	3,922	2,816	2,430	1,470
	Crew share	7,919	8,744	7,064	4,657	4,889	2,099
	RMUI	2,348	2,033	1,986	1,681	1,473	873
	Bus/Haul	3,162	2,839	2,726	2,288	1,950	1,141
	Sector fee	325	354	260	181	157	153
	RTO	11,822	13,151	8,644	4,805	6,627	1,566
	ASM cost	2,161	1,517	1,140	521	883	267
	Numvsls	235	192	192	153	141	85
50'to<75'	Total revenue	38,934	43,194	32,974	28,944	27,743	26,837
	Variable cost	10,326	13,490	12,008	10,347	8,077	7,735
	Crew share	12,454	13,817	10,549	9,242	8,834	8,567
	RMUI	3,026	2,884	2,884	2,752	2,681	2,405
	Bus/Haul	4,817	4,546	4,548	4,369	4,074	3,601
	Sector fee	613	660	486	438	443	492
	RTO	7,697	7,797	2,499	1,795	3,634	4,038
	ASM cost	1,557	1,655	953	760	866	982
	Numvsls	119	107	110	101	97	84
75'+	Total revenue	46,389	48,992	38,561	34,952	33,794	37,743
	Variable cost	17,053	21,826	19,614	17,374	13,530	14,445
	Crew share	13,894	14,673	11,564	10,537	10,186	11,381
	RMUI	3,325	3,267	3,146	2,805	2,923	2,893
	Bus/Haul	7,014	6,607	6,208	5,310	5,423	5,301
	Sector fee	831	809	641	636	547	664
	RTO	4,273	1,810	-2,613	-1,709	1,184	3,059
	ASM cost	1,454	1,670	947	689	934	1,381
	Numvsls	58	59	59	47	44	50

Table 13 - Estimated returns to owner by sector affiliation, with ASM costs (values reported in constant 2014 $1,000, *2014 data are preliminary, **2015 data are predictions)

SECTOR_NAME	Data	2010	2011	2012	2013	2014	2015
Common	Sum - total_revenue	6,910	5,780	3,564	2,449	3,408	1,411
	Sum - variable_cost	1,200	906	491	528	541	279
	Sum - crew_share1	1,921	1,532	955	722	992	437
	Sum - rmui1	872	579	490	436	392	87
	Sum - bushaul1	1,324	883	780	745	600	194
	Sum - sect_cost	0	0	0	0	0	0
	Sum - rto	1,548	1,869	836	-3	863	408
	Sum - obs_cost	246	56	31	18	26	35
	Sum - n	138	103	89	75	74	13
Fixed Gear Sector	Sum - total_revenue	5,792	6,191	3,861	3,525	4,753	299
	Sum - variable_cost	656	766	634	506	510	51
	Sum - crew_share1	1,403	1,557	978	928	1,281	82
	Sum - rmui1	407	345	359	307	302	161
	Sum - bushaul1	454	393	393	337	342	191
	Sum - sect_cost	69	49	19	21	19	12
	Sum - rto	2,803	3,080	1,479	1,425	2,299	-198
	Sum - obs_cost	545	341	251	139	234	128
	Sum - n	32	25	28	23	20	13
Maine Coast Community Sector	Sum - total_revenue		2,371	2,385	1,755	1,999	1,023
	Sum - variable_cost		454	507	325	273	192
	Sum - crew_share1		652	657	486	538	270
	Sum - rmui1		176	211	169	125	79
	Sum - bushaul1		298	360	275	198	120
	Sum - sect_cost		46	44	31	33	25
	Sum - rto		745	606	469	832	338
	Sum - obs_cost		144	118	46	112	71
	Sum - n		15	17	13	11	7
NCCS	Sum - total_revenue		132	21			
	Sum - variable_cost		25	8			
	Sum - crew_share1		35	2			
	Sum - rmui1		28	9			
	Sum - bushaul1		35	19			
	Sum - sect_cost		1	0			
	Sum - rto		8	-17			
	Sum - obs_cost		5	1			
	Sum - n	2	5	6	2	1	
NEFS 10	Sum - total_revenue	2,196	3,826	3,154	1,435	1,097	688
	Sum - variable_cost	292	614	561	269	173	150
	Sum - crew_share1	671	1,200	984	453	350	216
	Sum - rmui1	254	304	298	209	160	132
	Sum - bushaul1	332	434	393	282	216	171
	Sum - sect_cost	22	49	39	18	13	15
	Sum - rto	624	1,225	877	204	184	4
	Sum - obs_cost	163	206	150	48	61	58
	Sum - n	19	19	20	11	9	7
NEFS 11	Sum - total_revenue	4,613	4,570	3,774	2,356	3,107	1,398
	Sum - variable_cost	440	409	387	297	469	312
	Sum - crew_share1	1,379	1,380	1,166	743	957	415
	Sum - rmui1	290	192	170	146	207	168
	Sum - bushaul1	412	315	268	216	323	259
	Sum - sect_cost	78	78	52	36	45	43
	Sum - rto	2,014	2,196	1,731	919	1,105	202
	Sum - obs_cost	354	213	154	80	215	160
	Sum - n	23	18	15	13	16	14

NEFS 12	Sum - total_revenue		1,332	1,140	995		
	Sum - variable_cost		271	265	260		
	Sum - crew_share1		426	365	319		
	Sum - rmui1		71	71	101		
	Sum - bushaul1		122	120	169		
	Sum - sect_cost		32	21	17		
	Sum - rto		410	298	130		
	Sum - obs_cost		69	47	53		
	Sum - n	3	4	4	5		
NEFS 13	Sum - total_revenue	5,776	8,397	6,972	3,979	4,180	4,759
	Sum - variable_cost	2,203	3,454	3,066	1,561	1,349	1,432
	Sum - crew_share1	1,798	2,618	2,177	1,247	1,311	1,493
	Sum - rmui1	608	697	630	306	353	362
	Sum - bushaul1	1,190	1,404	1,216	569	632	644
	Sum - sect_cost	95	106	74	41	42	47
	Sum - rto	-119	118	-190	254	492	781
	Sum - obs_cost	229	287	170	85	131	132
	Sum - n	22	24	30	23	22	22
NEFS 2	Sum - total_revenue	15,264	15,514	11,012	8,296	7,492	6,426
	Sum - variable_cost	3,278	3,777	3,587	2,935	2,216	1,747
	Sum - crew_share1	4,650	4,749	3,342	2,432	2,134	1,917
	Sum - rmui1	1,251	1,025	1,048	957	852	761
	Sum - bushaul1	2,261	1,662	1,668	1,511	1,294	1,155
	Sum - sect_cost	250	252	205	166	149	180
	Sum - rto	3,574	4,049	1,160	295	847	665
	Sum - obs_cost	551	484	369	192	229	235
	Sum - n	40	34	35	30	27	29
NEFS 3	Sum - total_revenue	6,146	5,881	4,737	2,993	2,456	1,616
	Sum - variable_cost	580	786	709	534	374	340
	Sum - crew_share1	1,669	1,584	1,387	851	708	461
	Sum - rmui1	381	335	339	304	268	192
	Sum - bushaul1	412	363	380	330	296	196
	Sum - sect_cost	64	73	50	29	25	32
	Sum - rto	3,040	2,740	1,872	944	785	395
	Sum - obs_cost	498	447	255	86	175	179
	Sum - n	33	31	28	23	20	15
NEFS 5	Sum - total_revenue	3,921	3,833	2,837	3,056	2,660	2,902
	Sum - variable_cost	1,453	1,366	1,111	847	627	644
	Sum - crew_share1	1,240	1,217	902	962	818	928
	Sum - rmui1	408	328	275	285	272	228
	Sum - bushaul1	824	618	520	526	515	399
	Sum - sect_cost	50	37	27	40	29	39
	Sum - rto	-54	268	2	396	399	664
	Sum - obs_cost	223	182	110	97	124	105
	Sum - n	28	21	23	22	19	18
NEFS 6	Sum - total_revenue	4,383	5,181	4,128	3,388	2,977	5,057
	Sum - variable_cost	1,139	1,418	1,464	1,175	891	1,340
	Sum - crew_share1	1,321	1,605	1,270	1,084	953	1,576
	Sum - rmui1	321	230	213	234	179	200
	Sum - bushaul1	649	478	446	398	311	339
	Sum - sect_cost	81	89	78	67	58	71
	Sum - rto	872	1,361	658	430	585	1,532
	Sum - obs_cost	90	121	84	88	71	79
	Sum - n	6	4	4	5	4	8
NEFS 7	Sum - total_revenue	4,904	4,349	3,383	2,857	3,317	2,861
	Sum - variable_cost	1,993	1,921	1,624	1,705	1,404	1,368
	Sum - crew_share1	1,498	1,327	1,031	869	1,022	865
	Sum - rmui1	534	487	377	342	423	344

	Sum - bushaul1	869	768	579	516	607	503
	Sum - sect_cost	62	46	30	27	25	28
	Sum - rto	-52	-199	-256	-602	-164	-248
	Sum - obs_cost	190	203	112	78	104	90
	Sum - n	11	10	9	8	10	7
NEFS 8	Sum - total_revenue	5,603	4,684	3,794	2,832	2,955	2,879
	Sum - variable_cost	2,232	2,240	2,420	1,555	1,330	1,178
	Sum - crew_share1	1,762	1,459	1,193	906	936	921
	Sum - rmui1	449	432	361	272	354	270
	Sum - bushaul1	761	726	595	432	562	415
	Sum - sect_cost	90	67	47	43	44	47
	Sum - rto	309	-240	-822	-376	-270	48
	Sum - obs_cost	196	146	97	91	84	82
	Sum - n	7	8	6	4	5	4
NEFS 9	Sum - total_revenue	13,782	19,418	13,502	13,404	13,052	13,931
	Sum - variable_cost	5,536	9,258	7,046	6,890	5,506	5,523
	Sum - crew_share1	4,251	5,952	4,143	4,100	3,991	4,264
	Sum - rmui1	892	1,145	1,275	1,183	1,255	1,255
	Sum - bushaul1	1,608	2,017	2,198	2,056	2,153	2,119
	Sum - sect_cost	229	299	195	215	200	241
	Sum - rto	1,267	747	-1,354	-1,040	-52	530
	Sum - obs_cost	550	865	344	312	427	476
	Sum - n	15	19	22	21	21	21
Port Clyde Community Ground-fish Sector	Sum - total_revenue	1,798					
	Sum - variable_cost	304					
	Sum - crew_share1	482					
	Sum - rmui1	132					
	Sum - bushaul1	225					
	Sum - sect_cost	28					
	Sum - rto	627					
	Sum - obs_cost	198					
	Sum - n	17					
Sustainable Harvest Sector 1	Sum - total_revenue	32,524	32,904	28,427	27,487	25,893	1,733
	Sum - variable_cost	9,272	11,947	11,813	11,327	8,444	712
	Sum - crew_share1	9,988	10,067	8,712	8,440	7,976	534
	Sum - rmui1	1,824	1,820	1,925	2,033	1,964	141
	Sum - bushaul1	3,536	3,507	3,636	3,710	3,463	217
	Sum - sect_cost	600	596	500	492	450	9
	Sum - rto	7,304	4,967	1,841	1,485	3,595	120
	Sum - obs_cost	1,102	1,159	773	576	735	22
	Sum - n	38	38	41	41	39	6
Sustainable Harvest Sector 3	Sum - total_revenue						25,097
	Sum - variable_cost						8,433
	Sum - crew_share1						7,713
	Sum - rmui1						1,798
	Sum - bushaul1						3,138
	Sum - sect_cost						515
	Sum - rto						3,500
	Sum - obs_cost						782
	Sum - n						37
Tri-State Sector	Sum - total_revenue	880	580				
	Sum - variable_cost	224	254				
	Sum - crew_share1	256	171				
	Sum - rmui1	80	53				
	Sum - bushaul1	165	105				
	Sum - sect_cost	9	10				
	Sum - rto	146	-12				
	Sum - obs_cost	36	6				

Sum - n	6	6	2

REFERENCES

New England Fishery Management Council (NEFMC). 2009. Final Amendment 16 to the Northeast Multispecies Fishery Management Plan Including a Final Supplemental Environmental Impact Statement and an Initial Regulatory Flexibility Analysis. Newburyport, MA.

Min-Yang A. Lee and Eric M. Thunberg.2013. An Inverse Demand System for New England Groundfish: Welfare Analysis of the Transition to Catch Share Management Am. J. Agr. Econ.2013.

Chhandita Das. 2014. Northeast trip cost data - overview, estimation, and predictions. NOAA Technical Memorandum NMFS-NE-227, 2014.

Chhandita Das. 2014. An overview of the annual cost survey protocol and results in the northeastern region (2007-2009). NOAA Tech Memo NMFS NE-226.

Chhandita Das. 2015. Fisheries Annual Fixed Cost Data Collection and Estimation Methodology: An application in the Northeast, U.S. NOAA Tech Memo (in review).