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

MEMORANDUM

DATE: January 15, 2016

TO: Scientific and Statistical Committee

CC: Groundfish Committee

FROM: Groundfish Plan Development Team (PDT)

SUBJECT: **FY 2016 Witch Flounder ABC**

The Groundfish Plan Development Team (PDT) met on January 7 and 13, 2016 via webinar to discuss the FY 2016 – FY 2018 witch flounder OFLs/ABCs. The following summarizes the PDT discussion.

2015 Witch Flounder Stock Assessment

The 2015 witch flounder stock assessment indicates that the stock is overfished and overfishing is occurring. The stock is in a rebuilding plan with a rebuild by date of 2017. A retrospective adjustment was applied to the terminal year of the assessment. Compared to the 2012 assessment, the magnitude of the retrospective pattern has increased slightly for F and decreased slightly for SSB. In 2014, the stock was estimated to be at 22% of the rebuilding target SSB and 246% of its target F.

CY 2015 Estimate of Witch Flounder Catches

The PDT updated the estimated CY 2015 catches for witch flounder; using data through November 2015 (see Table 1). The result is a revised catch estimate of 601 mt (reduced from the previous estimate of 637 mt). The PDT used the revised catch estimate for CY 2015 as the "bridge" year for catch projections. The revised catch assumption had relatively little effect on the $75\%F_{MSY}$ and F_{MSY} estimate in 2016. The $75\%F_{MSY}$ estimate increased from 394 mt to 399 mt and the F_{MSY} estimate increased from 513 mt to 521 mt in 2016.

Table 1- Estimate of CY 2015 witch flounder catch (mt)

Estimated CY 2015 NE Multispecies Witch Flounder Catch (mt)

	ACLs and sub-ACLs; (with accountability measures (AMs))							sub-components: No AMs	
Stock	**Total Groundfish**	Groundfish*	Commercial Landings	Commercial Discard	Recreational	Herring Fishery	Scallop Fishery	State Water	Other
	A to G	A+B+C	A	B	C	D	E	F	G
Witch Flounder									
CY 2015	600.6	493.4	450.0	43.4				38.3	69.0

Values in live weight	Commercial
*Includes estimate of missing dealer reports	January - November, 2015 - Actual data used from Data Matching and Imputation System
Source: NMFS Greater Atlantic Regional Office	December 2015 - projected based on FY14 to FY15 to date proportional change in landings and discard from December 2014
Janury 4, 2016: Data Dates: December 2015	
	State Water and Other Subcomponent: See August 20, 2015 CY15 projections

These data are the best available to NOAA's National Marine Fisheries Service (NMFS). Data sources for this report include: (1) Vessels via VMS; (2) Vessels via vessel logbook reports; (3) Dealers via Dealer Electronic reporting. Differences with previous reports are due to corrections made to the database

Catch Projections

Rebuilding- The plan is a 7 year plan set to rebuild by 2017 with a 75% probability. Projections indicate that the stock cannot rebuild by 2017 with F=0. At F=0 the stock is projected to rebuild in 2020 with a 75% probability. At 75%F_{MSY}=0.209 the stock is projected to rebuild in 2025 with a 76% probability and 2023 at a 61% probability.

Catch Projections- The PDT developed four new catch projections at:

- 75%F_{MSY} (Table 2)
- 75% F_{MSY} constant with the value for 2016 (399 mt) (Table 3)
- Middle constant (between 75% F_{MSY} and F_{MSY}) with the value for 2016 (460 mt) (Table 4)
- F_{MSY} constant with the value for 2016 (521 mt) (Table 5)

The constant candidate ABC projections cover the range from a low using the updated 75%F_{MSY} (399 mt) to the F_{MSY} estimate (OFL = 521 mt) in 2016. The range of constant projections all meet the requirement that projected F in 2017 is below 75%F_{MSY} = 0.209.

Catch performance for witch flounder is also provided (Figure 1).

Table 2: Candidate OFLs and ABCs (mt) for FY 2016- FY 2018 for witch flounder, under 75%F_{MSY} projections. Projected F and SSB provided.

year	OFL	ABC	F	SSB
2016	521	399	0.209	3,253
2017	745	572	0.209	4,309
2018	945	724	0.209	5,466

Table 3: Candidate OFLs and ABCs (mt) for FY 2016- FY 2018 for witch flounder, holding the lowest value of 75% F_{MSY} for FY 2016- FY2018 projected catches constant for three years (i.e., 75%F_{MSY} constant 2016). Projected F and SSB provided.

year	OFL	ABC	F	SSB
2016	521	399	0.209	3,253
2017	745	399	0.142	4,342
2018	982	399	0.107	5,688

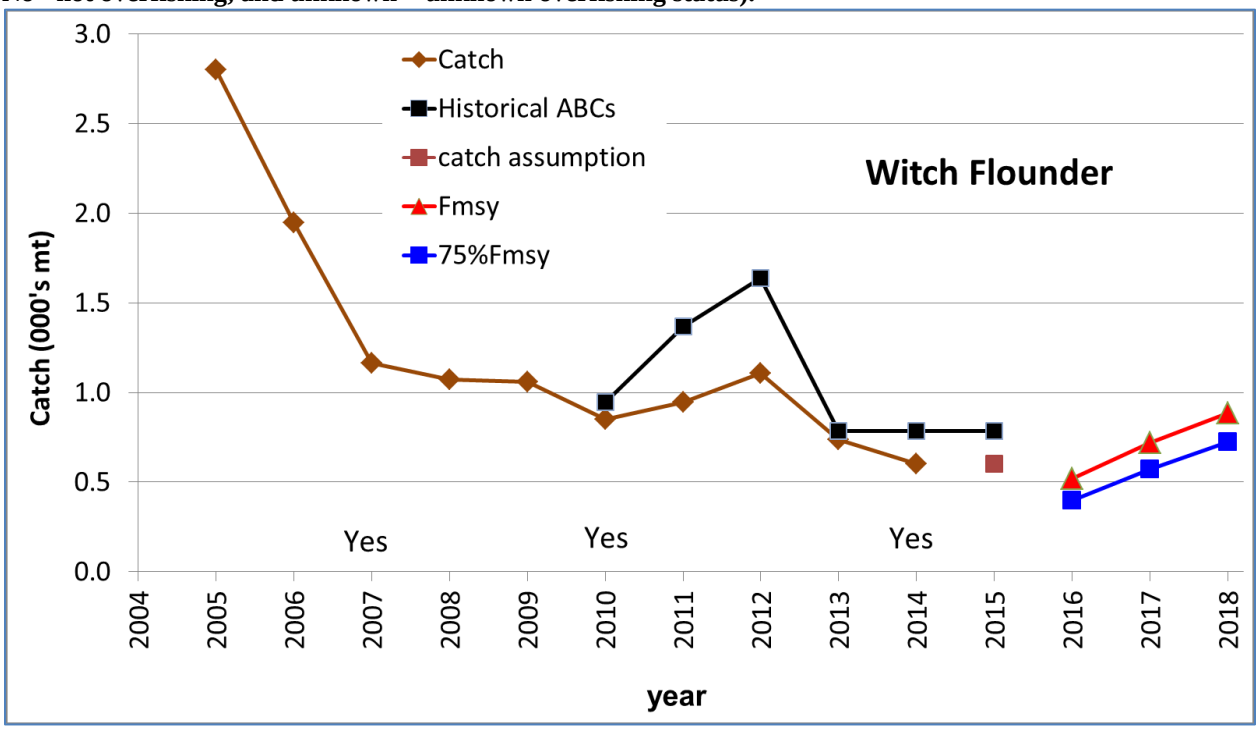
Table 4: Candidate OFLs and ABCs (mt) for FY 2016- FY 2018 for witch flounder, holding the middle value for 75% F_{MSY} and F_{MSY} for 2016 projected catches constant for three years (i.e., 460 mt). Projected F and SSB provided.

year	OFL	ABC	F	SSB
2016	521	460	0.244	3,244
2017	732	460	0.169	4,276
2018	954	460	0.128	5,562

Table 5: Candidate OFLs and ABCs (mt) for FY 2016- FY 2018 for witch flounder, holding the 2016 F_{MSY} value constant for three years (i.e., 75%F_{MSY} for 2016). Projected F and SSB provided.

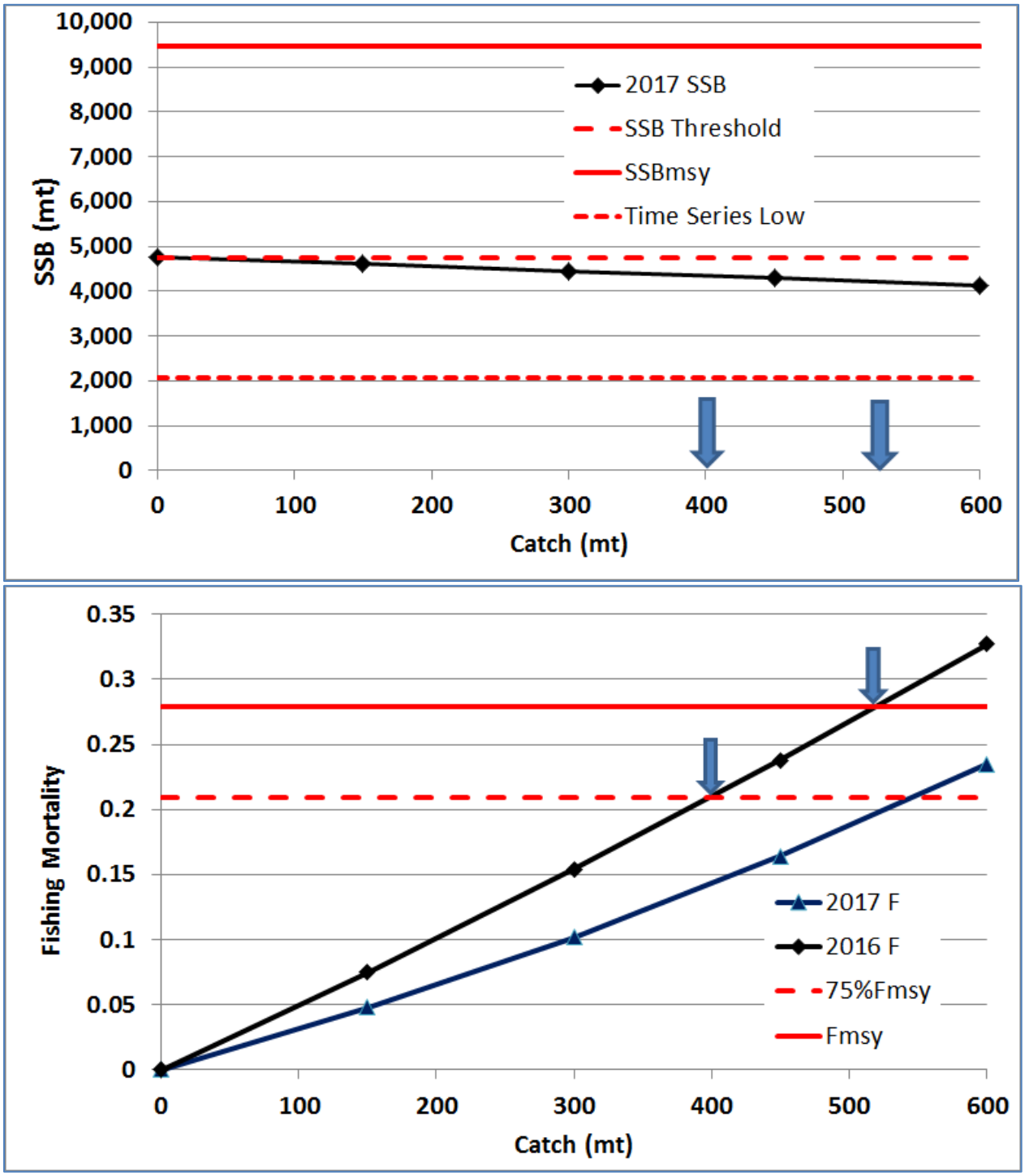
year	OFL	ABC	F	SSB
2016	521	521	0.279	3,234
2017	719	521	0.197	4,210
2018	927	521	0.150	5,437

Figure 1: Catch performance for witch flounder including: catches from CY 2005- CY 2014, historical ABCs since FY 2010, CY 2015 "bridge year" catch assumption, and projections for FY 2016- FY 2018 at F_{MSY} and 75%F_{MSY}. Overfishing status in the terminal year of the assessment indicated on the x-axis (Yes = overfishing, No= not overfishing, and unknown = unknown overfishing status).



Comparison Projections -For the purpose of examining the relative biological risk, projections were run at a range of 2016 quotas of 0, 150 mt, 300 mt, 450 mt, and 600 mt and plotted against the projected SSB in 2017. Likewise, projected F in 2016 and F in 2017 are compared. In general, projected increases in SSB decline with increases in quota and the risk of overfishing increases with increases in quota (**Figure 2**). An assumption of these conclusions is that the projections are correct, but past experience suggests that projections tend to be overly optimistic.

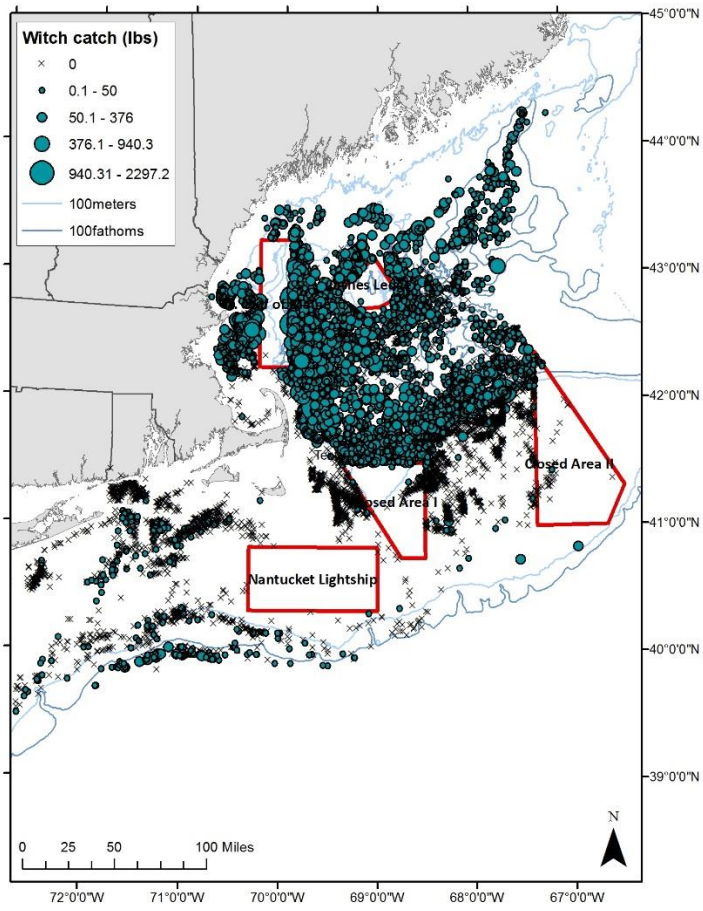
Figure 2- Projections to examine the relative biological risk of a range of 2016 quotas of 0, 150 mt, 300 mt, 450 mt, and 600 mt with projected SSB in 2017 (top) and projected F in 2016 and F in 2017 (bottom). Arrows identify the range of quotas under consideration.



Analysis of Witch Flounder Catches

Spatial Temporal Patterns- The PDT evaluated the presence and absence of witch flounder catches and landings at the trip and haul level using observer and ASM data gathered on sector trips using large mesh trawl gear during calendar year (CY) 2014. Figure 3 depicts the presence and absence of witch flounder in large mesh hauls during CY2014, with "x" noting the absence of any witch flounder in a haul (kept or discarded), and graduated circles illustrating the relative catch (lbs) on the haul. Based on the number of positive tows in Figure 3, witch flounder appears to be broadly distributed throughout the GOM and along the northern edge of GB. While witch flounder is considered a unit stock for management purposes, its presence is patchier in sector hauls in SNE and across the southern flank of GB as shown by the number of hauls with zero catch of witch flounder in this area.

Figure 3 - Witch flounder catch in pounds (end haul location) by large mesh otter trawl on sector trips in CY2014.



Recognizing that it is impossible to interpret any seasonal/temporal changes in catch when presenting twelve months of haul level data in a single map (Figure 3), the PDT reviewed haul level catch information on a bi-monthly basis, partitioning data into two month intervals beginning with January and February of 2014. These maps are intended to illustrate the spatial/temporal catch distribution of witch flounder at a finer scale than presented in Figure 3. When interpreting these maps, it is important to consider management measures in place for the

groundfish fishery during this time, particularly GOM rolling closures during April, May and June, and the GOM cod emergency action, which closed 30-minute blocks in the inshore GOM during November and December.

Figure 4 - Bi-monthly witch flounder catch haul level catch on sector trips by large mesh otter trawl.

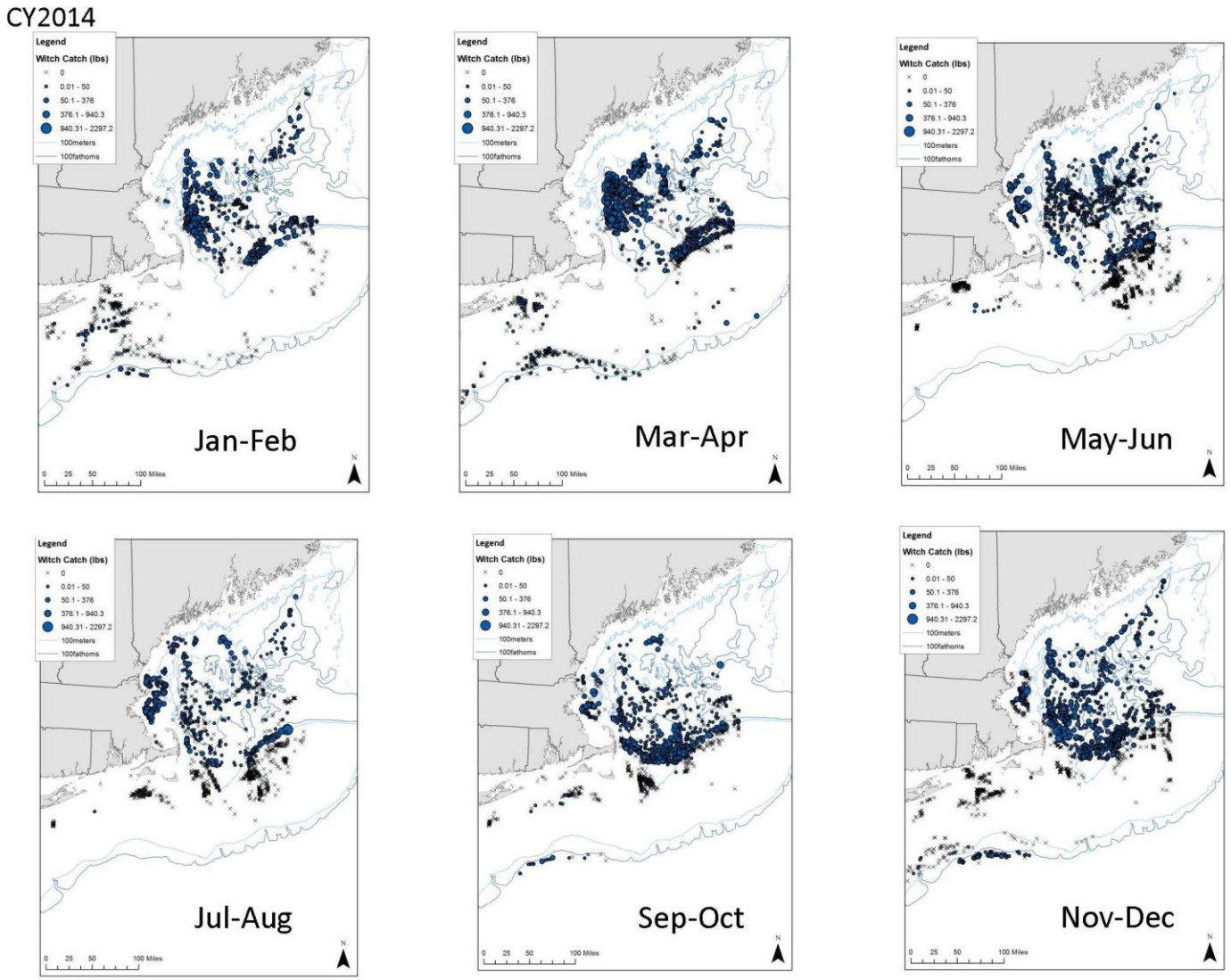


Figure 4 depicts witch flounder catch by large mesh otter trawl at the haul level on a bi-monthly basis. The PDT notes that when haul level presence/absence data is broken out at a finer scale, positive catch of witch flounder in the GOM and along the northern edge of GB is consistent with the spatial distribution in Figure 3. Said another way, the CY snapshot of haul level catch data does not appear to mask strong seasonal patterns of witch flounder in these areas. The fish are consistently caught in areas where the fleet is operating. In SNE, there is –more patchiness of positive and negative tow data when viewed on a bimonthly basis, particularly along the shelf break in SNE.

Kept Catch Ratios- The PDT also reviewed witch flounder kept catch ratios to total kept catch (Kall) at the haul and trip level by broad stock area (BSA) using the same dataset that was used to examine spatial/temporal patterns in catch. Trip level data is one way to examine targeting behavior. If the ratio of witch flounder kept to total kept is high, this would suggest that the trip was targeting witch flounder. Conversely, if the ratio of witch flounder kept to total kept catch is low (between 1%-10%), this would suggest other stocks were being targeted on that trip. Trip level kept catch ratios shown in
Figure **5** are consistent with the presence/absence plots in
Figure 3 and Figure 4 in all broad stock areas. Based on this trip level data, witch flounder tend to be caught on most trips and therefore more difficult for the groundfish fleet to avoid in BSA 1 to 3. Very similar results are seen in the Sustainable Harvest Sector data (Figure 6). This data also suggests that smaller vessels are more dependent on witch flounder landings relative to the larger vessels in the sector.

Figure 5 - Ratios of witch flounder kept to total kept catch by sector trip (large mesh otter trawl only) for CY2014, BSA 1 - GOM, BSA 2 - Inshore GB, BSA 3 - GB, BSA 4 - SNE/MA.

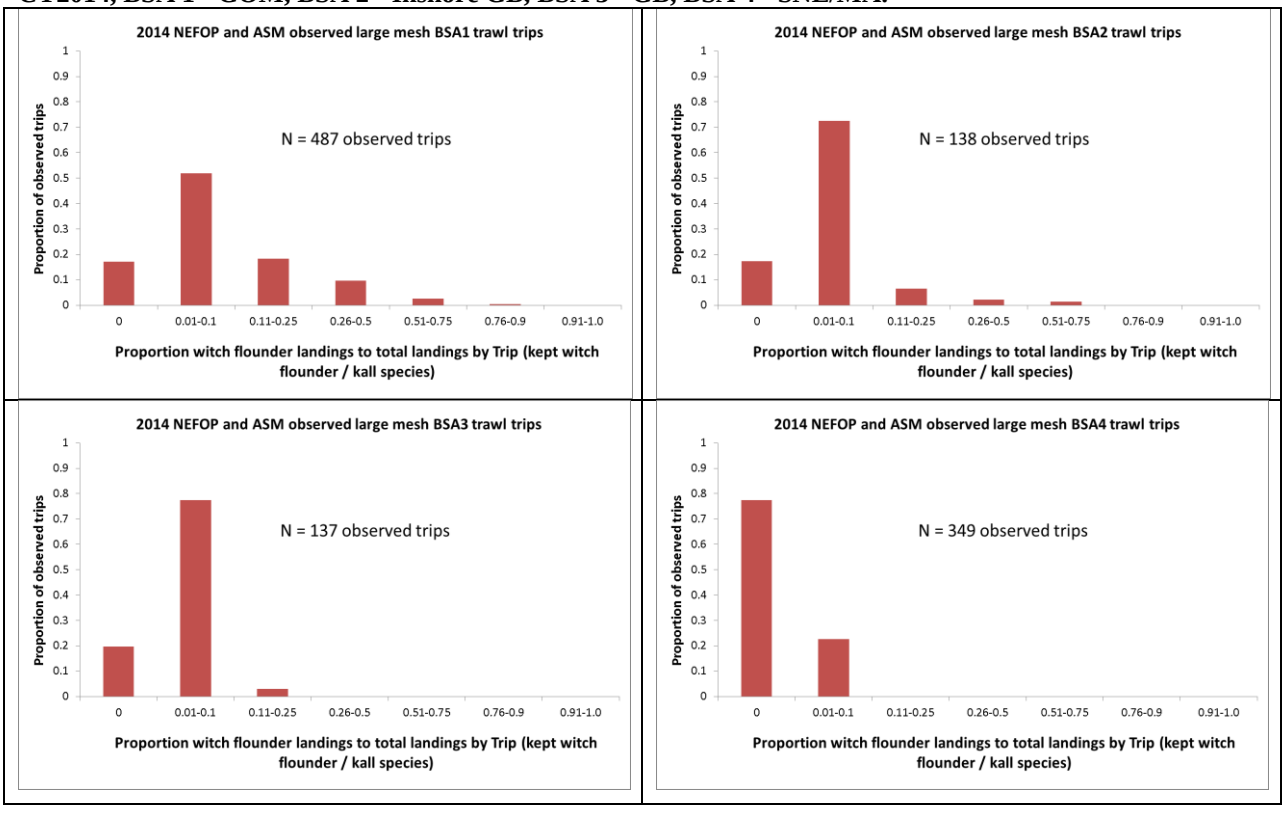
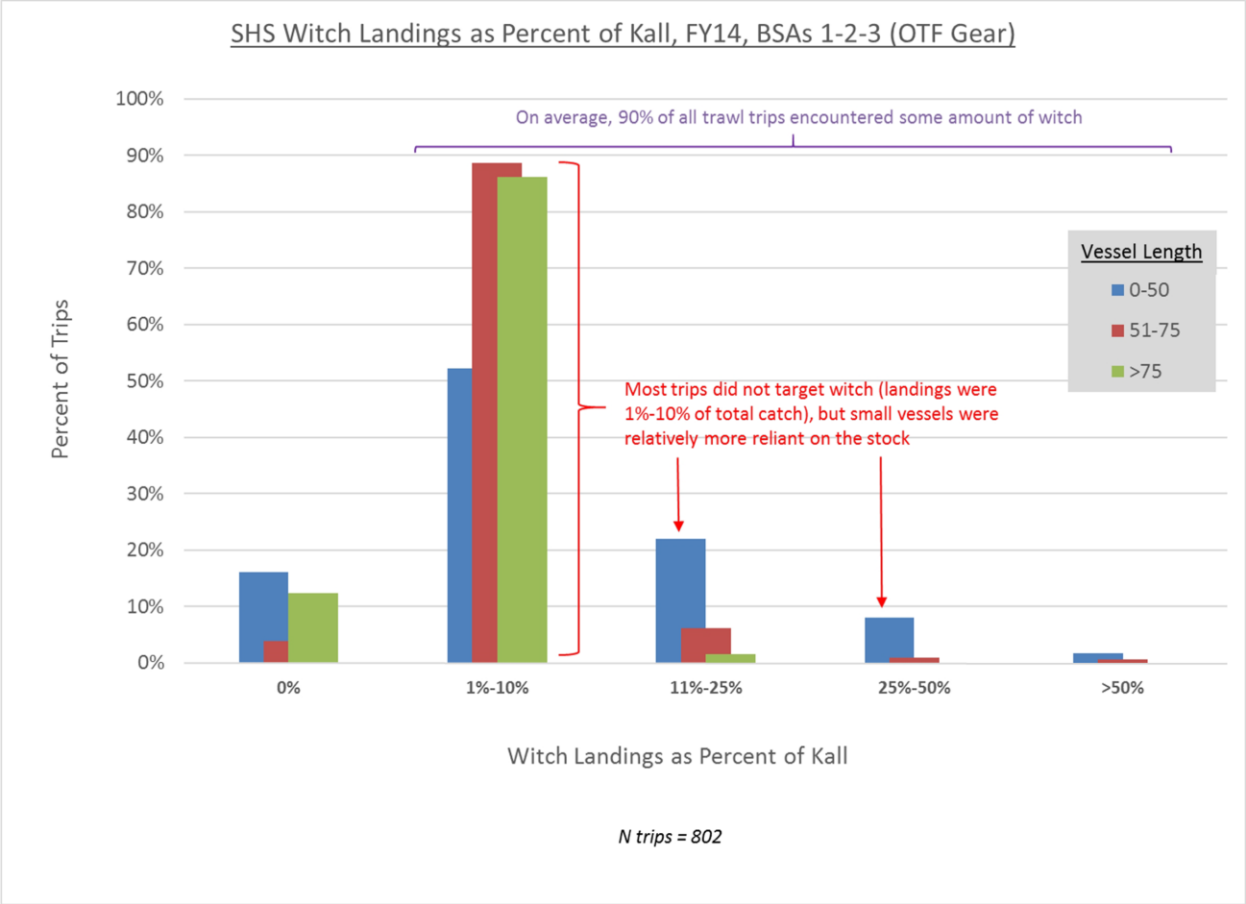


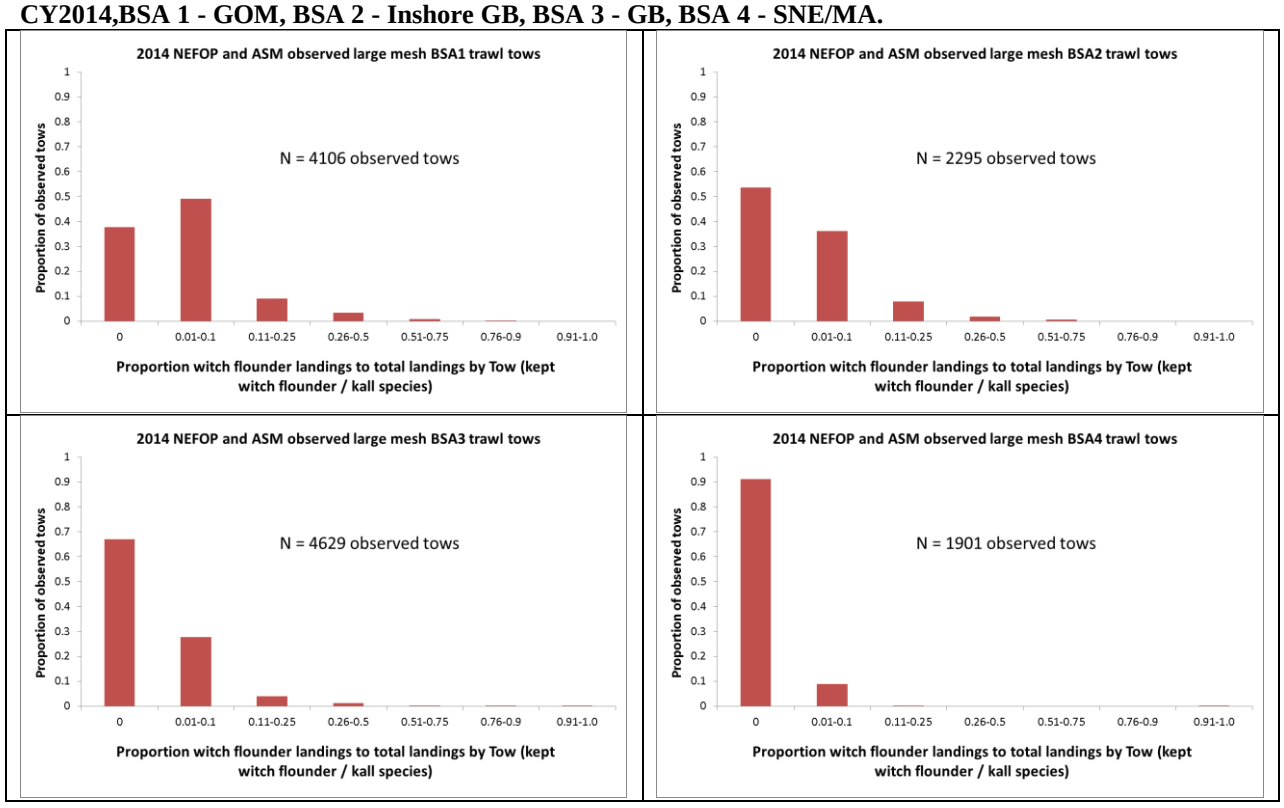
Figure 6- Ratios of witch flounder kept to total kept catch by Sustainable Harvest Sector for large mesh otter trawls by vessel size class for FY2014 (courtesy of Hank Soule).



Witch Landings Per Trip in Pounds		
Length	Median	Mean
0-51	235	318
51-75	410	664
>75	341	524

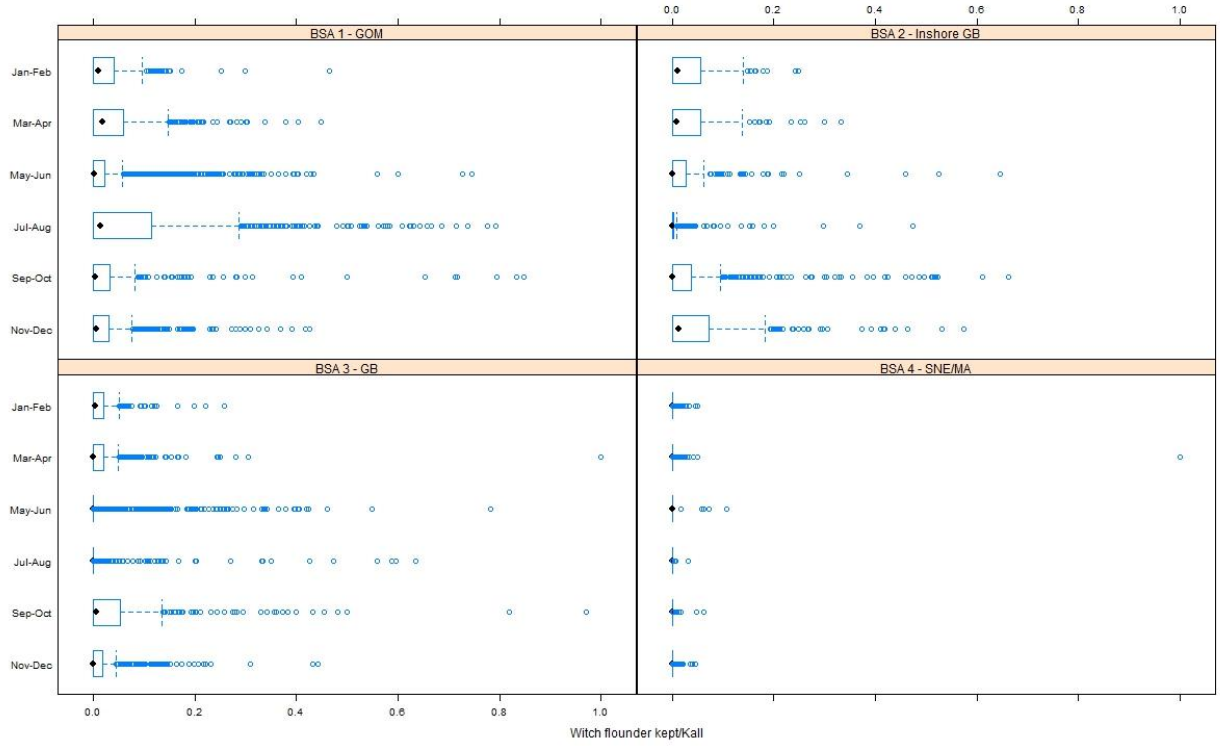
The PDT also examined haul level data for witch flounder kept to total kept catch since targeting behavior occurs on the haul level and not necessary on a trip level (Figure 7). Haul level data also shows that most hauls caught witch flounder and witch flounder was a relatively small proportion of the haul's landings in BSA1. While the bar charts in Figure 7 are not perfectly analogous to the presence/absence plots in Figure 3 and Figure 4 (kept catch and discards), they are correlated in that kept catch is consistent across the datasets. Consistent with Figure 3, the majority of hauls in the GOM (>60%) caught legal sized witch flounder during calendar year 2014. The BSA with the second highest ratio of hauls with kept catch was BSA 2, or the inshore GB (SA 521). The proportion of positive hauls with kept catch is around 30% in BSA 3, which is not unexpected given the spatial distribution of positive/negative hauls in Figure 3. Less than 10% of hauls in SNE caught legal sized witch flounder.

Figure 7 - Ratios of witch flounder kept to total kept catch by sector hauls (large mesh otter trawl only) for CY2014,BSA 1 - GOM, BSA 2 - Inshore GB, BSA 3 - GB, BSA 4 - SNE/MA.



The PDT also examined the haul level kept catch ratios temporally by BSA (Figure 8). The lattice boxplot is a way to look at how individual hauls in each BSA are distributed across the calendar year. Figure 7 is especially helpful in determining how many hauls did not have a kept catch of witch flounder. As over 50% of hauls in three of the four BSAs did not have kept catch, many on boxplots in Figure 8 are collapsed around zero. Tows with a large proportion of witch flounder kept catch are mostly shown as outliers in the plots. During July and August in the GOM (BSA 1), witch flounder appears to become more available to the fishery. Overall, it appears that witch flounder are available to the fishery year round in the GOM.

Figure 8-Lattice boxplot of witch flounder kept/Kall on sector hauls (large mesh otter trawl) in CY2014.



Economic Tradeoffs of setting a 2016 ABC greater than 75% F_{MSY} and up to F_{MSY}

Note: Tables and Figures in this section restart at 1.

Background on the Quota Change Model

The Quota Change Model (QCM) is used to analyze the economic impacts of adjusting the witch flounder sector sub-ACL for FY2016. The QCM is a Monte Carlo simulation model that selects from existing records the most likely trips to take place under new regulatory conditions. To do this, a large pool of actual trips from FYs 2014 and 2015 is created from a reference data set. The composition of this pool is conditioned on each trip's utilization of allocated ACE, under the assumption that the most likely trips to take place in the FY being analyzed are those fishing efficiently under the new regulatory requirements. The more efficiently a trip uses its ACE, the more likely that trip is to be drawn into the sample pool. ACE efficiency is determined by the ratio of ACE expended to net revenues on a trip, iterated over each of the 17 allocated stocks. Net revenues are calculated as gross revenues minus trip costs minus quota opportunity costs, where trip costs are based on observer data and quota opportunity costs are estimated from an inter-sector lease value model, based here on FY 2014 (details on the methods can be found in Murphy et al. 2015).

After the sample pool has been constructed, trips are pulled from the pool at random, summing the ACE expended for the 17 allocated stocks as each trip is drawn. When one stock's ACE reaches the sector sub-ACL limit, no further trips from that broad stock area are selected. The model continues selecting trips until sector sub-ACLs are achieved in all three broad stock areas or, alternatively, if sub-ACLs are reached for one of the unit stocks, the trip selection process ends for all broad stock areas at once. This selection process forms a "synthetic fishing year" and a number of years are drawn to form a model. Median values and confidence intervals for all draws in a model are reported.

By running simulations based on actual fishing trips, the model implicitly assumes that:

- 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.

These assumptions will surely not hold—fishermen will continue to develop their technology and fishing practices to increase their efficiency, market conditions will induce additional behavioral changes, and fishery stock conditions are highly dynamic. Fuel and other operating costs may change due to larger economic shifts or shore-side industry consolidation.

The net effect of the constraints placed by these assumptions is unclear. The selection algorithm draws only efficient trips—fishermen making relatively inefficient trips will bias the model results high.

Fishermen, however, are generally good at their job, and through a combination of technological improvement (gear rigging, equipment upgrades, etc.) or behavioral modifications, are likely to improve on their ability to avoid constraining stocks. This will bias the model results low.

The QCM was run with three different sector sub-ACLs for witch flounder during FY2016, while keeping the proposed FW 55 sub-ACLs for all other groundfish stocks constant. At each sub-ACL, the QCM was run for 250 iterations (i.e. 250 synthetic 2016 fishing years). A per-pound "fee" on groundfish was included so as to simulate the effect of industry-funded observer coverage at 10%. The sector sub-ACLs used for witch flounder were as follows:

- 304mt: corresponding to an ABC of 399mt set at 75% FMSY
- 361mt: corresponding to an ABC of 460mt, the average of the upper and lower ABCs considered
- 418mt: corresponding to an ABC of 521mt set at F_{MSY}

General Model Results

The model results (median values from all model runs) failed to show any gain in gross revenue (revenue from landing both groundfish and non-groundfish species) or groundfish revenue when the witch flounder sector sub-ACL was increased. The model, in fact, showed a decrease in revenue of roughly $1 million to the sector-based fishery when the witch flounder sector sub-ACL was increased from 304mt ($52.4 million in revenue-Table 1) to 418mt ($51.4 million in revenue-Table 7). However, the confidence intervals show that there is uncertainty surrounding these estimates and this change is within those confidence intervals. The discussion below examines output from the model but these differences are likely to be largely a result of random noise in the model. They should be interpreted with caution. The fact that there are multiple stocks across broadstock areas which are predicted to have high utilization rates further adds uncertainty into the model.

The model consistently showed other stocks (GB cod and GOM cod) to be more constraining than witch flounder and this is likely the primary reason that revenue increases did not materialize with a higher sub-ACL for witch flounder. Witch flounder-related revenue did increase by $348,000 across sector vessels when the sub-ACL was increased from 304mt to 418mt. However, these increases were offset by small, across the board, reductions in most other stocks. One exception is seen in the median revenue from plaice, a stock that is frequently caught with witch flounder, increased by $233,000 (see box plot of Plaice catch as compared to other stocks examined – Figure 1).

In terms of witch flounder median utilization rates, a decrease occurred from 91% with a sub-ACL of 304mt to 81% with a sub-ACL of 418mt. While witch flounder catch (and revenue) did increase when the sub-ACL was raised, the rate of increase was less than the rate of quota increase, resulting in a drop in utilization rates. Figure 1 shows the range of utilization rates and catch for witch flounder and some other groundfish stocks with predicted high utilization rates.

In terms of distributional changes, vessels of 30' to <50' are predicted to see groundfish revenue increases, with the model showing a roughly $100,000 increase across sector vessels when the witch flounder sector sub-ACL is increased from 304mt to 418mt. Conversely, vessels 75'+ are predicted to see revenue decreases with the model predicting a $600,000 drop in aggregate revenue. At the port level, the model predicts Portland, ME to be negatively impacted by a higher witch flounder sector sub-ACL, with

revenues dropping by $859,000 with a sub-ACL of 418mt relative to a 304mt sub-ACL. This drop would represent an 8.7% decrease from the aggregate port total. With a witch flounder sub-ACL of 361mt, Portland is still predicted to see a drop of $360,000 compared to the level of revenue with a 304mt sub-ACL. Point Judith, RI is predicted to see the largest increase in groundfish revenue with a higher sub-ACL, with a $107,000 increase when the sub-ACL is raised from 304mt to 418mt.

The aggregate revenue and distributional impacts that the model predicts are a result of a shift in the profitability of fishing trips that are selected. When the witch flounder sub-ACL is increased, the quota cost of witch flounder is decreased and so trips that caught witch flounder become more likely to be selected. These trips however may have also landed other stocks that can be constraining and in effect lower aggregate groundfish revenue.

Tables and Figures

spec	stock	Sub-ACL (mt)	Catch (mt)	Utilization	Revenue	p5 Revenue	p95 Revenue
pollock	all	17,705	3,804	21%	$9,760,753	$9,160,693	$10,434,880
haddock	gb_west	34,156	4,447	13%	$9,571,820	$8,543,644	$10,756,293
redfish	all	9,471	7,052	74%	$8,468,052	$7,635,971	$9,395,708
wh_hake	all	3,434	1,793	52%	$5,727,644	$5,362,592	$6,126,712
am_plaice	all	1,160	911	79%	$3,581,846	$3,319,923	$3,820,135
haddock	gb_east	17,053	1,558	9%	$3,255,368	$2,765,200	$3,786,214
winter_fl	gb	584	506	87%	$2,639,426	$2,204,032	$3,044,820
cod	gb_west	550	547	100%	$2,338,813	$2,234,068	$2,407,693
winter_fl	sne_ma	514	385	75%	$1,705,172	$1,337,393	$2,056,373
witch_fl	all	304	277	91%	$1,439,417	$1,337,546	$1,559,307
cod	gom	273	268	98%	$1,172,068	$1,122,815	$1,197,086
haddock	gom	2,385	357	15%	$1,074,154	$969,384	$1,213,872
yt_flounder	cc_gom	325	173	53%	$447,217	$381,541	$518,419
yt_flounder	sne	145	138	95%	$413,137	$366,801	$452,210
winter_fl	gom	604	85	14%	$316,775	$250,249	$394,319
halibut	all	0	46		$277,226	$257,576	$298,471
cod	gb_east	45	35	78%	$145,722	$118,001	$179,079
yt_flounder	gb	207	22	11%	$69,356	$49,270	$92,968
windowpane	north	0	78		$33	$1	$89
ocean_pout	all	0	29				
windowpane	south	0	67				
wolffish	all	0	17				
non_gfish	all	0	8,901		$16,380,126	$15,187,907	$17,666,307
				Total Groundfish	$52,434,232	$50,153,341	$54,806,509
				Total	$68,843,397	$65,893,825	$72,010,314

Table 1- Stock Level QCM Results: Witch Flounder ACL = 304, ASM coverage = 10%

Port	Groundfish Revenue	p5 revenue	p95 revenue
BOSTON	$16,909,800	$15,347,969	$18,356,949
GLOUCESTER	$10,565,564	$9,574,058	$11,780,457
PORTLAND	$9,826,404	$8,521,028	$11,286,873
NEW BEDFORD	$9,039,039	$8,079,568	$10,063,720
OTHER MA	$2,170,292	$1,735,821	$2,713,023
NH	$1,500,372	$1,230,218	$1,779,529
ME	$1,229,406	$1,047,512	$1,436,334
POINT JUDITH	$757,598	$596,155	$926,380
NY	$247,188	$180,192	$327,145
RI	$158,127	$104,937	$210,270
CT	$6,943	$2,325	$15,127
NJ	$515	$18	$1,502
CHATHAM	$161	$48	$387
OTHER NORTHEAST			
Total Groundfish	$52,434,232	$50,153,341	$54,806,509

Table 2- Port Level QCM Results: Witch Flounder ACL = 304, ASM coverage = 10%

Vessel Length	Groundfish Revenue	p5 revenue	p95 revenue
<30'	$185,678	$106,403	$287,707
30'to<50'	$4,565,260	$4,128,785	$4,966,385
50'to<75'	$20,451,683	$18,926,292	$21,999,438
75'+	$27,211,694	$25,431,438	$29,134,692
Total Groundfish	$52,434,232	$50,153,341	$54,806,509

Table 3- Vessel Length Class Level QCM Results: Witch Flounder ACL = 304, ASM coverage = 10%

spec	stock	Sub-ACL (mt)	Catch (mt)	Utilization	Revenue	p5 Revenue	p95 Revenue
haddock	gb_west	34,156	4,511	13%	$9,619,547	$8,477,777	$11,136,968
pollock	all	17,705	3,739	21%	$9,519,442	$8,835,447	$10,129,188
redfish	all	9,471	6,860	72%	$8,249,643	$7,481,355	$8,983,051
wh_hake	all	3,434	1,780	52%	$5,643,127	$5,247,860	$6,059,865
am_plaice	all	1,160	961	83%	$3,792,658	$3,545,718	$4,052,475
haddock	gb_east	17,053	1,574	9%	$3,290,543	$2,735,722	$3,853,793
winter_fl	gb	584	456	78%	$2,464,177	$2,063,073	$2,982,185
cod	gb_west	550	547	99%	$2,350,159	$2,248,421	$2,419,797
witch_fl	all	361	310	86%	$1,640,041	$1,542,188	$1,744,639
winter_fl	sne_ma	514	372	72%	$1,618,936	$1,259,053	$1,981,223
cod	gom	273	268	98%	$1,169,096	$1,120,279	$1,192,750
haddock	gom	2,385	365	15%	$1,085,528	$968,286	$1,214,118
yt_flounder	cc_gom	325	177	54%	$452,425	$390,519	$529,014
yt_flounder	sne	145	138	95%	$402,312	$359,542	$445,152
winter_fl	gom	604	85	14%	$322,167	$267,888	$392,386
halibut	all	0	45		$272,892	$256,093	$291,786
cod	gb_east	45	35	77%	$146,979	$115,322	$186,890
yt_flounder	gb	207	22	10%	$64,542	$44,426	$84,459
windowpane	north	0	78		$33	$10	$88
ocean_pout	all	0	28				
windowpane	south	0	68				
wolffish	all	0	17				
non_gfish	all	0	9,001		$16,634,934	$15,412,141	$18,206,727
				Total Groundfish	$52,241,216	$49,728,505	$54,481,247
				Total	$68,811,671	$65,966,465	$71,485,695

Table 4- Stock Level QCM Results: Witch Flounder ACL = 361, ASM coverage = 10%

Port	Groundfish Revenue	p5 revenue	p95 revenue
BOSTON	$16,651,804	$15,260,562	$18,082,957
GLOUCESTER	$10,763,062	$9,866,335	$11,737,970
PORTLAND	$9,466,694	$8,293,632	$10,695,315
NEW BEDFORD	$9,025,160	$8,139,694	$9,958,161
OTHER MA	$2,132,613	$1,708,839	$2,754,242
NH	$1,431,459	$1,190,731	$1,669,417
ME	$1,299,476	$1,139,055	$1,489,760
POINT JUDITH	$821,711	$655,818	$1,049,280
NY	$231,422	$156,425	$300,502
RI	$154,194	$106,288	$214,251
CT	$6,491	$2,325	$14,494
NJ	$515	$18	$1,521
CHATHAM	$161	$48	$548
OTHER NORTHEAST			
Total Groundfish	$52,241,216	$49,728,505	$54,481,247

Table 5- Port Level QCM Results: Witch Flounder ACL = 361, ASM coverage = 10%

Vessel Length Category	Groundfish Revenue	p5 revenue	p95 revenue
<30'	$167,843	$96,142	$271,640
30'to<50'	$4,515,414	$4,147,627	$4,857,799
50'to<75'	$20,023,041	$18,794,703	$21,373,497
75'+	$27,388,414	$25,324,034	$29,582,151
Total Groundfish	$52,241,216	$49,728,505	$54,481,247

Table 6- Vessel Length Class Level QCM Results: Witch Flounder ACL = 361, ASM coverage = 10%

spec	stock	Sub-ACL (mt)	Catch (mt)	Utilization	Revenue	p5 Revenue	p95 Revenue
haddock	gb_west	34,156	4,409	13%	$9,336,984	$8,155,337	$10,808,036
pollock	all	17,705	3,610	20%	$9,207,763	$8,607,823	$9,832,645
redfish	all	9,471	6,606	70%	$7,923,128	$7,096,174	$8,882,084
wh_hake	all	3,434	1,749	51%	$5,540,949	$5,148,018	$5,898,564
am_plaice	all	1,160	981	85%	$3,814,876	$3,563,550	$4,105,014
haddock	gb_east	17,053	1,474	9%	$3,102,593	$2,662,447	$3,651,116
winter_fl	gb	584	516	88%	$2,723,383	$2,251,764	$3,144,291
cod	gb_west	550	547	99%	$2,334,854	$2,232,986	$2,406,795
witch_fl	all	418	340	81%	$1,787,103	$1,672,827	$1,908,936
winter_fl	sne_ma	514	371	72%	$1,578,361	$1,286,441	$1,944,791
cod	gom	273	268	98%	$1,174,548	$1,125,442	$1,196,334
haddock	gom	2,385	366	15%	$1,090,557	$976,185	$1,208,185
yt_flounder	cc_gom	325	194	60%	$486,358	$423,252	$558,784
yt_flounder	sne	145	139	96%	$390,079	$342,352	$439,346
winter_fl	gom	604	88	15%	$338,466	$282,058	$418,165
halibut	all	0	45		$265,929	$246,941	$283,478
cod	gb_east	45	34	76%	$145,442	$116,161	$178,728
yt_flounder	gb	207	20	10%	$60,877	$45,640	$79,751
windowpane	north	0	79		$33	$1	$92
ocean_pout	all	0	29				
windowpane	south	0	68				
wolffish	all	0	17				
non_gfish	all	0	8,974		$16,419,511	$14,937,969	$18,031,233
				Total Groundfish	$51,460,759	$48,852,672	$53,742,609
				Total	$67,870,837	$64,509,734	$70,658,753

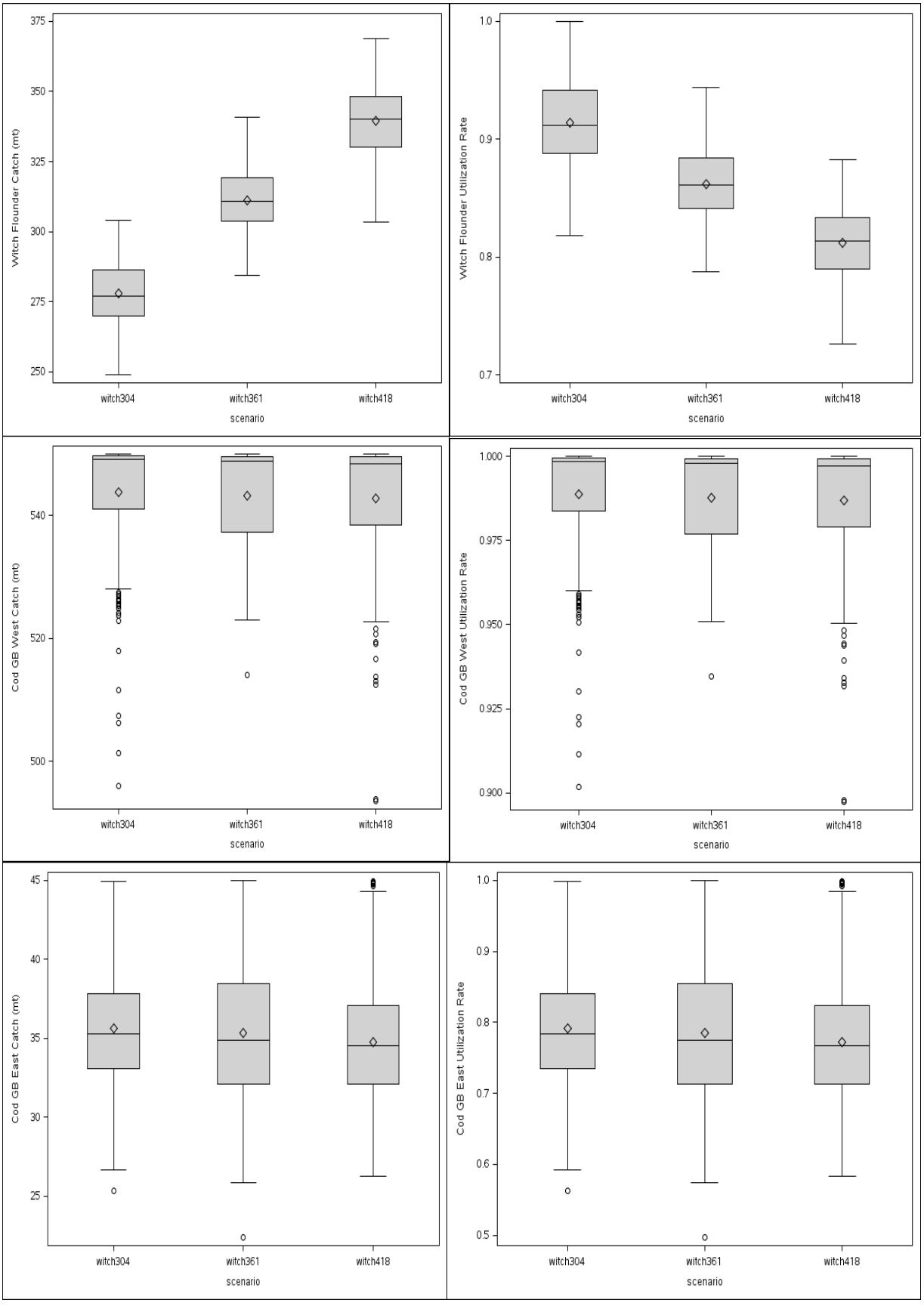
Table 7- Stock Level QCM Results: Witch Flounder ACL = 418, ASM coverage = 10%

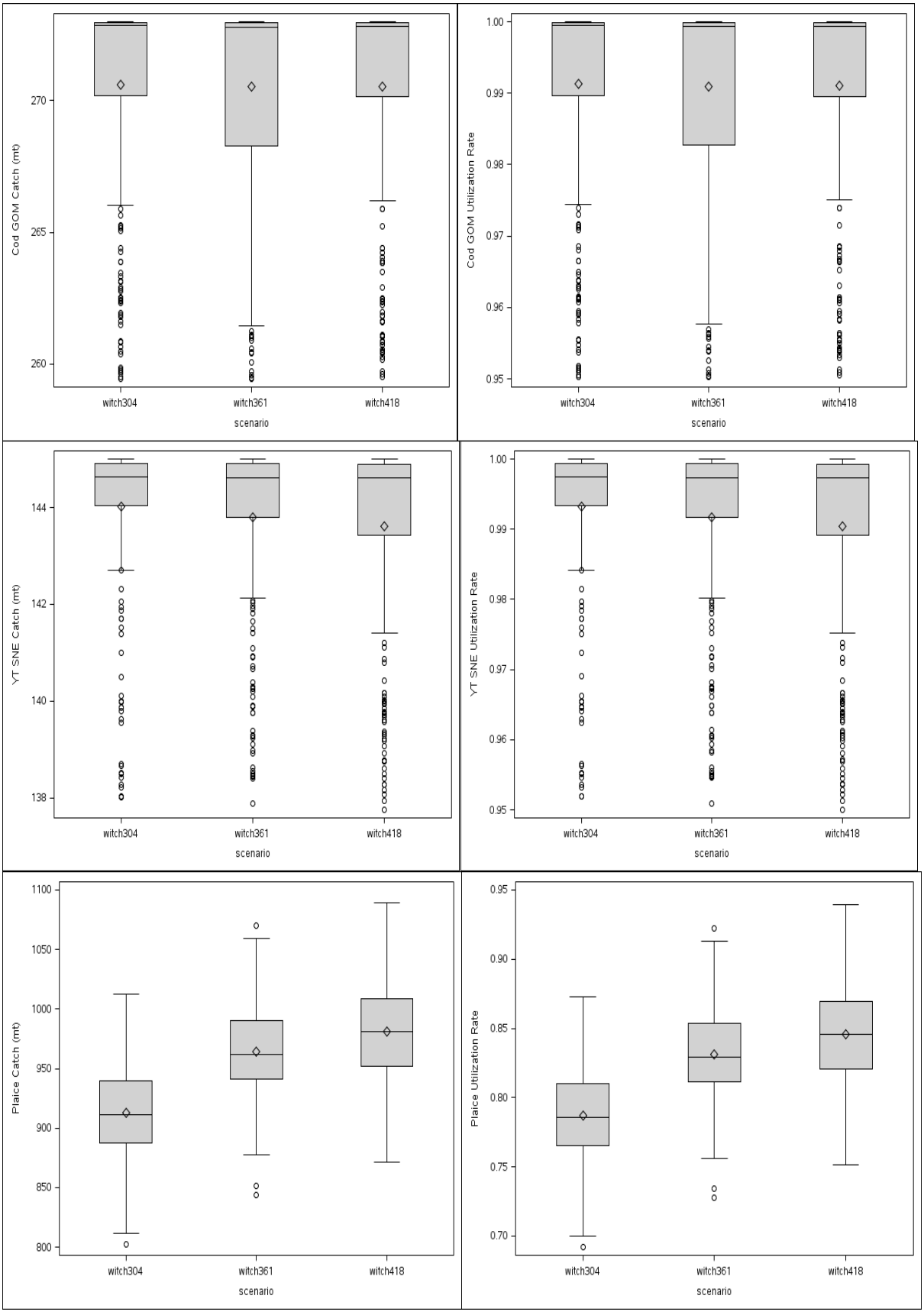
Port	Groundfish Revenue	p5 revenue	p95 revenue
BOSTON	$16,607,578	$14,934,078	$18,043,533
GLOUCESTER	$10,458,845	$9,336,144	$11,562,681
NEW BEDFORD	$9,103,636	$8,095,178	$10,043,087
PORTLAND	$8,967,657	$7,854,334	$10,339,787
OTHER MA	$2,179,114	$1,691,646	$2,783,393
NH	$1,440,735	$1,180,212	$1,715,966
ME	$1,367,877	$1,205,717	$1,565,432
POINT JUDITH	$864,682	$657,170	$1,047,022
NY	$253,729	$181,560	$361,238
RI	$163,522	$102,814	$226,353
CT	$6,401	$2,325	$13,343
NJ	$515	$18	$1,502
CHATHAM	$161	$48	$452
OTHER NORTHEAST			
Total Groundfish	$51,460,759	$48,852,672	$53,742,609

Table 8- Port Level QCM Results: Witch Flounder ACL = 418, ASM coverage = 10%

len_cat	Groundfish Revenue	p5 revenue	p95 revenue
<30'	$170,815	$90,781	$262,534
30'to<50'	$4,660,844	$4,282,979	$5,018,885
50'to<75'	$19,886,187	$18,625,319	$21,290,421
75'+	$26,610,720	$24,701,453	$28,597,577
Total Groundfish	$51,460,759	$48,852,672	$53,742,609

Table 9- Vessel Length Class Level QCM Results: Witch Flounder ACL = 418, ASM coverage = 10%


Witch Flounder Catch (mt)
375
350
325
300
275
250
witch304
witch361
witch418
scenario
Witch Flounder Utilization Rate
1.0
0.9
0.8
0.7
witch304
witch361
witch418
scenario
Cod GB West Catch (mt)
540
520
500
witch304
witch361
witch418
scenario
Cod GB West Utilization Rate
1.000
0.975
0.950
0.925
0.900
witch304
witch361
witch418
scenario
Cod GB East Catch (mt)
45
40
35
30
25
witch304
witch361
witch418
scenario
Cod GB East Utilization Rate
1.0
0.9
0.8
0.7
0.6
0.5
witch304
witch361
witch418
scenario


Cod GOM Catch (mt)
270
265
260
witch304
witch361
witch418
scenario
Cod GOM Utilization Rate
1.00
0.99
0.98
0.97
0.96
0.95
witch304
witch361
witch418
scenario
YT SNE Catch (mt)
144
142
140
138
witch304
witch361
witch418
scenario
YT SNE Utilization Rate
1.00
0.99
0.98
0.97
0.96
0.95
witch304
witch361
witch418
scenario
Plaice Catch (mt)
1100
1050
1000
950
900
850
800
witch304
witch361
witch418
scenario
Plaice Utilization Rate
0.95
0.90
0.85
0.80
0.75
0.70
witch304
witch361
witch418
scenario

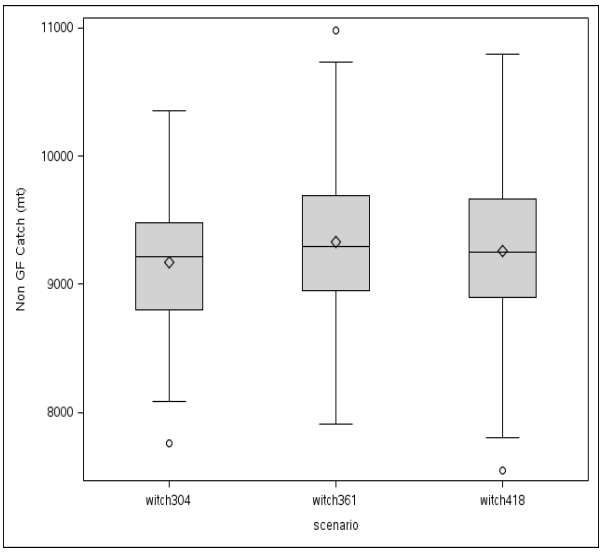


Figure 1- Predicted QCM groundfish catch and utilization rates by stock

Social impacts of the 2016 Sector sub-ACL for witch flounder

The three values for the witch flounder sub-ACL under consideration are 304 metric tons (mt), 361 mt, and 418 mt. With 10% ASM coverage, minor differences in groundfish revenue by port emerge from the quota change model (QCM) results across these three sub-ACL values (Tables 1-9). Among the noteworthy differences, Portland sees a relatively large decrease in groundfish revenue of $859,000 from the increase of the witch flounder sub-ACL from 304 mt to 418 mt. Other northern ports, including Boston and Gloucester, are also predicted to see decreases in groundfish revenue from a higher witch flounder sub-ACL, though not to the same extent as Portland. Ports in Southern New England, including New Bedford and Point Judith are predicted to see modest increases in groundfish revenue from the increased sub-ACL for witch flounder. Importantly, while the median values from the QCM results indicate southern ports to be more positively impacted from a higher witch sub-ACL than northern ports, the confidence intervals around these estimates are relatively wide. Considering these confidence intervals, it appears there will be relatively limited social impacts by port as a result of selecting the 304mt, 361 mt, or 418 mt sub-ACL for witch flounder with 10% ASM coverage.

In addition to these relatively minor port-level differences in groundfish revenues by the range of sub-ACLs, there are also interesting differences in revenues by vessel size categories. Vessels between 30’ and <50’ are expected to see around $100 groundfish revenue increases going from 304mt to 418mt. Whereas vessels over 75’ are expected see a decline in groundfish revenues by several hundred thousands of dollars ($600,000) across the same spectrum of sub-ACLs for witch flounder.

PDT Recommendation

The **PDT does not recommend setting the 2016 witch flounder ABC equal to OFL** for the following reasons:

- The stock is overfished and overfishing is occurring.
- The rebuilding target is not projected to be met in 2017.
- The biological risk is high, and overfishing is likely to continue based on the current model configuration and past experience with the projections and subsequent assessment findings.
- Setting an ABC equal to OFL assumes little if any uncertainty in the stock assessment.
    - It is unrealistic that scientific uncertainty for this stock is zero.
    - The stock is long-lived and slow growing.
    - Recent recruitment is relatively low, and potentially optimistic (i.e., recent recruitment tends to get adjusted downward in future assessments for example the 2004 and 2008 YC's in the 2012 versus 2015 assessments).
- Should stock condition decline or remain stagnant, the short-term economic gain of a higher ACL may not outweigh the long-term economic costs.

Recognizing the issues raised by industry and by the PDT in its analyses (i.e., stock is difficult to avoid, exceeding the quota of a unit stock could potential close the entire groundfish fishery in-season, small vessels may be more economically impacted, the ability of the fishery to operate and achieve quotas for other groundfish stocks (e.g., plaice) and non-groundfish stocks (e.g., monkfish) may be reduced), and in consideration of the above, **at a minimum some buffer should be considered between OFL and ABC**.

The PDT did not make a recommendation on this percentage but does offer the **following summary of trade-offs of setting a 2016 ABC greater than 75%F_{MSY} and up to F_{MSY}**:

- **Biological**: Results indicate that with increasing quota there is increased risk of overfishing, less projected stock growth, and increased projected fishing mortality. Past experience indicates that ABCs based on 75% F_{MSY} did not provide a sufficient scientific uncertainty buffer to end overfishing for many groundfish stocks. This conclusion led to the increased use of constant ABCs which tend to increase the uncertainty buffer in the out years.

- **Economic**: Results indicate that with an increasing quota there is no overall change in predicted revenue among the range of quotas examined for groundfish and non-groundfish revenues based on QCM results. The QCM has limitations, and although not detected by the QCM, more quota in the short-term is likely to be beneficial.

- **Social**: Results from the QCM indicate that with an increasing witch flounder quota vessels in the 30-50 ft. size class acquire some revenue gains of $100k to $200k, while larger vessels show a decrease of the same amount.