New England Fishery Management Council
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John Pappalardo, *Chairman* | Paul J. Howard, *Executive Director*

MEMORANDUM

DATE: June 12, 2009

TO: Groundfish Oversight Committee

FROM: Groundfish Plan Development Team

SUBJECT: **Amendment 16 Development; PDT meeting June 4, 2009**

1. The Groundfish PDT met in Mansfield, MA to review measures needed to meet pollock rebuilding targets and other Amendment 16 issues. Participants included Tom Nies and Anne Hawkins (NEFMC), Doug Christel and Tom Warren (NERO), John Walden, Eric Thunberg, and Paul Nitchske (NEFSC), Steve Correia (Mass DMF), Kohl Kanwit (Maine DMR), and Dan Holland (GMRI). Council chair John Pappalardo also attended.

2008 Catch Estimates

2. Mortality targets for the amendment were based on 2008 catch assumptions calculated in the fall of 2008. These were estimated using six months of preliminary landings data. Since preliminary landings data are available for the full calendar year, the PDT compared the earlier estimates with the year-end values (see enclosure 1). While the original estimates were fairly accurate for most stocks, they were not for pollock and GB winter flounder where the original estimate was substantially lower than the end of the year value. The PDT examined the implications for these two stocks. GB winter flounder is discussed below, while pollock is discussed in the following section.

3. The original estimate for GB winter flounder landings in 2008 was just under 600 mt, while the year end preliminary landings total was 1,050 mt. Since the NEFSC allocation algorithm landings for 2008 just became available, the PDT queried that database; 2008 landings were 817 mt (it is not unusual for the NEFSC landings to differ form the preliminary landings since they use different methods to allocate landings to stock area). Using the NEFSC landings, the estimated catch for 2008 for GB winter flounder was 1,017 mt. This value was used to estimate the mortality in 2008 and Frebuild needed to rebuild by 2017 with a 75 percent probability. Results are summarized in Table 1. For 2009, the projections used the assumption that the interim action will achieve F_{MSY}.

Table 1 – Updated GB winter flounder mortality targets

	Draft Amendment 16	Updated Values
2008 Catch	722 mt	1,017 mt
2008 F	0.131	0.189
Frebuild (2017, 75% probability)	0.205	0.205
75%FMSY	0.195	0.195
Change Needed to Frebuild	+56%	+8%
Change Needed to 75%FMSY	+49%	+3%

4. While the revised catch estimate increases the estimated 2008 fishing mortality, the estimated mortality remains lower than either Frebuild or 75%FMSY. All draft Amendment 16 effort control options are expected to reduce mortality on this stock. The revised catch does not trigger a need to modify effort control measures for GB winter flounder.

5. This exercise demonstrates that when calculating ABCs later this year, 2008 catch should be calculated again to get the most accurate values to use in the projections. The PDT will pursue updating discard estimates as well as landing estimates.

Pollock

6. Draft Amendment 16 acknowledges that two effort control alternatives do not meet the rebuilding objectives for pollock. The PDT re-estimated pollock catch in 2008, with the 2008 catch being 678 mt higher (7 percent) than estimated in draft Amendment 16. The calculations are compared below.

Table 2 – Comparison of 2008 catch estimates for pollock

	Draft Amendment 16	Updated Values
2008 Commercial Landings	8,964 mt	9,875 mt
2008 Recreational Harvest	383 mt	383 mt
Canadian Catch	650 mt	417 mt
Total	9,997 mt	10,675 mt

7. The fishing mortality (more accurately, exploitation index) needed to rebuild pollock by 2017 was also recalculated. Two changes in the use of the index projection were included in this calculation. First, the exploitation expected to result from the interim action was used for 2009. Second, the Science and Statistical Committee (SSC) provided advice on estimating the 2008 average survey index for the projection. The impact of these changes, and the 2008 revised catch estimate, is to increase the 2008 exploitation, reduce the rebuilding target exploitation, and as a result increase the change in exploitation targeted by the amendment. The calculations are compared below.

Table 3 – Comparison of pollock rebuilding targets

	Draft Amendment 16	Updated Values
2008 EI	11.249	15.516
Frebuild (2017)	4.564	4.039
Reduction Needed	-59%	-74%
75%FMSY	4.245	4.245
Reduction Needed	-62%	-73%

8. Since approximately 9 percent of pollock catches came from the Category B DAS program in recent years, eliminating the ability to target pollock in that program means that other effort control measures need to reduce exploitation by 66.6 percent. The PDT believes the CAM – which aggregates data by month – does not fully capture the impacts of the proposed pollock trip limit. The CAM does not completely capture changes in behavior at the tow level that the observer data suggests may occur with a trip limit on this stock. The trip limit model estimated a reduction of 23 percent. If this was completely independent of the CAM results, it would mean the CAM needed a 57 percent reduction, but this is not the case because the model does appear to capture some of the effects of the trip limit. The targeted reduction is thus between 57 and 67 percent. Only Option 3A meets this goal at present.

9. The PDT examined observer and dealer data to determine if there is evidence that a pollock trip limit might reduce pollock fishing mortality. Enclosure (2) summarizes an analysis that indicates there is fishing behavior that specifically targets pollock and that this behavior might be modified by a trip limit. In addition, PDT members used 2008 VTR data to construct a trip-based trip limit model that estimated exploitation reductions that might be achieved by a trip limit. Both approaches suggested a daily trip limit in the range of 1,000 – 5,000 pounds/DAS would be expected to reduce pollock catches, but would also increase discard rates. One of the weaknesses of these analyses is that Category A and Category B DAS trips were not analyzed independently because the DAS, observer, and VTR data are not linked. It is possible that the conclusions are biased to over-estimate the impact of a trip limit as a result. It should be noted that targeting pollock on B DAS did not become common until late 2007 and 2008, so to the extent the analyses included data from 2006 and the first half of 2007 this problem should not be substantial.

10. Based on these two analyses, the PDT developed two versions of effort control Alternative 2A that meet the pollock rebuilding target. Das reductions are increased, the differential DAS areas remain as described in Draft Amendment 16 but the rates change, and trip limits are also revised for pollock. Measures are shown in Table 4 and expected biological impacts in Table 5. For stocks that need a mortality reduction, the "change needed" column reflects a mortality target of 75% of F_{MSY} if that is lower than Frebuild, based on advice expected to be received from the SSC. This is only the case for GOM cod, witch flounder, and CC/GOM yellowtail flounder.

Table 4 – Modified measures for Alternative 2A

Measure	2A – Mod 1	2A – Mod 2
Cat A DAS Change	-30%	-35%
Differential DAS Counting	Inshore GOM 2.5:1 Offshore GOM 2:1 GB 1.5:1 SNE 2:1	
Trip Limits	GOM Cod -2,000 lbs./day/12,000 trip GB Cod - 2,000 lbs./day/20,000 trip EGB Cod - 500 lbs./day (E US/CA Area) CC/GOM GM YT - 500lbs./day/ 3,000 trip SNE/MA YT - 500 lbs./day/3,000 trip Pollock -1,000/day/10,000 trip	

Table 5 – Expected biological impacts of modified versions of Alternative 2A

Spec	AREA	Needed Difference based on SSC	Option 2A W/30% reduction in DAS	Option 2A W/35% reduction in DAS
COD	GBANK	-50.2%	-45.9%	-49.8%
COD	GM	*-36.0%*	-46.9%	-50.8%
HAD	GBANK	272.4%	-42.1%	-46.4%
HAD	GM	58.5%	-50.4%	-54.3%
BLACK	GBANK	86.9%	-41.2%	-45.6%
BLACK	GM	-9.3%	-34.1%	-38.8%
BLACK	SNEMA	-100.0%	-67.5%	-70.3%
PL	ALL	83.3%	-56.1%	-59.2%
WITCH	ALL	*-46.0%*	-52.6%	-56.0%
WHK	ALL	*28.1%*	-63.9%	-66.7%
WIND	NORTH	-74.5%	-43.0%	-47.0%
WIND	SOUTH	-20.5%	-43.5%	-48.1%
YT	CCGOM	-34.0%	-50.3%	-54.5%
YT	GBANK	-15.3%	-37.6%	-42.4%
YT	SNEMA	-36.1%	-45.4%	-48.7%
POL	ALL	-57% /- 67.0%	-61.4%	-64.1%
RED	ALL	368.0%	-63.5%	-66.3%

11. The PDT notes that there are considerable costs in lost yield that result of designing an effort control program to achieve mortality targets for the weakest stock. That problem is exacerbated when the stock in question is assessed with an index-based assessment, usually considered a less robust assessment model, and when the projection model also has considerable uncertainty. Whether this over-design is necessary may depend in part on the design of accountability measures for common pool vessels.

ABC Calculations

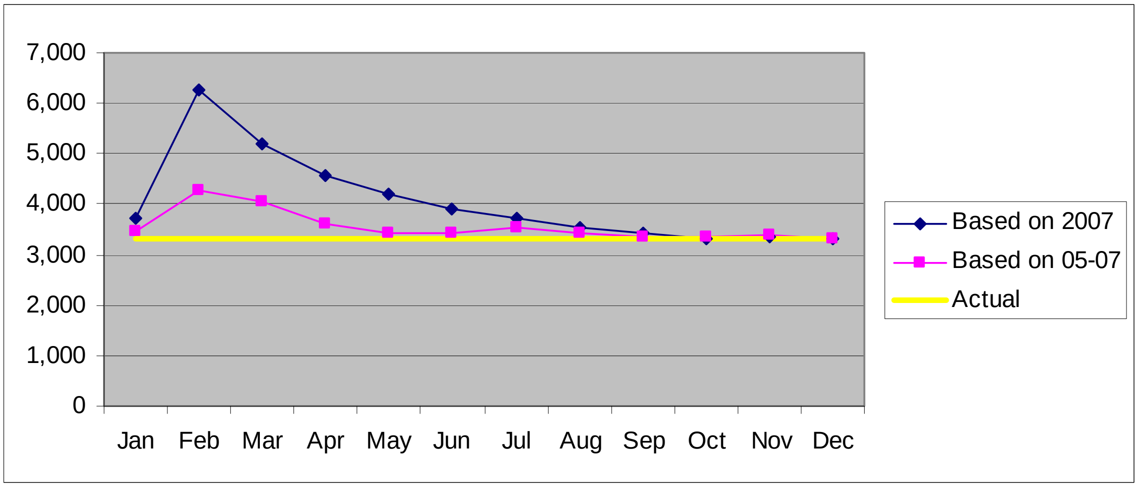
12. The PDT met with the SSC in late April to discuss evaluating scientific uncertainty when setting ABCs. Based on a meeting with the SSC last summer, the PDT used the GARM II

assessment results to test the PDT's approach for evaluating scientific uncertainty and setting ABCs using that evaluation to select the catch distribution from the projection model. When tested on GB cod, GOM cod, and CC/GOM yellowtail flounder, the approach would not have set ABCs at levels that would have constrained 2006 and 2007 catches and would not have ended overfishing as a result. The SSC is expected to reject the PDT's approach and to suggest an alternative. The SSC report was not completed as of the PDT meeting so the exact recommendation is uncertain, but the PDT expects that the SSC will recommend that the median catch at 75% of F_{MSY} will be the basis for groundfish control rules unless Frebuild is lower. Several illustrative projections were performed by the PDT that show the SSC's approach gives catches that are similar to those that would result from the PDT's approach (which would likely select a catch at a distribution lower than the median projection output). See enclosure (3).

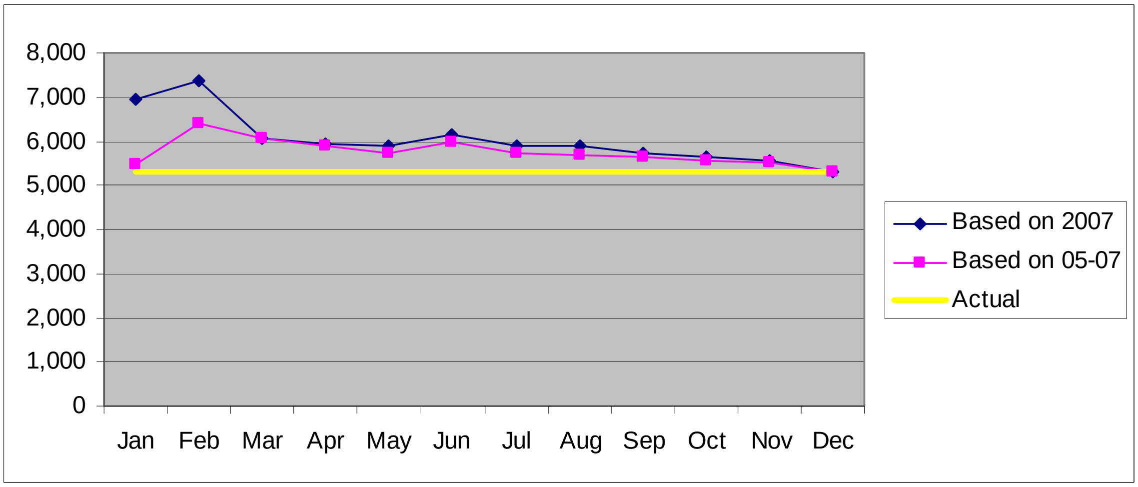
13. The PDT will meet with the SSC in August or September to set ABCs. Prior to that meeting, as mentioned above the PDT will attempt to calculate 2008 catch for these projections.

Enclosure (1) – Comparison of Catch Estimates

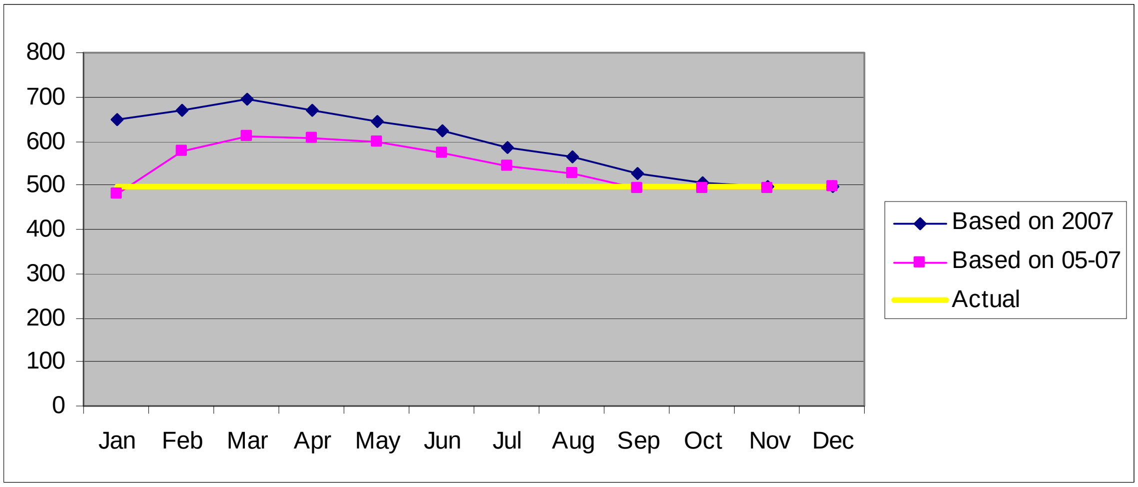
GB Cod



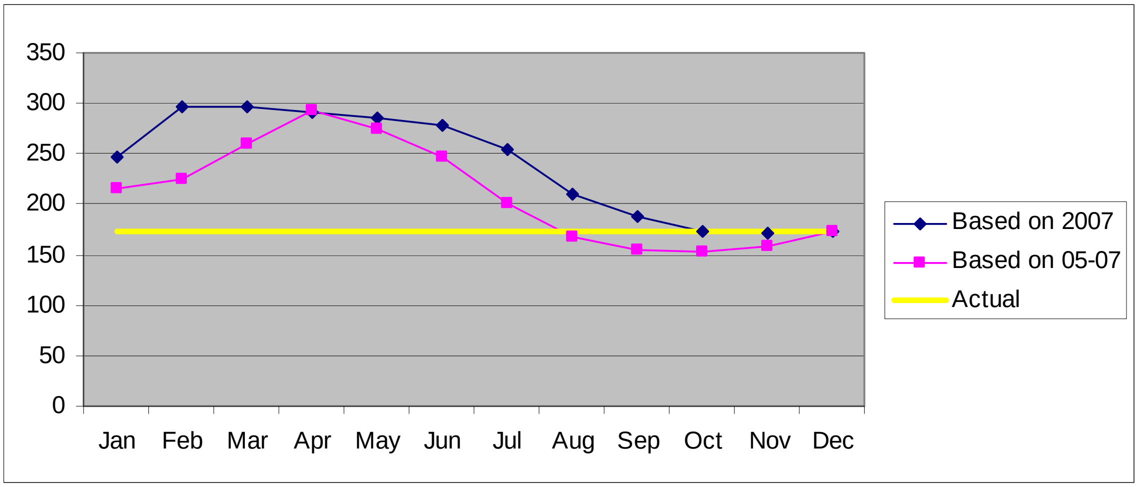
GOM Cod



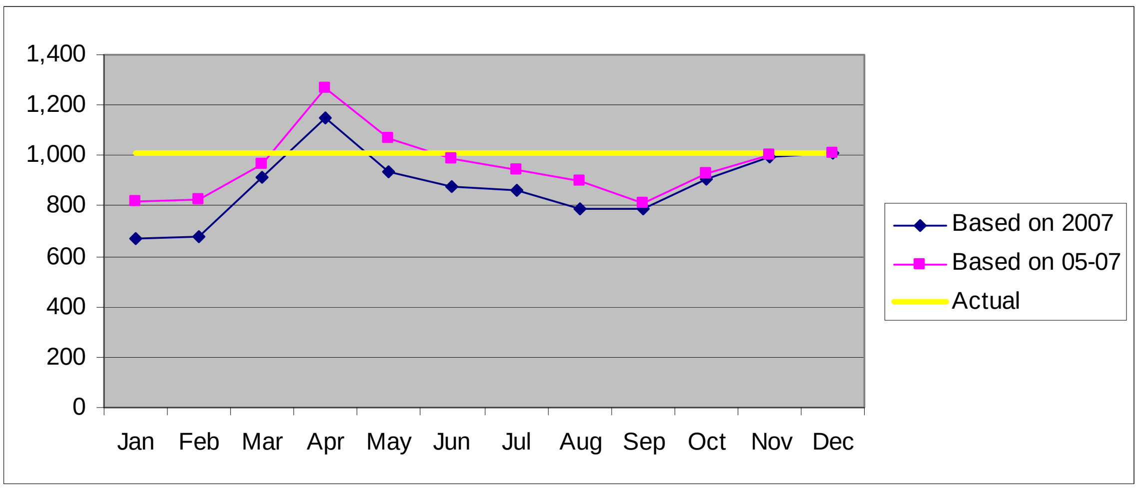
CCGOM YTF



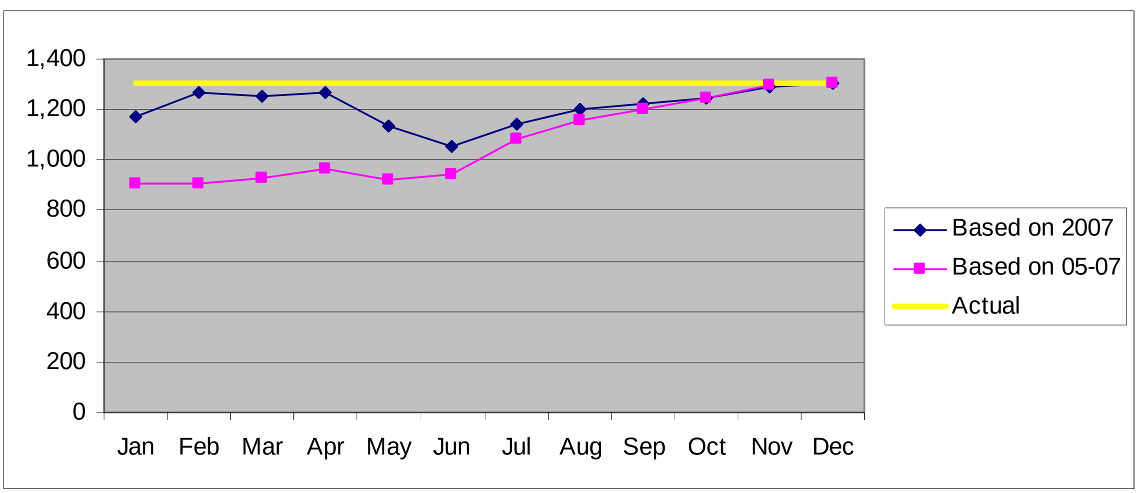
SNE/MA YTF



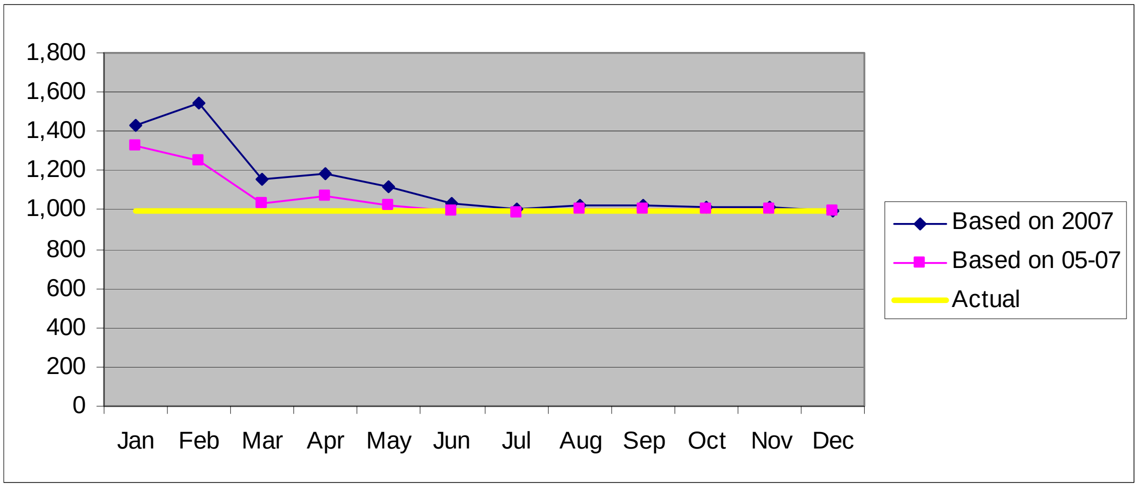
SNE/MA WFL



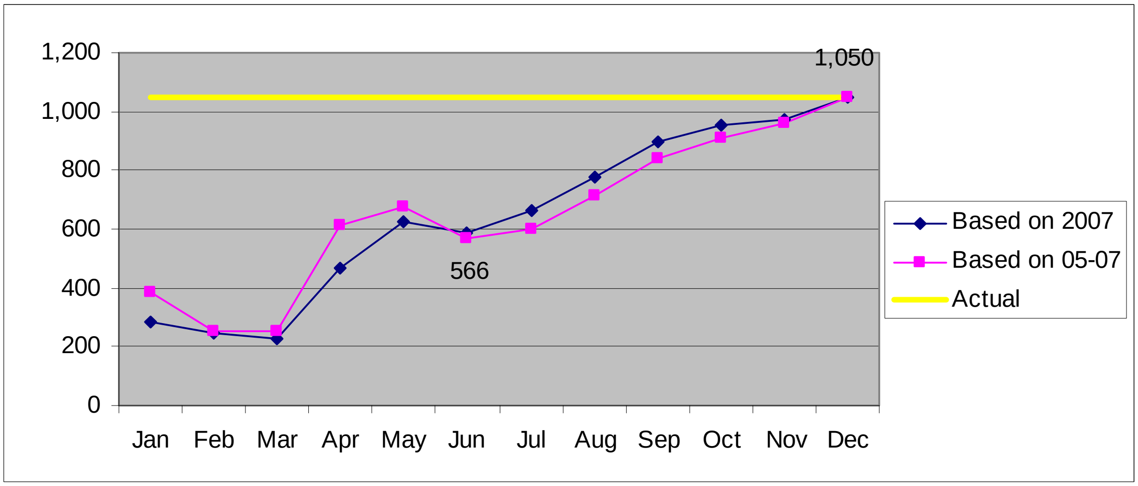
White Hake



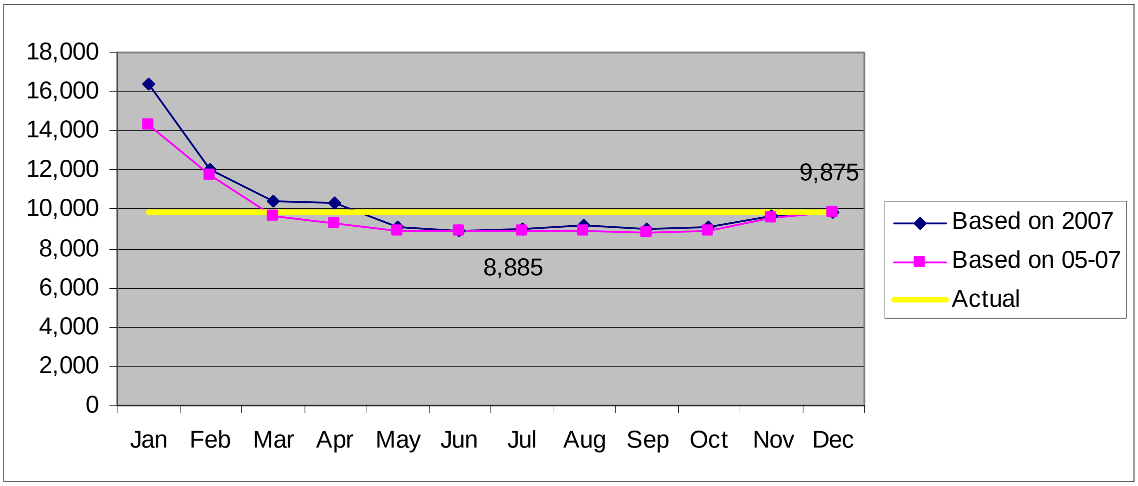
Witch



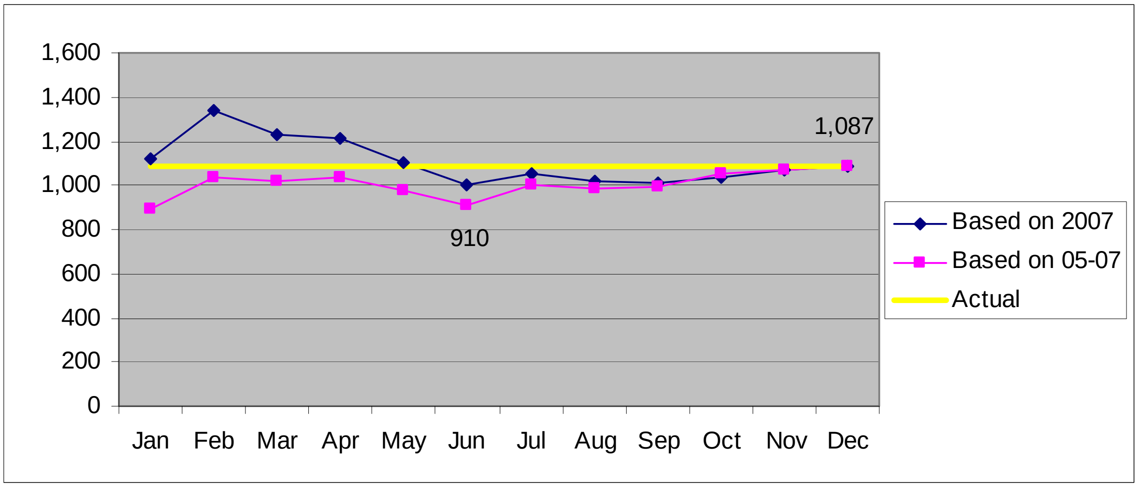
GB WFL



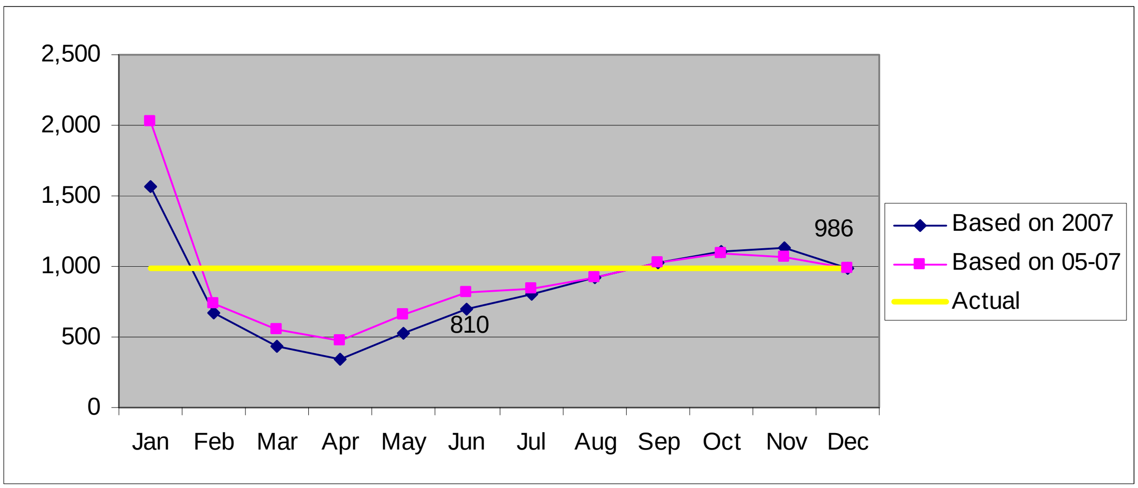
Pollock



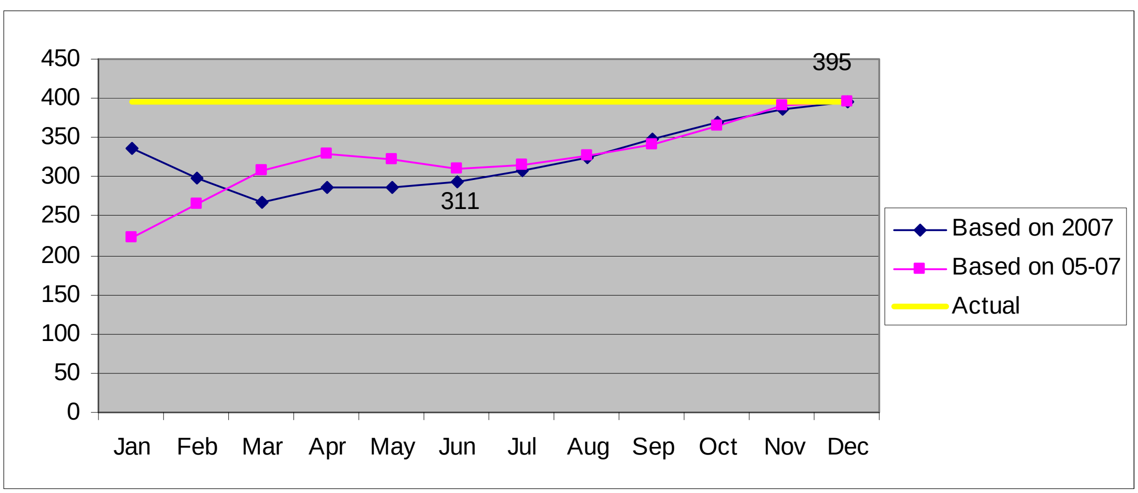
Plaice



GB YTF



GOM Haddock



Enclosure (2) – Pollock Trip Limit Exploration

Introduction
Available data was examined to determine if there is evidence that pollock catches might be successfully reduced by a trip limit. The focus was on observer data, since this is the only source that can reveal differences in catches at the tow level, and in accurate locations. Commercial dealer data was also queried, however, to suggest an appropriate trip limit and to determine if information in the observed trips was replicated in the dealer data.

Observer Data
Observer data for CY 2006 through 2008 was queried to determine if there were indications that catches of pollock by sink gillnet (100) and bottom trawl (050) gear can be effectively controlled by a trip limit.

Trip-Based Analyses
The first analyses focused on observed trips at the trip level. Trips were selected that kept any of the regulated groundfish species or monkfish in CY 2006 through 2008. The trips were assigned to one of three categories based on the amount of pollock kept: pollock as 80 percent or more of the live weight of the kept catch, pollock was 50 percent to 79 percent of the weight of the kept catch, and pollock was less than 50 percent of the weight of kept catch. These analyses focused on trips that kept at least one pound of pollock.

Trawl Gear
Figure 1 is a histogram of the pollock kept by trawl gear on observed trips. Kept catch ranged up to nearly 100,000 pounds of pollock, live weight. From 2006 to 2008 there is evidence of a shift in the distribution to higher catches per trip.

The data was pooled across all years. The catches of pollock (ln(kept catch +0.00001) were then correlated with other groundfish species to determine what species are kept on the trips that catch pollock. The correlation was performed for each of the three categories of pollock kept catch.

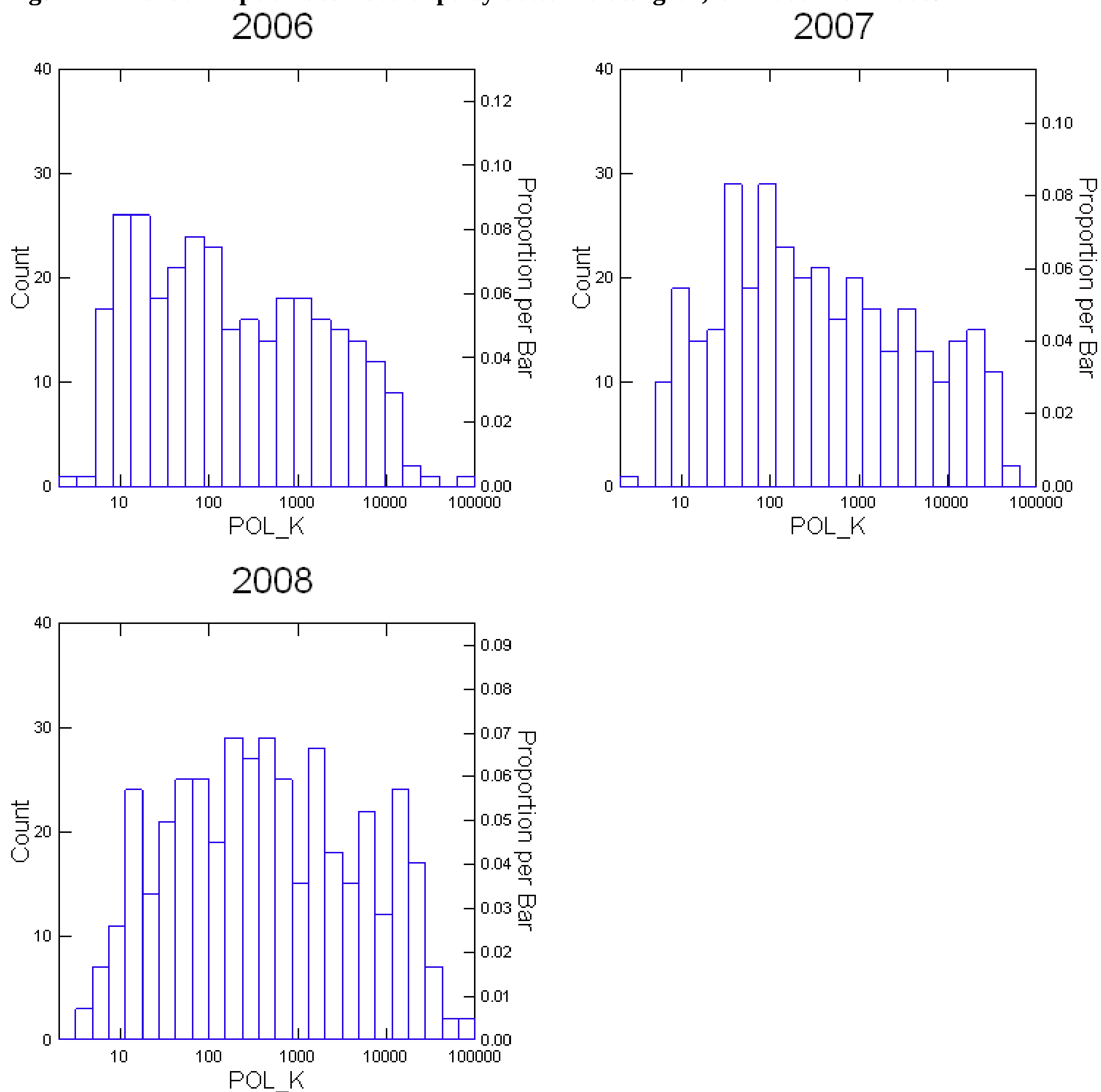
The results of the correlation analysis show differences in the relationship between pollock and other species among the different pollock kept categories. When pollock is less than 50 percent of the kept catch, catches of pollock show a weak positive correlation with witch flounder, plaice, redfish, and monkfish. When pollock is 50 to 79 percent of the kept catch, the catches are more strongly correlated with witch flounder (r=0.751), plaice (0.601), redfish (0.729) and monkfish (0.647). When pollock is 80 percent or more of the kept catch, the correlation of pollock with witch flounder, plaice, and monkfish is the lowest of the three pollock kept catch categories; redfish remains weakly correlated (r=0.429). Winter flounder and yellowtail flounder are negatively correlated with pollock in all three categories.

An ANOVA was performed on the three categories (data pooled across all years) to determine if there were significant differences in the amount of pollock kept per trip between the three categories. While the assigned categories were found to be significant in determining the amount of pollock kept per trip, there was no significant difference between the two largest categories for the pooled data.

Sink Gillnet
Similar analyses were performed for sink gillnet observed trips.

Figure 2 shows the distribution of pollock kept per trip. As noted with trawl gear, there is a shift to higher kept catches of pollock per trip between 2006 and 2008. The correlation analyses show that pollock kept catch per trip is only weakly correlated with redfish (r=0.381) and no other species when pollock is less than 50 percent of the kept catch. When pollock is 50 to 79 percent of the kept catch, it is correlated with witch flounder (r=0.332), monkfish (0.554), and redfish (0.354). When pollock is 80 percent or more of the kept catch it is more strongly correlated with witch flounder (0.541) and redfish (0.554); it is less correlated with monkfish (0.425).

Figure 1 – Pollock kept on observed trips by bottom trawl gear, CY 2006 – CY 2008.



Results for PCT_CLASS$ = Less_than_50%

Data for the following results were selected according to
SELECT (YR_LND$ <> '2009') AND (NEGEAR$ = '050') AND (POL_K > 0)

Number of Observations: 987

Means

LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
6.895	5.505	0.110	5.410	0.161	3.548	-0.488	2.947	-8.381	-1.423	6.419	-1.616

Pearson Correlation Matrix

	LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
LN_COD_K	1.000											
LN_HAD_K	0.413	1.000										
LN_WHAK_K	0.061	0.320	1.000									
LN_POL_K	0.177	0.273	0.534	1.000								
LN_WFL_K	0.258	0.166	-0.233	-0.289	1.000							
LN_WITCH_K	0.109	0.379	0.533	0.378	-0.136	1.000						
LN_YFL_K	0.162	0.080	-0.274	-0.346	0.665	-0.182	1.000					
LN_PLAICE_K	0.105	0.378	0.466	0.357	-0.098	0.703	-0.130	1.000				
LN_HAL_K	0.149	0.133	0.203	0.156	0.011	0.189	-0.022	0.159	1.000			
LN_REDF_K	0.075	0.280	0.620	0.586	-0.279	0.493	-0.374	0.450	0.178	1.000		
LN_MONK_K	0.133	0.370	0.497	0.324	-0.010	0.590	-0.100	0.527	0.186	0.408	1.000	
LN_SKTS_K	0.244	0.192	-0.001	-0.024	0.352	0.072	0.229	0.066	0.088	0.000	0.194	1.000

Results for PCT_CLASS$ = 50%_to_79%

Data for the following results were selected according to
SELECT (YR_LND$ <> '2009') AND (NEGEAR$ = '050') AND (POL_K > 0)

Number of Observations: 57

Means

LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
6.449	4.850	3.299	9.224	-5.327	3.499	-4.320	3.485	-10.730	3.327	6.250	-7.046

Pearson Correlation Matrix

	LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
LN_COD_K	1.000											
LN_HAD_K	0.353	1.000										
LN_WHAK_K	0.104	0.619	1.000									
LN_POL_K	0.341	0.708	0.745	1.000								
LN_WFL_K	0.186	-0.127	-0.345	-0.243	1.000							
LN_WITCH_K	0.227	0.529	0.809	0.751	-0.370	1.000						
LN_YFL_K	0.255	0.034	-0.139	-0.177	0.575	-0.234	1.000					
LN_PLAICE_K	0.234	0.364	0.593	0.601	-0.301	0.726	-0.119	1.000				
LN_HAL_K	-0.144	0.109	0.148	0.147	-0.013	0.092	0.087	0.086	1.000			
LN_REDF_K	0.034	0.541	0.768	0.729	-0.318	0.748	-0.280	0.481	0.095	1.000		
LN_MONK_K	0.085	0.295	0.671	0.647	-0.284	0.754	-0.278	0.531	0.110	0.625	1.000	
LN_SKTS_K	0.250	0.209	0.108	0.157	0.352	0.113	0.122	0.039	0.017	0.073	0.003	1.000

Results for PCT_CLASS$ = 80%_and_0ver

Data for the following results were selected according to
SELECT (YR_LND$ <> '2009') AND (NEGEAR$ = '050') AND (POL_K > 0)

Number of Observations: 33

Means

LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
2.986	0.062	-2.932	9.909	-5.675	-2.103	-7.655	-1.901	-11.009	-0.320	1.533	-10.633

Pearson Correlation Matrix

	LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
LN_COD_K	1.000											
LN_HAD_K	0.152	1.000										
LN_WHAK_K	0.020	0.698	1.000									
LN_POL_K	-0.019	0.403	0.356	1.000								
LN_WFL_K	0.454	-0.306	-0.392	-0.063	1.000							
LN_WITCH_K	0.381	0.560	0.597	0.087	-0.083	1.000						
LN_YFL_K	0.336	-0.232	-0.194	-0.271	0.680	0.089	1.000					
LN_PLAICE_K	0.301	0.440	0.619	0.089	-0.148	0.752	0.205	1.000				
LN_HAL_K	0.179	0.204	0.203	0.230	0.188	0.201	0.320	0.199	1.000			
LN_REDF_K	0.103	0.827	0.799	0.429	-0.379	0.653	-0.356	0.526	0.147	1.000		
LN_MONK_K	0.482	0.403	0.494	0.017	-0.027	0.604	0.032	0.596	0.155	0.410	1.000	
LN_SKTS_K	0.185	0.230	0.018	0.201	0.029	0.238	0.155	0.225	0.702	0.190	0.153	1.000

▼ Analysis of Variance

Data for the following results were selected according to
SELECT (YR_LND$ <> '2009') AND (NEGEAR$ = '050') AND (POL_K > 0)

Effects coding used for categorical variables in model.

Variables	Levels		
PCT_CLASS$ (3 levels)	50%_to_79%	80%_and_0ver	Less_than_50%

Dependent Variable	LN_POL_K
N	1077
Multiple R	0.471
Squared Multiple R	0.222

Estimates of Effects B = $(X'X)^{-1}X'Y$

Factor	Level	LN_POL_K
CONSTANT		8.181
PCT_CLASS$	50%_to_79%	1.043
PCT_CLASS$	80%_and_0ver	1.728

Analysis of Variance

Source	Type III SS	df	Mean Squares	F-ratio	p-value
PCT_CLASS$	1372.821	2	686.411	153.374	0.000
Error	4806.590	1074	4.475		

Least Squares Means

Factor	Level	LS Mean	Standard Error	N
PCT_CLASS$	50%_to_79%	9.224	0.280	57.000
PCT_CLASS$	80%_and_0ver	9.909	0.368	33.000
PCT_CLASS$	Less_than_50%	5.410	0.067	987.000

Post Hoc Test of LN_POL_K
Using least squares means.

Using model MSE of 4.475 with 1074 df.

Tukey's Honestly-Significant-Difference Test

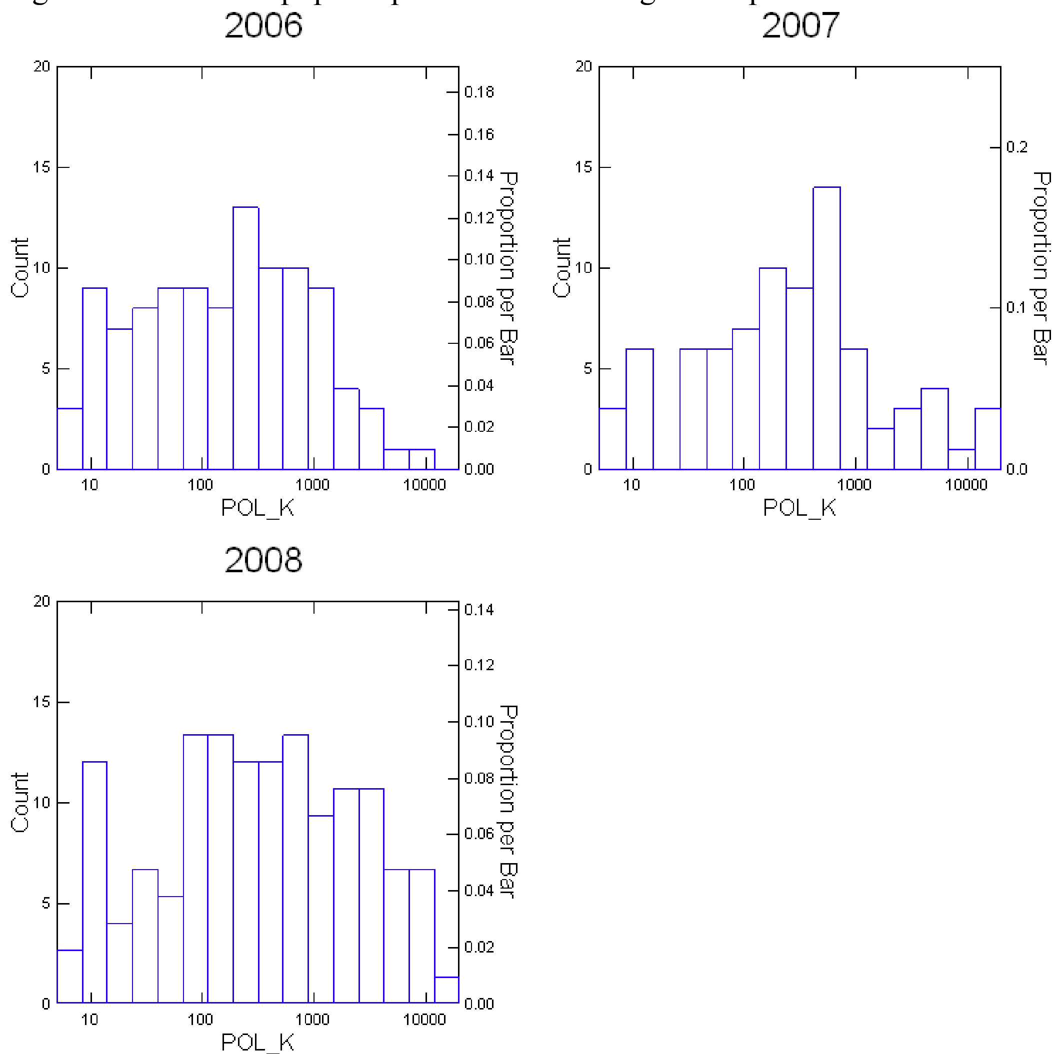
PCT_CLASS$(i)	PCT_CLASS$(j)	Difference	p-value	95.0% Confidence Interval	
				Lower	Upper
50%_to_79%	80%_and_0ver	-0.685	0.300	-1.769	0.400
50%_to_79%	Less_than_50%	3.814	0.000	3.139	4.489
80%_and_0ver	Less_than_50%	4.499	0.000	3.622	5.376

Bonferroni Test

PCT_CLASS$(i)	PCT_CLASS$(j)	Difference	p-value	95.0% Confidence Interval	
				Lower	Upper
50%_to_79%	80%_and_0ver	-0.685	0.417	-1.794	0.425
50%_to_79%	Less_than_50%	3.814	0.000	3.123	4.505
80%_and_0ver	Less_than_50%	4.499	0.000	3.601	5.397

Gillnet, 2006-2008, pollock kept>0

Figure 2 – Pollock kept per trip on observed sink gillnet rips



Results for PCT_CLASS$ = Less_than_50%

Data for the following results were selected according to
SELECT (NEGEAR$ = '100') AND (YR_LND$ <> '2009') AND (POL_K > 0)

Number of Observations: 237

Means

LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
5.748	-3.056	-4.974	4.872	-4.670	-8.669	-7.926	-9.149	-11.267	-8.410	0.800	-10.593

Pearson Correlation Matrix

	LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
LN_COD_K	1.000											
LN_HAD_K	0.240	1.000										
LN_WHAK_K	0.141	0.286	1.000									
LN_POL_K	0.323	0.326	0.400	1.000								
LN_WFL_K	0.156	0.122	-0.051	-0.102	1.000							
LN_WITCH_K	-0.011	0.126	0.287	0.115	-0.109	1.000						
LN_YFL_K	0.092	0.129	-0.241	-0.173	0.363	-0.021	1.000					
LN_PLAICE_K	0.103	0.188	0.262	0.169	-0.013	0.319	0.098	1.000				
LN_HAL_K	0.015	-0.021	-0.042	-0.027	0.017	0.009	0.052	0.017	1.000			
LN_REDF_K	0.066	0.157	0.391	0.381	-0.335	0.193	-0.211	0.286	0.014	1.000		
LN_MONK_K	-0.152	0.129	0.332	0.136	-0.030	0.234	-0.067	0.168	0.091	0.184	1.000	
LN_SKTS_K	-0.298	-0.034	-0.061	-0.106	0.110	0.043	0.118	0.056	0.105	-0.080	0.110	1.000

Results for PCT_CLASS$ = 50%_to_79%

Data for the following results were selected according to
SELECT (NEGEAR$ = '100') AND (YR_LND$ <> '2009') AND (POL_K > 0)

Number of Observations: 33

Means

LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
6.301	0.210	0.019	7.563	-7.901	-8.529	-10.836	-7.147	-11.513	-2.032	2.577	-11.082

Pearson Correlation Matrix

	LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
LN_COD_K	1.000											
LN_HAD_K	0.411	1.000										
LN_WHAK_K	0.208	0.047	1.000									
LN_POL_K	0.802	0.357	0.418	1.000								
LN_WFL_K	0.110	-0.052	-0.250	-0.111	1.000							
LN_WITCH_K	0.167	0.283	0.256	0.332	-0.343	1.000						
LN_YFL_K	0.090	0.063	-0.134	0.110	-0.154	0.124	1.000					
LN_PLAICE_K	0.127	0.330	0.370	0.223	-0.148	0.343	-0.179	1.000				
LN_HAL_K	.	.	.	.	.	.	.	.	.			
LN_REDF_K	0.232	0.011	0.472	0.354	-0.435	0.460	0.142	0.325	.	1.000		
LN_MONK_K	0.616	0.566	0.348	0.554	0.126	0.126	0.098	0.218	.	0.072	1.000	
LN_SKTS_K	0.248	0.118	0.190	0.290	-0.108	0.376	-0.045	0.281	.	0.216	0.090	1.000

Results for PCT_CLASS$ = 80%_and_0ver

Data for the following results were selected according to
SELECT (NEGEAR$ = '100') AND (YR_LND$ <> '2009') AND (POL_K > 0)

Number of Observations: 19

Means

LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
5.475	-4.217	-2.303	8.816	-8.258	-9.462	-11.513	-9.491	-11.513	-0.317	0.819	-10.791

Pearson Correlation Matrix

	LN_COD_K	LN_HAD_K	LN_WHAK_K	LN_POL_K	LN_WFL_K	LN_WITCH_K	LN_YFL_K	LN_PLAICE_K	LN_HAL_K	LN_REDF_K	LN_MONK_K	LN_SKTS_K
LN_COD_K	1.000											
LN_HAD_K	0.074	1.000										
LN_WHAK_K	0.168	0.440	1.000									
LN_POL_K	0.147	0.275	0.279	1.000								
LN_WFL_K	-0.387	0.063	0.257	0.053	1.000							
LN_WITCH_K	-0.195	0.410	0.350	0.541	0.380	1.000						
LN_YFL_K	.	.	.	.	.	.	.					
LN_PLAICE_K	-0.026	0.117	0.070	-0.081	-0.258	-0.187	.	1.000				
LN_HAL_K	.	.	.	.	.	.	.	.	.			
LN_REDF_K	0.475	0.567	0.673	0.554	-0.013	0.271	.	0.179	.	1.000		
LN_MONK_K	0.503	-0.052	0.114	0.425	0.015	0.235	.	0.188	.	0.339	1.000	
LN_SKTS_K	0.036	0.221	0.240	0.036	-0.141	-0.102	.	-0.102	.	0.241	-0.450	1.000

▼ Analysis of Variance

Data for the following results were selected according to
SELECT (YR_LND$ <> '2009') AND (NEGEAR$ = '100') AND (POL_K > 0)

Effects coding used for categorical variables in model.

Variables	Levels		
PCT_CLASS$ (3 levels)	50%_to_79%	80%_and_0ver	Less_than_50%

Dependent Variable	LN_POL_K
N	289
Multiple R	0.652
Squared Multiple R	0.425

Estimates of Effects B = (X'X)$^{-1}$X'Y

Factor	Level	LN_POL_K
CONSTANT		7.084
PCT_CLASS$	50%_to_79%	0.480
PCT_CLASS$	80%_and_0ver	1.732

Analysis of Variance

Source	Type III SS	df	Mean Squares	F-ratio	p-value
PCT_CLASS$	441.855	2	220.928	105.876	0.000
Error	596.784	286	2.087		

Least Squares Means

Factor	Level	LS Mean	Standard Error	N
PCT_CLASS$	50%_to_79%	7.563	0.251	33.000
PCT_CLASS$	80%_and_0ver	8.816	0.331	19.000
PCT_CLASS$	Less_than_50%	4.872	0.094	237.000

▼Hypothesis Tests

Post Hoc Test of LN_POL_K
Using least squares means.

Using model MSE of 2.087 with 286 df.

Tukey's Honestly-Significant-Difference Test

PCT_CLASS$(i)	PCT_CLASS$(j)	Difference	p-value	95.0% Confidence Interval	
				Lower	Upper
50%_to_79%	80%_and_0ver	-1.253	0.007	-2.228	-0.278
50%_to_79%	Less_than_50%	2.692	0.000	2.063	3.321
80%_and_0ver	Less_than_50%	3.944	0.000	3.137	4.751

Bonferroni Test

PCT_CLASS$(i)	PCT_CLASS$(j)	Difference	p-value	95.0% Confidence Interval	
				Lower	Upper
50%_to_79%	80%_and_0ver	-1.253	0.009	-2.254	-0.251
50%_to_79%	Less_than_50%	2.692	0.000	2.045	3.338
80%_and_0ver	Less_than_50%	3.944	0.000	3.115	4.774

Tow-based Analyses

Using the observer database, kept catches on observed tows (or sets) from 2006 through 2008 were examined to determine if there is evidence a trip limit for pollock might reduce pollock catches. Similar to the trip based analyses, the tows were classified based on the amount of pollock kept as a percent of the total pollock kept for the trip. Each tow was also categorized based on pollock kept as a percent of the total kept for that tow. While data was collected for all observed gear, the analyses focused on the two primary groundfish gears that land pollock: trawl (050) and sink gillnet (100).

For each of the trip and gear categories, the number of tows (or sets) was identified where pollock was 80 percent or more of the kept catch for the tow, and where pollock was 50 percent or more of the kept catch for the tow. While this approach indicates whether pollock is caught in large quantities on any given tow, it does not address the possibility that this may be a random event. For this reason, the analysis was extended. The number of times that a tow where pollock was 80 percent or more of the kept catch was followed by a similar tow was counted. A second analysis included tows in this count that were the first tow of a trip (which assumes that if pollock was a high percentage of the kept catch on the first tow it was not a random event). Results are summarized in Table 6.

For trawl gear, when pollock was a high percentage of the kept catch, the kept catch on 82 percent of the tows was 80 percent or more pollock. Over half these large tows were preceded by a similar tow; when first tows of the trip are included, the percentage increases to 62 percent. These large tows accounted for 97 percent of the pollock landed on these trips. When pollock was 50-79 percent of the kept catch for the trip, the percentage of tows that were 80 percent or more pollock declined to 24 percent of the tows, but these tows still accounted for 70 percent of the pollock landed on the trip. Repeat large tows declined to 12 percent (14 percent if first tows are included). The average pollock per tow on the large pollock trips was 3,292 pounds (live weight) while the average on the mid-category trips was 944 pounds. One interesting observation is that the large pollock trips, on average, made fewer total tows. This may explain why the trip level analyses did not detect a statistically significant difference in the pollock kept between these two trip categories.

For gillnet gear, the results are similar. On large pollock trips, pollock was 80 percent or more of the kept catch on 78 percent of the sets. These sets accounted for 93 percent of the pollock kept on these trips. 58 percent of the large sets were preceded by a similar set; if first sets are included this increases to 64 percent. For trips where pollock was 50 to 79 percent of the kept catch, only 19 percent of the sets resulted in pollock equal to 80 percent or more of the kept catch, and these sets accounted for only 33 percent of the pollock kept on these trips. Only 5 percent of these sets were preceded by a similar set (10 percent if first sets of the trip are included).

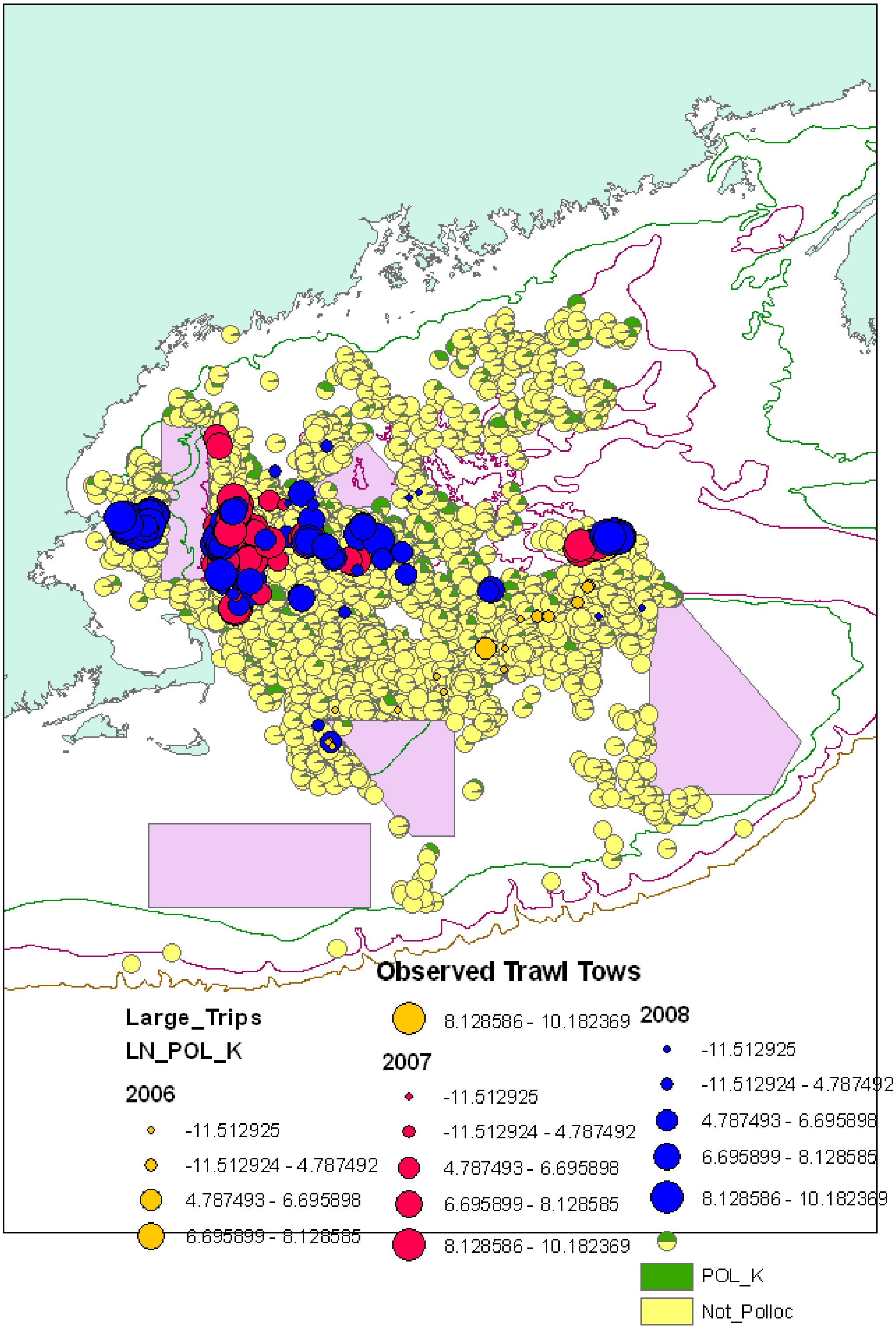
Figure 3 shows the location of tows on observed trips where pollock was more than 80 percent of the kept catch. The large tows are concentrated in the vicinity of the WGOM closed area and the Cashes Ledge closed area. The figure also shows trawl tows on trips where pollock was less than 80 percent of the kept catch. For this plot the symbols reflect pollock as a percent of the total kept catch, without scaling the symbol for the size of the tow. This chart suggests that the locations for the large pollock tows are narrowly defined and while pollock is caught in many areas, the areas where it consists of the majority of the kept catch on a tow are not random. The chart also shows that large pollock trawl catches west of the WGOM closed area are a recent change in the pattern of pollock fishing.

Table 6 – Pollock kept catch on observed trawl and gillnet trips catching groundfish or monkfish; CY 2006 – 2008.

		Trawl (050)					
		All Trips		**Trips, >=80%**		**Trips, 50-79**	
Tows, All							
	Trips	2,930		33		57	2%
	Tows	38,304		286		972	3%
	Pollock	3,474,043		941,595		918,229	26%
	Avg Pollock/Tow	91		3,292		944	
	1st tow or preceded by 80%	409	1%	178	62%	133	14%
	Preceded by 80%	357	1%	153	53%	119	12%
Tows, >=80% Pollock							
	Tows	712	2%	234	82%	233	24%
	Pollock	2,104,326	61%	912,575	97%	640,960	70%
Tows, >=50% Pollock							
	Tows	1,335	3%	253	88%	412	42%
	Pollock	2,747,688	79%	938,562	100%	848,448	92%

		Gillnet (100)					
		All Trips		**Trips, >=80%**		**Trips, 50-79**	
Sets, All							
	Trips	721		19		33	
	Sets	3,211		120		186	
	Pollock	326,247		153,686		88,390	
	Avg Pollock/Tow	102		1,281		475	
	1st set or preceded by 80%	96	3%	77	64%	18	10%
	Preceded by 80%	79	2%	69	58%	10	5%
Sets, >=80% Pollock							
	Sets	138	4%	93	78%	35	19%
	Pollock	178,071	55%	143,395	93%	29,282	33%
Sets, >=50% Pollock							
	Sets	320	10%	112	93%	125	67%
	Pollock	259,505	80%	153,033	100%	76,820	87%

Figure 3 – Observed trawl locations on tows keeping pollock, CY 2006 – 2008.



Dealer Data Analysis

In the analysis of observer data, there was no statistically significant difference in the average pollock kept per trip for the two largest pollock kept categories. The dealer trip data for 2008 was examined to see if the same relationship held true.

Unlike the observed trawl trips, there was a statistically different average pollock landed per trip among all three categories. Most notably, the average catch of pollock (ln(live pounds landed)) for trips where pollock was 50-79 percent of the landed catch was less than the average pounds of pollock landed for trips where pollock was 80 percent or greater of the landed catch. The following tables report the ANOVA results.

Dependent Variable	LN_POL
N	3564
Multiple R	0.519
Squared Multiple R	0.270

Analysis of Variance

Source	Type III SS	df	Mean Squares	F-ratio	p-value
POL_CAT$	5563.466	2	2781.733	657.862	0.000
Error	15057.483	3561	4.228		

▼Hypothesis Tests

Tukey's Honestly-Significant-Difference Test

POL_CAT$(i)	POL_CAT$(j)	Difference	p-value	95.0% Confidence Interval	
				Lower	Upper
50 to 79	80 and Over	-0.571	0.010	-1.030	-0.111
50 to 79	Less than 50	3.501	0.000	3.192	3.810
80 and Over	Less than 50	4.071	0.000	3.710	4.432

Bonferroni Test

POL_CAT$(i)	POL_CAT$(j)	Difference	p-value	95.0% Confidence Interval	
				Lower	Upper
50 to 79	80 and Over	-0.571	0.011	-1.040	-0.101
50 to 79	Less than 50	3.501	0.000	3.185	3.816
80 and Over	Less than 50	4.071	0.000	3.702	4.440

Catch Distributions

The dealer data for 2008 was summarized for trawl and gillnet trips to identify possible trip limits. The distribution of pollock landings was summarized for trips that were more than 80 percent pollock and trips that were less than 80 percent pollock.

Results for sink gillnet vessels are shown in Table 7. The two distributions overlap at approximately the 15 percent level for the higher percentage trips, where pollock landings are about 2,100 pounds or less. This suggests that a trip limit of about this level would affect primarily the high percentage pollock trips while affecting few of the lower percentage trips.

For trawl vessels, the results are shown in Table 8. There is more overlap between the two categories than is the case for sink gillnet vessels; roughly the bottom 30 percent of the higher percentage trips overlap with the lower percentage trips. This makes it more difficult to select an appropriate trip limit. A value of about 5,000 pounds would be expected to increase discards from the lower percentage trips while affecting only 70 percent of the higher percentage trips.

Conclusions

There is evidence in both the observer and dealer data that the proportion of pollock kept on individual trips and tows does not occur by chance but reflects decisions by fishermen. These decisions affect the average catch of pollock per tow or set for both gillnet and trawl vessels.

The observer data does not reveal a difference in the average pollock kept per trip when pollock is 80 percent or more of the kept catch than when it is between 50 and 79 percent of the kept catch. This does not hold true for the dealer data, where these two categories have statistically different average landings of pollock. On a tow basis, however, there are significant differences in the average pollock kept per tow for these two categories. This apparent inconsistency in the observer data may be partially explained by the observation that the trips with a lower percentage of pollock on average have more tows per trip.

For sink gillnet vessels the observer data is more consistent. There is a statistically significant difference in the average pollock kept per trip between the percentage categories, and the catch per set is also different.

Dealer data suggests that an appropriate trip limit that might reduce pollock catches would be in the range of 2,000 to 5,000 pounds per trip. At the lower level, discards from trawl trips might lessen the benefits of the limit, while at the higher level only half of gillnet trips and about 70 percent of trawl trips would have been affected in CY 2008.

Table 7 – Distribution of pollock landings from sink gillnet vessels, 2008 (CFDBS)

	Pollock < 80 Percent of Landings	Pollock >=80 Percent of Landings
N of Cases	6193	764
Minimum	1.000	7.000
Maximum	25434.000	34523.000
Arithmetic Mean	833.158	6185.984
Standard Deviation	1863.715	4600.037
10.000%	12.000	1796.700
20.000%	28.000	2746.100
30.000%	61.000	3642.200
40.000%	120.000	4488.500
50.000%	211.000	5171.500
60.000%	362.000	6100.600
70.000%	645.000	7206.300
80.000%	1173.000	8693.200
90.000%	2124.000	11290.000

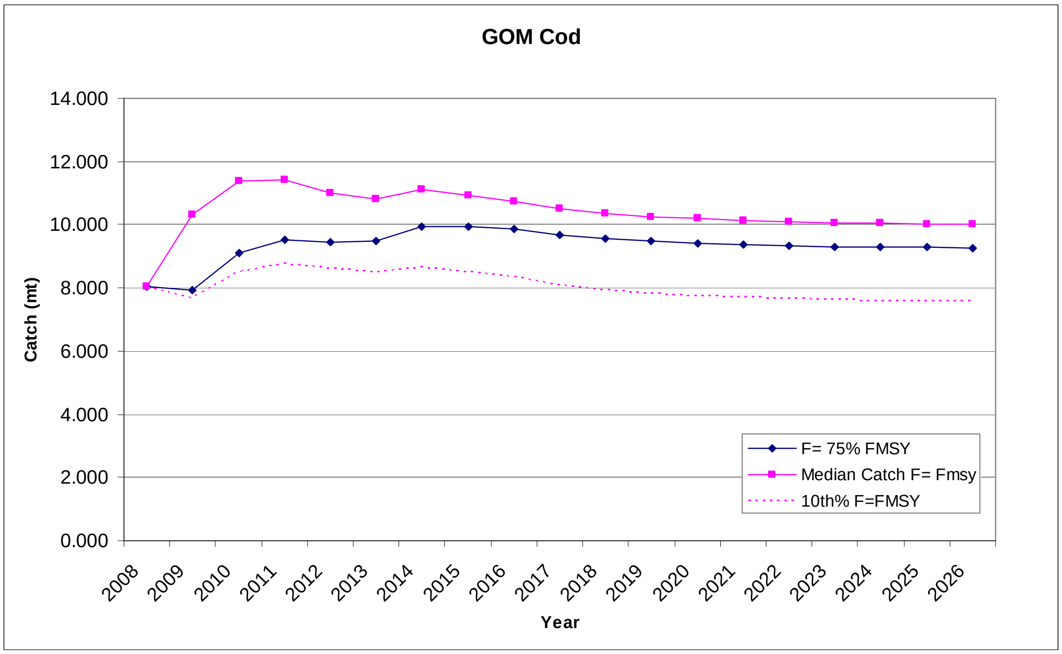
Table 8 - Distribution of pollock landings from trawl vessels, 2008 (CFDBS)

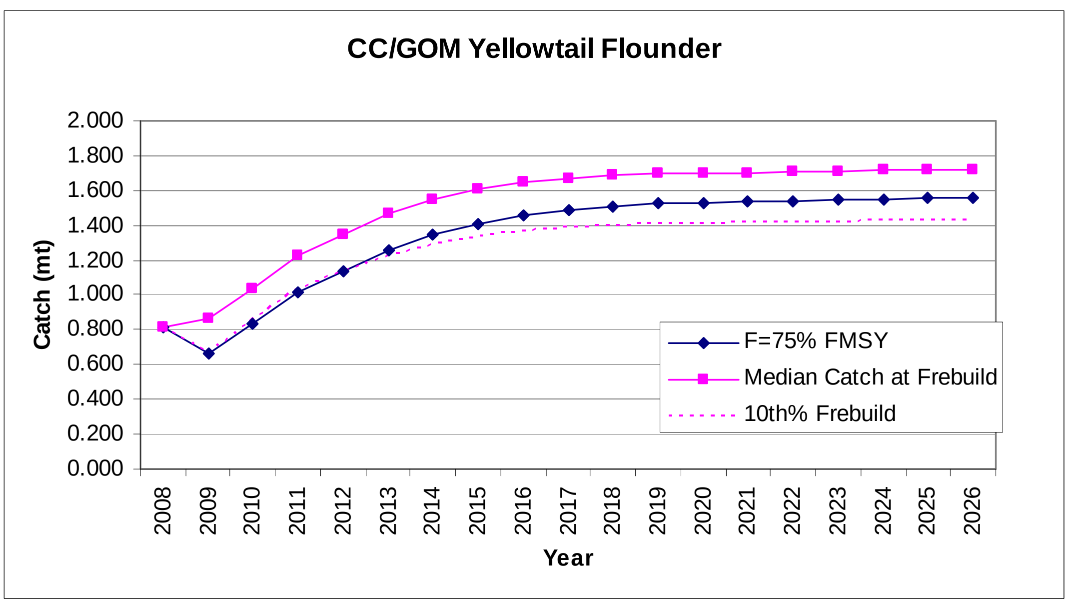
	Pollock < 80 Percent of Landings	Pollock >=80 Percent of Landings
N of Cases	3375	189
Minimum	1.000	1.000
Maximum	78094.000	103163.000
Arithmetic Mean	2116.849	25288.836
Standard Deviation	5281.122	24116.807
10.000%	11.000	1707.200
20.000%	28.000	3429.800
30.000%	68.000	5853.600
40.000%	131.500	9361.000
50.000%	254.000	17920.000
60.000%	497.500	27911.600
70.000%	961.000	35464.400
80.000%	2054.000	44923.300
90.000%	5650.000	63155.400

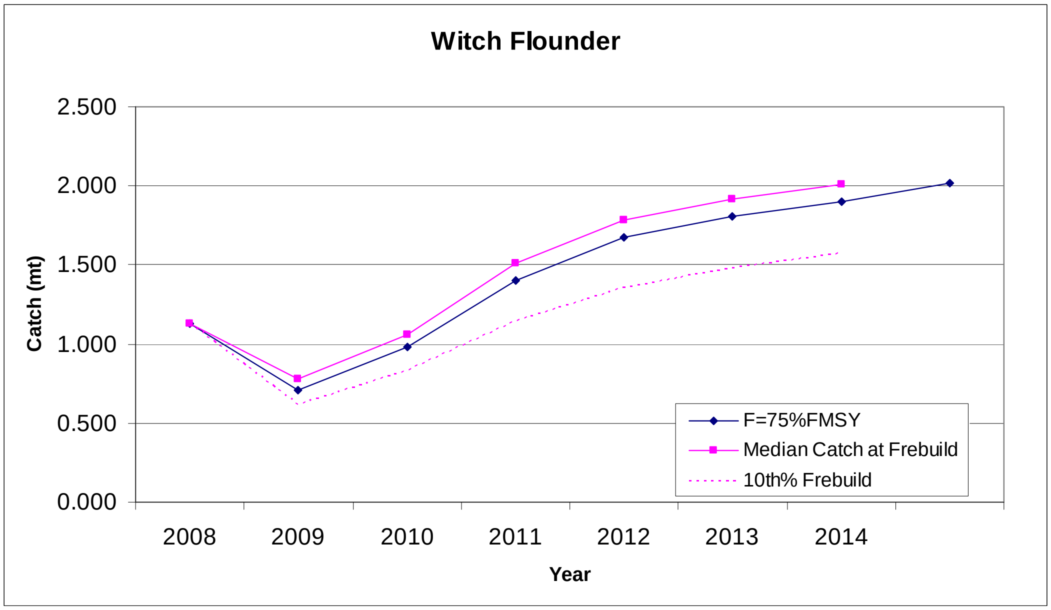
Enclosure (3) – Comparison of Catches Resulting from Expected SSC ABC Control Rule and Initial PDT ABC Approach

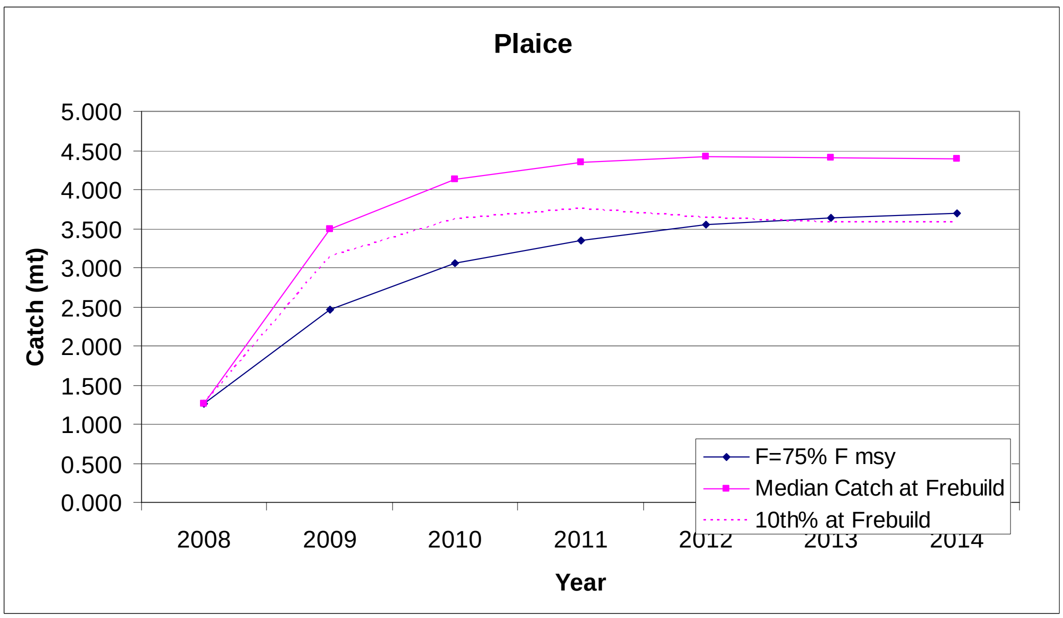
These catch streams are outputs from projections run for several stocks. For a given stock, the chart shows the catch from the median and 10th percentile of the catch distribution using Frebuild or FMSY. This illustrates the range of catch values that the PDT's original concept for considering scientific uncertainty would have suggested to the SSC as the ABC. This value is compared to the median catch output using 75% of F_{MSY} as the fishing mortality.

In general, the SSC's catch output is within the range of values that would have been expected from the PDT's approach. While GB cod is not shown, Frebuild is nearly identical to 75%FMSY.






Witch Flounder
2.500
2.000
1.500
1.000
0.500
0.000
Catch (mt)
2008
2009
2010
2011
2012
2013
2014
Year
F=75%FMSY
Median Catch at Frebuild
10th% Frebuild


Plaice
5.000
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
0.500
0.000
Catch (mt)
2008
2009
2010
2011
2012
2013
2014
Year
F=75% F msy
Median Catch at Frebuild
10th% at Frebuild