Gulf of Alaska Halibut Mortality Data Tables and Charts

Draft

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Prepared by

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Abbreviations

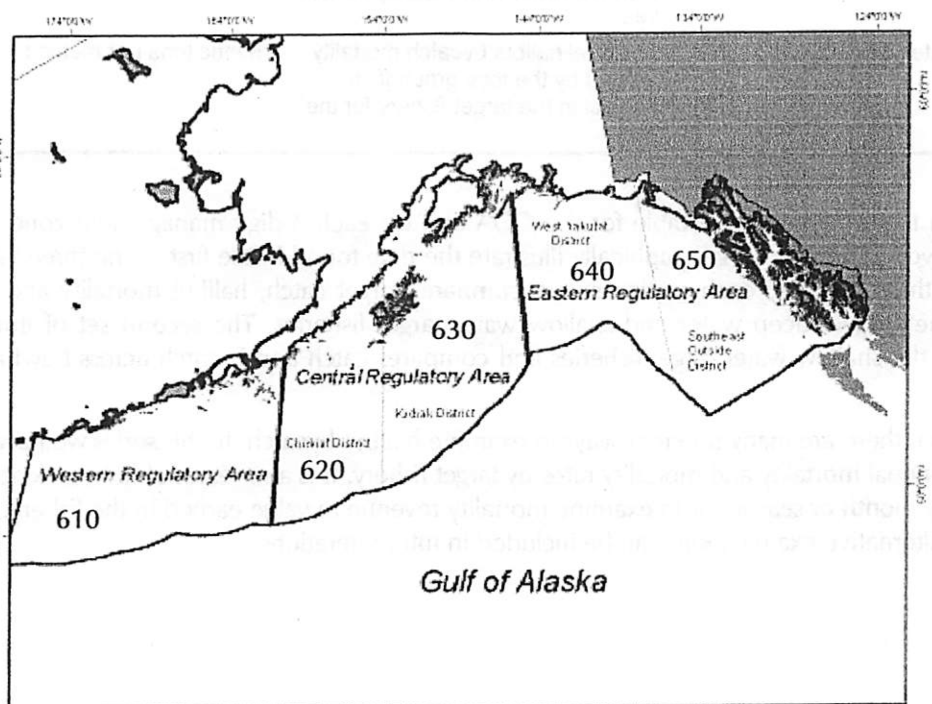
GOA	Gulf of Alaska
H&L	hook and line
MT	Metric ton
NPFMC	North Pacific Fishery Management Council

1 Halibut Bycatch Mortality in the Trawl and Fixed Gear Fisheries of the Gulf of Alaska.

This summary presents a series of tables that show successively greater amounts of detail regarding the sources of halibut bycatch in the Gulf of Alaska (GOA) for the year 2000 - 2009. The summary is divided into 6 sections, one section summarizing the entire GOA, and a section for each of the five 3-digit management zones as listed below and as shown in Figure 1:

- Area 610 - Western Gulf Regulatory Area
- Area 620 – Chirikof District of the Central Gulf Regulatory Area
- Area 630 – Kodiak District of the Central Gulf Regulatory Area
- Area 640 – West Yakutat District of the Eastern Gulf Regulatory Area
- Area 650 – Southeast Outside District Eastern Gulf Regulatory Area

Figure 1. Regulatory Areas, 3-Digit Zones and Management Districts in the Gulf of Alaska



Source: Adapted by Northern Economics from NPFMC (2009).

In each section there are three tables:

- The first table is a high level table that shows total halibut mortality by all gears and targets combined as well as halibut mortality in deep water and shallow water fisheries by general gear type—trawl and fixed gear.
- The second table in each section focuses on target fisheries in the Deep Water Complex of target species. These target fisheries include: arrowtooth flounder, deep water flatfish, rex

sole, rockfish, sablefish. It should be noted that halibut taken in a sablefish hook and line (H&L) fishery are not counted toward halibut mortality caps and thus we do not include halibut mortality in sablefish H&L fisheries.

- The third table in each section focuses on target fisheries in the Shallow Water Complex of target species. These target fisheries include: Atka mackerel, flathead sole, "Other Species", Pacific cod, pollock (bottom and mid-water), and shallow water flatfish.

The data in the tables come from NMFS Catch Accounting System (CAS) and were provided by AKFIN to Northern Economics. Each of the tables consists of a series of data for various target fisheries and gears. For each target fishery and gear combination we present three rows of data showing: Mortality, Target Catch, and Mortality Rate. The definitions of these row labels are listed in Table 1.

Table 1. Table Key—Definition of Row Labels

Row Labels	Description	Unit
Mortality (MT)	The total halibut mortality for the target fishery for the year.	Metric tons
Target Catch (MT)	The total catch of the groundfish species in the target fishery for the year	Metric tons
Mortality Rate (%)	The total halibut bycatch mortality divided by the total groundfish harvest in the target fishery for the year	Metric tons per metric ton

In addition to the three sets of table for the GOA and for each 3-digit management zone, we have included two sets of charts that graphically illustrate the data found in the first of the three tables. The first set of three charts in each section shows compares target catch, halibut mortality and mortality rates for the area in deep water and shallow water target fisheries. The second set of three charts focuses on the shallow water target fisheries and compares catch and bycatch across trawl and fixed gears.

We note that there are many different ways to examine halibut bycatch. In this series we have chosen to look at annual mortality and mortality rates by target fishery. It is also reasonable to look at halibut mortality by month or season, or to examine mortality revenue to value earned in the fishery. These and other alternative examinations can be included in future iterations.

1.1 Summary of Halibut Bycatch Mortality in the Gulf of Alaska

Table 2. Summary of Halibut Mortality by Complex and Gear for All GOA Reporting Areas, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All Targets And Species Combined										
Mortality (MT)	2,162.8	2,484.6	2,241.3	2,384.5	2,758.8	2,348.1	2,336.6	2,257.0	2,482.3	2,095.6
Target Catch (MT)	183,992.2	164,773.2	138,593.8	169,582.2	162,641.3	177,867.4	185,911.6	170,486.0	179,466.6	160,189.4
Mortality Rate (%)	1.18%	1.51%	1.62%	1.41%	1.70%	1.32%	1.26%	1.32%	1.38%	1.31%
All Trawl Targets										
Mortality (MT)	1,887.5	2,196.6	1,995.2	2,085.4	2,443.8	2,107.6	1,984.1	1,947.8	1,955.3	1,817.8
Target Catch (MT)	151,789.2	145,628.6	115,779.9	137,071.8	125,276.1	146,867.7	150,177.7	132,960.8	144,272.4	123,491.2
Mortality Rate (%)	1.24%	1.51%	1.72%	1.52%	1.95%	1.44%	1.32%	1.46%	1.36%	1.47%
Deep Water Trawl Targets										
Mortality (MT)	868.4	779.2	900.5	942.8	874.8	833.4	912.6	670.9	752.0	634.5
Target Catch (MT)	49,143.2	36,356.5	45,913.5	56,796.5	39,679.6	41,218.1	53,852.0	51,102.9	54,541.8	54,898.9
Mortality Rate (%)	1.77%	2.14%	1.96%	1.66%	2.20%	2.02%	1.69%	1.31%	1.38%	1.16%
Shallow Water Trawl Targets										
Mortality (MT)	1,019.1	1,417.4	1,094.7	1,142.7	1,568.9	1,274.2	1,071.4	1,277.0	1,203.4	1,183.3
Target Catch (MT)	102,646.1	109,272.1	69,864.6	80,275.3	85,596.6	105,649.6	96,325.7	81,857.8	89,730.6	68,592.3
Mortality Rate (%)	0.99%	1.30%	1.57%	1.42%	1.83%	1.21%	1.11%	1.56%	1.34%	1.73%
Shallow Water Fixed Gear Targets										
Mortality (MT)	263.3	279.9	242.6	297.2	308.8	235.9	347.9	309.1	527.0	277.7
Target Catch (MT)	31,611.2	18,503.9	22,514.3	32,507.6	37,136.3	30,836.4	35,703.4	37,525.2	35,194.2	36,684.7
Mortality Rate (%)	0.83%	1.51%	1.08%	0.91%	0.83%	0.76%	0.97%	0.82%	1.50%	0.76%

Figure 2. Deep v. Shallow Target Comparisons of Catch, Halibut Mortality, and Mortality Rates, Gulf Wide

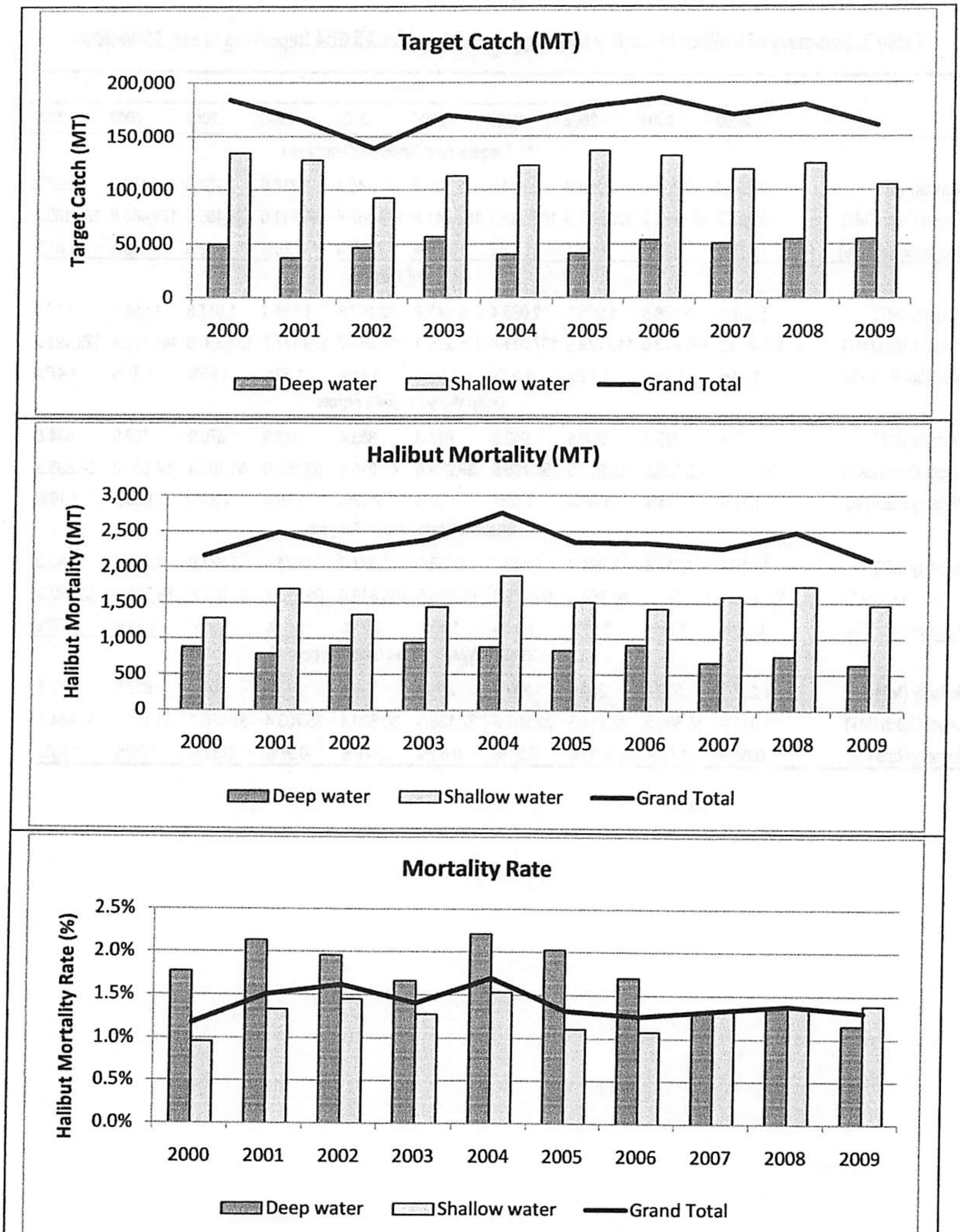


Figure 3. Comparison of Catch, Halibut Mortality and Rates by Gear in Shallow Targets, Gulf Wide

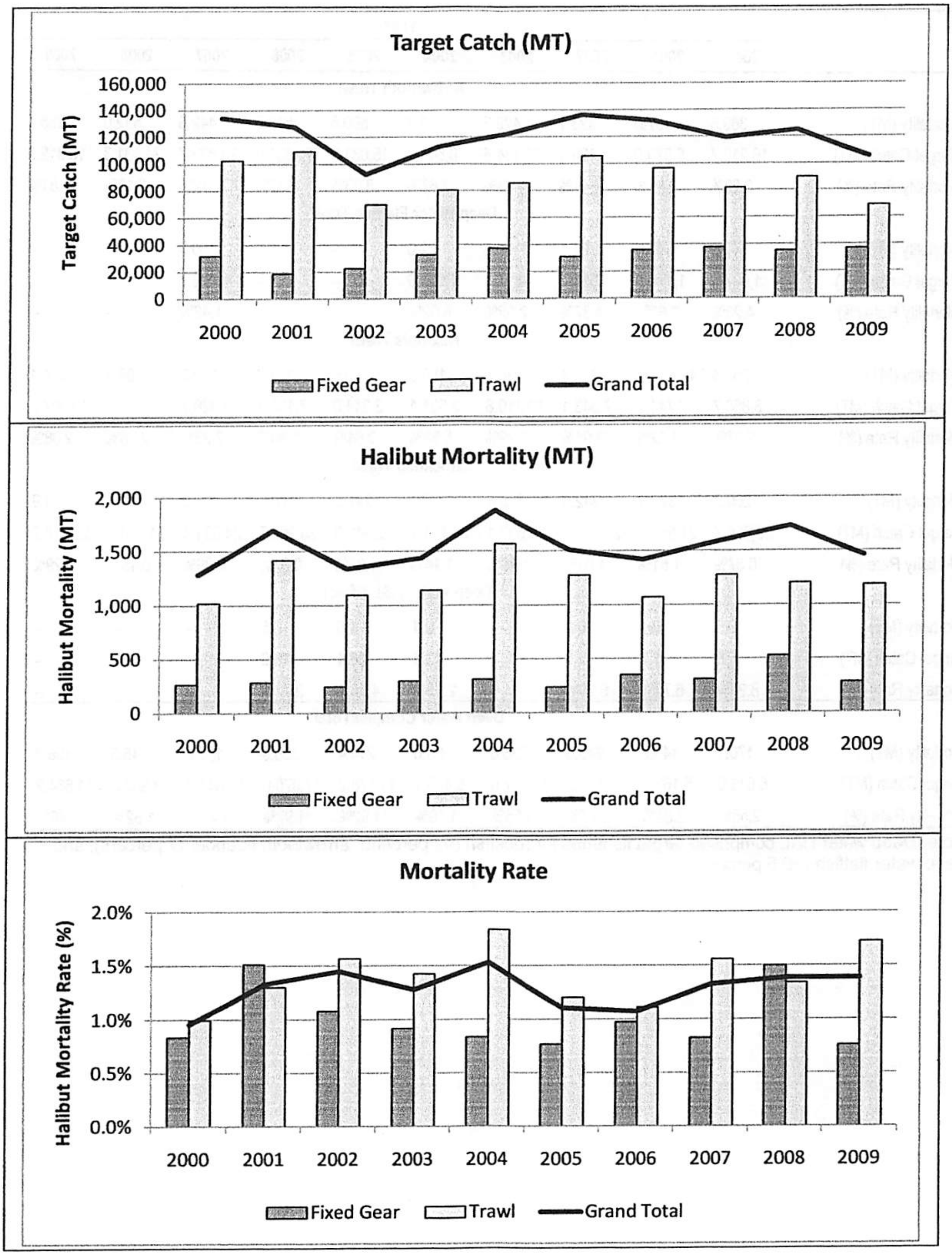


Table 3. Halibut Mortality in the Deep Water Complex Fisheries by Target and Gear for the GOA, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Arrowtooth Trawl										
Mortality (MT)	369.5	157.0	323.1	429.3	313.2	500.5	613.0	442.3	532.0	285.6
Target Catch (MT)	16,210.7	5,579.9	13,429.5	20,134.4	8,541.3	15,031.8	21,331.0	20,822.7	24,931.3	15,812.3
Mortality Rate (%)	2.28%	2.81%	2.41%	2.13%	3.67%	3.33%	2.87%	2.12%	2.13%	1.81%
Deep Water Flatfish Trawl										
Mortality (MT)	42.6	43.4	24.1	20.5	72.0	–	–	0.3	–	–
Target Catch (MT)	1,007.0	1,176.8	551.2	814.4	1,196.0	–	–	22.1	–	–
Mortality Rate (%)	4.23%	3.69%	4.37%	2.52%	6.02%	–	–	1.42%	–	–
Rex Sole Trawl										
Mortality (MT)	255.4	249.4	310.4	236.6	189.6	85.6	129.2	132.2	108.3	274.1
Target Catch (MT)	8,898.7	7,741.2	7,943.1	10,310.6	3,521.1	3,244.0	7,166.3	5,926.7	4,740.4	13,207.9
Mortality Rate (%)	2.87%	3.22%	3.91%	2.29%	5.38%	2.64%	1.80%	2.23%	2.28%	2.08%
Rockfish Trawl										
Mortality (MT)	200.9	329.4	242.9	256.4	300.1	247.3	170.5	96.0	111.7	74.9
Target Catch (MT)	23,026.7	21,858.6	23,989.7	25,537.1	26,421.1	22,942.3	25,354.7	24,331.4	24,870.1	25,878.7
Mortality Rate (%)	0.87%	1.51%	1.01%	1.00%	1.14%	1.08%	0.67%	0.39%	0.45%	0.29%
Deep Water H&L (Misc)										
Mortality (MT)	0.5	0.1	0.2	–	0.4	1.6	0.5	–	–	–
Target Catch (MT)	5.6	1.2	2.6	–	13.4	36.4	16.6	–	–	–
Mortality Rate (%)	8.98%	6.72%	6.20%	–	2.75%	4.38%	2.71%	–	–	–
Deep Water ComplexTotal										
Mortality (MT)	170.1	146.7	245.0	236.0	65.0	214.4	336.9	135.0	145.3	196.7
Target Catch (MT)	6,648.9	5,161.0	7,485.3	15,252.6	5,440.1	11,178.9	17,070.0	10,644.7	8,957.0	11,864.2
Mortality Rate (%)	2.56%	2.84%	3.27%	1.55%	1.19%	1.92%	1.97%	1.27%	1.62%	1.66%

Note: Deep water H&L comprised target fisheries for rockfish (92 percent), arrowtooth flounder (7 percent), and deep water flatfish (>0.5 percent).

Table 4. Halibut Mortality in the Shallow Water Complex Fisheries by Target for the GOA, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					Pollock - Bottom Trawl					
Mortality (MT)	1.4	33.0	2.0	6.0	1.4	0.1	8.0	11.4	9.9	19.0
Target Catch (MT)	333.7	8,448.5	3,376.3	1,278.0	3.7	7,704,386.4	17,090.8	4,637.8	3,858.7	4,120.4
Mortality Rate (%)	0.41%	0.39%	0.06%	0.47%	0.04%	0.00%	0.05%	0.25%	0.26%	0.46%
					Pollock - Midwater Trawl					
Mortality (MT)	1.2	0.6	0.2	0.2	0.3	0.1	0.1	0.0	0.3	0.2
Target Catch (MT)	11,627.5	10,489.0	17,140.6	18,893.4	19,390.0	21,418.4	11,512.2	14,171.0	15,595.5	10,201.8
Mortality Rate (%)	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
					Shallow Water Flatfish Trawl					
Mortality (MT)	96.2	13.4	402.3	156.9	62.5	115.1	57.3	72.1	74.9	153.5
Target Catch (MT)	1,066.3	280.2	6,449.8	2,006.0	1,073.7	1,617.7	1,534.2	1,866.4	1,955.3	2,996.2
Mortality Rate (%)	9.03%	4.79%	6.24%	7.82%	5.82%	7.11%	3.73%	3.86%	3.83%	5.12%
					Flathead Sole Trawl					
Mortality (MT)	1.3	–	0.5	8.3	4.1	1.6	–	–	5.7	10.3
Target Catch (MT)	33.0	–	38.7	441.0	579.4	375.7	–	–	60.6	437.6
Mortality Rate (%)	3.88%	–	1.19%	1.88%	0.71%	0.43%	–	–	9.35%	2.35%
					Other Species/Atka Mackerel Trawl					
Mortality (MT)	1.0	0.2	0.0	9.8	15.0	–	–	0.0	–	0.2
Target Catch (MT)	14.5	2.8	0.1	948.2	340.7	–	–	88.3	–	7.4
Mortality Rate (%)	7.17%	6.41%	8.33%	1.04%	4.40%	–	–	0.00%	–	3.07%
					Pacific Cod Trawl					
Mortality (MT)	76.4	202.3	13.5	25.8	69.5	22.0	21.4	34.4	93.8	18.0
Target Catch (MT)	2,246.3	4,349.1	1,346.3	933.7	2,189.0	486.6	192.7	844.4	3,636.2	487.3
Mortality Rate (%)	3.40%	4.65%	1.00%	2.77%	3.18%	4.51%	11.09%	4.07%	2.58%	3.70%
					Pacific Cod Pot					
Mortality (MT)	1.6	0.7	0.3	1.9	2.3	4.3	1.6	5.2	4.7	0.9
Target Catch (MT)	3,744.9	1,840.7	1,274.2	3,677.2	4,049.5	3,325.2	3,113.5	5,710.4	3,716.3	4,359.1
Mortality Rate (%)	0.04%	0.04%	0.02%	0.05%	0.06%	0.13%	0.05%	0.09%	0.13%	0.02%
					Pacific Cod H&L					
Mortality (MT)	4.4	4.9	64.1	11.2	25.8	14.8	78.3	71.5	86.0	20.9
Target Catch (MT)	131.6	178.0	1,916.2	1,711.4	1,871.7	691.6	3,104.5	3,472.9	3,524.1	2,767.0
Mortality Rate (%)	3.32%	2.75%	3.35%	0.65%	1.38%	2.14%	2.52%	2.06%	2.44%	0.76%
					Shallow Water H&L (Misc)					
Mortality (MT)	0.1	1.9	1.1	7.7	–	0.1	0.0	–	–	–
Target Catch (MT)	1.1	19.0	10.5	112.6	–	1.8	0.8	–	–	–
Mortality Rate (%)	11.71%	10.05%	10.15%	6.83%	–	7.84%	4.96%	–	–	–
					Shallow Water Complex Total					
Mortality (MT)	183.6	257.0	483.9	227.8	180.9	158.2	166.7	194.6	275.1	223.1
Target Catch (MT)	19,198.9	25,607.3	31,552.6	30,001.4	32,880.8	35,621.4	36,548.7	30,791.3	32,346.7	25,376.9
Mortality Rate (%)	0.96%	1.00%	1.53%	0.76%	0.55%	0.44%	0.46%	0.63%	0.85%	0.88%

Note: Shallow water H&L comprised target fisheries for "other species" (99 percent), flathead sole (1 percent), and bottom pollock (>0.5 percent).

1.2 Reporting Area 610

Table 5. Summary of Halibut Mortality by Gear, Target and Complex for Area 610, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All Targets And Species Combined										
Mortality (MT)	380.4	440.7	351.9	411.2	345.0	209.2	262.8	330.8	323.7	262.4
Target Catch (MT)	52,806.1	53,656.6	35,764.1	50,820.0	54,171.9	56,131.4	53,742.6	49,607.5	49,387.7	43,921.8
Mortality Rate (%)	0.72%	0.82%	0.98%	0.81%	0.64%	0.37%	0.49%	0.67%	0.66%	0.60%
All Trawl Targets										
Mortality (MT)	294.2	316.8	250.4	304.0	237.2	161.5	152.1	231.2	229.5	125.3
Target Catch (MT)	42,840.7	46,237.4	24,421.0	32,222.7	34,998.7	43,226.9	38,957.6	35,110.2	35,461.4	26,119.4
Mortality Rate (%)	0.69%	0.69%	1.03%	0.94%	0.68%	0.37%	0.39%	0.66%	0.65%	0.48%
Deep Water Trawl Targets										
Mortality (MT)	144.4	175.1	199.3	193.1	91.5	92.2	61.2	161.1	109.9	58.6
Target Catch (MT)	9,748.8	7,542.6	10,536.3	12,697.7	6,974.8	5,420.9	8,059.9	11,025.2	11,418.0	11,538.2
Mortality Rate (%)	1.48%	2.32%	1.89%	1.52%	1.31%	1.70%	0.76%	1.46%	0.96%	0.51%
Shallow Water Trawl Targets										
Mortality (MT)	149.8	141.8	51.2	110.8	145.7	69.3	90.9	70.2	119.6	66.7
Target Catch (MT)	33,092.0	38,694.8	13,884.8	19,525.0	28,023.9	37,806.0	30,897.7	24,085.0	24,043.3	14,581.2
Mortality Rate (%)	0.45%	0.37%	0.37%	0.57%	0.52%	0.18%	0.29%	0.29%	0.50%	0.46%
Shallow Water Fixed Gear Targets										
Mortality (MT)	86.2	123.6	101.1	105.4	107.7	47.4	110.8	99.6	94.2	137.0
Target Catch (MT)	9,965.4	7,408.5	11,337.3	18,594.5	19,171.8	12,887.9	14,784.4	14,497.3	13,926.3	17,789.1
Mortality Rate (%)	0.86%	1.67%	0.89%	0.57%	0.56%	0.37%	0.75%	0.69%	0.68%	0.77%

Figure 4. Deep v. Shallow Target Comparisons of Catch, Halibut Mortality, and Mortality Rates, Area 610

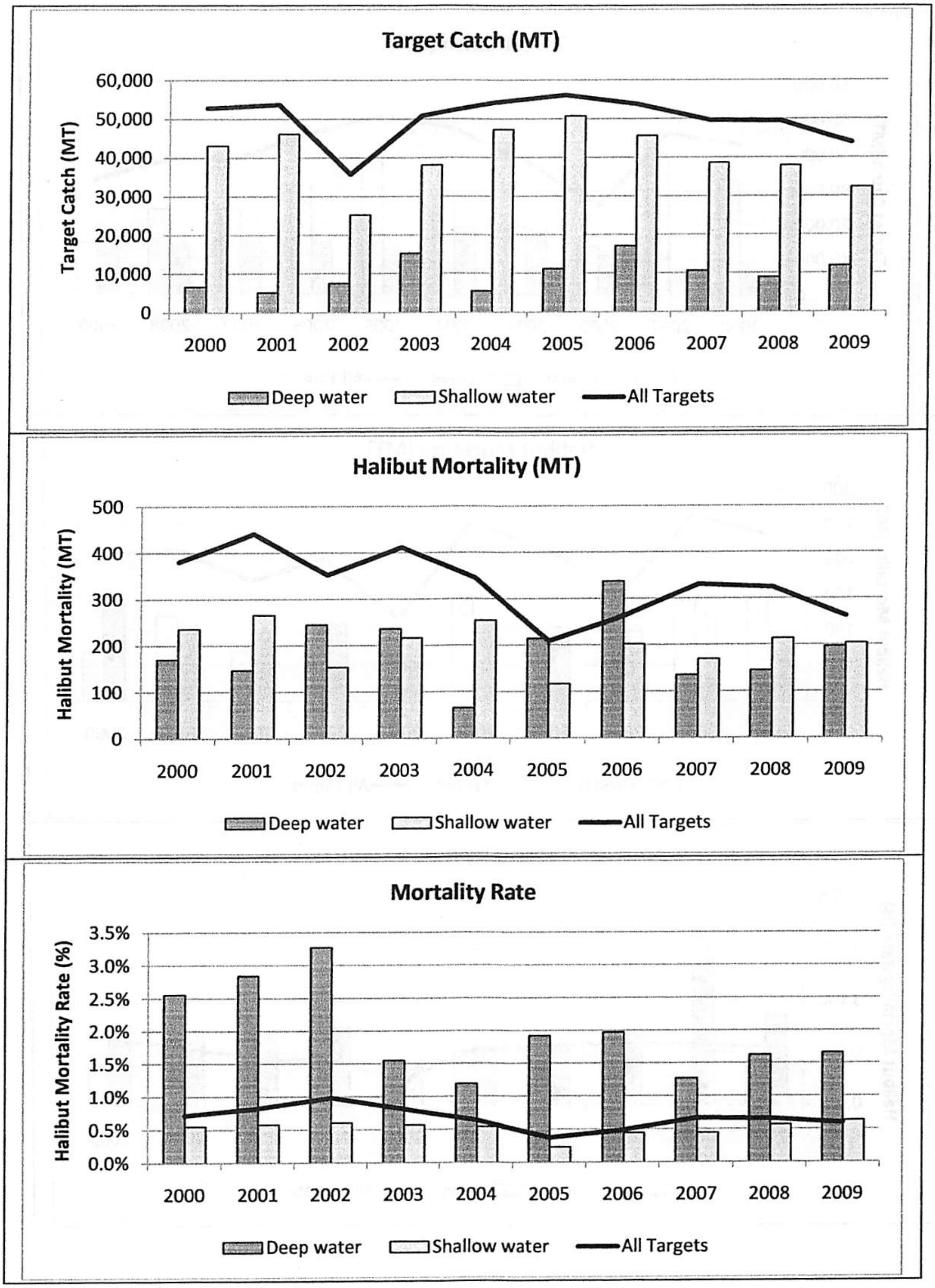


Figure 5. Comparison of Catch, Halibut Mortality and Rates by Gear in Shallow Targets, Area 610

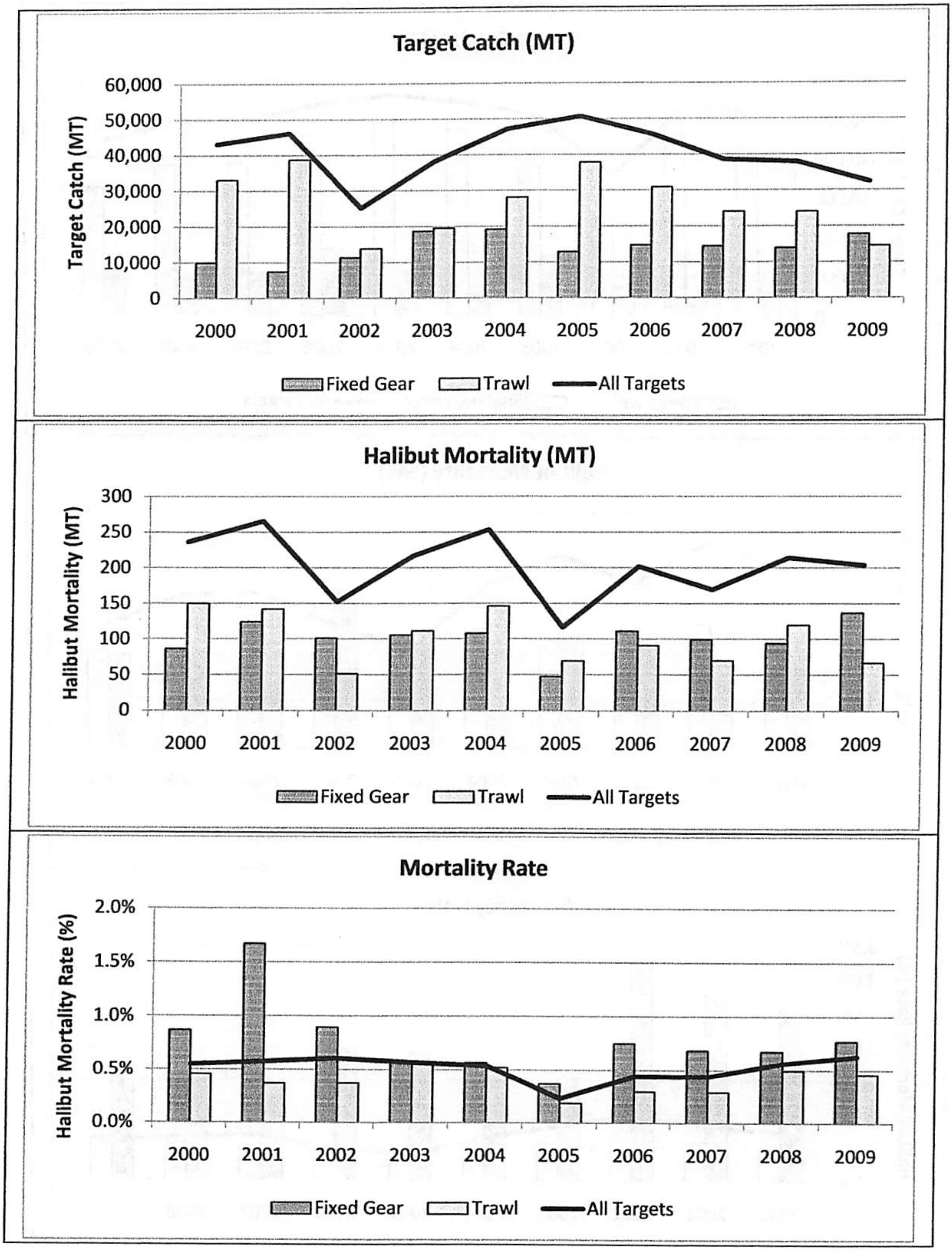


Table 6. Halibut Mortality in the Deep Water Complex Fisheries by Target for Area 610, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					Arrowtooth Trawl					
Mortality (MT)	86.3	138.9	153.6	142.5	25.5	44.7	18.7	108.7	45.0	15.7
Target Catch (MT)	4,923.2	4,967.8	6,169.2	8,121.4	927.9	1,231.3	1,033.2	2,318.0	2,236.8	577.5
Mortality Rate (%)	1.75%	2.80%	2.49%	1.75%	2.75%	3.63%	1.81%	4.69%	2.01%	2.72%
					Deep Water Flatfish Trawl					
Mortality (MT)	–	–	–	–	–	–	–	–	–	–
Target Catch (MT)	–	–	–	–	–	–	–	–	–	–
Mortality Rate (%)	–	–	–	–	–	–	–	–	–	–
					Rex Sole Trawl					
Mortality (MT)	44.4	28.4	13.9	21.3	35.9	8.8	7.1	12.5	1.8	5.9
Target Catch (MT)	2,482.3	1,117.1	589.6	1,454.9	754.6	395.2	283.1	342.3	85.1	799.7
Mortality Rate (%)	1.79%	2.54%	2.36%	1.46%	4.75%	2.23%	2.52%	3.65%	2.13%	0.73%
					Rockfish Trawl					
Mortality (MT)	13.8	7.8	31.8	29.4	30.2	38.7	35.4	39.9	63.1	37.1
Target Catch (MT)	2,343.3	1,457.7	3,777.5	3,121.4	5,292.3	3,794.4	6,743.6	8,364.9	9,096.1	10,161.0
Mortality Rate (%)	0.59%	0.53%	0.84%	0.94%	0.57%	1.02%	0.52%	0.48%	0.69%	0.36%
					Deep Water H&L (Misc)					
Mortality (MT)	0.0	0.3	0.4	1.9	0.0	0.4	0.0	–	–	0.1
Target Catch (MT)	0.0	10.7	5.7	2.8	1.4	16.6	0.6	–	–	13.3
Mortality Rate (%)	0.00%	2.91%	6.29%	67.38%	2.75%	2.31%	0.00%	–	–	0.38%
					Deep water Complex					
Mortality (MT)	144.4	175.4	199.6	195.0	91.6	92.6	61.2	161.1	109.9	58.7
Target Catch (MT)	9,748.8	7,553.3	10,542.0	12,700.4	6,976.2	5,437.5	8,060.6	11,025.2	11,418.0	11,551.5
Mortality Rate (%)	1.48%	2.32%	1.89%	1.54%	1.31%	1.70%	0.76%	1.46%	0.96%	0.51%

Note: Deep water H&L comprised target fisheries for rockfish (50 percent), arrowtooth flounder (38 percent), and deep water flatfish (12 percent).

Table 7. Halibut Mortality in the Shallow Water Complex Fisheries by Target for Area 610, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pollock - Bottom Trawl										
Mortality (MT)	0.4	0.4	0.2	0.1	0.1	0.1	0.5	0.3	2.9	0.1
Target Catch (MT)	2,902.1	3,057.1	1,186.8	570.0	416.4	1,762.6	3,692.7	2,939.4	4,775.9	4,688.7
Mortality Rate (%)	0.01%	0.01%	0.01%	0.01%	0.02%	0.00%	0.01%	0.01%	0.06%	0.00%
Pollock - Midwater Trawl										
Mortality (MT)	0.8	5.6	0.2	0.1	0.6	0.2	0.2	0.3	1.2	0.3
Target Catch (MT)	16,415.6	27,282.3	6,156.4	15,729.5	22,975.3	29,519.3	20,181.6	14,893.7	10,721.4	7,278.6
Mortality Rate (%)	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
Shallow Water Flatfish Trawl										
Mortality (MT)	2.0	–	0.5	8.7	2.3	11.7	17.3	2.3	–	2.4
Target Catch (MT)	78.8	–	30.5	145.6	39.6	297.4	177.2	54.9	–	13.8
Mortality Rate (%)	2.50%	–	1.64%	5.97%	5.89%	3.93%	9.78%	4.24%	–	17.34%
Flathead Sole Trawl										
Mortality (MT)	0.4	24.9	12.0	35.4	55.4	32.2	12.1	15.7	15.3	11.0
Target Catch (MT)	36.4	796.9	575.5	988.8	2,272.8	1,825.1	606.7	1,040.3	302.6	412.9
Mortality Rate (%)	1.02%	3.12%	2.08%	3.58%	2.44%	1.77%	1.99%	1.51%	5.06%	2.66%
Other Species/Atka Mackerel Trawl										
Mortality (MT)	–	–	–	1.1	–	–	–	–	–	–
Target Catch (MT)	–	–	–	56.5	–	–	–	–	–	–
Mortality Rate (%)	–	–	–	1.89%	–	–	–	–	–	–
Pacific Cod Trawl										
Mortality (MT)	146.3	110.9	38.4	65.5	87.2	25.0	60.7	51.6	100.1	52.9
Target Catch (MT)	13,659.1	7,558.5	5,935.5	2,034.7	2,319.8	4,401.6	6,239.4	5,156.8	8,243.4	2,187.1
Mortality Rate (%)	1.07%	1.47%	0.65%	3.22%	3.76%	0.57%	0.97%	1.00%	1.21%	2.42%
Pacific Cod Pot										
Mortality (MT)	1.2	1.3	1.2	5.8	8.4	7.5	4.6	5.4	13.3	3.1
Target Catch (MT)	4,992.9	3,068.4	4,286.9	13,847.0	15,845.9	11,822.0	11,549.9	10,759.1	10,003.0	10,997.4
Mortality Rate (%)	0.02%	0.04%	0.03%	0.04%	0.05%	0.06%	0.04%	0.05%	0.13%	0.03%
Pacific Cod H&L										
Mortality (MT)	85.0	122.3	100.0	99.3	99.3	39.9	106.0	94.2	80.9	133.8
Target Catch (MT)	4,972.5	4,340.1	7,050.4	4,742.6	3,326.0	1,065.9	3,233.2	3,736.1	3,923.2	6,791.7
Mortality Rate (%)	1.71%	2.82%	1.42%	2.09%	2.98%	3.74%	3.28%	2.52%	2.06%	1.97%
Shallow Water H&L (Misc)										
Mortality (MT)	–	–	–	0.3	–	–	0.1	0.0	–	–
Target Catch (MT)	–	–	–	4.9	–	–	1.3	2.0	–	–
Mortality Rate (%)	–	–	–	6.83%	–	–	10.56%	1.18%	–	–
Shallow Water Complex Total										
Mortality (MT)	236.0	265.3	152.3	216.2	253.4	116.6	201.6	169.7	213.8	203.7
Target Catch (MT)	43,057.4	46,103.3	25,222.1	38,119.5	47,195.7	50,693.9	45,682.0	38,582.3	37,969.6	32,370.3
Mortality Rate (%)	0.55%	0.58%	0.60%	0.57%	0.54%	0.23%	0.44%	0.44%	0.56%	0.63%

Note: Shallow water H&L comprised target fisheries for "other species" (76 percent), and bottom pollock (24 percent).

1.3 Reporting Area 620

Table 8. Summary of Halibut Mortality by Gear, Target and Complex for Area 620, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All Targets And Species Combined										
Mortality (MT)	353.7	403.7	728.9	463.8	245.9	372.6	503.6	329.6	420.5	419.8
Target Catch (MT)	25,847.8	30,768.3	39,037.9	45,254.0	38,320.8	46,800.3	53,618.7	41,436.0	41,303.7	37,241.0
Mortality Rate (%)	1.37%	1.31%	1.87%	1.02%	0.64%	0.80%	0.94%	0.80%	1.02%	1.13%
All Trawl Targets										
Mortality (MT)	347.1	396.1	663.3	443.0	217.4	351.7	423.2	252.9	329.8	398.0
Target Catch (MT)	21,964.7	28,729.4	35,836.3	39,752.8	32,386.2	42,745.3	47,383.3	32,252.7	34,063.3	30,114.9
Mortality Rate (%)	1.58%	1.38%	1.85%	1.11%	0.67%	0.82%	0.89%	0.78%	0.97%	1.32%
Deep Water Trawl Targets										
Mortality (MT)	169.6	146.6	244.8	236.0	64.6	212.8	336.4	135.0	145.3	196.7
Target Catch (MT)	6,643.3	5,159.8	7,482.7	15,252.6	5,426.6	11,142.6	17,053.4	10,644.7	8,957.0	11,864.2
Mortality Rate (%)	2.55%	2.84%	3.27%	1.55%	1.19%	1.91%	1.97%	1.27%	1.62%	1.66%
Shallow Water Trawl Targets										
Mortality (MT)	177.5	249.5	418.5	207.0	152.8	138.9	86.7	117.9	184.5	201.3
Target Catch (MT)	15,321.3	23,569.6	28,351.7	24,500.2	26,959.5	31,602.7	30,329.9	21,608.0	25,106.3	18,250.7
Mortality Rate (%)	1.16%	1.06%	1.48%	0.85%	0.57%	0.44%	0.29%	0.55%	0.73%	1.10%
Shallow Water Fixed Gear Targets										
Mortality (MT)	6.1	7.5	65.5	20.8	28.2	19.3	80.0	76.7	90.7	21.8
Target Catch (MT)	3,877.6	2,037.7	3,200.9	5,501.2	5,921.2	4,018.6	6,218.8	9,183.3	7,240.4	7,126.1
Mortality Rate (%)	0.16%	0.37%	2.05%	0.38%	0.48%	0.48%	1.29%	0.84%	1.25%	0.31%

Figure 6. Deep v. Shallow Target Comparisons of Catch, Halibut Mortality, and Mortality Rates, Area 620

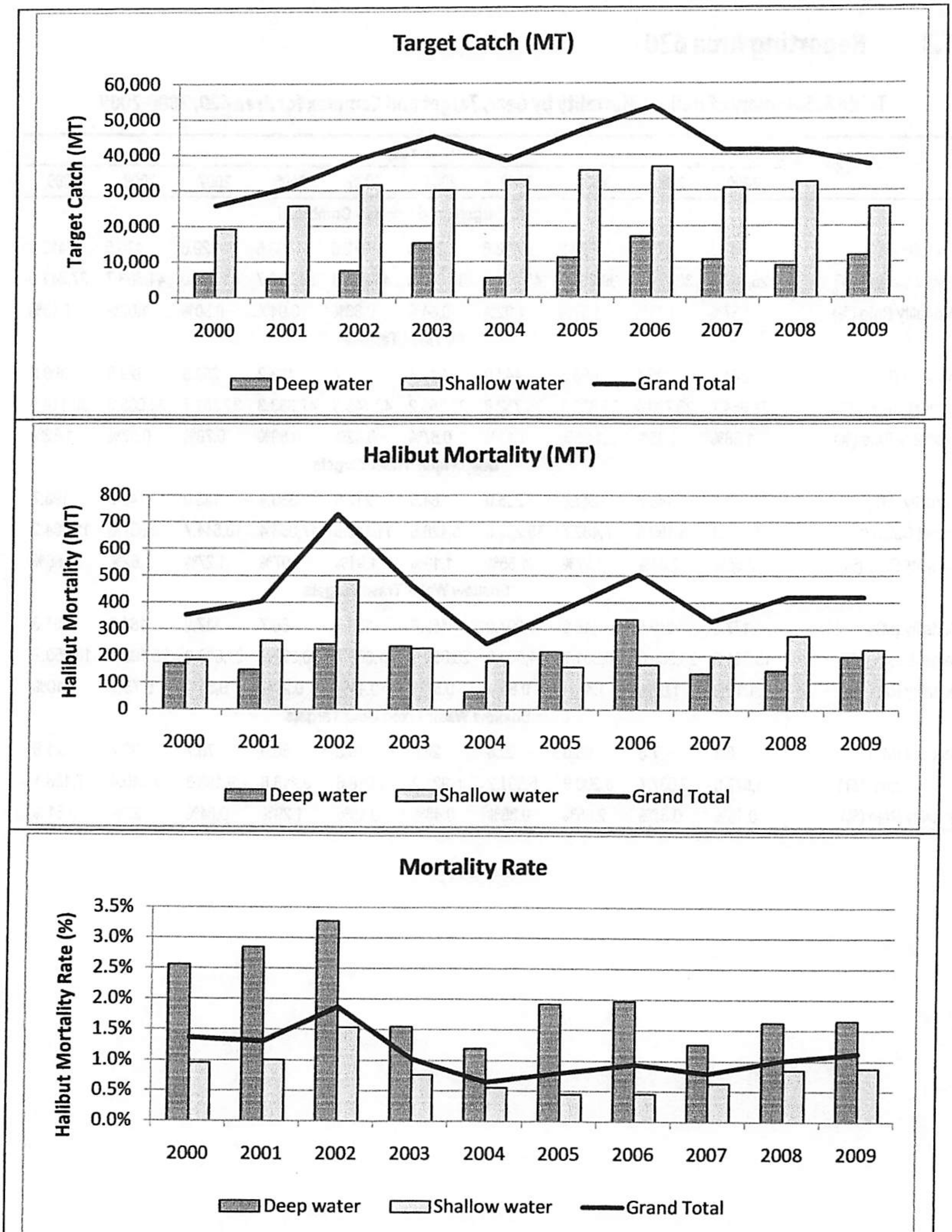


Figure 7. Comparison of Catch, Halibut Mortality and Rates by Gear in Shallow Targets, Area 620

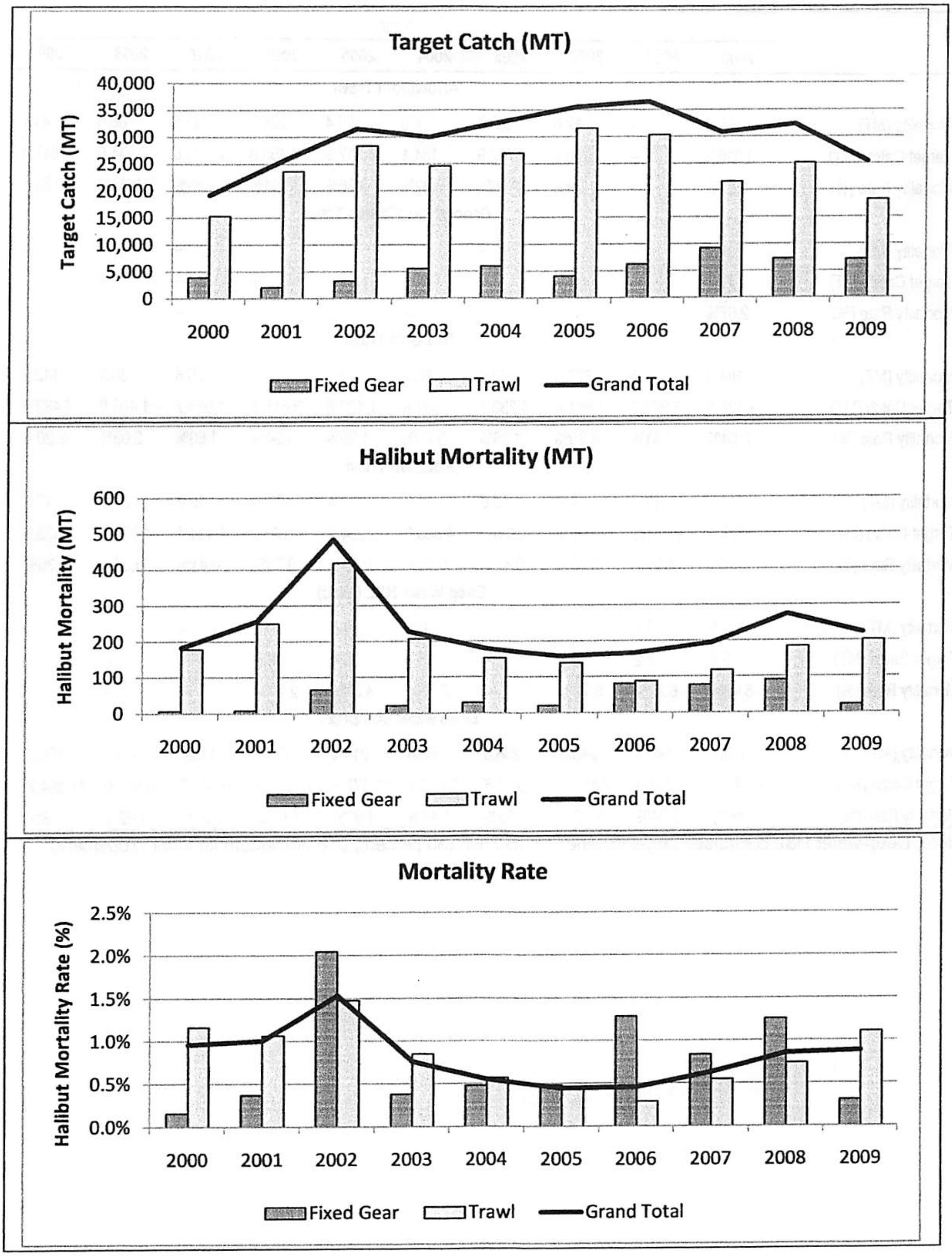


Table 9. Halibut Mortality in the Deep Water Complex Fisheries by Target for Area 620, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					Arrowtooth Trawl					
Mortality (MT)	62.4	–	12.6	143.4	4.0	155.4	224.7	92.5	88.5	41.4
Target Catch (MT)	3,016.2	–	979.1	5,782.9	134.1	4,617.9	7,466.8	5,004.6	2,544.0	1,847.4
Mortality Rate (%)	2.07%	–	1.29%	2.48%	3.02%	3.36%	3.01%	1.85%	3.48%	2.24%
					Deep Water Flatfish Trawl					
Mortality (MT)	0.6	–	–	–	–	–	–	–	–	–
Target Catch (MT)	27.5	–	–	–	–	–	–	–	–	–
Mortality Rate (%)	2.07%	–	–	–	–	–	–	–	–	–
					Rex Sole Trawl					
Mortality (MT)	104.3	133.5	227.5	72.6	50.2	27.9	70.1	25.8	30.9	142.5
Target Catch (MT)	3,426.3	3,908.3	4,841.4	5,233.7	897.6	1,429.8	3,610.4	1,525.7	1,486.9	6,483.0
Mortality Rate (%)	3.04%	3.41%	4.70%	1.39%	5.60%	1.95%	1.94%	1.69%	2.08%	2.20%
					Rockfish Trawl					
Mortality (MT)	2.3	13.2	4.7	19.9	10.3	29.5	41.6	16.8	25.8	12.9
Target Catch (MT)	173.4	1,251.6	1,662.2	4,236.0	4,395.0	5,094.9	5,976.2	4,114.4	4,926.1	3,533.9
Mortality Rate (%)	1.31%	1.05%	0.28%	0.47%	0.24%	0.58%	0.70%	0.41%	0.52%	0.36%
					Deep Water H&L (Misc)					
Mortality (MT)	0.5	0.1	0.2	–	0.4	1.6	0.5	–	–	–
Target Catch (MT)	5.6	1.2	2.6	–	13.4	36.4	16.6	–	–	–
Mortality Rate (%)	8.98%	6.72%	6.20%	–	2.75%	4.38%	2.71%	–	–	–
					Deep water Complex					
Mortality (MT)	170.1	146.7	245.0	236.0	65.0	214.4	336.9	135.0	145.3	196.7
Target Catch (MT)	6,648.9	5,161.0	7,485.3	15,252.6	5,440.1	11,178.9	17,070.0	10,644.7	8,957.0	11,864.2
Mortality Rate (%)	2.56%	2.84%	3.27%	1.55%	1.19%	1.92%	1.97%	1.27%	1.62%	1.66%

Note: Deep water H&L comprised target fisheries for rockfish (30 percent) and arrowtooth flounder (70percent).

Table 10. Halibut Mortality in the Shallow Water Complex Fisheries by Target for Area 620, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pollock - Bottom Trawl										
Mortality (MT)	1.4	33.0	2.0	6.0	1.4	0.1	8.0	11.4	9.9	19.0
Target Catch (MT)	333.7	8,448.5	3,376.3	1,278.0	3,386.7	7,704.4	17,090.8	4,637.8	3,858.7	4,120.4
Mortality Rate (%)	0.41%	0.39%	0.06%	0.47%	0.04%	0.00%	0.05%	0.25%	0.26%	0.46%
Pollock - Midwater Trawl										
Mortality (MT)	1.2	0.6	0.2	0.2	0.3	0.1	0.1	0.0	0.3	0.2
Target Catch (MT)	11,627.5	10,489.0	17,140.6	18,893.4	19,390.0	21,418.4	11,512.2	14,171.0	15,595.5	10,201.8
Mortality Rate (%)	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Shallow Water Flatfish Trawl										
Mortality (MT)	96.2	13.4	402.3	156.9	62.5	115.1	57.3	72.1	74.9	153.5
Target Catch (MT)	1,066.3	280.2	6,449.8	2,006.0	1,073.7	1,617.7	1,534.2	1,866.4	1,955.3	2,996.2
Mortality Rate (%)	9.03%	4.79%	6.24%	7.82%	5.82%	7.11%	3.73%	3.86%	3.83%	5.12%
Flathead Sole Trawl										
Mortality (MT)	1.3	–	0.5	8.3	4.1	1.6	–	–	5.7	10.3
Target Catch (MT)	33.0	–	38.7	441.0	579.4	375.7	–	–	60.6	437.6
Mortality Rate (%)	3.88%	–	1.19%	1.88%	0.71%	0.43%	–	–	9.35%	2.35%
Other Species/Atka Mackerel Trawl										
Mortality (MT)	1.0	0.2	0.0	9.8	15.0	–	–	0.0	–	0.2
Target Catch (MT)	14.5	2.8	0.1	948.2	340.7	–	–	88.3	–	7.4
Mortality Rate (%)	7.17%	6.41%	8.33%	1.04%	4.40%	–	–	0.00%	–	3.07%
Pacific Cod Trawl										
Mortality (MT)	76.4	202.3	13.5	25.8	69.5	22.0	21.4	34.4	93.8	18.0
Target Catch (MT)	2,246.3	4,349.1	1,346.3	933.7	2,189.0	486.6	192.7	844.4	3,636.2	487.3
Mortality Rate (%)	3.40%	4.65%	1.00%	2.77%	3.18%	4.51%	11.09%	4.07%	2.58%	3.70%
Pacific Cod Pot										
Mortality (MT)	1.6	0.7	0.3	1.9	2.3	4.3	1.6	5.2	4.7	0.9
Target Catch (MT)	3,744.9	1,840.7	1,274.2	3,677.2	4,049.5	3,325.2	3,113.5	5,710.4	3,716.3	4,359.1
Mortality Rate (%)	0.04%	0.04%	0.02%	0.05%	0.06%	0.13%	0.05%	0.09%	0.13%	0.02%
Pacific Cod H&L										
Mortality (MT)	4.4	4.9	64.1	11.2	25.8	14.8	78.3	71.5	86.0	20.9
Target Catch (MT)	131.6	178.0	1,916.2	1,711.4	1,871.7	691.6	3,104.5	3,472.9	3,524.1	2,767.0
Mortality Rate (%)	3.32%	2.75%	3.35%	0.65%	1.38%	2.14%	2.52%	2.06%	2.44%	0.76%
Shallow Water H&L (Misc)										
Mortality (MT)	0.1	1.9	1.1	7.7	–	0.1	0.0	–	–	–
Target Catch (MT)	1.1	19.0	10.5	112.6	–	1.8	0.8	–	–	–
Mortality Rate (%)	11.71%	10.05%	10.15%	6.83%	–	7.84%	4.96%	–	–	–
Shallow Water Complex Total										
Mortality (MT)	183.6	257.0	483.9	227.8	180.9	158.2	166.7	194.6	275.1	223.1
Target Catch (MT)	19,198.9	25,607.3	31,552.6	30,001.4	32,880.8	35,621.4	36,548.7	30,791.3	32,346.7	25,376.9
Mortality Rate (%)	0.96%	1.00%	1.53%	0.76%	0.55%	0.44%	0.46%	0.63%	0.85%	0.88%

Note: "Other Species" target fisheries were the only component of the Shallow Water H&L aggregate.

1.4 Reporting Area 630

Table 11. Summary of Halibut Mortality by Gear, Target and Complex for Area 630, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All Targets And Species Combined										
Mortality (MT)	1,411.3	1,624.6	1,154.4	1,495.5	2,138.7	1,764.6	1,567.2	1,589.3	1,731.2	1,395.8
Target Catch (MT)	103,432.3	77,984.0	61,313.4	70,998.4	68,069.2	71,730.0	75,891.1	77,510.0	85,857.1	75,343.2
Mortality Rate (%)	1.36%	2.08%	1.88%	2.11%	3.14%	2.46%	2.07%	2.05%	2.02%	1.85%
All Trawl Targets										
Mortality (MT)	1,235.9	1,471.8	1,076.5	1,331.6	1,967.5	1,592.6	1,406.6	1,457.4	1,393.4	1,289.2
Target Catch (MT)	85,680.9	68,857.2	53,368.9	62,713.0	56,108.0	57,690.1	61,200.1	63,708.5	72,119.5	64,329.6
Mortality Rate (%)	1.44%	2.14%	2.02%	2.12%	3.51%	2.76%	2.30%	2.29%	1.93%	2.00%
Deep Water Trawl Targets										
Mortality (MT)	547.6	446.4	451.5	506.8	697.2	526.6	512.8	368.4	495.3	373.9
Target Catch (MT)	31,544.4	22,040.3	26,432.7	27,218.0	25,756.0	23,505.9	27,048.5	27,631.9	32,691.4	29,790.6
Mortality Rate (%)	1.74%	2.03%	1.71%	1.86%	2.71%	2.24%	1.90%	1.33%	1.52%	1.26%
Shallow Water Trawl Targets										
Mortality (MT)	688.3	1,025.5	625.0	824.8	1,270.4	1,066.0	893.8	1,089.0	898.0	915.3
Target Catch (MT)	54,136.5	46,816.9	26,936.2	35,495.0	30,352.1	34,184.1	34,151.5	36,076.6	39,428.2	34,538.9
Mortality Rate (%)	1.27%	2.19%	2.32%	2.32%	4.19%	3.12%	2.62%	3.02%	2.28%	2.65%
Shallow Water Fixed Gear Targets										
Mortality (MT)	169.6	148.8	75.7	163.9	170.8	169.3	156.5	131.9	337.8	106.6
Target Catch (MT)	17,660.4	9,051.9	7,907.5	8,285.5	11,946.7	13,929.6	14,677.8	13,801.5	13,737.6	11,013.6
Mortality Rate (%)	0.96%	1.64%	0.96%	1.98%	1.43%	1.22%	1.07%	0.96%	2.46%	0.97%

Figure 8. Deep v. Shallow Target Comparisons of Catch, Halibut Mortality, and Mortality Rates, Area 630

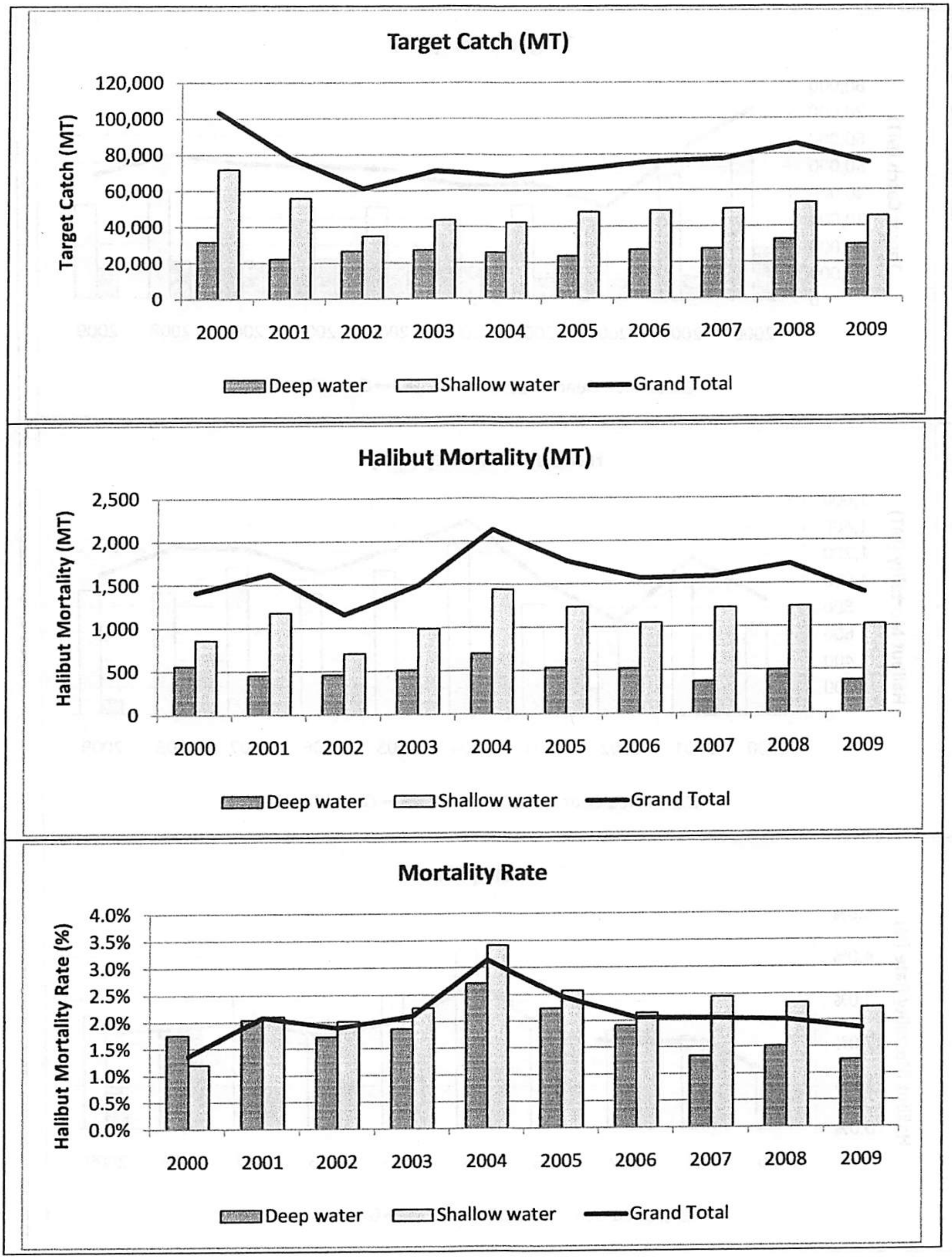


Figure 9. Comparison of Catch, Halibut Mortality and Rates by Gear in Shallow Targets, Area 630

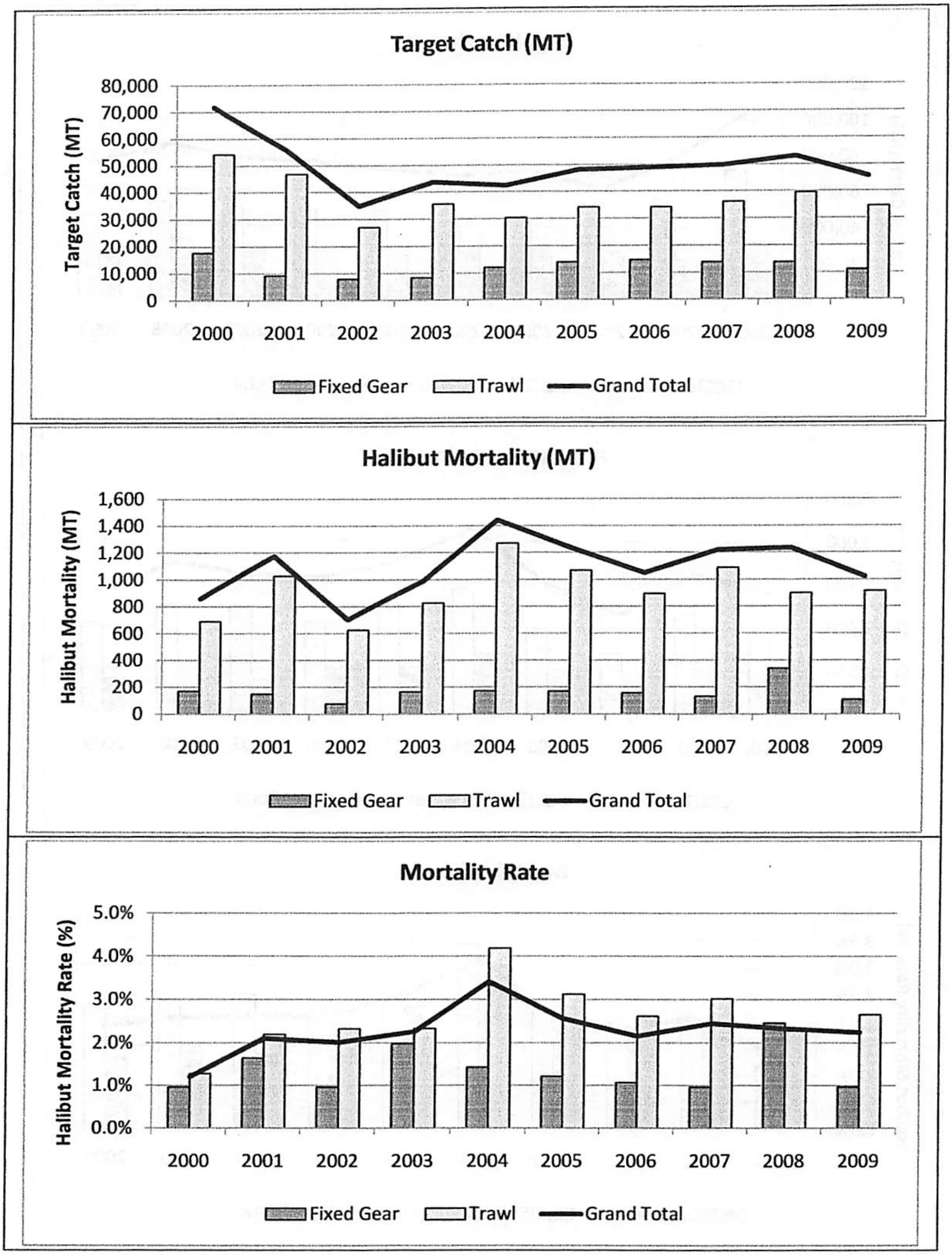


Table 12. Halibut Mortality in the Deep Water Complex Fisheries by Target for Area 630, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Arrowtooth Trawl										
Mortality (MT)	219.9	18.1	156.9	143.3	283.7	300.4	369.6	241.1	398.5	228.5
Target Catch (MT)	8,253.7	612.1	6,281.1	6,230.1	7,479.4	9,182.6	12,831.1	13,500.1	20,150.4	13,387.4
Mortality Rate (%)	2.66%	2.95%	2.50%	2.30%	3.79%	3.27%	2.88%	1.79%	1.98%	1.71%
Deep Water Flatfish Trawl										
Mortality (MT)	38.6	37.1	24.1	20.5	56.3	–	–	0.3	–	–
Target Catch (MT)	836.0	920.5	551.2	814.4	1,066.5	–	–	22.1	–	–
Mortality Rate (%)	4.62%	4.03%	4.37%	2.52%	5.28%	–	–	1.42%	–	–
Rex Sole Trawl										
Mortality (MT)	106.8	87.5	69.1	142.7	103.5	48.8	52.0	94.0	75.5	125.7
Target Catch (MT)	2,990.2	2,715.8	2,512.1	3,622.0	1,868.9	1,419.1	3,272.8	4,058.7	3,168.5	5,925.3
Mortality Rate (%)	3.57%	3.22%	2.75%	3.94%	5.54%	3.44%	1.59%	2.32%	2.38%	2.12%
Rockfish Trawl										
Mortality (MT)	182.2	303.8	201.5	200.3	253.7	177.4	91.2	33.0	21.3	19.6
Target Catch (MT)	19,464.5	17,791.9	17,088.3	16,551.5	15,341.2	12,904.2	10,944.7	10,051.0	9,372.5	10,478.0
Mortality Rate (%)	0.94%	1.71%	1.18%	1.21%	1.65%	1.37%	0.83%	0.33%	0.23%	0.19%
Deep Water H&L (Misc)										
Mortality (MT)	5.8	4.0	2.3	–	0.4	2.7	4.1	–	–	0.0
Target Catch (MT)	90.9	74.9	37.0	–	14.5	110.4	13.2	–	–	0.0
Mortality Rate (%)	6.39%	5.38%	6.19%	–	2.75%	2.44%	31.11%	–	–	0.36%
Deep water Complex										
Mortality (MT)	553.4	450.4	453.8	506.8	697.6	529.3	516.9	368.4	495.3	373.9
Target Catch (MT)	31,635.3	22,115.2	26,469.7	27,218.0	25,770.4	23,616.3	27,061.8	27,631.9	32,691.4	29,790.7
Mortality Rate (%)	1.75%	2.04%	1.71%	1.86%	2.71%	2.24%	1.91%	1.33%	1.52%	1.26%

Note: Deep water H&L comprised target fisheries for rockfish (79 percent), arrowtooth flounder (21 percent).

Table 13. Halibut Mortality in the Shallow Water Complex Fisheries by Target for Area 630, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pollock - Bottom Trawl										
Mortality (MT)	37.5	35.7	0.7	3.4	11.3	1.6	59.4	67.6	56.2	16.8
Target Catch (MT)	6,615.4	18,676.7	5,070.8	1,716.3	7,084.4	8,946.2	14,166.9	7,159.7	7,903.6	1,014.1
Mortality Rate (%)	0.57%	0.19%	0.01%	0.20%	0.16%	0.02%	0.42%	0.94%	0.71%	1.66%
Pollock - Midwater Trawl										
Mortality (MT)	9.6	4.6	0.1	0.1	0.1	0.2	0.0	0.3	0.4	0.6
Target Catch (MT)	29,361.3	1,778.3	4,268.5	10,528.0	7,463.3	10,367.7	4,640.4	7,846.7	5,984.6	8,693.2
Mortality Rate (%)	0.03%	0.26%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%
Shallow Water Flatfish Trawl										
Mortality (MT)	474.7	470.2	439.1	364.4	461.6	437.8	560.0	633.1	421.0	640.2
Target Catch (MT)	8,542.3	8,000.3	7,512.0	6,296.6	3,002.4	6,345.2	9,502.0	12,472.2	13,119.2	16,764.3
Mortality Rate (%)	5.56%	5.88%	5.84%	5.79%	15.37%	6.90%	5.89%	5.08%	3.21%	3.82%
Flathead Sole Trawl										
Mortality (MT)	2.8	37.6	43.6	76.4	5.5	9.3	10.6	0.8	37.1	38.3
Target Catch (MT)	70.7	738.5	2,110.3	2,593.8	223.3	857.8	854.4	550.8	1,416.5	1,935.0
Mortality Rate (%)	3.97%	5.09%	2.07%	2.95%	2.45%	1.08%	1.24%	0.15%	2.62%	1.98%
Other Species/Atka Mackerel Trawl										
Mortality (MT)	0.8	0.5	0.1	9.9	10.1	0.1	–	–	0.0	1.0
Target Catch (MT)	107.2	68.3	6.5	1,361.2	230.8	73.7	–	–	3.1	32.0
Mortality Rate (%)	0.74%	0.72%	0.77%	0.73%	4.40%	0.08%	–	–	0.67%	3.07%
Pacific Cod Trawl										
Mortality (MT)	162.9	477.0	141.4	370.6	781.7	617.1	263.9	387.1	383.4	218.3
Target Catch (MT)	9,439.7	17,554.9	7,968.2	12,999.0	12,347.9	7,593.6	4,987.8	8,047.2	11,001.2	6,100.3
Mortality Rate (%)	1.73%	2.72%	1.77%	2.85%	6.33%	8.13%	5.29%	4.81%	3.48%	3.58%
Pacific Cod Pot										
Mortality (MT)	4.1	2.5	1.0	1.5	5.3	21.2	12.4	8.3	13.2	2.8
Target Catch (MT)	8,872.7	2,459.2	1,527.3	3,630.8	6,191.8	9,559.5	9,163.4	8,199.8	7,079.1	6,746.3
Mortality Rate (%)	0.05%	0.10%	0.07%	0.04%	0.09%	0.22%	0.14%	0.10%	0.19%	0.04%
Pacific Cod H&L										
Mortality (MT)	165.1	139.3	73.9	74.2	165.5	148.1	139.1	123.5	324.7	103.8
Target Catch (MT)	8,783.2	6,529.4	6,372.5	3,362.9	5,754.9	4,370.1	5,464.7	5,601.8	6,658.4	4,267.2
Mortality Rate (%)	1.88%	2.13%	1.16%	2.21%	2.88%	3.39%	2.55%	2.21%	4.88%	2.43%
Shallow Water H&L (Misc)										
Mortality (MT)	0.5	7.0	0.7	88.2	–	–	5.0	–	–	–
Target Catch (MT)	4.5	63.2	7.7	1,291.8	–	–	49.7	–	–	–
Mortality Rate (%)	10.56%	11.01%	9.43%	6.83%	–	–	10.11%	–	–	–
Shallow Water Complex Total										
Mortality (MT)	858.0	1,174.2	700.6	988.7	1,441.2	1,235.2	1,050.4	1,220.8	1,235.9	1,021.9
Target Catch (MT)	71,796.9	55,868.7	34,843.7	43,780.4	42,298.7	48,113.7	48,829.3	49,878.1	53,165.7	45,552.5
Mortality Rate (%)	1.19%	2.10%	2.01%	2.26%	3.41%	2.57%	2.15%	2.45%	2.32%	2.24%

Note: Shallow water H&L comprised fisheries for "other species" (99 percent), and flathead sole (1 percent).

1.5 Reporting Area 640

Table 14. Summary of Halibut Mortality by Gear, Target and Complex for Area 640, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All Targets And Species Combined										
Mortality (MT)	16.3	15.6	5.8	13.3	22.0	1.7	2.9	7.3	6.9	17.6
Target Catch (MT)	1,417.1	1,865.9	2,228.3	2,479.2	1,797.0	3,205.4	2,659.2	1,932.4	2,917.9	3,676.8
Mortality Rate (%)	1.15%	0.83%	0.26%	0.54%	1.22%	0.05%	0.11%	0.38%	0.24%	0.48%
All Trawl Targets										
Mortality (MT)	10.3	11.8	5.1	6.8	21.6	1.7	2.2	6.3	2.6	5.3
Target Catch (MT)	1,302.9	1,804.6	2,153.6	2,383.3	1,783.3	3,205.4	2,636.7	1,889.4	2,628.2	2,927.4
Mortality Rate (%)	0.79%	0.66%	0.23%	0.29%	1.21%	0.05%	0.09%	0.34%	0.10%	0.18%
Deep Water Trawl Targets										
Mortality (MT)	1,206.7	1,613.8	1,461.8	1,628.2	1,522.2	1,148.7	1,690.1	1,801.1	1,475.4	1,705.9
Target Catch (MT)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mortality Rate (%)	338.00%	75.00%	7.00%	1.54%	6.46%	0.80%	0.13%	0.04%	122.43%	3.06%
Shallow Water Trawl Targets										
Mortality (MT)	3.4	0.8	0.1	0.0	0.1	0.0	0.0	0.0	1.2	0.0
Target Catch (MT)	133.4	193.8	740.4	755.1	261.1	2,056.7	946.6	88.3	1,152.8	1,244.4
Mortality Rate (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shallow Water Fixed Gear Targets										
Mortality (MT)	0.3	0.0	0.1	6.5	0.1		0.7	1.0	4.3	12.2
Target Catch (MT)	50.8	4.1	52.2	95.9	1.9		22.4	43.0	289.8	749.4
Mortality Rate (%)	0.59%	0.49%	0.11%	6.74%	4.21%		3.04%	2.30%	1.49%	1.63%

Figure 10. Deep v. Shallow Target Comparisons of Catch, Halibut Mortality, and Mortality Rates, Area 640

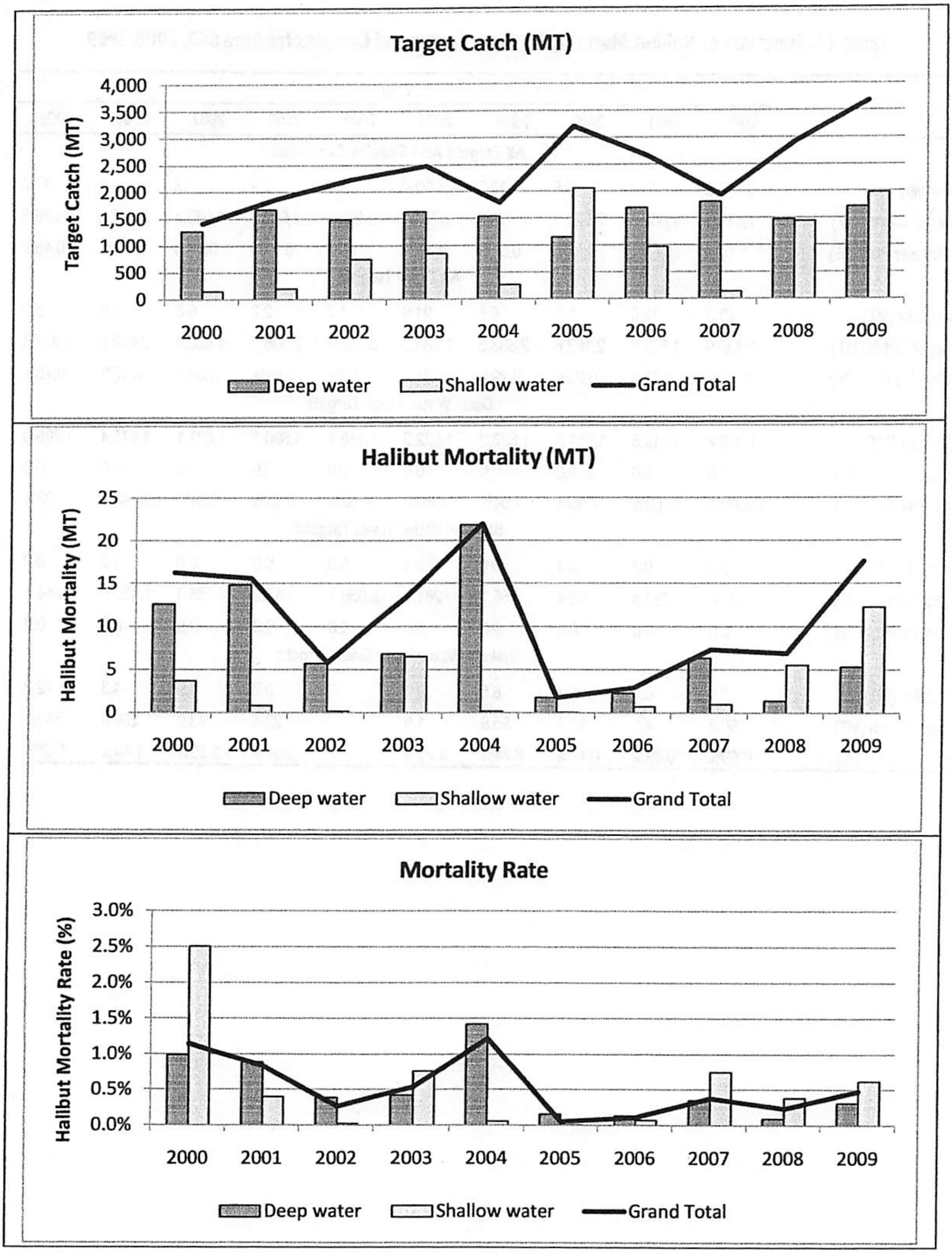


Figure 11. Comparison of Catch, Halibut Mortality and Rates by Gear in Shallow Targets, Area 640

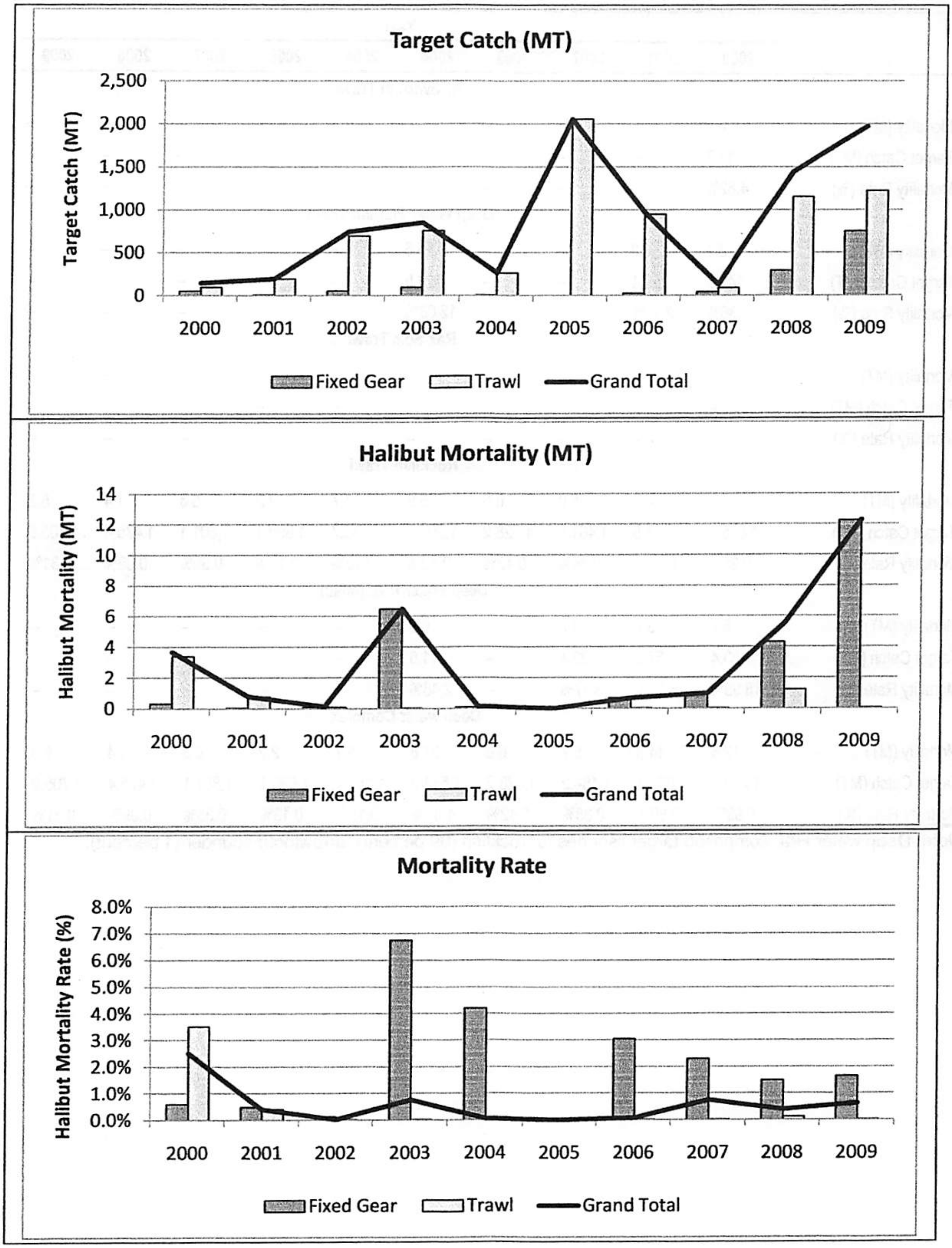


Table 15. Halibut Mortality in the Deep Water Complex Fisheries by Target for Area 640, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					Arrowtooth Trawl					
Mortality (MT)	0.9	–	–	–	–	–	–	–	–	–
Target Catch (MT)	17.7	–	–	–	–	–	–	–	–	–
Mortality Rate (%)	4.82%	–	–	–	–	–	–	–	–	–
					Deep Water Flatfish Trawl					
Mortality (MT)	3.4	6.3	–	–	15.6	–	–	–	–	–
Target Catch (MT)	143.5	256.4	–	–	129.5	–	–	–	–	–
Mortality Rate (%)	2.36%	2.47%	–	–	12.08%	–	–	–	–	–
					Rex Sole Trawl					
Mortality (MT)	–	–	–	–	–	–	–	–	–	–
Target Catch (MT)	–	–	–	–	–	–	–	–	–	–
Mortality Rate (%)	–	–	–	–	–	–	–	–	–	–
					Rockfish Trawl					
Mortality (MT)	2.7	4.7	5.0	6.8	5.9	1.7	2.2	6.3	1.4	5.3
Target Catch (MT)	1,045.5	1,357.5	1,461.8	1,628.2	1,392.7	1,148.7	1,690.1	1,801.1	1,475.4	1,705.9
Mortality Rate (%)	0.25%	0.35%	0.34%	0.42%	0.42%	0.15%	0.13%	0.35%	0.09%	0.31%
					Deep Water H&L (Misc)					
Mortality (MT)	5.7	3.7	0.7	–	0.3	–	–	–	–	–
Target Catch (MT)	63.4	57.2	22.4	–	11.8	–	–	–	–	–
Mortality Rate (%)	8.98%	6.52%	3.17%	–	2.48%	–	–	–	–	–
					Deep water Complex					
Mortality (MT)	12.6	14.8	5.7	6.8	21.8	1.7	2.2	6.3	1.4	5.3
Target Catch (MT)	1,270.0	1,671.1	1,484.2	1,628.2	1,534.0	1,148.7	1,690.1	1,801.1	1,475.4	1,705.9
Mortality Rate (%)	0.99%	0.89%	0.38%	0.42%	1.42%	0.15%	0.13%	0.35%	0.09%	0.31%

Note: Deep water H&L comprised target fisheries for rockfish (99 percent), arrowtooth flounder (1 percent).

Table 16. Halibut Mortality in the Shallow Water Complex Fisheries by Target for Area 640, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Pollock - Bottom Trawl										
Mortality (MT)	–	0.8	0.1	0.0	0.0	0.0	0.0	0.0	1.2	0.0
Target Catch (MT)	–	190.8	691.9	11.8	169.7	131.2	146.1	54.8	352.1	868.8
Mortality Rate (%)	–	0.39%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.35%	0.00%
Pollock - Midwater Trawl										
Mortality (MT)	–	0.8	0.1	0.0	0.0	0.0	0.0	0.0	1.2	0.0
Target Catch (MT)	–	190.8	691.9	11.8	169.7	131.2	146.1	54.8	352.1	868.8
Mortality Rate (%)	–	0.39%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.35%	0.00%
Shallow Water Flatfish Trawl										
Mortality (MT)	3.4	–	–	–	–	–	–	–	–	–
Target Catch (MT)	96.3	–	–	–	–	–	–	–	–	–
Mortality Rate (%)	3.51%	–	–	–	–	–	–	–	–	–
Flathead Sole Trawl										
Mortality (MT)	–	–	–	–	–	–	–	–	–	–
Target Catch (MT)	–	–	–	–	–	–	–	–	–	–
Mortality Rate (%)	–	–	–	–	–	–	–	–	–	–
Other Species/Atka Mackerel Trawl										
Mortality (MT)	–	–	–	–	0.1	0.0	–	–	–	–
Target Catch (MT)	–	–	–	–	1.4	116.9	–	–	–	–
Mortality Rate (%)	–	–	–	–	4.40%	0.00%	–	–	–	–
Pacific Cod Trawl										
Mortality (MT)	–	–	–	–	–	–	–	–	–	–
Target Catch (MT)	–	–	–	–	–	–	–	–	–	–
Mortality Rate (%)	–	–	–	–	–	–	–	–	–	–
Pacific Cod Pot										
Mortality (MT)	0.0	0.0	0.0	–	–	–	–	–	–	0.0
Target Catch (MT)	37.2	3.0	48.6	–	–	–	–	–	–	22.9
Mortality Rate (%)	0.05%	0.00%	0.00%	–	–	–	–	–	–	0.03%
Pacific Cod H&L										
Mortality (MT)	0.3	0.0	0.1	0.1	0.1	–	0.7	1.0	4.3	12.2
Target Catch (MT)	13.1	0.5	3.7	2.2	1.9	–	22.4	43.0	289.8	726.5
Mortality Rate (%)	1.99%	1.92%	1.63%	2.92%	4.21%	–	3.03%	2.30%	1.49%	1.69%
Shallow Water H&L (Misc)										
Mortality (MT)	0.0	0.0	–	6.4	–	–	0.0	–	–	–
Target Catch (MT)	0.6	0.5	–	93.7	–	–	0.0	–	–	–
Mortality Rate (%)	3.17%	2.00%	–	6.83%	–	–	9.89%	–	–	–
Shallow Water Complex Total										
Mortality (MT)	3.7	0.8	0.1	6.5	0.1	0.0	0.7	1.0	5.5	12.3
Target Catch (MT)	147.1	194.9	744.1	851.0	262.9	2,056.7	969.0	131.3	1,442.5	1,970.9
Mortality Rate (%)	2.50%	0.40%	0.02%	0.76%	0.05%	0.00%	0.07%	0.75%	0.38%	0.62%

Note: "Other Species" target fisheries were the only component of the Shallow Water H&L aggregate.

1.6 Reporting Area 650

Trawling is closed by regulation in Area 650, and therefore the bycatch tables have a slightly different format with a focus on fixed gears. As seen in Table 17, in 2000 – 2002 and in 2004 the largest groundfish catch amounts were in the deep water species complex. Note that zero halibut bycatch were reported in the deep water fixed gear target fisheries from 2000 – 2002 and again in 2009. It is possible (although we are not certain) that these deep water fixed gear targets were incidentally classified as rockfish targets, when in fact harvesters were participating in a IFQ sablefish or halibut fishery and were able to land all of the halibut that was taken.

Table 17. Summary of Halibut Mortality by Gear, Target and Complex for Area 650, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
All Fixed Gear Targets And Species Combined										
Mortality (MT)	1.1	0.0	0.2	0.6	7.3	0.0	–	0.0	0.0	0.1
Target Catch (MT)	488.9	498.5	250.2	30.6	282.5	0.3	–	0.1	0.2	6.7
Mortality Rate (%)	0.23%	0.00%	0.09%	2.12%	2.57%	4.09%	–	2.45%	0.80%	1.70%
Deep water Fixed Gear Targets										
Mortality (MT)	0.0	0.0	0.0	–	5.2	–	–	–	–	0.0
Target Catch (MT)	431.9	496.7	233.9	–	187.8	–	–	–	–	0.1
Mortality Rate (%)	0.00%	0.00%	0.00%	–	2.75%	–	–	–	–	0.36%
Shallow Water Fixed Gear Targets										
Mortality (MT)	1.1	0.0	0.2	0.6	2.1	0.0	–	0.0	0.0	0.1
Target Catch (MT)	57.0	1.8	16.3	30.6	94.7	0.3	–	0.1	0.2	6.5
Mortality Rate (%)	2.00%	1.11%	1.41%	2.12%	2.23%	4.09%	–	2.45%	0.80%	1.72%

Figure 12. Deep v. Shallow Target Comparisons of Catch, Halibut Mortality, and Mortality Rates, Area 650

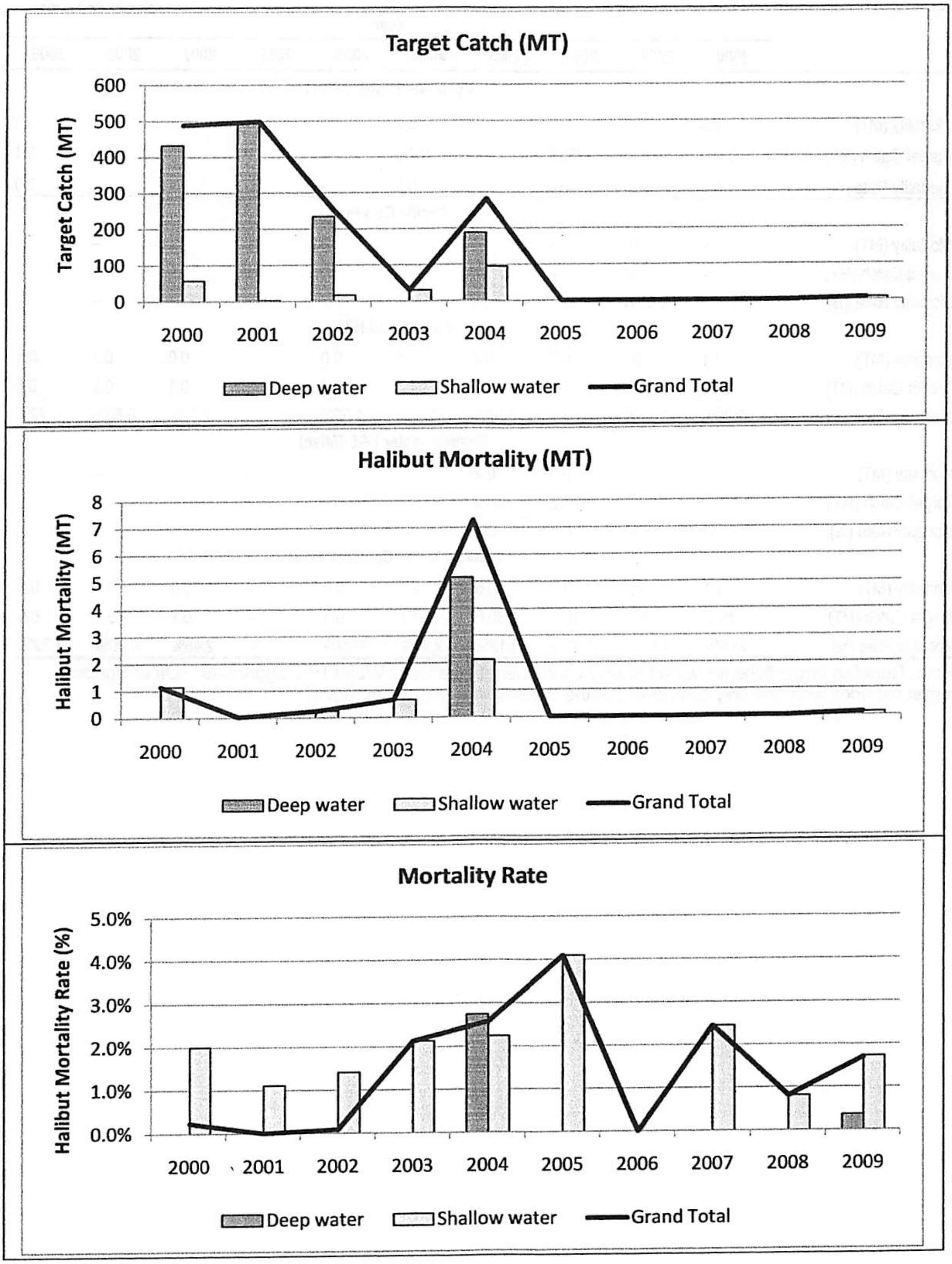


Table 18. Halibut Mortality by Specific Target Fisheries in Area 650, 2000-2009

	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					Deep Water H&L (Misc)					
Mortality (MT)	0.0	0.0	0.0	–	5.2	–	–	–	–	0.0
Target Catch (MT)	431.9	496.7	233.9	–	187.8	–	–	–	–	0.1
Mortality Rate (%)	0.0	0.0	0.0	–	0.0	–	–	–	–	0.0
					Pacific Cod Pot					
Mortality (MT)	–	0.0	–	–	–	–	–	–	–	–
Target Catch (MT)	–	0.3	–	–	–	–	–	–	–	–
Mortality Rate (%)	–	0.00%	–	–	–	–	–	–	–	–
					Pacific Cod H&L					
Mortality (MT)	1.1	0.0	0.2	0.4	2.1	0.0	–	0.0	0.0	0.1
Target Catch (MT)	57.0	1.5	13.1	27.3	94.7	0.3	–	0.1	0.2	6.5
Mortality Rate (%)	2.00%	1.32%	1.67%	1.57%	2.23%	4.09%	–	2.45%	0.80%	1.72%
					Shallow Water H&L (Misc)					
Mortality (MT)	–	–	0.0	0.2	-	–	–	–	–	–
Target Catch (MT)	–	–	3.2	3.2	–	–	–	–	–	–
Mortality Rate (%)	–	–	0.0	0.1	–	–	–	–	–	–
					Shallow Water Complex Total					
Mortality (MT)	1.1	0.0	0.2	0.6	2.1	0.0	–	0.0	0.0	0.1
Target Catch (MT)	57.0	1.8	16.3	30.6	94.7	0.3	–	0.1	0.2	6.5
Mortality Rate (%)	2.00%	1.11%	1.41%	2.12%	2.23%	4.09%	–	2.45%	0.80%	1.72%

Note: Rockfish target fisheries were the only component of the Deep Water H&L aggregate. "Other Species" target fisheries were the only component of the Shallow Water H&L aggregate.

2 References

NPFMC. 2009. Fishery Management Plan for Groundfish of the Gulf of Alaska. North Pacific Fishery Management Council. December 2009. Anchorage, Alaska. Accessed on June 6, 2010 from http://www.fakr.noaa.gov/npfmc/fmp/goa/GOA.pdf.

MEMORANDUM

TO: Council, SSC and AP Members

FROM: Chris Oliver [signature] for
Executive Director

DATE: June 1, 2010

SUBJECT: Miscellaneous Issues

ESTIMATED TIME
2 HOURS
ALL D-2 ITEMS

ACTION REQUIRED

(a) Review preliminary discussion paper on GOA Halibut PSC Limits.
(b) Receive briefing on Alaska MPAs and fishery overlap.
(c) Review Pacific cod assessment model run proposals (SSC only).
(d) Review Council request for Tier 6 Working Group (SSC Only).
(e) AFA preliminary report removal – initial/final action.

BACKGROUND

(a) Review preliminary discussion paper on GOA Halibut PSC Limits.

At the December 2009 meeting, the Council requested a discussion paper on the process for changing the halibut PSC limits in the GOA and the BSAI. In February 2010, the Council reviewed a NMFS discussion paper which described how PSC limits for halibut are established in both the BSAI and the GOA, and how PSC limits in the GOA could be modified under the current GOA Groundfish FMP. Halibut mortality PSC limits are specified annually as a component of the proposed and final GOA groundfish harvest specifications rulemakings. However, the actual amount of the trawl and non-trawl halibut PSC limits are discretionary, consistent with the considerations set forth in the FMP and implementing regulations. The FMP identifies criteria for the annual PSC limits that must be considered by the Council for setting or amending apportionments of halibut PSC. These considerations are addressed in this paper (Item D-2(a)).

The Council may choose to 1) take no action; 2) initiate an amendment (EA) to the GOA Groundfish FMP to revise the PSC setting process to mirror the regulatory process (RIR/IRFA) as in the BSAI, as needed; 3) initiate an analysis of halibut PSC limits to support the harvest specifications EA for 2012; or 4) include an analysis of halibut PSC limits in the next harvest specifications EA. The earliest that GOA halibut PSC limits could be revised is coincident with rulemaking for the annual groundfish specifications for 2012. The next step under any action alternative, *if that is the Council's intent,* would be for the Council to identify 1) a problem in the fishery, 2) goals and objectives for addressing the problem, and 3) management alternatives. If the Council chose to take no action to initiate a separate analysis, it always has the option to incorporate halibut PSC limit reductions in other proposed actions, as it did with BSAI Amendment 80. Even under no action, more widespread (mandatory or voluntary) use of halibut excluder devices would continue to result in a "win/win" situation whereby less halibut are taken as bycatch in groundfish fisheries thus leading to 1) potential increases in halibut abundance and commercial longline fishery catch limits and 2) increased GOA groundfish target harvests.

(b) Receive briefing on Alaska MPAs and fishery overlap.

In 2000, President Clinton signed Executive Order 13158, which requires NOAA to establish a Marine Protected Area Center and develop a framework for a national system of marine protected areas (MPAs). Section 5 of the MPA Executive Order states that *"Each Federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each Federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA."*

The provision to 'avoid harm' will require agencies to assess how their activities affect MPAs that are part of the National System. Because the NMFS conducts, approves, and funds activities that would affect MPAs, NMFS will be required to identify these activities. Further, because NMFS approves regulations that manage fishing activities in the EEZ, the agency would be required to ensure that the fisheries avoid harm to the maximum extent permitted by law and to the maximum extent practicable.

The framework leaves the definition of 'affect', 'avoid harm', and "to the extent permitted by law and to the maximum extent practicable" up to the individual Federal agencies. NOAA is in the process of preparing guidance on how these terms might be defined, interpreted, or analyzed. It is anticipated that this guidance will come out mid-2010, and will provide a mechanism for agencies to consult regarding potentially adverse activities within MPAs that are part of the national system.

In December 2009, the Council tasked staff to prepare a brief report with an initial evaluation of the "avoid harm" provision relative to fishing impacts on resources protected by the four MPAs off Alaska that are already part of the National System of MPAs. These are all managed by the Department of Interior, and include:

- The Alaska Marine National Wildlife Refuge,
- The Arctic National Wildlife Refuge,
- Glacier Bay National Park and Preserve, and
- The Yukon Delta National Wildlife Refuge.

John Olson (NMFS AKRO) examined fishing effort data (from the Ecosystems Considerations chapter of the yearly SAFE report) relative to the four DOI MPA sites. Observed fishery data were gridded to 10km x 10km blocks and filtered for confidentiality (3 or more individual vessels per block) over the years 1998-2008, and put on a GIS overlay with the four MPA sites, whose boundaries were downloaded directly from http://www.mpa.gov.

This analysis examined fishery overlap with MPA sites by gear type (longline, pot, pelagic trawl, and non-pelagic trawl). The results are shown by the figures attached as <u>Item D-2(b)(1)</u>. The figures indicate virtually no overlap with the MPA System sites, although there may be a minimal amount of fishing effort by all gear types (at the lowest category of effort of 4-10 tows/hauls over a ten year period) within state waters on the north side of Kodiak Island. The DOI sites in question tend to be terrestrial or nearshore in nature, while most fisheries managed by NMFS and the NPFMC are outside state waters.

The Council may wish to forward the results of this evaluation to the MPA Center and applicable DOI agencies (USFWS, NPS).

(c) Review Pacific cod assessment model run proposals (SSC only).

Following a recommendation from the SSC in December 2009, the Council posted a call for proposals from stakeholders for models to be requested from the author of the BSAI and GOA Pacific cod stock assessments. The deadline for model proposals was April 19, 2010. These proposals were reviewed by the Groundfish Plan Teams during a teleconference on May 6. The SSC is also scheduled to review all proposals (Item D-2(c)(1)), along with recommendations from the author and Plan Teams (Item D-2(c)(2)). The SSC will provide its recommendations for which models to request of Dr Grant Thompson for review by the plan teams in September 2010 and by the SSC in October 2010.

(d) Review Council request for Tier 6 Working Group (SSC Only).

At final action on groundfish FMP amendments to address requirements for annual catch limits (ACLs) in April 2010, the Council discussed specific cases where new group level ACLs based on Tier 6 (average catch) may constrain directed fisheries, noting particular concern regarding octopus and shark bycatch in the Pacific cod longline fisheries. The Council requested that the SSC schedule a discussion of Tier 6 methodologies on its June 2010 agenda, with the goal of developing new methods for determining Tier 6 OFLs and max ABCs for those groups that are poorly sampled by the bottom trawl surveys. In anticipation of SSC direction to schedule a workshop during Summer 2010 to develop new Tier 6 approaches for possible application for 2011 or later, Council staff coordinated with the SSC Chair and other SSC members, Groundfish Plan Team Chairs and other members, and all Tier 6 stock assessment authors to identify a tentative meeting date of July 8 for a teleconference. A report from the working group will be provided to the Groundfish Plan teams in September and to the SSC in October.

(e) AFA preliminary report removal – initial/final action.

The Council is scheduled to take initial/final action on a proposed amendment to remove the requirement for AFA cooperatives participating in the directed pollock fishery to prepare and submit the preliminary annual report. The analysis for this action, attached as Item D-2(e)(1), was mailed on May 18, 2010.

Currently, a preliminary AFA cooperative report is due to the Council by December 1 of the year in which the pollock fishing occurred. The Council originally recommended a preliminary report, because it wanted to have this report available for its December Council meeting when it adopts annual groundfish harvest specifications for the upcoming fishing year. The preliminary report is followed by a final report, due by February 1 of the following year, to update or add any information that became available after December 1. However, the Council may not be relying on the preliminary cooperative annual report to develop its recommendations on final groundfish specifications as much as it originally thought it would. Therefore, this action assess whether the existing final annual report submitted before February 1 of the following year is sufficient for the Council's and public's needs for information under section 210(a)(1) of the AFA.

Gulf of Alaska

HALIBUT PROHIBITED SPECIES CATCH LIMIT DISCUSSION PAPER[1]
June 2010

Prepared by North Pacific Fishery Management Council staff[2]

Executive Summary: The incidental catch of halibut has been a major bycatch issue in the Gulf of Alaska (GOA) for the North Pacific Council since the 1960s. During the last several annual groundfish specification cycles, the Council has discussed the procedure for setting halibut prohibited species catch (PSC) limits in the GOA and Bering Sea/Aleutian Islands (BSAI) management areas. Halibut PSC limits are specified by gear and may be apportioned by season, regulatory area, and/or target fishery. A PSC limit is an apportioned, non-retainable amount of fish provided to a fishery for bycatch purposes. The attainment of a PSC limit for a species results in the closure of the appropriate fishery.

In February 2010 the Council reviewed a NMFS discussion paper that identified the different procedures for setting halibut PSC limits under each FMP. While halibut PSC limits in the BSAI are set in federal regulation, GOA PSC limits are set under the authority of the GOA Groundfish FMP in rulemaking for the annual specifications process. Therefore the Council may continue to this process or it may choose to amend the GOA Groundfish FMP to mirror the process for BSAI groundfish fisheries, whereby halibut PSC limits may be revised through a regulatory amendment.

During its review of the NMFS paper the Council requested that its staff prepare this discussion paper for review in June 2010, which would address the criteria required by the GOA Groundfish FMP for setting halibut PSC limits. The Council also requested a paper on revising the BSAI halibut PSC limits in federal regulations, but did not identify a schedule for its review. This paper addresses the following criteria for GOA PSC limits in a general manner: 1) estimated change in biomass and stock condition of halibut; 2) potential impacts on halibut stocks; 3) potential impacts on the halibut fisheries; 4) estimated bycatch in years prior to that for which the halibut PSC mortality limit is being established; 5) expected change in target groundfish catch; 7) estimated change in target groundfish biomass; 8) methods available to reduce halibut bycatch; 9) the cost of reducing halibut bycatch; and 10) other biological and socioeconomic factors that affect the appropriateness of specific bycatch measures in terms of objectives.

After reviewing this information, the Council may choose to 1) take no action; 2) initiate an amendment (EA) to the GOA Groundfish FMP to revise the PSC setting process to mirror the regulatory process (RIR/IRFA) as in the BSAI, as needed; 3) initiate an analysis of halibut PSC limits to support the harvest specifications EA for 2012; or 4) include an analysis of halibut PSC limits in the next harvest specifications EA. The earliest that GOA halibut PSC limits could be revised is coincident with rulemaking for the annual groundfish specifications for 2012. The next step under any action alternative, *if that is the Council's intent,* would be for the Council to identify 1) a problem in the fishery, 2) goals and objectives for addressing the problem, and 3) management alternatives. If the Council chose to take no action to initiate a separate analysis, it always has the option to incorporate halibut PSC limit reductions in other proposed actions, as it did with BSAI Amendment 80. Even under no action, more widespread (mandatory or voluntary) use of halibut excluder devices would continue to result in a "win/win" situation whereby less halibut are taken as bycatch in groundfish fisheries thus leading to 1) potential increases in halibut abundance and commercial longline fishery catch limits and 2) increased GOA groundfish target harvests.

[1] Future analyses will review groundfish and halibut catch data by target fishery and sector.
[2] Based on source material from NPFMC, NMFS Sustainable Fisheries Division, & Int. Pacific Halibut Commission

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A brief history of halibut bycatch policy in the Gulf of Alaska

Section 3.6.2.1 of the GOA Groundfish FMP states the following Council policy on halibut bycatch in GOA groundfish fisheries.

> *"The Council believes that discarding incidental catches of fish is wasteful and should be minimized. However, recognizing that in the groundfish fisheries halibut incidentally caught are managed outside this FMP, the treatment of halibut as a prohibited species is appropriate in the short term. Except as provided under the prohibited species donation program, retention of prohibited species captured while harvesting groundfish is prohibited to prevent covert targeting on these species. The prohibition removes the incentive that groundfish fishers might otherwise have to target on the relatively high valued prohibited species, and thereby, results in a lower incidental catch. It also eliminates the market competition that might otherwise exist between halibut fishers and groundfish fishers who might land halibut in the absence of the prohibition.*
>
> *Halibut that are taken as bycatch in the trawl and fixed gear fisheries result in fishing mortality even though the FMP requires that these species be discarded. Bycatch survival rates of halibut are typically less than 100 percent and may approach zero for some fisheries and some gear.*
>
> *When a PSC limit is reached, further fishing with specific types of gear or modes of operation during the year is prohibited in an area by those who take their PSC limit in that area. All other users and gear would remain unaffected.*
>
> *However, when the fishery to which a PSC limit applies has caught an amount of prohibited species equal to that PSC limit, the Secretary may, by notice, permit some or all of those vessels to continue to engage in fishing for groundfish in the applicable regulatory area, under specified conditions. These conditions may include the avoidance of certain areas of prohibited species concentrations and will be determined on a case-by-case basis."*

The proposed rule for GOA FMP Amendment 21 summarizes the issue of bycatch management being considered by the Council in 1990; which, to some degree, is still applicable 20 years later. It states,

"The use of trawl, hook-and-line, and pot gear in the groundfish fisheries are to varying degrees non-selective harvesting techniques in that incidental (bycatch) species, including crabs and halibut, are taken in addition to target groundfish species. A conflict occurs when the bycatch in one fishery measurably or potentially impacts the level of resource available to another fishery. Bycatch management is an attempt to balance the effects of various fisheries on each other. It is a particularly contentious allocative issue because groundfish fishermen value the use of crabs and halibut very differently than do crab and halibut fishermen. . . . The prohibition on retention of prohibited species or the establishment of PSC limits eliminates the incentive that the groundfish fleets might otherwise have to target on crabs and halibut, but this prohibition does not provide a substantial incentive for them to avoid or control bycatch."

Alaska Sea Grant sponsored a 3-day national workshop in 1995[3] to review recent developments in bycatch reduction and promote dialogue on research and policy goals for the future.[4] A number of papers remain relevant to the Council's future considerations of ecological and economic implications of allocation decisions, observer requirements for the GOA groundfish and halibut fleets, and innovative gear to reduce halibut bycatch. One of the conclusions of the proceedings included, "regulatory schemes that encourage innovation and responsibility through incentives for bycatch reduction, and discourage those who jeopardize personal and collective fishing opportunities through disincentives, must be implemented." To that end, the Council has adopted catch share programs in the GOA that include bycatch reduction elements (halibut and sablefish individual fishing quota (IFQ) program, GOA rockfish pilot program). While primarily in the Bering Sea/Aleutian Islands, the commercial groundfish industry

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[3] A 1992 work shop identified and defined the problems of bycatch: Proceedings of the National Industry Bycatch Workshop, Feb 4-6, 1992, Newport, OR. Natural Resources Consultants, Inc. Seattle, WA

[4] Solving Bycatch: Considerations for Today and Tomorrow. Alaska Sea grant College Program report No. 96-03, University of Alaska Fairbanks

has responded to known ecological impacts and public perception and image of bycatch by cooperative research with NMFS on gear modifications for reducing bycatch of halibut, salmon, and crab.

Current interest in halibut bycatch reductions

> ***February 2010 Council motion***
>
> ***Council staff should bring back a discussion paper that develops the background information and clarifies the nature of the problem that needs to be addressed in context of considerations set forth in the GOA FMP for the establishment of halibut PSC limits, (Appendix 1 to the February discussion paper.) This paper would inform a subsequent decision to pursue an analysis to adjust halibut PSC limits under either an FMP amendment or the annual specification process for the GOA.***

As part of its deliberations in February 2010 to request a Council staff discussion paper on current GOA halibut PSC limits, the Council noted that it would need to identify a problem in the fishery goals and objectives, and proposed alternatives to take a management action to revise the current halibut PSC limits. The Council is often faced with conflicting goals and objectives, and the management of halibut as bycatch in directed groundfish fisheries (both trawl and fixed gear) is no exception.

Bycatch issues, which have been raised during public testimony and deliberations of both the Council and International Pacific Halibut Commission (IPHC), have focused on the biological impacts on the affected fisheries and the fishery resources. The IPHC has stated its intent to reconvene the Bycatch Work Group, that had met in 1991, to examine how impacts of bycatch can best be incorporated into halibut assessment and management, as well as to review progress on bycatch reduction and the target levels for reduction identified in 1991 (Salveson et al. 1992). Bycatch of halibut is not believed to be a conservation issue because the IPHC sets commercial halibut fishery catch limits at levels that account for bycatch mortality of adult and juvenile halibut. However, bycatch of juveniles reduces the recruitment of fish to the adult stock and, because juveniles are still highly migratory, the distribution of impacts differs from the distribution of bycatch. The means by which the IPHC compensates the stock for the effects of bycatch are complex and the relatively recent finding that migration continues well into adult ages further complicates matters. The IPHC seeks to prevent additional mortality above target harvest levels, which are computed after factoring expected annual bycatch levels.

In summary, the IPHC has identified the following biological impacts to the halibut resource due to halibut bycatch in both commercial groundfish trawl and fixed gear and commercial halibut longline fisheries:

1. Reduced yield, due to reduced recruitment and mortality of adults, which results in lower halibut commercial and sport fishery catch limits (i.e., yield) in U.S. and Canadian waters;
2. Out-of-area (or, "downstream") impacts of halibut bycatch, where the take of bycatch in one area reduces recruitment and available yield to other areas.
3. Reduced spawning biomass and egg production, due to reduced recruitment and mortality of adults.

With the management authority for conservation assigned to the IPHC, problems that have been raised in Council discussions predominantly address the effects on the directed halibut fishery of bycatch in non-directed fisheries. *Proponents of directed halibut fixed gear (IFQ) fisheries may point to declining halibut biomass and halibut fishery CEYs, particularly for the eastern segments of the halibut population, in addition to decreased size at age of halibut, as reasons to decrease the halibut PSC limits (for either the trawl, fixed gear, or both apportionments). They could identify that trawlers in the BSAI and GOA take 4 lb of halibut bycatch for every 1 lb longliners and pot fishermen take. They could point to reductions in halibut bycatch in recently rationalized fisheries as a source for potential PSC limit reduction(s).*

Conversely, proponents of rationalized trawl fisheries can point to their halibut bycatch reductions as a source of halibut PSC amounts (under the cap) that be reallocated to underutilized groundfish fisheries that could allow them to better achieve optimum yield in other fisheries for which the halibut PSC limit(s) have constrained the harvests of target groundfish stocks (e.g., shallow water flatfish trawl fishery).

In its discussion related to the development of this paper, the Council noted other actions at various stages of analysis that directly or indirectly address halibut bycatch in GOA groundfish fisheries. These include, but are not limited to, observer program restructuring and the GOA rockfish program. Both of these management issues are on the Council's June 2010 meeting agenda, and proposed actions are subject to revision per Council direction, on halibut PSC limits or any other management context. They are used as case studies in this paper for assessing potential impacts of potential changes to GOA halibut PSC limits.

Background on Process for Changing Current Halibut PSCs

The GOA Groundfish FMP notes that halibut PSC limits that are already in effect will remain so in the absence of a new recommendation for setting PSC limits by December 15 each year. A NMFS discussion paper in February 2010 (http://www.alaskafisheries.noaa.gov/npfmc/analyses/GOAHalibutPSCmod210.pdf) reviewed the process for amending halibut PSC limits. The FMP and implementing regulations authorize the Council to recommend, and NMFS to approve, annual halibut mortality PSC limits as a component of the proposed and final groundfish harvest specifications. Halibut PSC limits are separately set for trawl and fixed gear, which may further be apportioned by season, regulatory area, and/or target fishery. A PSC limit is an apportioned, non-retainable amount of fish provided to a fishery for bycatch purposes. The attainment of a PSC limit for a species will result in the closure of the appropriate fishery. Changes to the GOA PSC limits would require that an analysis be prepared within a timeframe that allows for final Council action in December and implementation through the harvest specification process. Alternatively, an FMP amendment could be considered that authorizes the establishment of modified PSC limits in regulations, similar to the BSAI.

Prior to 2007, the environmental and socioeconomic effects of the annual harvest specifications, including the PSC limits, were considered in annual environmental assessments (EA) prepared each year for the harvest specifications process. Preparation of annual EAs ceased in 2007 with the development of an environmental impact statement (EIS) prepared for the groundfish harvest strategy supporting the annual harvest specifications. The EIS did not address the process for setting annual PSC limits and likely will be updated with a supplemental EIS in 2011. A new analysis would be needed if the Council chooses to revise the GOA halibut PSC limits because the harvest specifications EA does not contain a specific discussion of changing the halibut PSC limit. Or the Council could amend the Groundfish FMP to specify the halibut PSC limits in regulations.

NMFS outlined a number of approaches that the Council could have selected in April 2010. By not initiating a new analysis at that time, a problem statement and alternatives, or a timeline for selecting a preliminary preferred alternative in October 2010, the Council is not in a position to recommend changes to the halibut PSC limits during the annual specifications process for 2011. Instead, it may wish to recommend that NMFS expand the supplemental EIS in 2011 to include a range of alternatives for halibut PSC limits that could be selected during the annual specifications process for 2012.

The FMP stipulates that the Council consider the following criteria for setting or amending apportionments of halibut PSC limits. While it is not clear what aspect of halibut PSC limit in the GOA that the Council may intend to modify in the future, a summary treatment of these issues is addressed below.

- estimated change in biomass and stock condition of halibut;
- potential impacts on halibut stocks;
- potential impacts on the halibut fisheries;
- estimated bycatch in years prior to that for which the halibut PSC mortality limit is being established;
- expected change in target groundfish catch;
- estimated change in target groundfish biomass;
- methods available to reduce halibut bycatch;
- the cost of reducing halibut bycatch; and
- other biological and socioeconomic factors that affect the appropriateness of specific bycatch measures in terms of objectives.

While the Council requested a separate discussion paper to address halibut PSC limits under the BSAI Groundfish FMP, information on the BSAI in some instances is included here for broader context for the Council to identify a problem statement, management goals, and alternatives for analysis.

Use of Halibut Bycatch Limits and Related Measures[5]

Bycatch limits have been used by the Council to control the bycatch of halibut, king crab, Tanner crab, and salmon in the groundfish fisheries off Alaska since the initial groundfish FMPs were developed. Previously, bycatch management measures used in the foreign groundfish fisheries were limited to closures of specific areas during selected times of the year. Bycatch limits were a relatively new tool devised to control the bycatch or bycatch mortality not only in the foreign fisheries, but also in the joint venture and fully domestic fisheries. As these latter fisheries have evolved, the use of time/area closures as the sole means of controlling bycatch has been reduced, and bycatch limits have been used with increasing frequency. This section provides background on the use of PSC limits and the method for choosing the limits that were adopted.

Halibut Bycatch Controls Prior to MFCMA[6]

Control of foreign bycatch of halibut. Halibut bycatch was recorded in late 1950s and early 1960s with expansion of foreign fishing (primarily USSR, Japan targeting flounders) off Alaska after World War II. Bycatch increased further with the expansion of foreign fishing by Korea, China, East Germany and Poland in the 1970s. During the late 1960s and early 1970s, regulation of foreign fishing fleets resulted from bilateral agreements between the United States and the national government of the foreign fleet, e.g., Japan, U.S.S.R., etc. The agreements identified specific areas and time periods when the foreign fishery was not allowed to operate. This often resulted in a "patchwork" of areas within the GOA and the BSAI closed to groundfish fishing at various times of the year. Agreements formulated in the late 1960s were directed at reducing gear conflicts between the North American halibut longline fishery and foreign trawl operations. Typically, foreign trawling was prohibited during the 5-15 day period surrounding the halibut fishery seasons established by IPHC (Fredin 1987). Time/area closures, another tool used by the U.S., may have provided some unintended but minor reduction in the halibut bycatch by those fisheries.

The first direct attempt to control the halibut bycatch in a foreign fishery began in 1973, when the IPHC proposed to its member governments that foreign trawling be prohibited in certain areas of the Bering Sea when the incidence of halibut was high (Skud 1977). Japan responded by voluntarily refraining from trawling in certain areas within the eastern Bering Sea from December 1, 1973 through November 31, 1974 in an effort to reduce the bycatch of halibut. These time/area closures, and similar measures for the GOA, were part of subsequent bilateral agreements between the U.S. and Japan, the U.S.S.R., the Republic of Korea, and Poland during 1975 and 1976 (Fredin 1987).

Up to this point only time/area closures were used to control halibut bycatch. Bycatch limits were not part of the measures employed, probably because of the lack of a comprehensive observer program which is needed to monitor compliance. A few observers had been placed on foreign vessels as part of a joint program by IPHC, NMFS, and the International North Pacific Fisheries Commission (INPFC) to obtain better information on the magnitude of the halibut bycatch (Hoag and French 1976), but coverage was limited. Managing bycatch with limits would have been impractical at that time.

Halibut Bycatch Controls After MFCMA

Following the enactment of the MFCMA in 1977, the Council included many of the time/area closures in its groundfish FMPs as bycatch control measures for the foreign fisheries. The Council has since developed other measures, such as bycatch limits and gear limitations, which are discussed in the following section.

Control of domestic bycatch of halibut. Regulations to control halibut bycatch in domestic groundfish fisheries were implemented initially as part of the GOA groundfish fishery management plan (FMP). These regulations reflected some of the time-area closures in effect for foreign trawl operations. The

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[5] This section is taken from Williams (1992).

[6] Source: http://www.iphc.washington.edu/halcom/pubs/techrep/tech0025.pdf and http://www.iphc.washington.edu/halcom/research/sa/BycatchWorkshop/Bycatch%20History.pdf

GOA fisheries were also monitored under halibut bycatch limits. Restrictions on domestic operations were relaxed and revised as the domestic groundfish fishery developed, consistent with the desire to enhance development of this fishery. Beginning in 1985, annual halibut bycatch limits were implemented for the GOA groundfish trawl fisheries, attainment of which triggered closure of the GOA to bottom trawl gear. In 1990, regulatory authority was also implemented to limit GOA halibut bycatch in fixed-gear fisheries. Seasonal allocations of halibut PSC limits also are authorized. Their attainment will close the GOA to further fishing with the applicable gear type for the remainder of the season.

Industry funded domestic observer program. Regulations require operators of catcher vessels and catcher/processor vessels to obtain either 100, 30, or 0 percent observer coverage during each calendar quarter, depending on size of vessel. Shoreside and mothership processors are required to have either 100, 30, or 0 percent observer coverage during a month, depending on the weight of groundfish received during that month. The small catcher vessel fleet and the entire halibut longline fleet is unobserved. While the amount of halibut bycatch can be estimated, the variances surrounding those estimates cannot be estimated under current levels of observer coverage, which according to the Council staff analysis is not likely to improve until the program is restructured in 2013 at the earliest. More information on halibut bycatch in the observed (and unobserved) groundfish fisheries can be found at http://www.alaskafisheries.noaa.gov/npfmc/current_issues/observer/ObserverRest510.pdf and is the subject of Council consideration under June 2010 agenda Item C-4.

Vessels less than 60 ft length over all (LOA) and mothership and shoreside processors that receive less than 500 mt groundfish during a month are not required to obtain an observer unless specifically requested to do so by NMFS. Observer data on halibut bycatch rates are applied against industry reported groundfish catch to derive estimates of halibut bycatch amounts each week. Actual procedures used by NMFS to calculate halibut bycatch amounts may be obtained from the Sustainable Fisheries Division, Alaska Region.

As noted in the observer program restructuring analysis,[7] there is no observer coverage in the halibut fisheries. Halibut fisheries are only minimally observed incidental to groundfish operations. In 2008, 3,141 permit holders fished halibut and sablefish IFQ using 1,157 vessels.[8] There are a number of potential bycatch issues pertaining to the halibut fleet. Most of the information gathered for management of halibut vessels (and groundfish vessels <60') currently takes place at shoreside processors, which may provide adequate catch accounting for target species and retained incidental catch species. However, discards are self-reported for all vessels in these sectors. NMFS does not currently have a verifiable measure to account for these discards, nor does it have a method for assessing the accuracy of its management decisions. Additionally, current self-reporting requirements do not include information about vessel fishing behavior. The IPHC port sampling program collects data needed for halibut stock assessment, including fishing effort and age/size composition of the landed catch.

Bycatch limits. Halibut bycatch mortality limits (round weight) for trawl, hook-and-line, and pot gear may be specified annually. Mortality limits specified are 2,000 mt (3.3 million pounds, net wgt.) for trawl gear (first implemented in 1985) and 750 mt (1.2 million pounds, net wgt.) for fixed gear (first implemented in 1990; and reduced to 300 mt (0.5 million pounds, net wgt.) in 1995 through the FMP's framework process). Groundfish pot gear is exempted from halibut bycatch restrictions because (l) halibut discard mortality rate and total mortality associated with this gear type is relatively low; and (2) existing pot gear restrictions are intended to further reduce halibut bycatch mortality.

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[7] http://www.alaskafisheries.noaa.gov/npfmc/current_issues/observer/ObserverRest510.pdf

[8] NMFS and the IPHC are funded under an NPRB grant to evaluate the potential for EM systems on these vessels.

Current season allowances of halibut PSC limits

Final 2009 and 2010 GOA Pacific halibut PSC limits, allowances, and apportionments (all values are in metric tons)

Trawl gear		Hook-and-line gear [1]			
		Other than DSR		DSR	
Season	Amount	Season	Amount	Season	Amount
January 20–April 1	550 (27.5%)	January 1–June 10	250 (86%)	January 1–December 31	10 (100%)
April 1–July 1	400 (20%)	June 10–September 1	5 (2%)		
July 1–September 1	600 (30%)	September 1–December 31	35 (12%)		
September 1–October 1	150 (7.5%)	n/a	n/a		
October 1–December 31	300 (15%)	n/a	n/a		
Total	2,000 (100%)	n/a	290 (100%)		10 (100%)

[1] The Pacific halibut PSC limit for hook-and-line gear is allocated to the demersal shelf rockfish (DSR) fishery and fisheries other than DSR. The hook-and-line sablefish fishery is exempt from halibut PSC limits.

Final 2009 and 2010 apportionment of GOA Pacific halibut PSC trawl limits between the trawl gear deep-water species complex and the shallow-water species complex (values are in metric tons)

Season	Shallow-water species complex	Deep-water species complex [1]	Total
January 20–April 1	450	100	550
April 1–July 1	100	300	400
July 1–September 1	200	400	600
September 1–October 1	150	Any remainder	150
Subtotal January 20–October 1	900	800	1,700
October 1–December 31 [2]	n/a	n/a	300
Total	n/a	n/a	2,000

[1] Vessels participating in cooperatives in the Central Gulf of Alaska Rockfish Pilot Program will receive a portion of the third season (July 1–September 1) deep-water category halibut PSC apportionment. At this time, this amount is unknown but will be posted later on the Alaska Region Web site at *http://www.alaskafisheries.noaa.gov* when it becomes available.

[2] There is no apportionment between shallow-water and deep-water fishery complexes during the 5th season (October 1–December 31).

Season delays. While the FMP allows the Council to set the season start dates to accommodate fishery interests, it has relied on the seasonal apportionment to take advantage of seasonal differences in halibut and some groundfish fishery species distributions.

Gear restrictions. Gear restrictions are specified to reduce bycatch or bycatch mortality of halibut. Restrictions include (a) requiring biodegradable panels on groundfish pots, (b) requiring halibut exclusion devices on groundfish pots, and (c) revised specifications for pelagic trawl gear that constrain the pelagic trawl fisheries for groundfish to a trawl gear configuration designed to enhance escapement of halibut.

Vessel Incentive Program A vessel incentive program (VIP) designed to reduce the rate at which halibut are incidentally in specified groundfish trawl fisheries became effective May 6, 1991. Individual trawl vessels became accountable for their observed halibut bycatch rates when they participated in GOA Pacific cod fishery and bottom rockfish fishery (as well as the BSAI Pacific cod fishery and BSAI flatfish fishery). If a vessel's bycatch rate at the end of a month exceeded a specified bycatch rate standard, the vessel owner/operator will be subject to prosecution. Halibut bycatch rate standards are specified annually, based on criteria set forth in regulations. The bycatch rate standards specified were based on average bycatch rates exhibited by vessels. However the program did not perform as intended because the costs associated with enforcement and the relatively small number of vessels impacted by the regulation resulted in withdrawal of the VIP from federal regulations in 2008.

Fishery Management Plans and Amendments

One of the tasks required of each regional fishery council by the MFCMA was the preparation of FMPs for all fisheries within a council's jurisdiction which require management. Preparation of the GOA groundfish FMP was quickly initiated following MFCMA implementation and drafting of the BSAI groundfish FMP followed soon thereafter. The GOA FMP became effective on December 11, 1978 and the BSAI FMP was effective on January 1, 1982. The initial GOA FMP contained halibut bycatch limits for the fully domestic fishery, whereas the BSAI FMP did not. Each FMP has been amended several times since implementation, with several of the amendments containing provisions regarding halibut bycatch limits. This section provides an overview of these bycatch limit measures.

GOA Groundfish Fishery Management Plan

The Council identified the GOA groundfish fishery as one requiring immediate attention so it was the first of two groundfish FMPs it implemented (Larkins 1980). The urgency to implement a FMP in the GOA may have been due to (1) the large number of foreign nations participating in the GOA fishery and resultant lack of control by the U.S., (2) the lack of information on the condition of the groundfish resources, (3) the low abundance of halibut, and (4) the relatively low catch limits imposed on the halibut fishery. Two management objectives for the groundfish fishery were adopted, the first of which sought to rebuild the halibut resource, while the second sought to maximize the opportunity for the development of a domestic groundfish fishery (Larkins ibid). The Council chose to give highest priority to rebuilding the halibut stock.

In order to provide opportunity for development of a fully domestic fishery and protection for the halibut resource, the FMP specified halibut PSC (bycatch) limits for a domestic fishery. The limits applied to fishing conducted between December 1 and May 31, and were specified at 29 mt (48,000 pounds) for the Western area and 52 mt (86,000 pounds) for the Central area. The limits were based on the assumption of a one percent bycatch rate, or roughly equal to one percent of the domestic harvest of Pacific cod expected in 1979 or soon thereafter (NPFMC 1985). When the limits were reached, further domestic trawling during the December-May period in that area was prohibited. Fishing conducted outside this period was unencumbered by limits.

The domestic groundfish fishery grew more quickly than anticipated and by the mid-1980s, the bycatch limits began to seriously restrict the fishery. For the 1984 and 1985 fisheries, the Council requested NMFS to enact Emergency Rules increasing the bycatch limits to 270 mt (0.45 million pounds) in the Western area and 768 mt (1.27 million pounds) in the Central area to prevent domestic on-bottom trawling from being excessively restricted (NPFMC ibid.). Also, additional Emergency Rules were implemented for the 1984 and 1985 fisheries to exempt midwater trawls from any fishery closure because of the inherently low halibut bycatches. This was done in recognition of the valuable pollock fishery in Shelikof Strait, which was conducted with midwater trawls.

Amendment 3

The original FMP subdivided the Chirikof statistical area into two segments at 157° W. The total allowable level for foreign fishing (TALFF) for Pacific cod in the entire Chirikof area was established at 1,500 mt, which was further split to 600 mt and 900 mt for the western and eastern subdivisions, respectively. Amendment 3 was intended to allow an increase in the amount of Pacific cod taken by foreign longliners, within the confines of the overall quota for Chirikof. Since longline gear is more selective than trawl gear, allowing an increase in longline harvest was expected to reduce the amount taken by trawlers, and thus reduce the incidental catch of halibut and shellfish.

Amendment 14

The growth of the domestic, including joint venture, groundfish fishery and the expected continued use of Emergency Rules to overcome the halibut bycatch limits specified in the GOA FMP led to Amendment 14 in 1985. It provided a framework for the Council to annually set a halibut PSC limit based on consideration of a set of factors (outlined above) separately for domestic and joint venture fisheries in each area. The framework process, which became effective in1986, allows the NMFS Alaska Regional Administrator flexibility to permit those fisheries with low bycatch potential to continue after fisheries and areas have been closed by attainment of the limit.

The halibut bycatch framework process worked to limit the bycatch from bottom trawling of both domestic and joint venture (foreign) fisheries. For instance, all bottom trawling was closed for the remainder of the year when the halibut bycatch limit for the GOA was reached, however, other gears could continue to fish, such as the longline fisheries for sablefish and Pacific cod.

Regulations implementing the FMP contained restrictions on foreign and domestic fishermen in the western and central GOA that were designed to minimize the taking of halibut. Foreign fishermen were restricted to the use of off-bottom gear when trawling in the western and central GOA regulatory areas from December 1 through May 31, a period when juvenile halibut are subject to high rates of incidental capture. Domestic fishermen were allowed to use on-bottom trawl gear during this period, but all trawling by domestic fishermen was prohibited until June 1 if the incidental harvest of halibut by domestic trawlers in those areas reached 29 or 52 mt in the western or central GOA, respectively. These PSCs were implemented in 1978 and approximated one percent of the weight of Pacific cod expected to be taken by domestic fishermen in 1979 or soon thereafter. Domestic groundfish catches were increasing as market opportunities developed. Most of the increase was attributed to large amounts of pollock taken in joint venture fisheries operating in the Shelikof Strait region of the central GOA. Relatively few halibut were taken in this fishery because only off-bottom gear was used. For example, only about 4 mt of halibut was taken incidental to a pollock catch of 132,000 mt in 1983. At the same time, domestic catches of other groundfish species (primarily cod and flounder) that have significant halibut bycatch were also increasing.

Regulations at 50 CFR 672.20(d) still? Require that all trawl caught halibut be released. While some halibut survive, that survival varies with the type of operation. Observer data in the 1980s suggested very low survival of halibut in operations that involve the transfer of codends at sea and where halibut cannot be released immediately – these were typically JV or large freezer/processor operations. Halibut survival was relatively high (~50 percent) on smaller shore-based trawl operations where the trawl catch is sorted on deck and the halibut can be immediately released.

Halibut bycatch fluctuates with abundance of both halibut and groundfish target species. In 1984, the Council requested an emergency rule to raise the halibut PSC limit to 270 mt in the western GOA and 768 mt in the central GOA during the December through May fisheries. The Council also requested that users of off-bottom gear be exempted from PSC limits in recognition that few halibut were caught by that gear. A second ER for the same halibut PSC limits was implemented again in 1985.

The Council became aware that halibut were vulnerable to trawls during periods other than the December-May period specified in the FMP, which led to an annual PSC limit that would provide protection for halibut all year. The Council determined that imposing limits on the amounts of halibut that could be taken incidentally by domestic and foreign fishermen will convey a benefit to halibut fishermen, as well as for groundfish fishermen who would benefit from the best available information each year regarding the abundance of halibut and the distribution of the expected groundfish harvest. Therefore the groundfish fisheries would run less risk of being terminated as a result of outdated PSC limits.

The Council identified the following five problems in the fishery in the 1985 plan amendment.

1) The Shelikof Strait joint venture pollock fishery is jeopardized by the 52 mt PSC in the Central area even though the halibut bycatch is very low in this highly productive fishery.
2) The PSC limits for the Western and Central Area jeopardize the maintenance and further development of domestic trawl fisheries for cod, flounders, and other groundfish species that are targeted with bottom gear.
3) The bycatch of halibut by domestic trawlers during the six months for which there are no restrictions on the use of bottom gear has increased significantly.
4) Although the PSC limits are for all domestic trawlers, only the bycatch of the joint ventures is monitored because bycatch cannot be extensively monitored without extensive onboard observer coverage of wholly domestic operations.
5) With respect to regulating the bycatch of halibut in groundfish trawl fisheries, the FMP has not been flexible enough to remain effective as conditions in the fisheries change.

<u>Amendment 18</u>

In June 1989, the Council approved Amendment 18 to the GOA Groundfish FMP, which sought to correct the perceived inequity of closing one fishery when bycatch limits were reached but allowing others to continue. Amendment 18 specified interim fixed halibut bycatch mortality limits of 2,000 mt (3.3 million pounds) for the GOA trawl fishery and 750 mt (1.2 million pounds) for all GOA longline fisheries for one year (1990). The purpose of the action was that there was to allocate specific amounts of

PSC limits to the two gear types for the 1990 fishing year so that PSC amounts and closures for the two gear types would be independent of each other. The intent was for a regulatory amendment to follow this action in 1990 that would further prohibit further fishing by hook-and-line gear fishermen as well as trawl fishermen if they were to reach a PSC limit. The FMP would retain the framework procedure then used to establish PSC limits.

The combined trawl/longline bycatch mortality limits represented an increase in the PSC limits from earlier years. The trawl bycatch limit increased from the limit applied in previous years, because only trawl bycatch mortality would be tallied against the trawl bycatch mortality limit. The longline fishery, however, had never operated under a bycatch limit. The sablefish fishery, the largest non-halibut longline fishery in the GOA, had also never been observed, so the magnitude of halibut bycatch and bycatch rates in this fishery was relatively unknown. The data required to monitor halibut bycatch was to be collected by a comprehensive observer program, also required under Amendment 18.

Industry representatives requested the Council divide the bycatch mortality limits for each fishery into quarterly allotments, or apportionments, in an effort to avoid taking the entire limit early in the year, thus prohibiting fisheries which might occur late in the year.

The limits specified by Amendment 18 had a significant effect on the 1990 GOA groundfish fisheries. The trawl fishery was closed from May 29 through June 30 because the portion of the limit allocated to the second quarter of 1990 had been taken. The fishery continued uninterrupted from the July 1 reopening until November 21, when observer data indicated the annual limit of 2,000 mt (3.32 million pounds) had been reached. NMFS estimated that halibut mortality in all trawl fisheries totaled 2,139 mt (3.55 million pounds) for the year.

The bycatch limit, however, had a much greater impact on the longline fishery. Longline effort in the first quarter was low, which resulted in only a small amount of halibut bycatch. High bycatch rates in the sablefish fishery, which opened on April 1, caused bycatch to accrue quicker than could be monitored by NMFS. Consequently, the limit was exceeded by the time longlining was closed on May 29. NMFS estimated the longline fishery bycatch mortality reached 1,004 mt (1.66 million pounds) in 1990. The trend was similar in 1991, although total mortality had reached 826 mt (1.37 million pounds) by the date NMFS closed the fishery.

Amendment 21

The Council expanded and revised the provisions of earlier bycatch-related amendments with Amendment 21. Approved in June, 1990, the amendment included the following:

(1) Allowed the bycatch mortality limits to be divided by time period;

(2) Divided the "fixed gear" limit into separate limits for longline and groundfish pot fisheries;

(3) Implemented a vessel incentive program which allowed NMFS to penalize vessels with bycatch rates exceeding predetermined standards; and

(4) Required that groundfish pots have biodegradable panels and halibut excluder devices.

The vessel incentive program as originally designed could not be implemented for 1991 by NMFS. Substantial revision of the program occurred in late 1990, replacing an in-season program with one that entailed a post-season examination of bycatch rates and comparison with established standards. The Council approved the new incentive program during a conference call in November, 1990. Actual implementation of the program did not occur until May, 1991, although it was retroactively applied to fishing beginning on April 1, 1991. Halibut bycatch rate standards used for 1991 were based on rates observed in previous years.

Amendment 20

An Individual Fishing Quota Program was implemented for the Pacific halibut (via regulatory amendment) and sablefish fixed gear fisheries in the federal waters of the BSAI and GOA in1995. Bycatch reduction was inherent in the program, due to the close interaction between sablefish and halibut fisheries. Much of the longline bycatch of halibut occurred in the sablefish fisheries, and many fishermen fish for both (and received IFQ for both). To the extent sablefish fishermen have halibut IFQ, this halibut is now retained and counted against the target quotas, as opposed to being caught as bycatch and discarded (by regulation it previously had to be discarded). This resulted in an immediate reduction of the GOA halibut Prohibited Species Catch limit from 750 mt annually to around 150 mt annually (Oliver and Pautzke 1997). In the annual specifications process for 1995, the halibut PSC apportionment to the longline sector was reduced from 750 to 300 mt.

Amendment 24

The purpose of this amendment in 1992 was to further address bycatch issues that were raised under Amendment 21. This amendment was aimed to control and reduce halibut bycatch mortality in the Alaska groundfish fisheries in response to the international, social, and economic conflicts between U.S. and Canadian halibut fishermen and U.S. groundfish fishermen that take halibut as bycatch. It implemented three management measures. Since the amendment was approved, bycatch of crab and halibut has been controlled to stay within the PSC limits.

(1) Delay the season opening date of the GOA groundfish trawl fisheries to January 20 of each fishing year to reduce salmon and halibut bycatch rates;

(2) Further delay the season opening date of the GOA trawl rockfish fishery to the Monday closest to July 1 to reduce halibut and chinook salmon bycatch rates;

(3) Change directed fishing standards to further limit halibut bycatch associated with bottom trawl fisheries:

(4) Expand the vessel incentive program to address halibut bycatch rates in all trawl fisheries.

Estimated change in biomass and stock condition of halibut[9]

Since 2006, the International Pacific Halibut Commission (IPHC) stock assessment has been fitted to a coastwide dataset to estimate total exploitable biomass. Coastwide exploitable biomass at the beginning of 2010 is estimated to be 334 million pounds. The halibut stock is considered healthy but is experiencing an ongoing decline in size at age for all ages in all areas. Projections based on the currently estimated age compositions suggest that the exploitable and female spawning biomasses will increase over the next several years as a sequence of strong year classes recruit to the over 32 inch (O32) component of the population.

Each year the International Pacific Halibut Commission (IPHC) staff assesses the abundance and potential yield of Pacific halibut using all available data from the commercial and sport fisheries, other removals and scientific surveys. A biologically determined level for total removals from each regulatory area is calculated by applying a fixed harvest rate to the estimate of exploitable biomass in that area. This level is called the "constant exploitation yield" or CEY for that area in the coming year. The corresponding level for catches in directed fisheries subject to allocation is called the fishery CEY. It comprises the commercial setline catch in all IPHC areas in Alaska. It is calculated by subtracting from the total CEY an estimate of all unallocated removals—bycatch of halibut over 32 inches in length (hereafter, "O32"), wastage of O32 fish in the halibut fishery, fish taken for personal use, and sport catch

For many years the staff assessed the stock in each regulatory area by fitting a model to the data from that area. This procedure relied on the assumption that the stock of fish of catchable size in each area was closed, meaning that net migration was negligible. A growing body of evidence from both the assessments (Clark and Hare 2007) and the ongoing mark-recapture experiment (Webster and Clark 2007, Webster 2010) shows that there is a continuing and predominantly eastward migration of catchable fish from the western area (Areas 3 and 4) to the eastern side (Area 2). The effect of this unaccounted for migration on the closed-area stock assessments was to produce underestimates of abundance in the western areas and overestimates in the eastern areas. To some extent this has almost certainly been the

[9] From http://www.iphc.washington.edu/halcom/research/sa/papers/sa09.pdf

case for some time, meaning that exploitation rates were well above the target level in Area 2 and a disproportionate share of the catches have been taken from there.

In order to obtain an unbiased estimate of the total exploitable biomass (EBio) beginning with the 2006 assessment, the staff built a coastwide data set and fitted the model to it. Exploitable biomass in each regulatory area was estimated by partitioning, or apportioning, the total in proportion to an estimate of stock distribution derived from the setline survey catch rates (WPUE). Specifically, an index of abundance in each area was calculated by multiplying survey WPUE (running 3-year average) by total bottom area between 0 and 400 fm (Hare et al. 2010). The logic of this index is that survey WPUE can be regarded as an index of density, so multiplying it by bottom area gives a quantity proportional to total abundance. This year several adjustments to the index for each area, derived on the basis of hook competition, survey timing and depth distribution of survey stations were examined. For apportionment purposes, the staff recommended that the survey index for each area be adjusted on the basis of hook competition and survey timing. The estimated proportion in each area is then the adjusted index value for that area divided by the sum of the adjusted index values.

The IPHC recommended total catch limits for 2010 totaling 50,670,000 pounds, a 6.3% decrease from the 2009 catch limit of 54,080,000 pounds. This estimate is based on the 2009 Pacific halibut stock assessment which implemented a coastwide estimation of biomass, with apportionment to regulatory biomass based on the data from the annual IPHC assessment survey. For 2010, the IPHC staff recommended a 20% harvest rate for use in Areas 2A through 3A. The IPHC staff expressed concern over continued declining catch rates in Area 3B and recommended a reduction of the harvest rate for this area to 15%, similar to that used for the Bering Sea (Areas 4A, 4B, and 4CDE). Catch limits adopted for 2010 were lower for most regulatory areas except Areas 4B and 4CDE, for which the recommended catch limits increased approximately 15 and 3 percent, respectively. Decreased catch limits reflect stock biomass declines as the exceptionally strong 1987 and 1988 year classes pass out of the fishery. Recruitment from the 1999 and 2000 year classes is estimated to be above average but the lower growth rates of fish in recent years means that these year classes are recruiting to the exploitable stock very slowly.

Apportioning the coastwide biomass among regulatory areas

Apportionment of the coastwide biomass among regulatory areas has proved controversial. The IPHC staff believes that survey WPUE-based apportionment is the most objective and consistent method of estimating the biomass distribution among areas and therefore the best distribution of total CEY to achieve the IPHC's goal of proportional harvest among areas. The validity of the survey WPUE apportioning requires that survey catchability – the relationship between density and WPUE – be roughly equal among areas. Over the past few years, several checks for area differences in catchability were made (Clark 2008a, Clark 2008b, Clark 2008c, Webster 2009b) but results were inconclusive in determining differences. This year, three factors were considered for adjusting survey WPUE. Methodologies and analyses of all three factors - in isolation and in combination - is contained in Webster and Hare (2010). A brief summary of the rationale behind the three factors is presented below but details, and the adjustments themselves, are not repeated here - see Webster and Hare 2010. Following (potential) adjustment of the annual survey WPUE values, the IPHC has usually averaged the last few years to smooth out annual variation in the survey. This year, an alternate weighting scheme for the averaging was also investigated to compute apportionments. Also new this year, at the request of industry, is the addition of a historical removals shares weighting factor.

Much greater detail on apportionments of halibut biomass can be found on the IPHC website, where a summary of a 2009 work shop and background material has been made available: http://www.iphc.washington.edu/halcom/meetings/workshops.htm#reports.

Estimated change in biomass and stock condition of halibut[10]

Since the 1960s, fisheries for groundfish other than Pacific halibut have caused an average of about 9,000 metric tons (mt, round weight) of halibut bycatch mortality every year, whereas annual directed catches of Pacific halibut have varied from 13,000 to almost 50,000 mt. About half of the bycatch consists of juvenile Pacific halibut caught in Alaska, some of which would otherwise migrate south and contribute to the fishery in British Columbia.

These interceptions have long been a difficult issue for the United States and Canada. At levels of high juvenile abundance in the 1990s, juvenile bycatch reduces coastwide recruitment by about 10%. The resulting yield loss, plus bycatch of adult fish, reduces yield to the directed fishery by about 11,000 mt per year. Migration modeling done in the 1990s indicated that the yield loss due to bycatch occurred almost entirely in the area where the bycatch is taken. In particular, bycatch in Alaska reduced Pacific halibut

yields in British Columbia by, at most, a few percent. During the 1980s and early 1990s, annual quotas in the directed Pacific halibut fishery were reduced by an amount equal to, or sometimes greater than, the total Pacific halibut bycatch mortality, and the quota reduction was distributed among regulatory areas in proportion to Pacific halibut exploitable biomass. In the late 1990s, the Pacific halibut quota in each regulatory area is reduced by the amount of adult Pacific halibut bycatch mortality in that area, and the target exploitation rate is adjusted downward (slightly) to offset the bycatch mortality of juveniles.

Bycatch in other groundfish fisheries substantially reduced yield to the directed Pacific halibut fishery over the last few decades, and it continues to do so. The IPHC staff has estimated the long term potential productivity of the stock as 30,000–40,000 mt/year, so at recent levels of bycatch the yield loss has amounted to about a fifth of potential production (7,200 mt/year).

The main advantage of accounting for sublegal bycatch by including that mortality in the population model used to choose the target harvest rate is that now the treatment of bycatch is an integral part of the harvest strategy. The effects of all sources of mortality on both biomass and yield are considered simultaneously, and the Commissioners can consider both when choosing a harvest rate that achieves the best balance of their management objectives, which include maintaining a healthy level of spawning biomass along with obtaining a high and stable yield. In equilibrium conditions, it can be expected that the addition of sublegal bycatch mortality to the population model would result in the choice of a slightly lower target harvest rate, but that might not happen when the stock is at a high level of abundance, as it is now.

Another advantage of the present procedure is that it does not explicitly reduce the setline quota in one regulatory area to account for bycatch in another regulatory area. The only explicit quota reduction is for the bycatch of legal-sized fish within each regulatory area. That avoids some controversy, even though changing the procedure has in no way reduced the yield loss resulting from sublegal bycatch.

This new finding of ongoing adult migration has re-opened the contentious debate as to the extent of the impact on Canadian halibut production losses from U32 bycatch in US groundfish fisheries. At present, the effect of U32 bycatch continues to be handled by adjusting the target harvest rate but this is under current review. Over 32 inch (O32) inch bycatch, which is on the order of 3000 mt continues to be handled by reducing CEY by an equivalent amount in the area where the bycatch takes place.

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[10] From http://www.iphc.washington.edu/halcom/research/sa/papers/sa09.pdf and updated by Steven Hare, IPHC

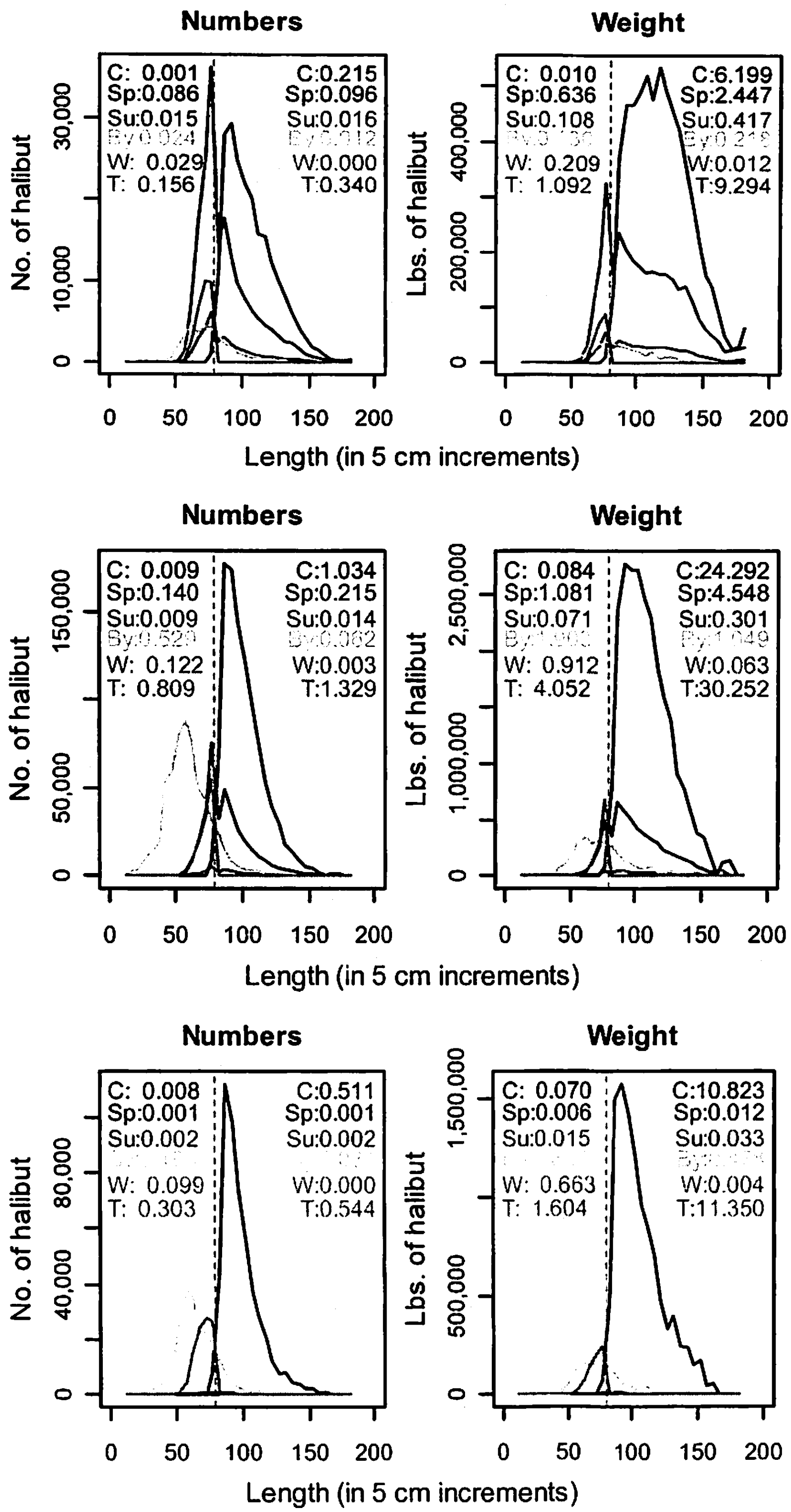

Figure 1. Total Removals in 2008 (2C top, 3A middle, 3B bottom) (best viewed in color)

Incidental catch and mortality of Pacific halibut, 1962-2008[11]

Area 2C Crab pot fishing and shrimp trawling occur in various locations and harvests have held steady over the years. Pot fishing for brown king crab (*Lithodes aequispina*) occurs in the deep waters of Chatham Strait during the winter months, and beam trawling occurs for shrimp and flounders in the inside waters of southeast Alaska. These fisheries have not been reviewed since the early 1990s, but these fisheries are small scale in nature, with low bycatch. It is assumed that mortality has been relatively stable since first examined.

Area 3 Bycatch mortality in Area 3 was estimated at 4.3 million pounds in 2008, an 8.7% increase from 2007. Slight decreases in trawl bycatch mortality were offset by increases in hook-&-line fishery bycatch mortality. The Rockfish Pilot Program (RPP), a study which permits a portion of the rockfish trawl fishery to operate as fishery cooperatives, continued in 2008. Vessels participating in the rockfish cooperatives were able to fish more off-bottom and at a slower pace offered by the cooperative structure. The RPP consisted of two catcher/processor (CP) cooperatives and five catcher vessel (CV) cooperatives, with each cooperative allocated its own halibut bycatch limit. The two CP coops had a total of 55 mt (91,000 lbs net) for their halibut mortality cap, while the CV coops were allocated 115 mt (190,000 lbs net). These halibut bycatch allocations were a part of the Gulf of Alaska trawl fishery bycatch limit of 2,000 mt. In other fisheries, pot effort for cod, which has lower bycatch properties than other gears, continues to be high. Within Area 3B, trawl and hook-&-line fishery bycatch both increased from 2007. The total 2008 Area 3 bycatch mortality is slightly below the 10-year average of 4.5 million pounds.

In 2010 the IPHC held a workshop[12] on halibut bycatch that had three goals: 1) Review history and treatment of halibut bycatch and treatment of fish < 32 inches (U32); 2) Review changes in understanding and potential treatment of bycatch impacts based on new understanding of halibut movements; and 3) Investigate options for future treatment of bycatch in halibut management. The workshop covered the following topics (many of the staff presentations are cited throughout this paper).

1. Historical methods by which the Commission has accounted for bycatch mortality in management of the halibut stock
2. Methods of estimation of bycatch mortality in non - target fisheries
3. Incorporation and impacts of bycatch mortality estimates and noncommercial removals on halibut productivity and yield
4. Impacts of non - local bycatch mortality on fisheries yield of individual IPHC Regulatory Areas
5. Progress on halibut bycatch control and management in other fisheries
6. Methods employed to reduce non - target halibut bycatch mortality in the northeast Pacific Ocean
7. Future of halibut bycatch management

Potential impacts on the halibut fisheries

The Programmatic Groundfish EIS determined that the GOA halibut PSC limits (2,000 mt to trawl and 300 mt to longline) did not adversely affect the halibut stock or place an unfair burden on directed halibut fisheries. Any economic benefit to halibut fisheries would be offset by economic costs to groundfish fisheries.[13]

Having made the blanket statement that there are no NEPA concerns related to halibut bycatch management, the summary provided in an earlier section of this paper is repeated here. The IPHC has identified the following biological impacts to the halibut resource due to halibut bycatch in both commercial groundfish trawl and fixed gear and commercial halibut longline fisheries:

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[11] http://www.iphc.washington.edu/halcom/pubs/rara/2009rara/papers/389.pdf

[12] http://www.iphc.washington.edu/halcom/research/sa/BycatchWorkshop/Bycatch%20History.pdf

[13] http://www.fakr.noaa.gov/sustainablefisheries/seis/final062004/Appen/App_F/app_f5.pdf

1. Reduced yield, due to reduced recruitment and mortality of adults, which results in lower halibut commercial and sport fishery catch limits (i.e., yield) in U.S. and Canadian waters;
2. Out-of-area (or, "downstream") impacts of halibut bycatch where the take of bycatch in one area reduces recruitment and available yield to other areas.
3. Reduced spawning biomass and egg production, due to reduced recruitment and mortality of adults.

Table 1. Bycatch in the domestic Gulf of Alaska groundfish fishery since 1990. Source: IPHC

	Thousands of Pounds, net weight				*Metric Tons, round weight*			
Year	**Trawls**	**H&L**	**Pot**	**Total**	**Trawls**	**H&L**	**Pot**	**Total**
1990	4,331	2,012	52	6,395	2,612	1,214	31	3,857
1991	4,538	2,081	7	6,626	2,737	1,255	4	3,997
1992	4,060	2,684	26	6,770	2,449	1,619	16	4,083
1993	3,548	1,900	19	5,467	2,140	1,146	19	3,305
1994	3,619	1,512	23	5,154	2,183	912	14	3,109
1995	3,745	645	35	4,425	2,259	389	21	2,669
1996	3,890	498	11	4,399	2,346	300	7	2,653
1997	3,291	855	13	4,159	1,985	516	8	2,509
1998	3,042	705	19	3,766	1,835	425	11	2,272
1999	3,333	854	147	4,334	2,010	515	89	2,614
2000	3,416	718	17	4,151	2,060	433	10	2,504
2001	3,724	614	41	4,379	2,246	370	25	2,641
2002	3,193	615	4	3,812	1,926	371	2	2,299
2003	3,748	827	34	4,609	2,261	499	21	2,780
2004	3,899	710	52	4,661	2,352	428	31	2,811
2005	3,526	457	57	4,040	2,127	276	34	2,437
2006	3,265	778	27	4,070	1,969	469	16	2,455
2007	3,142	479	33	3,654	1,895	289	20	2,204
2008	3,043	912	45	4,000	1,835	550	27	2,413

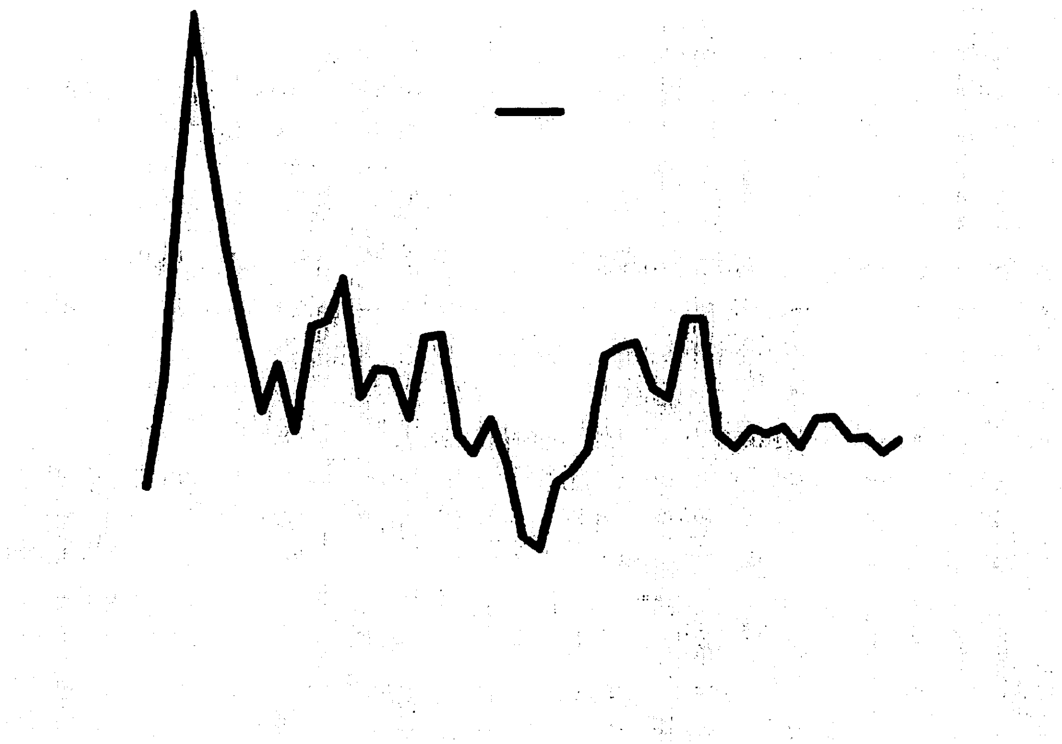


Figure 2. Groundfish Catch vs. Halibut Mortality (Source: IPHC)

Figure 3. Groundfish Catch vs. Ratio of Halibut Mortality to Groundfish Catch (Source: IPHC)

Estimated bycatch in years prior to that for which the halibut PSC mortality limit is being established

The halibut PSC limit for the GOA is 2,300 mt. The 2,000 mt PSC limit for the GOA trawl fisheries has remained unchanged since 1989, and approximated this amount in the domestic and joint venture groundfish fisheries during 1986 – 1988 as well. The 300 mt PSC limit for the non-trawl fisheries has remained unchanged since 1995 when the IFQ sablefish fishery was exempted from the PSC limit and the PSC limit was lowered from 750 mt. Tables 2 – 5 present halibut bycatch mortality data by FMP area, IPHC area, gear type, and fishery. Total catch removals by category and IPHC regulatory area are presented in Appendix II.

Expected change in target groundfish catch

Figure 4 shows the history of GOA groundfish benchmarks and catches. Generally, (cumulative) groundfish catch has been about 75 percent of (cumulative) annual catch limits, capped by halibut PSC limits to some degree. Any future analysis to revise GOA halibut PSC limits (trawl v fixed gear, or total) would examine harvest information for each groundfish fishery (and halibut longline fishery).

A potential decrease in halibut PSC amounts would be linked to the sector to which it is applied. As a case study of potential trawl halibut PSC limit changes (Appendix III), the public review draft of the GOA Rockfish Program analysis points out that there may be reduced incentive to alter fishing behavior to accrue halibut PSC amount reductions in target groundfish (in this case, rockfish) fisheries without the ability to use the halibut PSC amounts in other directed groundfish fisheries (in this case through a proposed rollover to fourth quarter flatfish fisheries). The late season rollover was estimated to have generated between $1.4 million and $2.8 million in ex vessel gross revenues; conversely, the value of that amount of halibut if caught in the longline fishery is approximately $1.4 million (at $4.50/lb ex- vessel). The reapportionment of halibut PSC allowance (128 mt in 2007, 135 mt in 2008, and 139 mt in 2009) has clearly supported additional fishing activity, but the benefit derived from the rollover depends on target preferences and opportunities, which have varied year-to-year, as well as the impact of this additional halibut mortality on other fisheries (e.g., target halibut fisheries) and stock productivity. Reductions of halibut PSC amounts, however, demonstrate that fishing behavior may be altered with the appropriate incentives (either through voluntary efforts by industry or mandatory PSC limit reductions).

Additional information on GOA groundfish catch, both fleet-wide and by fishery, may be available at the June Council meeting or for future analyses.

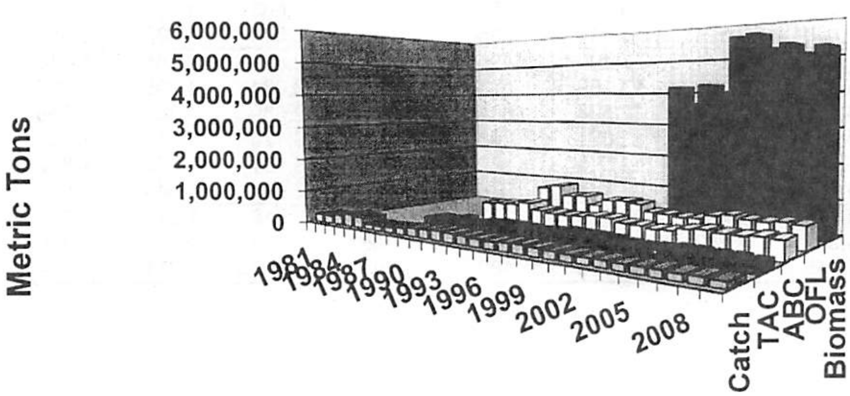


Figure 4. Cumulative estimates of biomass, overfishing level (OFL), acceptable biological catch (ABC), total allowable catch (TAC), and actual catch (all in million t) across all groundfish species in the Gulf of Alaska, 1981-2009.

Table 2. Estimates of halibut bycatch and mortality by IPHC Regulatory Sub-area and year (Source: IPHC)

	Thousands of Pounds, net weight					*Metric Tons, round weight*				
Year	Wash., Oreg., Calif.	B.C.	Gulf of Alaska	Bering Sea & Aleu.	Total	Wash., Oreg., Calif.	B.C.	Gulf of Alaska	Bering Sea & Aleu.	Total
1962	-	1,176	3,290	4,143	8,609	-	709	1,984	2,499	5,192
1963	-	1,077	6,308	2,038	9,423	-	649	3,805	1,229	5,683
1964	-	1,105	11,844	2,965	15,914	-	667	7,144	1,788	9,599
1965	-	1,435	16,744	3,182	21,361	-	866	10,100	1,919	12,884
1966	-	1,666	12,708	3,400	17,774	-	1,005	7,665	2,051	10,721
1967	-	1,652	9,967	4,718	16,337	-	996	6,012	2,846	9,854
1968	-	1,963	7,568	5,685	15,216	-	1,184	4,565	3,429	9,178
1969	-	2,183	5,448	7,599	15,230	-	1,317	3,286	4,584	9,186
1970	-	1,470	6,792	8,028	16,290	-	886	4,097	4,842	9,825
1971	-	1,745	4,880	13,095	19,720	-	1,052	2,943	7,899	11,894
1972	-	1,750	7,855	9,675	19,280	-	1,056	4,738	5,836	11,629
1973	-	1,509	7,995	8,029	17,533	-	910	4,822	4,843	10,575
1974	477	1,729	9,199	7,620	19,025	288	1,043	5,549	4,596	11,475
1975	477	1,909	5,870	3,650	11,906	288	1,151	3,541	2,202	7,181
1976	477	2,064	6,646	4,564	13,751	288	1,245	4,009	2,753	8,294
1977	477	1,817	6,568	2,914	11,776	288	1,096	3,962	1,758	7,103
1978	477	1,471	5,272	5,023	12,242	288	887	3,180	3,029	7,384
1979	476	1,852	7,536	5,419	15,282	287	1,117	4,545	3,269	9,218
1980	476	1,372	7,619	9,235	18,702	287	828	4,595	5,570	11,280
1981	475	1,188	6,789	6,408	14,859	287	716	4,095	3,865	8,963
1982	475	867	6,274	4,756	12,373	287	523	3,784	2,869	7,463
1983	476	943	5,196	4,269	10,883	287	568	3,134	2,575	6,564
1984	475	1,074	3,949	4,692	10,189	287	648	2,382	2,830	6,146
1985	475	1,139	1,879	4,207	7,700	287	687	1,133	2,538	4,644
1986	476	1,161	1,549	5,576	8,762	287	700	934	3,363	5,285
1987	476	1,649	3,416	5,738	11,279	287	995	2,060	3,461	6,803
1988	477	1,609	3,718	8,858	14,662	288	971	2,243	5,343	8,844
1989	477	1,498	4,388	7,282	13,646	288	904	2,647	4,393	8,231
1990	408	1,679	7,015	8,580	17,682	246	1,013	4,231	5,175	10,665
1991	408	1,992	7,247	10,022	19,669	246	1,202	4,371	6,045	11,864
1992	444	1,745	7,386	10,718	20,293	268	1,053	4,455	6,465	12,240
1993	444	1,661	6,095	7,764	15,964	268	1,002	3,676	4,683	9,629
1994	444	1,219	5,822	9,466	16,951	268	735	3,512	5,710	10,224
1995	614	1,522	5,071	8,726	15,933	370	918	3,059	5,263	9,610
1996	614	299	5,045	8,507	14,465	370	180	3,043	5,131	8,725
1997	614	215	4,805	7,880	13,514	370	130	2,898	4,753	8,151
1998	1,082	213	4,412	7,725	13,432	653	128	2,661	4,660	8,102
1999	987	193	4,980	7,684	13,844	595	116	3,004	4,635	8,350
2000	822	230	4,797	7,441	13,290	496	139	2,893	4,488	8,016
2001	837	177	5,025	7,120	13,159	505	107	3,031	4,295	7,937
2002	553	244	4,458	7,273	12,528	334	147	2,689	4,387	7,556
2003	503	244	5,255	6,822	12,824	303	147	3,170	4,115	7,735
2004	302	251	5,307	6,735	12,595	182	151	3,201	4,062	7,597
2005	459	346	4,686	7,692	13,183	277	209	2,826	4,640	7,952
2006	387	294	4,716	7,491	12,888	233	177	2,845	4,518	7,774
2007	298	319	4,300	7,262	12,179	180	192	2,594	4,380	7,346
2008	298	131	4,646	5,588	10,663	180	79	2,802	3,371	6,432

Table 3. Estimates of halibut bycatch and mortality by IPHC Regulatory Sub-area and year (Source: IPHC)

	Thousands of Pounds, net weight							*Metric Tons, round weight*						
Year	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	TOTAL	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	TOTAL
1962	-	1,176	207	1,919	1,164	4,143	8,609	-	709	125	1,157	702	2,499	5,192
1963	-	1,077	206	3,314	2,788	2,038	9,423	-	649	124	1,999	1,682	1,229	5,683
1964	-	1,105	205	9,370	2,269	2,965	15,914	-	667	124	5,652	1,369	1,788	9,599
1965	-	1,435	205	6,097	10,442	3,182	21,361	-	866	124	3,678	6,298	1,919	12,884
1966	-	1,666	213	4,513	7,982	3,400	17,774	-	1,005	128	2,722	4,815	2,051	10,721
1967	-	1,652	439	4,633	4,895	4,718	16,337	-	996	265	2,795	2,953	2,846	9,854
1968	-	1,963	515	5,476	1,577	5,685	15,216	-	1,184	311	3,303	951	3,429	9,178
1969	-	2,183	468	3,806	1,174	7,599	15,230	-	1,317	282	2,296	708	4,584	9,186
1970	-	1,470	562	3,389	2,841	8,028	16,290	-	886	339	2,044	1,714	4,842	9,825
1971	-	1,745	539	2,974	1,367	13,095	19,720	-	1,052	325	1,794	825	7,899	11,894
1972	-	1,750	756	5,406	1,693	9,675	19,280	-	1,056	456	3,261	1,021	5,836	11,629
1973	-	1,509	848	4,452	2,695	8,029	17,533	-	910	511	2,685	1,626	4,843	10,575
1974	477	1,729	532	5,247	3,420	7,620	19,025	288	1,043	321	3,165	2,063	4,596	11,475
1975	477	1,909	639	3,158	2,073	3,650	11,906	288	1,151	385	1,905	1,250	2,202	7,181
1976	477	2,064	708	3,495	2,443	4,564	13,751	288	1,245	427	2,108	1,474	2,753	8,294
1977	477	1,817	580	4,094	1,894	2,914	11,776	288	1,096	350	2,469	1,142	1,758	7,103
1978	477	1,471	377	3,055	1,840	5,023	12,242	288	887	227	1,843	1,110	3,029	7,384
1979	476	1,852	821	5,780	935	5,419	15,282	287	1,117	495	3,486	564	3,269	9,218
1980	476	1,372	520	5,852	1,246	9,235	18,702	287	828	314	3,530	752	5,570	11,280
1981	475	1,188	507	4,720	1,563	6,408	14,859	287	716	306	2,847	942	3,865	8,963
1982	475	867	302	3,797	2,175	4,756	12,373	287	523	182	2,290	1,312	2,869	7,463
1983	476	943	304	2,957	1,935	4,269	10,883	287	568	183	1,784	1,167	2,575	6,564
1984	475	1,074	302	2,140	1,507	4,692	10,189	287	648	182	1,290	909	2,830	6,146
1985	475	1,139	301	1,001	577	4,207	7,700	287	687	182	604	348	2,538	4,644
1986	476	1,161	303	836	410	5,576	8,762	287	700	183	504	247	3,363	5,285
1987	476	1,649	303	2,240	873	5,738	11,279	287	995	183	1,351	527	3,461	6,803
1988	477	1,609	303	3,365	50	8,858	14,662	288	971	183	2,030	30	5,343	8,844
1989	477	1,498	303	3,267	818	7,282	13,646	288	904	183	1,971	494	4,393	8,231
1990	408	1,679	856	4,114	2,045	8,580	17,682	246	1,013	516	2,481	1,233	5,175	10,665
1991	408	1,992	733	4,843	1,671	10,022	19,669	246	1,202	442	2,921	1,008	6,045	11,864
1992	444	1,745	736	4,668	1,982	10,718	20,293	268	1,053	444	2,816	1,195	6,465	12,240
1993	444	1,661	742	4,291	1,062	7,764	15,964	268	1,002	448	2,588	641	4,683	9,629
1994	444	1,219	528	3,907	1,387	9,466	16,951	268	735	318	2,357	837	5,710	10,224
1995	614	1,522	348	2,963	1,760	8,726	15,933	370	918	210	1,787	1,062	5,263	9,610
1996	614	299	345	2,743	1,957	8,507	14,465	370	180	208	1,655	1,180	5,131	8,725
1997	614	215	397	2,965	1,443	7,880	13,514	370	130	239	1,788	870	4,753	8,151
1998	1,082	213	361	2,662	1,389	7,725	13,432	653	128	218	1,606	838	4,660	8,102
1999	987	193	358	2,885	1,737	7,684	13,844	595	116	216	1,740	1,048	4,635	8,350
2000	822	230	395	2,892	1,510	7,441	13,290	496	139	238	1,744	911	4,488	8,016
2001	837	177	341	3,009	1,675	7,120	13,159	505	107	206	1,815	1,010	4,295	7,937
2002	553	244	340	2,194	1,924	7,273	12,528	334	147	205	1,323	1,161	4,387	7,556
2003	503	244	341	3,180	1,734	6,822	12,824	303	147	206	1,918	1,046	4,115	7,735
2004	302	251	362	3,671	1,274	6,735	12,595	182	151	218	2,214	768	4,062	7,597
2005	459	346	340	3,220	1,126	7,692	13,183	277	209	205	1,942	679	4,640	7,952
2006	387	294	341	2,975	1,400	7,491	12,888	233	177	206	1,794	844	4,518	7,774
2007	298	319	342	2,843	1,115	7,262	12,179	180	192	206	1,715	673	4,380	7,346
2008	298	131	344	2,964	1,338	5,588	10,663	180	79	207	1,788	807	3,371	6,432

Table 4. 1995 - 2009 trawl and hook-and-line halibut PSC mortality in the GOA; Trawl PSC limit is 2000 mt and Hook-and-Line PSC limit is 300 mt. (Source: IPHC)

Year	Trawl bycatch mortality	Hook and Line bycatch mortality	Total bycatch mortality
1995	2,152	377	2,529
1996	2,050	172	2,221
1997	1,946	125	2,071
1998	2,113	296	2,409
1999	2,028	348	2,376
2000	2,137	276	2,414
2001	1,888	285	2,173
2002	2,197	244	2,441
2003	1,995	290	2,286
2004	2,444	302	2,745
2005	2,108	208	2,316
2006	1,984	335	2,319
2007	1,948	294	2,242
2008	1,955	502[14]	2,458
2009	1,818	277	2,095

[14] Observer data with high halibut mortality rates from September (2-3 weeks late) for a hook-and-line catcher vessel increased halibut mortality rates and halibut mortality estimates, and resulted in an overage (Source: Mary Furuness).

Table 5. Estimates of halibut bycatch mortality (thousands of lb, net weight) for 1998-2008.

Estimates for 2008 are preliminary and subject to change. Source: IPHC

Region and Area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
AREA 2A										
Groundfish Trawl	946	781	796	512	462	261	418	346	257	257
Shrimp Trawl	25	25	25	25	25	25	25	25	25	25
Hook & Line	16	16	16	16	16	16	16	16	16	16
Total	987	822	837	553	503	302	459	387	298	298
AREA 2B										
Domestic Trawl	193	230	177	244	244	251	346	294	319	131
Total	193	230	177	244	244	251	346	294	319	131
AREA 2C										
Crab Pot/Shrimp Trawl	303	303	303	303	303	303	303	303	303	303
Groundfish Trawl	1	0	0	0	0	0	0	0	0	0
Hook & Line (non-IFQ)	18	56	2	1	2	23	1	2	3	5
Hook & Line (IFQ)	3	3	3	3	3	3	3	3	3	3
Chatham Str. Sablefish	8	8	8	8	8	8	8	8	8	8
Clarence Str. Sablefish	25	25	25	25	25	25	25	25	25	25
Total	358	395	341	340	341	362	340	341	342	344
AREA 2 Subtotal	**1,538**	**1,447**	**1,355**	**1,137**	**1,088**	**915**	**1,145**	**1,022**	**959**	**773**
AREA 3A										
Crab Pot/Shrimp Trawl	250	250	250	250	250	250	250	250	250	250
Groundfish Trawl	2,148	2,222	2,404	1,685	2,407	3,033	2,664	2,339	2,347	2,157
Hook & Line (non-IFQ)	317	281	203	128	389	244	149	239	102	408
Hook & Line (IFQ)	119	119	119	119	119	119	119	119	119	119
Groundfish Pot	41	10	23	2	5	15	28	18	15	20
Pr Wm Sd Sablefish	10	10	10	10	10	10	10	10	10	10
Total	2,885	2,892	3,009	2,194	3,180	3,671	3,220	2,975	2,843	2,964
AREA 3B										
Crab Pot/Shrimp Trawl	50	50	50	50	50	50	50	50	50	50
Groundfish Trawl	1,184	1,194	1,320	1,508	1,341	866	862	926	795	886
Hook & Line (non-IFQ)	281	143	171	248	198	205	69	299	136	261
Hook & Line (IFQ)	116	116	116	116	116	116	116	116	116	116
Groundfish Pot	106	7	18	2	29	37	29	9	18	25
Total	1,737	1,510	1,675	1,924	1,734	1,274	1,126	1,400	1,115	1,338
AREA 3 Subtotal	**4,622**	**4,402**	**4,684**	**4,118**	**4,914**	**4,945**	**4,346**	**4,375**	**3,958**	**4,302**
AREA 4										
Crab Pot/Shrimp Trawl	300	300	300	300	300	300	300	300	300	300
Groundfish Trawl	5,972	5,379	5,322	5,591	5,589	5,499	6,454	6,269	5,841	3,980
Hook & Line (non-IFQ)	982	1,508	1,300	1,058	556	617	666	593	659	1,064
Hook & Line (IFQ)	60	60	60	60	60	60	60	60	60	60
Groundfish Pot	11	24	13	17	28	6	2	8	7	10
CDQ Trawl	187	64	57	131	187	176	128	187	309	136
CDQ Hook & Line	172	106	68	116	102	77	82	74	86	38
AREA 4 Subtotal	**7,684**	**7,441**	**7,120**	**7,273**	**6,822**	**6,735**	**7,692**	**7,491**	**7,262**	**5,588**
GRAND TOTAL	**13,844**	**13,290**	**13,159**	**12,528**	**12,824**	**12,595**	**13,183**	**12,888**	**12,179**	**10,663**

Prct Chg from prev yr		**-4.0%**	**-1.0%**	**-4.8%**	**2.4%**	**-1.8%**	**4.7%**	**-2.2%**	**-5.5%**	**-12.4%**
AK GFISH TOTAL	**11,718**	**11,292**	**11,199**	**10,785**	**11,131**	**11,096**	**11,432**	**11,261**	**10,616**	**9,288**

Estimated change in target groundfish biomass

The Gulf of Alaska management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the United States (Figure 1). Five categories of finfishes and invertebrates have been designated for management purposes. They are: target species, other species, prohibited species, forage fish species and non-specified species. Amendment 85 proposes to eliminate the other species assemblage and designate separate annual catch limits (ACLs) for sharks, sculpins, octopuses, and squids beginning in 2011. Also, the prohibited species category and forage fish category will be listed under a new ecosystem category, which will be exempt from ACL requirements. And reference to non-specified species will be removed from the FMP.

The 2009 SAFE report (NPFMC 2009) describes stock status of target species and other species. Species or complexes included in the report are listed below.

Target Species	Other Species	Prohibited Species
Pollock	Octopus	Pacific halibut
Pacific cod	Squids	Pacific herring
Flatfishes	Sculpins	Pacific salmon
Rockfishes	Sharks	Steelhead trout
Sablefish		King crabs
Atka mackerel		Tanner crabs
Skates		

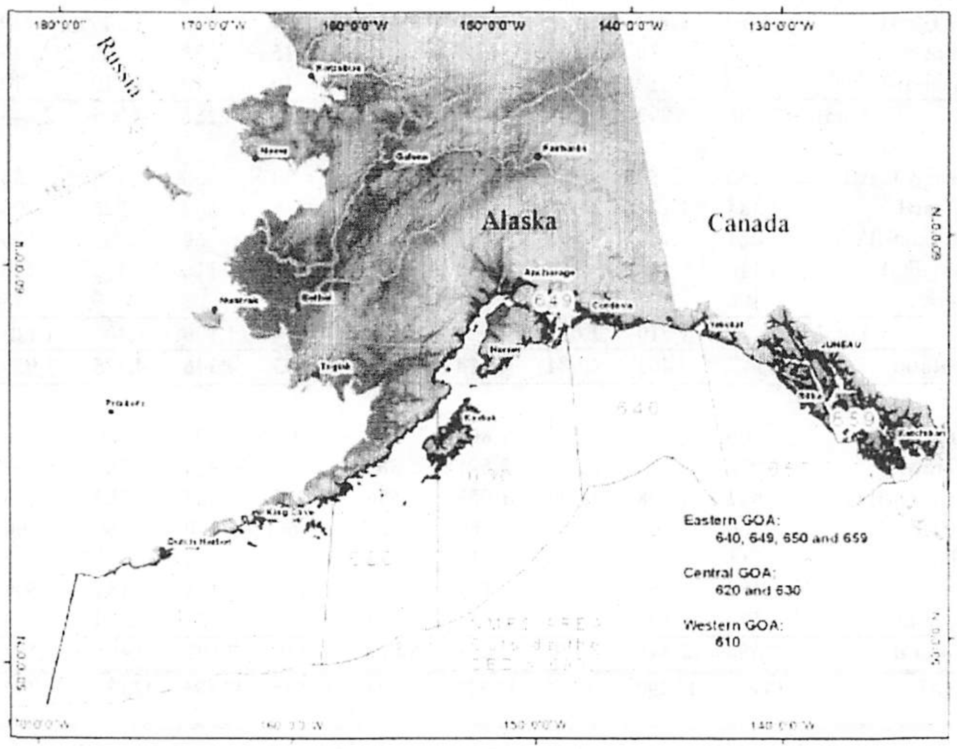


Figure 5. Gulf of Alaska regulatory areas.

The GOA Groundfish FMP recognizes single species and species complex management strategies. Single species specifications are set for stocks individually, recognizing that different harvesting sectors catch an array of species. In the Gulf of Alaska these species include Pacific cod, pollock, sablefish, Pacific ocean perch, flathead sole, rex sole, arrowtooth flounder, northern rockfish, shortraker rockfish, Atka mackerel, big skates, and longnose skates. Other groundfish species that are usually caught in groups have been managed as complexes (also called assemblages). For example, other slope rockfish, rougheye and blackspotted rockfish, pelagic shelf rockfish, demersal shelf rockfish, thornyhead rockfish, deep water flatfish, shallow water flatfish, other skates, and "other species" have been managed within complexes. The FMP authorizes splitting species, or groups of species, from the complexes for purposes of promoting the goals and objectives of the FMP.

Groundfish catches are managed against TAC specifications for the EEZ and near coastal waters of the GOA. The Plan Team has provided subarea ABC recommendations on a case-by-case basis since 1998.

The current status of individual groundfish stocks managed under the FMP is summarized in this section. The abundances of Pacific cod, Dover sole, flathead sole, arrowtooth flounder, Pacific ocean perch, rougheye and blackspotted rockfish, northern rockfish, and dusky rockfish are above target stock size. The abundances of pollock and sablefish are below target stock size (Figure 6). The target biomass levels for other deep-water flatfish, shallow-water flatfish, rex sole, shortraker rockfish, demersal shelf rockfish, other pelagic shelf rockfish, other slope rockfish, thornyhead rockfish, Atka mackerel, skates, sculpins, squid, octopus, and sharks are unknown.

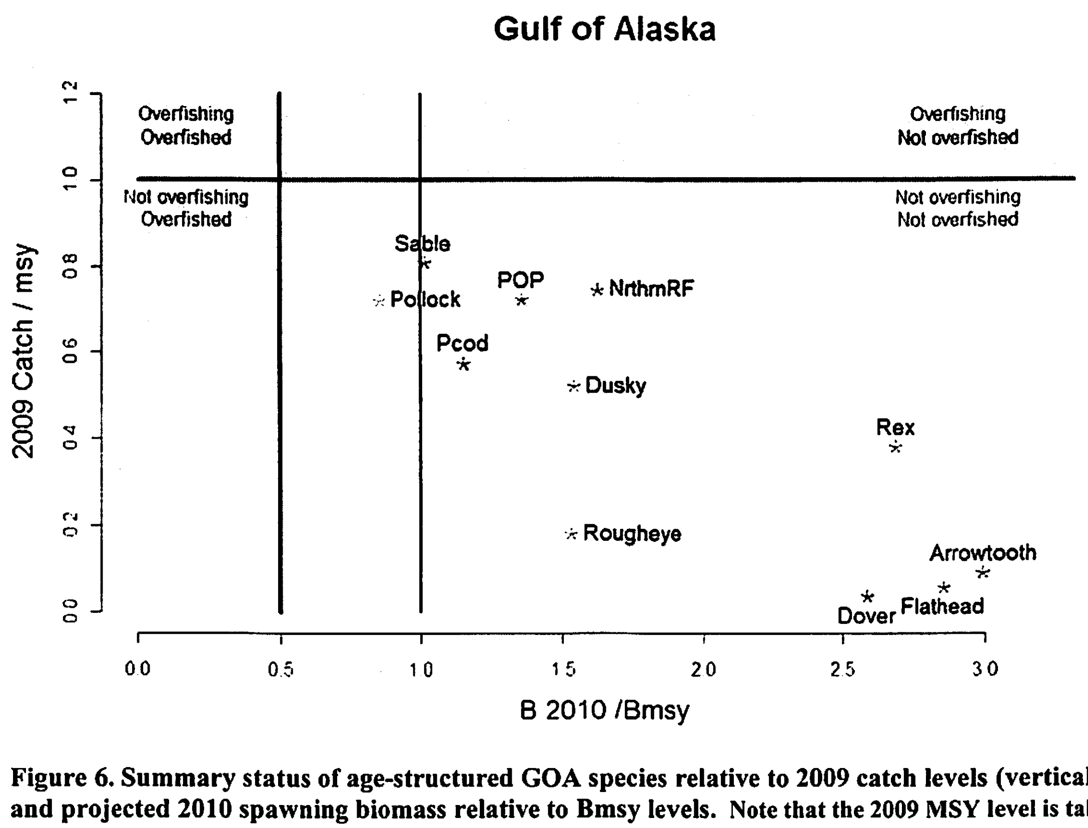


Figure 6. Summary status of age-structured GOA species relative to 2009 catch levels (vertical axis) and projected 2010 spawning biomass relative to Bmsy levels. Note that the 2009 MSY level is taken as the 2009 OFL (which is defined as the catch at F_{msy}) and overfishing and overfished status occurs at less than ½ B_{msy}.

The sum of the preliminary 2010, 2011 ABCs for target species are 565,501 t (2010), 605,088 t (2011) which are within the FMP-approved optimum yield (OY) of 116,000 - 800,000 t for the Gulf of Alaska. The sum of 2010 and 2011 OFLs are 693,253 t and 742,559 t, respectively. The Team notes that because of halibut bycatch mortality considerations in the high-biomass flatfish fisheries, an overall OY for 2010 will be considerably under this upper limit. For perspective, the sum of the 2009 TACs was 242,727 t, and the sum of the ABCs was 516,055 t.

Both GOA pollock and Pacific cod showed increases in 2009 bottom trawl survey biomass which were difficult to reconcile with size and age data within stock assessment models. 2009 size and age compositions indicated a full set of age groups comprised the increased biomass, not a single new strong year class. An increase in the availability of both species to the survey might explain this pattern, perhaps due to environmental factors. Gulf of Alaska rockfish also showed a synchronous pattern of reduced sampling error compared to other years indicating a possible shift in distribution/availability.

Halibut discard mortality rates (DMRs) are set by the Council on a 3-year cycle based on recommendations by International Pacific Halibut Commission staff. Current rates will expire at the end of 2009; new rates are needed for 2010 -2012. The recommended rates are based on an average of annual DMRs from the previous 10 years. The GOA Plan Team endorsed IPHC staff recommendations for DMRs for the GOA groundfish fisheries for 2010 - 2012. The Council i adopted these rates during its December 2009 meeting. This procedure will be repeated in 2012 for 2013-2015.

Table 6. Pacific halibut discard mortality rates (DMR) for 2010-2012 GOA groundfish fisheries.

Gear	Target	Recommendation
Trawl	Bottom pollock	59
	Pacific cod	62
	Deepwater flatfish	48
	Shallow water flatfish	71
	Rockfish	67
	Flathead sole	65
	Mid water pollock	76
	Sablefish	65
	Arrowtooth flounder	72
	Rex sole	64
Pot	Pacific cod	17
Longline	Pacific cod	12
	Rockfish	9

Methods available to reduce halibut bycatch

Several fleets have voluntarily modified their gear or fishing behavior to reduce halibut bycatch in order to increase their target fishery catches. These efforts are documented in the Pacific cod longline fishery, flatfish trawl fisheries, and rockfish trawl fisheries.

Flatfish trawl fisheries Craig Rose, NMFS AFSC, has worked for years with commercial trawl industry representatives to develop bycatch excluders for use in trawl fisheries for flatfish and Pacific cod trawl fisheries in the BSAI and GOA. Several halibut excluder devices have been developed by flatfish trawl fishermen. In an undated report to the Council, Dr Rose reported that halibut excluders developed for the flatfish fishery consisted of sloped panels across the intermediate section with holes (rigid squares or mesh) of a size that allowed the sole to pass through while directing the larger halibut to an escape opening at the top or bottom of the net. In some of the designs, there was a wide, compressed horizontal tunnel along the top (or bottom) of the net between the end of the slope and the escape opening. Large meshes between this tunnel and the main body of the net provided sole with more opportunities to remain in the catch.

Rose and Gauvin (2000) and Gauvin and Rose (2000) reported on a rigid grate system and escape panel, which are installed ahead of the trawl codend to avoid catching halibut. In test trials in the GOA deepwater flatfish fishery because halibut and deep water flatfish are concentrated in the same areas and exclusion of halibut could dramatically increase harvest of the target species. Also the halibut caught in this fishery tended to be large, resulting in more halibut exclusion. The test gear excluded 94% of the halibut while releasing 38% of the target flatfish. Results of simulations of its use in the flatfish fishery estimated that fleet-wide use of the grate would result in a 171% increase in the duration of the fishery, a 61% increase in target flatfish catch, and a 71% reduction in overall halibut bycatch. Other simulations, however, demonstrated a high incentive for individual non-compliance without some type of rationalized fishery.

In a study of tradeoffs in target catch rates and halibut bycatch in Central Gulf of Alaska trawl fisheries Gauvin (2004) analyzed the spatial aspects of the Central Gulf of Alaska flatfish fisheries and historical halibut bycatch to assess impediments to increasing flatfish catches. He also examined the potential for gear modifications to reduce halibut bycatch rates to increase utilization of Gulf of Alaska flatfish resources within the available halibut bycatch allowance.

Gauvin (2004) determined differences in the target catch to halibut usage ratios for different GOA fishing areas within different target fisheries, with a strong seasonal component to the differences, with the relative strength and repeatability of between-area and within-season patterns still an open question for improving halibut PSC limit usage and flatfish yields. He drew some general observations from experience with the BSAI flatfish trawl fleet.

- The GOA flatfish fishery faces greater challenges in terms of finding areas where good tradeoffs between target and bycatch rates can be achieved. This observation is based primarily on the relative degree of consistency and predictability of target catch and halibut bycatch rates by area for the flatfish fisheries of the Bering Sea relative to the Central GOA.
- Catch and bycatch trends the Bering Sea flatfish fishery appears less-variable both in terms of the range of catch rates for target species and the range in halibut bycatch rates from season to season and year to year at the core fishing locations.
- The cod fishery in the GOA and Bering Sea appear more similar in several respects. For instance, the GOA and Bering Sea cod fisheries appear to have relatively similar catch and bycatch rates in terms of the range from high to low. Additionally, the Gulf and the Bering Sea cod fisheries both have a few core areas that tend to offer clearly better tradeoffs in terms catch rates and halibut bycatch usage. For the GOA cod fishery, however, fishing areas with a variety of rates for catch and halibut bycatch spread over a larger number of relatively small and discrete locations. This is not the case for the Bering Sea where, in fact, cod fishing tends to occur in three basic locations: Unimak Pass, the Slime Bank, and south and west of the Pribilof Islands. The differences in the catch rates and halibut bycatch rates between these areas are relatively small and generally predictable from year to year and within seasons.

Gauvin (2004) noted that Bering Sea flatfish and cod fisheries have reduced halibut bycatch rates through the use of a data-sharing program called Sea State. Under this system, fishermen share bycatch rate information depicted on charts detailing vessel-specific bycatch rates and "hotspots" on a daily basis. The small number of participants and the transparency of vessel-specific bycatch performance allow it to function reasonably well with only informal agreements between fishermen determining when they should leave a given area based on relative or absolute bycatch rates. The program works best with a limited number of entrants. Bycatch avoidance is reduced when peer pressure becomes more difficult as participants begin to doubt that the savings in terms of additional fishing opportunity from bycatch savings will accrue to the ones who incurred the sacrifices. This is a classic case where the lack of assigned rights to catch and bycatch tends to allow individual profit maximization incentives to prevail even when such behavior decreases total yields and overall revenue.

A critical factor in the success of bycatch management in the Bering Sea flatfish fishery is the relatively predictable and consistent spatial patterns in bycatch locations that emerge within seasons and annually that does not exist in the GOA. The system works overall, however, because there are generally reasonable alternative areas for fishermen to relocate fishing effort to reduce bycatch while achieving acceptable target catch rates. So peer pressure works because fishermen are rarely faced with "no win" situations wherein to achieve lower bycatch rates they must necessarily accept lower target catch rates.

Gauvin (2004) predicted that halibut bycatch management in the Central Gulf of Alaska could reduce halibut bycatch and increase yields of flatfish with a change in the basic incentives of the fishery (as has been evidenced in the RPP and Pacific cod sector split). Without some form of catch share program, competition for cod TAC with the fixed gear sector could make redirection of the trawl cod fishery to areas with better tradeoffs in terms of bycatch management ineffectual. This is because the longer travel times to fishing grounds with better tradeoffs might not be worthwhile if it came with the cost of loss of target catch opportunities to the fixed gear sector. With such incentives he predicted that fishermen would change their behavior.

Gauvin reported that fishermen suggested that the winter months may hold some seasonal advantages for shallow-water flatfish and halibut bycatch reduction, and this has proven true under the RPP.

Gauvin (2004) also reviewed the halibut excluder devices tested in the Bering Sea and Gulf of Alaska for flatfish and cod fisheries. He concluded that use of soft halibut excluders on shoreside trawlers could increase under some type of catch share program, with potential for increases in flatfish yields as halibut bycatch rates declined. Remaining selectivity and usage issues could likely be overcome with additional field testing for some species, but fisheries for arrowtooth flounder and flathead sole continue to appear problematic for halibut bycatch reduction due to similar average size of arrowtooth flounder, flathead sole and halibut. He reports limited success with the use of spreading bars has provided some success for achieving the proper surface for sorting panels made of square mesh webbing. Alternative sorting panels could be more successful in these fisheries.

Dr Rose also has worked with industry to design a halibut excluder for the Pacific cod trawl fishery, based on the excluder designed for the flatfish fishery. The square openings were replaced with circular openings. This configuration was effective for large halibut, but it was necessary to add new components to exclude small halibut and skates.

The main challenge in applying the flatfish excluder device to cod fisheries was that cod are much more similar in size and swimming ability to halibut than are sole. Thus, a square hole or mesh large enough to allow all cod to pass would only exclude the very largest halibut. The different body shapes of these fish were considered a characteristic that could be exploited for separation. Excluders were constructed with rigid circular holes in the selection panels because rigid circular holes, sized for the largest cod, had the best chance of excluding smaller halibut (Rose undated). Gulf of Alaska tests released 80% of the halibut while retaining an average of 85% of the cod.

The efforts by the flatfish fleet were rewarded when on June 1, 2010, when all major flatfish fisheries off Alaska were certified under the Marine Stewardship Council (MSC) environmental standard for sustainable and well-managed fisheries. The certification applies to flathead sole, arrowtooth flounder, rex sole, northern rock sole; and southern rock sole trawl fisheries in designated areas in the GOA and BSAI.

Pacific cod longline fishery[15] The Freezer Longline Coalition has implemented a voluntary cooperative in the GOA since 2006. The FLCC formed a cooperative that negotiated which vessels could fish and what share of the halibut PSC limit each boat would be allocated to harvest. The suballocation of the PSC limit was determined by subtracting the estimated halibut needs of the shoreside hook-and-line sector from the remaining H&L cap amount prior to the fishery. During the fishery, each boat carried an observer and each observer sent data into the observer database daily.

The FLCC contracts with Fisheries Information Service (FIS) to administer a monitoring program to track and analyze trends in real-time target catch (usually cod) and halibut bycatch in the hook-and-line sector. An ancillary function is to collect and analyze halibut viability data. All federally permitted freezer-longliners participate in the program. All sets of raw data are developed by observer personnel

[1515] This summary was provided by Janet Smoker (FIS) and Kenny Down (FLC) aboard boats, which send sampled set data, including species numbers and weight in kilograms, and halibut injury code data, to the NMFS observer database. This data transfer is at least twice a week, or daily under some circumstances- including Gulf coop monitoring. With permission of individual boats, FIS downloads this data from observer database and incorporates selected portions into excel spreadsheets.

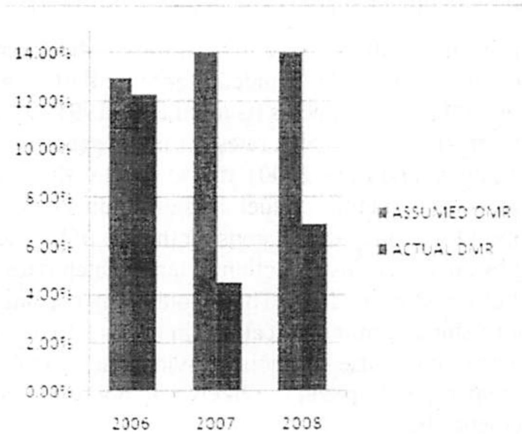
Observers do not sample all sets, so catch and bycatch in unsampled sets must be estimated for a complete accounting using procedures used by a NMFS model (based on ratios of total catch in adjacent sampled sets). For the Freezer Longline Coalition Cooperative (FLCC), FIS spreadsheets showed such calculations as well as totals (and halibut cap remainders) to-date, bycatch rates (ratio of halibut to cod), estimates of end-date based on recent catches, and a graphic showing progression of halibut catch toward the boat cap. These spreadsheets were sent to boat and/or boat manager on a daily basis. While each boat was free to share its own information with another, this was not done or facilitated by FIS.

For fleet monitoring, all data was combined for totals of cod and halibut that were compared to weekly totals from NMFS public reports. Any discrepancies were resolved. These fleet-total spreadsheets were provided on a daily basis to members of the coop, and to NMFS inseason managers.

Halibut viability analysis is less critical since caps are not involved (NMFS uses an assumed halibut discard mortality rate -DMR- for each fishery). Nonetheless FIS looked at this at least once a week for each boat. FIS incorporates raw halibut injury data into IPHC's model to calculate a DMR for each set sampled for viability. Tables of these data, including running totals, are sent to boat/manager at least weekly. Rates higher than the "assumed" DMR rate or sudden increases in DMR rates are flagged.

	2006	2007	2008
assumed DMR	13.00%	14.00%	14.00%
Coop actual* DMR	12.30%	4.56%	6.94%
NMFS halibut mort. (metric tons)	113.95	49.99	72.73
Halibut mort. with actual DMR	107.79	16.28	36.07
Difference	6.16	33.71	36.66

*based on inseason observer data on sampled halibut condition



Prior to "B" season in 2007, substantial amounts of Pacific cod TAC, but a small amount of H&L halibut PSC limit, remained in the Gulf. NMFS managers agreed to leave the fishery open if a limited number of freezer-longliners entered the fishery, and if those boats were monitored and NMFS was kept updated daily. FLCC contracted with FIS to do the latter.

The efforts of the FLCC to assign direct responsibility for halibut bycatch reduction to individual vessels resulted in a reduced halibut discard mortality rate (DMR) from 13% to 11% for 2010 – 2012 for the Pacific cod longline fishery. The DMR is calculated by the IPHC and adopted by the Council every three years (and based on a ten-year moving average). Figure 7shows the difference in assumed rates vs. actual rates achieved by the FLC cooperative. Additional background on bycatch avoidance practices by the freezer longline fleet can be found in Smoker (1996).

Rockfish The Rockfish Pilot Program analysis summarized the reduction in halibut PSC in that program as follows (p.235). "*The drastic reduction in halibut mortality (particularly in the catcher vessel sector) likely arises from several factors. First, vessels have exclusive allocations, allowing them to move from areas of high halibut catch without risking loss of catch of the primary rockfish. Second, exclusive allocations also increase the incentive for participants to communicate with each other concerning catch rates, improving information concerning areas of high halibut incidental catch in the fleet, and preventing repeated high halibut mortality among vessels exploring fishing grounds. Third, several vessels have begun employing new pelagic gear that limits bottom contact and halibut incidental catch. These gear changes are apparent when comparing the percentage of catch using pelagic trawl gear and non-pelagic gear in the first two years of the program with catch by those gear types in the preceding years (see Table 3 12). In the second year of the program over 40 percent of primary rockfish catch was with pelagic trawl, in comparison to less than 25 percent in 2006 and 6 percent or less in the preceding years. In the second ear of the program, nearly 85 percent of the catcher vessel fleet used pelagic gear for some of its catch, in comparison to slightly more than half of that fleet in 2006 and less than 20 percent in the proceeding years. In the catcher processor sector, two of the four active vessels used pelagic gear in the first year of the program, in comparison to no pelagic trawl gear prior to implementation of the program. Catch data by gear type cannot be revealed for the catch processor sector because of confidentiality protections. Participants in the program report that a primary motivation for these changes in gear types is constraining halibut allocations, which could jeopardize cooperative catches in the event that halibut bycatch exceeds allocations.*"

Additional information extracted from the June 2010 Rockfish Program is provided in Appendix III.

Cost of reducing halibut bycatch

The current management regime for halibut that makes it a prohibited species in groundfish trawl and fixed gear fisheries creates inherent costs for bycatch avoidance and halibut bycatch mortality on fishermen and the Nation. Only when, and if, the benefits of gains in yield from the target fisheries outweigh the loss of revenue from costs incurred from avoiding halibut bycatch, whether from increased fuel use to move to grounds with lower halibut bycatch or new gear that avoid halibut bycatch. The costs associated with the intensive catch sampling and experimental design that is necessary to scientifically evaluate their performance is generally beyond what any single fishing operation could reasonably manage during an open fishery (Rose and Gauvin 2000).

Despite improvements to the selectivity of trawls, the potential for gear modifications is inherently limited when the species to be avoided is another flatfish of approximately the same size and characteristic as the target species (Gauvin et al. 1995). Avoiding halibut PSC imposes relatively high costs for fishermen because catch rates for target species can be relatively high in areas of high halibut abundance (Gauvin and Rose 2000). In addition to what may be considerable direct capital investments for new gear, costs of additional fuel, loss of product quality due to longer soak or towing times, the authors suggest that policy discussions on the use of bycatch reduction devices often overlook the "costs" of reducing bycatch, such as reduction in target catch rates and target catch itself that occur from the escapement of target groundfish. These potentially considerable losses (documented in numerous experimental fishing permit applications in the late 1990s) partly explain industry's resistance to their mandatory or voluntary use. Without individual accountability that occurs under different forms of catch share management, widespread use likely will not occur without ensuring compliance through monitoring and enforcement (the "free rider" effect).

Despite several failed attempts at mandatory individual bycatch accounting in open access fisheries (Vessel Incentive Program, Vessel Bycatch Account), the BSAI bottom trawl industry voluntarily uses the Sea State Program to identify bycatch hotspots. The program uses satellite transmissions of unprocessed observer data which are rapidly converted into plotted reports and bycatch rate assessments. The program allows the fleet to rapidly respond (both individually and collectively) to by avoiding areas of high bycatch rates, thereby leaving more of the cap(s) to harvest more of their target species (Gauvin et al. 1995).

Several catch share programs have intentionally included elements to reduce halibut bycatch (sablefish IFQ program, BSAI Amendment 80), while another employed voluntary measures that freed up unused halibut PSC amounts to be "rolled over" to an underutilized fourth quarter shallow water flatfish fishery (GOA Rockfish Pilot Program). Costs of gear modified to reduce halibut bycatch can be high. The mid-water trawl doors used by trawlers in GOA Rockfish Pilot Program to avoid halibut bycatch costs between $20,000 and $30,000, depending on the size of the doors. The rigging costs an additional $4,000 to $5,000 (J. Bonney, pers. commun.).

The Council and the public have voiced concerns regarding allocating bycatch limits to harvesters, as it may appear to, or in fact, reward "bad behavior." The Council mitigated this concern by allocating a portion of the cap to the Amendment 80 sector, with phased in reductions of the cap over five years. Halibut trawl bycatch amounts have been reduced by 300,000 lb between 2008 and 2012. Additional reductions of an additional five percent may occur if additional amounts of the cap are transferred from the trawl limited access sector to the Amendment 80 trawl sector.

In addition to costs of reducing halibut bycatch, two types of benefits are potentially available from the use of excluder devices. According to Gauvin and Rose (2000) increased harvest and revenues could increase economic performance from fishing with associated increases in product and consumer benefits from groundfish fisheries that are constrained by halibut bycatch caps. And reduction of halibut bycatch cicely would result in increased halibut abundance and catch limits. These benefits would accrue depending on which fisheries would be affected by rollovers of halibut bycatch caps or which fisheries would be allocated reduced halibut bycatch caps. Because halibut are valuable as a fishery commodity, as well as a component of a healthy marine ecosystem, avoiding bycatch creates benefits to the halibut (commercial, subsistence, personal use, and recreational) fisheries and the Nation.

Other biological and socioeconomic factors that affect the appropriateness of specific bycatch measures in terms of objectives

This section cannot be completed until the Council identifies both the specific bycatch measures and its objectives for the proposed action. The analysis of other biological and socioeconomic factors would be provided in the NEPA and Regulatory Flexibility Analyses (RFA), as needed, that are associated with either a plan amendment or annual catch specifications rulemaking.

Conclusions

After reviewing the information contained in this paper, the Council may choose to 1) take no action; 2) initiate an amendment (EA) to the GOA Groundfish FMP to revise the PSC setting process to mirror the regulatory process (RIR/IRFA) as in the BSAI, as needed; 3) initiate an analysis of halibut PSC limits to support the harvest specifications EA for 2012; or 4) include an analysis of halibut PSC limits in the next harvest specifications EA. The earliest that GOA halibut PSC limits could be revised is coincident with rulemaking for the annual groundfish specifications for 2012. The next step under any action alternative, if that is the Council's intent, would be for the Council to identify 1) a problem in the fishery, 2) goals and objectives for addressing the problem, and 3) management alternatives.

If the Council chose to take no action to initiate a separate analysis, it always has the option to incorporate halibut PSC limit reductions in other proposed actions, as it did with BSAI Amendment 80. Even under no action, more widespread (mandatory or voluntary) use of halibut excluder devices would continue to result in a "win/win" situation whereby less halibut are taken as bycatch in groundfish fisheries thus leading to 1) potential increases in halibut abundance and commercial longline fishery catch limits and 2) increased GOA groundfish target harvests.

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Appendix I. GOA FMP policy regarding halibut PSC limits

(Section 3.6.2.1.1 Apportionment and Seasonal Allocation of Pacific Halibut)

Apportionments of PSC limits, and seasonal allocations thereof, will be determined annually by the Secretary of Commerce in consultation with the Council. Separate PSC limits may be established for specific gear. PSC limits, apportionments, and seasonal allocations will be determined using the following procedure:

1. Prior to the October Council meeting. The GOA Groundfish Plan Team will provide the Council the best available information on estimated halibut bycatch and mortality rates in the target groundfish fisheries. [16]

2. October Council meeting. While developing proposed groundfish harvest levels under Section 3.2.3, the Council will also review the need to control the bycatch of halibut and, if necessary, recommend proposed halibut PSC mortality limits and apportionments thereof. The Council will also review the need for seasonal allocations of the halibut PSC. The Council will make proposed recommendations to the Secretary about some or all of the following:

a. the regulatory areas and districts for which PSC mortality limits might be established;
b. PSC for particular target fisheries and gear types;
c. seasonal allocations by target fisheries, gear types, and/or regulatory areas and district;
d. PSC allocations to individual operations; and
e. types of gear or modes of fishing operations that might be prohibited once a PSC is reached.

The Council will consider the best available information in doing so. Types of information that the Council will consider relevant to recommending proposed PSCs include:

a. estimated change in biomass and stock condition of halibut;
b. potential impact on halibut stocks;
c. potential impacts on the halibut fisheries;
d. estimated bycatch in years prior to that for which the halibut PSC mortality limit is being established;
e. expected change in target groundfish catch;
f. estimated change in target groundfish biomass;
g. methods available to reduce halibut bycatch;
h. the cost of reducing halibut bycatch; and
i. other biological and socioeconomic factors that affect the appropriateness of specific bycatch measures in terms of objectives.

Types of information that the Council will consider in recommending seasonal allocations of halibut include:

a. seasonal distribution of halibut;
b. seasonal distribution of target groundfish species relative to halibut distribution;
c. expected halibut bycatch needs on a seasonal basis relevant to changes in halibut biomass and expected catches of target groundfish species;
d. expected bycatch rates on a seasonal basis;
e. expected changes in directed groundfish fishing seasons;
f. expected start of fishing effort; and
g. economic effects of establishing seasonal halibut allocations on segments of the target groundfish industry.

3. As soon as practicable after the Council's October meeting, the Secretary will publish the Council's recommendations as a notice in the Federal Register. Information on which the recommendations are based will also be published in the Federal Register or otherwise made available by the Council. Public

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[16] *Staff discontinued appending this information to the GOA SAFE Report in 2004 (see Appendix I B below to advise staff whether the Council wishes to continue to see this information in future GOA SAFE Reports).*

comments will be invited by means specified in regulations implementing the FMP for a minimum of 15 days.

4. Prior to the December Council meeting. The Plan Team will prepare for the Council a final Stock Assessment and Fishery Evaluation (SAFE) report under Section 3.2.3 which provides the best available information on estimated halibut bycatch rates in the target groundfish fisheries and recommendations for halibut PSCs. If the Council requests, the Plan Team also may provide PSC apportionments and allocations thereof among target fisheries and gear types, and an economic analysis of the effects of the apportionments.

5. December Council meeting. While recommending final groundfish harvest levels, the Council reviews public comments, takes public testimony, and makes final decisions on annual halibut PSC limits and seasonal apportionments, using the factors set forth under (2) above relevant to proposed PSC limits, and concerning seasonal allocations of PSC limits. The Council will provide recommendations, including no change for the new fishing year, to the Secretary of Commerce for review and implementation.

6. As soon as practicable after the Council's December meeting, the Secretary will publish the Council's final recommendations as a notice of final harvest specifications in the Federal Register. Information on which the final harvest specifications are based will also be published in the Federal Register or otherwise made available by the Council.

APPENDIX I.B.

HALIBUT PROHIBITED SPECIES CATCH LIMITS

Updated

by

Diana Stram

North Pacific Fishery Management Council

This chapter presents information on halibut bycatch in the groundfish fisheries conducted in the Gulf of Alaska (GOA). It is intended for use by the Council to determine the halibut bycatch framework measures. Domestic groundfish fisheries for halibut, sablefish, pollock, flounder, rockfish, and Pacific cod are all currently managed by species or complex, and yet most species are caught together to some extent. This is true for all gear types. Under the current management scheme, fisheries directed at one species often discard other species, resulting in some discard mortality. Discard mortality of several species may be significant. The incidental catch and mortality of halibut in bottom trawl and longline groundfish fisheries are of principal concern in the Gulf.

Bycatch has in the past been controlled by reducing the total allowable catch (TAC) of other target species through the use of Prohibited Species Catch (PSC) limits, season delays, or some combination of these measures. Since 1995, an Individual Fishing Quota (IFQ) program has been in place in Gulf of Alaska, Bering Sea, and Aleutian Islands which allows the concurrent landing of both species with appropriate quota share holdings. Halibut discard mortality was reduced by 450 mt when the sablefish IFQ fishery was exempted from setting halibut PSC limits in 1995.

The Framework Process

Regulations require the Secretary of Commerce, after consultation with the Council, to propose the PSC limits as soon as practical after October 1 for the next fishing year. Thus, when the Council meets during October, it must decide what recommendations it will provide to the Secretary.

The Council can make recommendations for PSC mortality limits as follows:

1. Among trawl, hook-and-line, and pot gear.
2. Among fisheries complexes (i.e., shallow water trawl and deep water trawl complexes).
3. By season, which may be quarterly, semiannually, or any other reasonably configured period.
4. Gulf-wide or between the Western and Central Regulatory Areas and among the Districts of the Eastern Regulatory Area.

The Secretary will propose the PSC mortality limits in the *Federal Register* and request comment for 30 days from the date of filing with the Office of the Federal Register. The Council will review comments and will make final recommendations on PSC mortality limits at its December meeting. The Secretary will publish final PSC mortality limits again in the *Federal Register* to be used to manage halibut bycatch mortality in the bottom trawl, hook-and-line, and/or pot fisheries in the Gulf of Alaska during that following fishing year.

The Council is not constrained to any particular PSC limit. The International Pacific Halibut Commission (IPHC) has recommended that halibut bycatch mortality not exceed 6,000 mt in the North Pacific, and has further recommended that halibut bycatch mortality in the Bering Sea/Aleutian Islands and GOA be limited to 4,000 mt and 2,000 mt, respectively. In 1996, the IPHC requested that the Council further decrease PSC caps by 10 percent in 1998, further reduce bycatch in 1999, and divide the savings between lower halibut bycatch limits and increased groundfish harvest.

During each year between 1986-89, the Council recommended a 2,000 mt bycatch mortality limit in the GOA, with only the bottom trawl fishery being affected if this limit had been reached. Between 1990-94, the Council has recommended an additional bycatch mortality limit of 750 mt for fixed gear fisheries. Since 1995, the Council reduced the PSC cap for hook-and-line gear to 300 mt by exempting the IFQ sablefish fishery from halibut PSC restrictions. Pot gear was exempted from closures under the fixed gear cap, so all of the 750 mt was allocated to hook-and-line gear.

Establishing PSC limits for the Gulf of Alaska

Bycatch mortality of Pacific halibut in the Gulf of Alaska groundfish fisheries (trawl and hook & line) is shown below for the last twenty years (in mt, based on IPHC and NMFS estimates). The amounts of halibut bycatch mortality shown for 1980-1986 reflect estimates of halibut bycatch and mortality from primarily foreign and joint-venture fisheries. The fishing practices currently in use by the fully domesticated fishery may produce very different bycatch estimates. Therefore, data gathered under the domestic observer program beginning in 1990 probably present a more realistic picture of the current groundfish fishery in the Gulf of Alaska. The Plan Team feels that this is the best information available upon which to base decisions regarding the setting of PSC limits for halibut in the Gulf of Alaska.

Year	Bycatch (mt)
1980	4,596
1981	4,096
1982	3,785
1983	3,134
1984	2,382
1985	1,134
1986	935
1987	2,061
1988	2,243
1989	2,646
1990	3,936
1991	3,700
1992	3,383
1993	3,244
1994	2,973
1995	2,449
1996	2,118
1997	2,228
1998	2,319
1999	2,526
2000	2,128
2001	2,485
2002	2,172
2003*	2,286

*November 15, 2003

Halibut Bycatch Management in the Gulf of Alaska

Definition of terms:

- Bycatch rate - kg/mt of halibut caught in total groundfish catch.
- Mortality rate - that % of halibut bycatch that die after being caught.
- Bycatch mortality rate - kg/mt of halibut that are killed in total groundfish catch.

The NMFS Alaska Region manages the groundfish fisheries using halibut bycatch rates from the NMFS Alaska Fishery Science Center's Observer Program Office. The Alaska Region also used assumed mortality rates, which were recommended by the IPHC and reviewed by the Council. These mortality rates were based on a study of release condition factors. The 2003 fishery-specific discard mortality rates used were as follows:

GOA Trawl fisheries:	
Atka mackerel	70%
Bottom trawl pollock	61
Pacific cod	61
Deepwater flatfish	60
Shallow water flatfish	69
Rockfish	69
Flathead Sole	58
Other species	14
Pelagic pollock	72
Sablefish	66
Arrowtooth flounder	62
Rex Sole	61

GOA Hook and Line fisheries:
(under mandatory Careful Release Measures)

Pacific cod	14
Rockfish	8
Sablefish	24
Other Species	14

GOA Pot fisheries:

Pacific cod	14
Other Species	14

Seasonal Apportionments of the Halibut PSC Limit

Under Amendment 21, the halibut PSC limits can be seasonally apportioned. These limits were apportioned quarterly to trawl and hook-and-line gear beginning in 1991. Hook-and-line apportionments were charged to trimesters under Amendment 45 beginning in 1996. Halibut are expected to be in shallow water during summer months (June through September), and fisheries for Pacific cod and shallow water flatfish require larger shares of the PSC mortality limit during this time to preclude a premature fishery closure. Fisheries for sablefish and deepwater flatfish require larger shares of the PSC mortality limit during January through May and during October through December for similar reasons. Since 1995, the sablefish IFQ hook-and-line fishery has been conducted from March 15 to November 15, coincident with the halibut IFQ fishery

Total halibut PSC limits for all fisheries and gear types in the Gulf of Alaska equals 2,300 mt. This cap was reduced from 2,750 mt after the sablefish IFQ fishery was exempted from the halibut PSC requirements in 1995. The following 2004 halibut PSC apportionments were instituted for the Gulf of Alaska groundfish:

2003 Trawl		**2003 Hook and Line**		
Jan 1 – Apr 1	550 mt	1st trimester:	Jan 1 – Jun 10	250 mt
Apr 1 – Jun 29	400 mt	2nd trimester:	Jun 10 – Sep 1	5 mt
Jun 29 – Sep 1	600 mt	3rd trimester:	Sep 1 – Dec 31	35 mt
Sep 1 – Oct 1	150 mt			
Oct 1 – Dec 31	300 mt	DSR	Jan 1 – Dec 31	10 mt
Total	2,000 mt			300 mt

One of the Council's objectives is to promote harvest of as much of the groundfish optimum yield (OY) as possible with a given amount of halibut PSC. If some gear types have excessively high bycatch rates during a given season, the Council may consider withholding halibut PSC in order to promote other gear types, which otherwise might be closed prematurely, thereby promoting harvest of the OY.

A regulatory amendment implemented in 1994 set up shallow water and deep water fishery complex categories. The shallow water complex includes pollock, Pacific cod, Atka mackerel, shallow water flatfish, flathead sole, and other species. The closures do not apply to fishing for pollock by vessels using pelagic trawl gear in those portions of the GOA open to directed fishing for pollock. The deep water complex includes deep water flatfish, rex sole, arrowtooth flounder, sablefish, and rockfish. The bycatch trawl limit for the first three quarters was subdivided between shallow water and deep water complexes. The remaining 400 mt trawl limit is not apportioned.

Seasonal Halibut Bycatch Mortality Caps

Since 1993, halibut PSC mortality has applied only to the bottom trawl and hook-and-line fisheries. The midwater trawl fishery (targeting on pollock) has been exempt from bycatch-related closures. The pot fishery (primarily for Pacific cod), was exempted from fixed gear PSC limit due to minimal bycatch mortality. Descriptions of halibut bycatch management in the 2003 trawl and hook-and-line fisheries follow.

The Gulf of Alaska Trawl Fisheries

Trawl gear was used to harvest pollock, flatfish, rockfish, Pacific cod, sablefish, and arrowtooth flounder. The 2003 mt PSC halibut bycatch mortality limit has been unchanged since 1989, and has been apportioned quarterly such that 28%, 22%, 35%, and 15% (or 600 mt, 400 mt, 600 mt, and 400 mt) are apportioned during the first, second, third, and fourth quarters, respectively.

Trawl fishery categories

Season	**Shallow Water**	**Deep Water**	**Total**
Jan 1 - Apr1	450 mt	100 mt	550 mt
Apr 1 - Jun 29	100 mt	300 mt	400 mt
	200 mt	400 mt	600 mt
Sep 1 - Oct 1	150 mt	any rollover	150 mt
Oct 1 - Dec 31	no apportionment		300 mt
TOTAL	900 mt	800 mt	2,000 mt

Trawling for the deep-water fishery complex were closed in each quarter on May 16, and October 15 to prevent exceeding the halibut bycatch limit. The shallow-water fishery was closed in each quarter on June 19, September 12, and October 15. All trawling in the GOA closed (with the exception of pelagic trawl gear targeting pollock) on October 15.

Through November 15, 2003 total halibut bycatch mortality from trawl gear was 1,900 mt (Table 1). A summary of trawl halibut bycatch in the Gulf of Alaska for shallow water and deep water complexes by season is shown in Table 2.

The Gulf of Alaska Hook-and-Line Fisheries

The hook-and-line fisheries are directed primarily at sablefish and Pacific cod, with minor effort on rockfish. The PSC halibut mortality limit of 300 mt for the hook-and-line fisheries was apportioned seasonally by trimester. The 300 mt allocation included 10 mt for the demersal shelf rockfish fishery in Southeast Alaska. For the first trimester, 250 mt was allocated. For the second trimester, 5 mt was allocated. The remaining 35 mt was allocated to the rest of the fishing year. The sablefish hook-and-line fishery is managed as an IFQ fishery. The season runs from March 15 to November 15, simultaneous with the halibut IFQ fishery.

Through November 15, 2003, total halibut bycatch mortality from hook-and-line gear was 296 mt (Table 1). The breakdown of hook and line halibut bycatch rates by season is provided in Table 2.

The Gulf of Alaska Pot Fishery

Pot gear was used to harvest mostly Pacific cod. Total mortality attributed to pot gear was approximately 13 mt in 2003, 2 mt in 2002, 4 mt in 2001, and 7 mt in 2000. Pot gear has been exempted from PSC mortality limits since 1993.

Expected Changes in Groundfish and Halibut Stocks

Given the preceding review of the bycatch situation in the Gulf for 1999, it may be useful to examine possible changes in the levels of biomass for target groundfish species and Pacific halibut. Some changes in the expected catch of groundfish for the upcoming fishing year will follow from the biomass estimates reported elsewhere in this SAFE report for GOA groundfish species as a result of the TACs established by the Council. Groundfish catch for most species will equal the TACs, tempered only by the PSC limits imposed by the Council. Lack of interest by industry in harvesting low value species, such as flatfish, may moderate this assumption to some degree. In general, it is apparent that changes in groundfish catch can have no effect on halibut bycatch once a PSC is established; rather, the PSC drives the formula and dictates the catch of groundfish. The Team recommended an ABC of 508,010 mt for 2004. The 2003 ABC was 414,820 mt. The catch in the GOA fisheries was only 173,590 mt (as of November 15, 2003) of the total 2003 TAC of 236,440 mt (73 %) due to PSC limitations and lack of interest in low value species.

In 1997, the IPHC revised its stock assessment methodology for setting annual catch limits for Pacific halibut. As a result, catch limits for the GOA has increased from 19,730 mt in 1995, peaked at 29,270 mt in 1999, and dropped to 28,010 mt in 2003. The higher catch limits reflect healthier stock conditions. IPHC staff report no significant change to the Pacific halibut stock assessment or quotas for 2004 for the Gulf of Alaska. Catch limits for 2004 will be decided in late January 2004.

Potential methods for bycatch reduction

With the implementation of an individual fishing quota system for halibut and sablefish longline fisheries in 1995, bycatch and waste were reduced because the race for fish was eliminated, allowing for more selective fishing practices and significant reductions in actual gear deployment/loss. As a result of the IFQ halibut and sablefish program, the halibut bycatch limit for non-trawl fisheries was reduced by 450 mt in Gulf of Alaska.

Since 1991, NMFS has implemented numerous management measures that reduce halibut bycatch in the groundfish fleet. The Council is developing a vessel bycatch allowance program, but further development has been stalled by the press of other Council business. In the interim, management options such as bycatch incentive programs, timing of groundfish seasons, and seasonal apportionments of the halibut PSC limits probably represent the most realistic methods of reducing halibut bycatch. In addition to bycatch limits, gear restrictions and other regulatory changes have also been implemented to reduce bycatch and waste. Biodegradable panels are required for pot gear to minimize waste associated with so-called ghost fishing of lost gear. Tunnel openings for pot gear are limited in size to reduce incidental catch of halibut and crabs. Gillnets for groundfish have been prohibited to prevent ghost fishing and reduce bycatch of non-target species.

Several possible methods exist which could contribute to a reduction in halibut bycatch by the groundfish fisheries. One method would be to set the TACs for groundfish at a level which would preclude excessive bycatch. Based on prevailing bycatch rates and mortality rates for each gear group, TACs can be back-calculated and set at levels to attain the desired level of bycatch. The economic tradeoffs associated with this method are discussed in the EA/RIR for Amendment 18. The current halibut bycatch limits amount to approximately 1% of halibut total biomass.

Gear modifications are a potential method of reducing the bycatch rates in the groundfish fisheries. The Council has examined the voluntary use of grid sorting to reduce halibut mortality and is currently reviewing the results of an experimental fishing permit for the use of a halibut excluder device in trawl gear. Any of these options would impose some kind of costs to the fishery which may or may not be offset by the potential benefits of the option chosen.

Gulf of Alaska Trawl Fisheries

<u>Pacific cod</u> — Bycatch rates have been lower from February through mid April compared to rates from late April through early August.

<u>Pollock</u> — Bycatch rates are lowest during the periods when pelagic gear is used.

<u>Flatfish</u> — Bycatch rates have been low in February and high from late March through mid May. However, differences in rate may be due to species composition. Dover sole, rex sole, and flathead sole are considered deep water flatfish species. Others are considered to be shallow water flatfish species.

<u>Rockfish</u> — Bycatch rates have been high from March through mid May and lower from late May through mid August. If trawling for rockfish were directed at slope species, then the lower rates during summer may be the result of halibut moving into shallower water, thereby escaping the deep water rockfish fishery.

<u>Sablefish</u> — Sablefish is limited to bycatch status for trawl gear. NMFS assumes that any catches occurs as a result of incidental catches in other directed groundfish fisheries.

<u>Arrowtooth flounder</u> — This species is considered to be a deep water flatfish species, although they may occur in shallow water, also. Few data exist to indicate a trend. High bycatch rates have occurred from late June through mid August as a result of trawling for arrowtooth in shallow water.

Gulf of Alaska Hook-and-Line Fisheries

<u>Pacific cod</u> — Bycatch rates have been lower from January through mid-April and in the past, have been relatively high from late April through May, likely as a result of halibut moving into shallow water where Pacific cod are found.

Gulf of Alaska Pot Fishery

<u>Pacific cod</u> — Bycatch rates generally have been low year-round due to regulations limiting the size of tunnel openings.

<u>Seasonal distribution of halibut and target groundfish</u>

Halibut bycatch rates for trawl, hook-and-line, and pot gear vary seasonally. Much of the information on the seasonal distribution of halibut can be drawn from the commercial fishery and research surveys. These sources indicate that adult halibut undertake a seasonal migration related to a winter spawning period and a summer feeding period. Spawning generally takes place between 230 and 450 m in depth during November through March, but is greatest during December and January. During April and May, the fish can be found moving up through the gullies and onto the offshore banks, typically 135 to 270 m. During the summer months of June through August, halibut are found shallow, up to 45 m or less in some cases, but generally less than 135 m. Halibut are occasionally found in bays feeding on salmon and other fish. In September and October, halibut begin their movement back to deeper water for spawning. Thus, the spring months of April/May and fall months of September/October can be considered transition periods.

Trawl surveys have yielded information on the distribution of juvenile halibut (ages 2 through 4). Fish of this age are distributed throughout the entire Gulf during the year out to a depth of 180 m and occasionally deeper. However, abundance is greatest at depths of 100 meters or less. Little, if any, seasonal migration is observed in halibut of this size.

The seasonal distribution of the major groundfish species in the Gulf should be considered relevant to the distribution of halibut in efforts to minimize halibut bycatch. Walleye pollock, a pelagic species in all life stages, have probably the least interaction with halibut, in terms of physical location, of all the target groundfish species in the Gulf. Seasonal movements do occur with the fish moving to shallower water in the spring and summer. In the fall and winter months they return to deeper water. There may be vertical movement in the water column associated with feeding and diurnal patterns. Typically, they are found throughout the water column from shallow to deep water, frequently forming large schools at depths of 100-400 m along the outer continental shelf and slope.

Pacific cod are a widespread demersal species found along the continental shelf from inshore waters to the upper slope with adults commonly found at depths of 50-200 m. During the winter and spring cod appear to concentrate in the canyons that cut across the shelf and along the shelf edge and upper slope at depths of 100-200 m where they overwinter and spawn. Most spawning occurs in the spring at depths of 150-200 m along the outer continental shelf off Kodiak Island and in the Shelikof Strait area, as well as Prince William Sound. In the summer, they shift to shallower depths, usually less than 100 m.

The flatfish group, which are all demersal but have varying depth ranges, includes arrowtooth flounder, starry flounder, flathead sole, rock sole, Dover sole, yellowfin sole, and rex sole. Arrowtooth flounders are abundant over a depth range of 100-500 m and aggregate in the deeper portion of that range during the winter months. High densities have been indicated by resource surveys in the waters off southeastern Alaska at depths of 200-400 m. Most occurrences of starry flounder in the Gulf have been at depths less than 150 m while flathead sole are typically found at depths less than 250 m. Rock sole are more of a shallow water species and are most abundant in the Kodiak and Shumagin areas at depths of less than 100 m. Dover sole and rex sole are found throughout the northeastern Pacific and Bering Sea at depths usually less than 275 m. Yellowfin sole are a relatively abundant species in Cook Inlet and are also found in Prince William Sound.

The rockfish group includes four assemblages separated on the basis of habitat and behavioral characteristics - slope rockfish, pelagic shelf rockfish, demersal shelf rockfish, and thornyhead rockfish. Little information is available on life history and distribution patterns of demersal and pelagic shelf rockfish.

Little is known of the slope assemblage, except for Pacific ocean perch (POP). POP are found over a wide range of depths, usually between 100 and 450 m, with the adults performing seasonal bathymetric migrations associated with reproduction and feeding. They apparently migrate into deep water during fall and winter to spawn and then move to shallower depths to feed in the spring and summer. Separate schools of males and females have been observed migrating from feeding grounds at depths of 150-185 m in the Unimak Pass region to spawning areas at depths of 350-400 m in the Yakutat Bay area. Thornyhead rockfish are benthic and seldom venture off the bottom where they occur at depths of 100-1,500 m.

Sablefish occur in the outer shelf, slope, and abyssal habitats over a depth range of 200-1,200 m with the centers of abundance occurring from 400-1,000 m along the continental slope, especially in or near submarine canyons. Sablefish spawn during late winter to early spring along the continental slope at depths exceeding 400 m. Sablefish spend their first year in estuarine areas, after which their depth distribution increases with age and some fish reach depths of 300 m by their third year. Some research evidence points to migratory movements by sablefish during different life stages, while other research indicates that sablefish remain in the same general bottom area where they settle as sub-adults.

Economic effects of groundfish seasons and seasonal halibut PSCs

An alteration of any species/gear type fishing season will impose some types of costs on certain segments of the fishing industry as well as result in benefits to the same or other segments of the industry. A delay in the season opening could impose costs in the form of foregone revenues. For instance, a delay in the season may shift effort, resulting in less of the PSC limit being available to a higher valued fishery.

Seasonal allocations of the PSC limits will likely have the same potential effects on the fishery as outlined above. The setting of the seasonal apportionments of the PSC limits will be directly related to any season changes adopted by the Council. The way in which these PSC limits are seasonally apportioned will affect the character of the fisheries for each major gear group throughout the year. A change in fishing seasons would require a corresponding shift in the PSC apportionments to accommodate the new season. The result is a tradeoff that must consider the relative values of the different groundfish species harvested and the relative values of halibut bycatch to those fisheries. Ideally, the seasonal apportionment of halibut PSC limits will provide the mechanism for each fishery to fully exploit the available resource without exceeding the PSC limits for each gear group. Fishermen and other industry representatives may be in the best position to provide the relevant information upon which to base the decisions regarding the seasonal apportionment of these halibut PSC limits.

Fishing seasons have been modified as a result of management measures required to minimize fishing impacts on endangered Steller sea lions. Further, changes to season start dates will be examined in a proposed plan amendment to revise the annual specification-setting process.

Table 1: 2003 Annual halibut mortality by gear type (through November 15, 2003)

Gulf of Alaska Prohibited Species Report	National Marine Fisheries Service
Through: 15-NOV-03	Alaska Region, Sustainable Fisheries Catch Accounting

Chinook Salmon

Trawl Gear

Sea-sons	Account	Units	Total Catch	Limit	Remaining	% Taken	Last Wk Catch
	Chinook Salmon	Count	15,097	0			0
Total:			**15,097**	**0**			**0**

Halibut Mortality

Non-Trawl Gear

Sea-sons	Account	Units	Total Catch	Limit	Remaining	% Taken	Last Wk Catch
X	Other Hook-and-Line Fisheries	MT	296	290	-6	102%	0
Total:			**296**	**290**	**-6**	**102%**	**0**

Trawl Gear

Sea-sons	Account	Units	Total Catch	Limit	Remaining	% Taken	Last Wk Catch
	Trawl Fishery	MT	1,990	2,000	10	100%	0
Total:			**1,990**	**2,000**	**10**	**100%**	**0**

No PSC Limits apply to salmon in the GOA.

Other hook-and-line fisheries means all hook-and-line fisheries except sablefish and demersal shelf rockfish in the Southeast District. The hook-and-line sablefish fishery is exempt from halibut bycatch restrictions.

Halibut mortality for the demersal shelf rockfish fishery, Southeast District is not listed due to insufficient observer coverage.

Data is based on observer reports, extrapolated to total groundfish harvest. Estimates for all weeks may change due to incorporation of late or corrected data.

Table 2: 2003 Seasonal halibut mortality by gear type (through November 15, 2003)

Gulf of Alaska Halibut Mortality Report Through: 15-NOV-03	National Marine Fisheries Service Alaska Region, Sustainable Fisheries Catch Accounting

Trawl Fisheries

Deep Water Species Complex

Season	Begin	End	Total Catch	Limit	Limit Remaining	% Taken
1st Season	20-JAN-03	01-APR-03	105	100	-5	105%
2nd Season	01-APR-03	29-JUN-03	290	300	10	97%
3rd Season	29-JUN-03	01-SEP-03	310	400	90	77%
4th Season	01-SEP-03	30-SEP-03	34	0	-34	0%
Total:			**740**	**800**	**60**	**92%**

Shallow Water Species Complex

Season	Begin	End	Total Catch	Limit	Limit Remaining	% Taken
1st Season	20-JAN-03	01-APR-03	274	450	176	61%
2nd Season	01-APR-03	29-JUN-03	314	100	-214	314%
3rd Season	29-JUN-03	01-SEP-03	127	200	73	64%
4th Season	01-SEP-03	30-SEP-03	282	150	-132	188%
Total:			**998**	**900**	**-98**	**111%**

Year-To-Date

Account	Total Catch	Limit	Limit Remaining	% Taken	Last Wk Catch
Trawl Fishery	1,990	2,000	10	100%	0

Other Hook-and-Line Fisheries

Season	Begin	End	Total Catch	Limit	Limit Remaining	% Taken
1st Season	01-JAN-03	10-JUN-03	233	250	17	93%
2nd Season	10-JUN-03	01-SEP-03	33	5	-28	655%
3rd Season	01-SEP-03	31-DEC-03	30	35	5	86%
			296	**290**	**-6**	**102%**

Deep-water species complex: sablefish, rockfish, deep-water flatfish, rex sole and arrowtooth flounder. Shallow-water species complex: pollock, Pacific cod, shallow-water flatfish, flathead sole, Atka mackerel, and 'other species'.

No apportionment between shallow-water and deep-water fishery complexes during October 1 to December 31 (300 mt allocated).

Other hook-and-line fisheries means all hook-and-line fisheries except sablefish and demersal shelf rockfish in the Southeast District. The hook-and-line sablefish fishery is exempt from halibut bycatch restrictions.

Halibut mortality for the demersal shelf rockfish fishery, Southeast District is not listed due to insufficient observer coverage.

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Note: All weights are in metric tons.

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Appendix II. Total removals by category, 1996-2008 (Source: IPHC)

Total	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1996	0.296	9.545	8.872	19.693	3.663	1.699	2.069	1.506	47.343
1997	0.413	12.421	9.918	24.628	9.072	2.908	3.318	2.519	65.197
1998	0.460	13.172	10.196	25.698	11.161	3.417	2.901	2.752	69.757
1999	0.450	12.705	10.143	25.316	13.835	4.369	3.571	3.916	74.305
2000	0.483	10.811	8.445	19.273	15.413	5.155	4.692	4.018	68.290
2001	0.680	10.288	8.403	21.539	16.336	5.015	4.468	3.970	70.699
2002	0.851	12.073	8.602	23.131	17.313	5.091	4.080	3.518	74.659
2003	0.819	11.789	8.410	22.748	17.231	5.024	3.863	3.257	73.141
2004	0.884	12.162	10.234	25.167	15.460	3.561	2.719	2.923	73.110
2005	0.803	12.331	10.625	26.033	13.171	3.404	1.975	3.482	71.824
2006	0.830	12.005	10.492	25.714	10.791	3.332	1.590	3.227	67.981
2007	0.789	9.772	8.473	26.493	9.249	2.828	1.416	3.849	62.869
2008	0.707	7.794	6.209	24.376	10.893	3.011	1.765	3.871	58.626

Sport	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1996	0.229	0.887	2.129	4.740	0.021	0.077	0.000	0.000	8.083
1997	0.355	0.887	2.172	5.514	0.028	0.069	0.000	0.000	9.025
1998	0.383	0.887	2.501	4.702	0.017	0.096	0.000	0.000	8.586
1999	0.338	0.859	1.843	4.228	0.017	0.094	0.000	0.000	7.379
2000	0.344	1.021	2.258	5.305	0.015	0.073	0.000	0.000	9.016
2001	0.446	1.015	1.925	4.675	0.016	0.029	0.000	0.000	8.106
2002	0.399	1.260	2.090	4.202	0.013	0.048	0.000	0.000	8.012
2003	0.404	1.218	2.258	5.427	0.009	0.031	0.000	0.000	9.347
2004	0.487	1.613	2.937	5.606	0.007	0.053	0.000	0.000	10.703
2005	0.484	1.841	2.798	5.672	0.014	0.050	0.000	0.000	10.859
2006	0.516	1.773	2.526	5.337	0.014	0.046	0.000	0.000	10.212
2007	0.504	1.556	3.049	6.283	0.025	0.044	0.000	0.000	11.461
2008	0.457	1.520	3.083	5.629	0.018	0.043	0.000	0.000	10.750

Bycatch (legal-sized)

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1996	0.473	0.166	0.233	1.403	0.960	0.594	0.459	2.991	7.279
1997	0.473	0.109	0.240	1.549	0.729	0.844	0.198	2.964	7.106
1998	0.834	0.117	0.238	1.471	0.731	1.193	0.327	2.725	7.636
1999	0.761	0.107	0.230	1.283	0.743	0.909	0.336	2.642	7.011
2000	0.634	0.128	0.254	1.286	0.646	0.808	0.580	2.279	6.615
2001	0.645	0.149	0.184	1.617	0.632	0.574	0.387	2.900	7.088
2002	0.382	0.152	0.166	1.073	0.719	0.534	0.196	2.735	5.957
2003	0.355	0.133	0.144	1.177	0.500	0.515	0.219	2.105	5.148
2004	0.323	0.140	0.149	1.520	0.393	0.516	0.294	1.915	5.250
2005	0.183	0.191	0.144	1.321	0.360	0.456	0.279	2.206	5.140
2006	0.177	0.151	0.214	1.062	0.508	0.649	0.231	2.136	5.128
2007	0.177	0.154	0.215	0.989	0.451	0.656	0.324	1.895	4.861
2008	0.141	0.067	0.216	1.058	0.485	0.496	0.211	1.552	4.226

Personal use and subsistence

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1996	0.015	0.300	0.000	0.097	0.037	0.094	0.000	0.000	0.543
1997	0.015	0.300	0.000	0.097	0.037	0.094	0.000	0.000	0.543
1998	0.011	0.300	0.170	0.097	0.037	0.094	0.000	0.000	0.709
1999	0.011	0.300	0.170	0.074	0.020	0.166	0.000	0.000	0.741
2000	0.018	0.300	0.170	0.074	0.020	0.166	0.000	0.000	0.748
2001	0.016	0.300	0.170	0.074	0.020	0.166	0.000	0.000	0.746
2002	0.016	0.300	0.170	0.074	0.020	0.166	0.000	0.000	0.746
2003	0.027	0.300	0.628	0.280	0.028	0.021	0.003	0.096	1.383
2004	0.019	0.300	0.677	0.404	0.034	0.029	0.001	0.056	1.520
2005	0.036	0.300	0.598	0.429	0.046	0.036	0.001	0.091	1.537
2006	0.036	0.300	0.598	0.429	0.046	0.036	0.001	0.091	1.537
2007	0.036	0.300	0.580	0.380	0.050	0.027	0.003	0.107	1.483
2008	0.036	0.405	0.580	0.380	0.050	0.027	0.003	0.107	1.588

Commercial wastage (legal-sized)

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
1996	0.001	0.029	0.044	0.177	0.022	0.024	0.029	0.022	0.348
1997	0.006	0.037	0.040	0.074	0.054	0.026	0.030	0.022	0.289
1998	0.001	0.053	0.041	0.154	0.056	0.020	0.017	0.016	0.358
1999	0.007	0.040	0.067	0.117	0.071	0.034	0.028	0.031	0.395
2000	0.007	0.028	0.038	0.059	0.058	0.026	0.023	0.021	0.260
2001	0.003	0.046	0.037	0.065	0.032	0.033	0.029	0.026	0.271
2002	0.005	0.036	0.026	0.139	0.034	0.020	0.016	0.014	0.290
2003	0.002	0.035	0.025	0.068	0.035	0.020	0.016	0.014	0.215
2004	0.000	0.036	0.031	0.076	0.015	0.015	0.012	0.012	0.197
2005	0.005	0.037	0.032	0.156	0.026	0.012	0.007	0.012	0.287
2006	0.002	0.036	0.021	0.051	0.011	0.007	0.004	0.007	0.139
2007	0.003	0.029	0.029	0.053	0.018	0.008	0.004	0.012	0.156
2008	0.001	0.023	0.012	0.063	0.004	0.012	0.012	0.014	0.141

Bycatch (sublegal-sized)

	2A	2B	2C	3A	3B	4A	4B	4CDE	total
1996	0.140	0.133	0.111	1.297	0.972	1.582	0.160	2.708	7.103
1997	0.140	0.106	0.157	1.415	0.714	1.543	0.098	2.230	6.403
1998	0.248	0.096	0.123	1.192	0.657	1.297	0.157	2.030	5.800
1999	0.226	0.085	0.127	1.602	0.992	1.586	0.073	2.141	6.832
2000	0.188	0.102	0.141	1.606	0.863	1.335	0.106	2.330	6.671
2001	0.192	0.028	0.158	1.392	1.045	0.934	0.145	2.177	6.071
2002	0.171	0.092	0.174	1.121	1.205	1.697	0.081	2.038	6.579
2003	0.199	0.115	0.197	1.613	1.064	1.571	0.039	2.349	7.147
2004	0.181	0.121	0.205	2.084	0.837	1.574	0.053	2.136	7.191
2005	0.103	0.165	0.197	1.810	0.765	1.392	0.050	2.461	6.943
2006	0.197	0.143	0.127	1.912	0.892	1.063	0.193	3.217	7.744
2007	0.197	0.146	0.127	1.781	0.792	1.075	0.270	2.855	7.243
2008	0.157	0.064	0.128	1.905	0.852	0.814	0.176	2.337	6.433

Commercial wastage (sublegal-sized)

	2A	2B	2C	3A	3B	4A	4B	4CDE	total
1996	0.002	0.184	0.115	0.323	0.059	0.016	0.017	0.009	0.725
1997	0.002	0.248	0.136	0.426	0.161	0.029	0.029	0.016	1.047
1998	0.002	0.275	0.147	0.473	0.218	0.039	0.025	0.019	1.198
1999	0.003	0.276	0.154	0.491	0.296	0.055	0.031	0.029	1.335
2000	0.003	0.240	0.135	0.393	0.370	0.072	0.041	0.033	1.287
2001	0.005	0.236	0.143	0.459	0.443	0.080	0.038	0.040	1.444
2002	0.009	0.286	0.155	0.516	0.528	0.092	0.032	0.040	1.658
2003	0.009	0.302	0.165	0.530	0.593	0.104	0.029	0.038	1.770
2004	0.011	0.343	0.225	0.612	0.597	0.085	0.018	0.043	1.934
2005	0.013	0.388	0.260	0.659	0.558	0.093	0.012	0.047	2.030
2006	0.014	0.410	0.283	0.667	0.511	0.101	0.009	0.051	2.046
2007	0.016	0.438	0.267	0.918	0.423	0.132	0.018	0.074	2.286
2008	0.015	0.262	0.212	0.924	0.681	0.133	0.019	0.091	2.337

Appendix III. CASE STUDY: GOA Rockfish Program.

Excerpt from GOA Rockfish Program June 2010 Public Review Draft

Halibut

Pacific halibut (*Hippoglossus stenolepsis*) range from the Eastern Bering Sea to Oregon, with the center of abundance in the GOA. Spawning takes place in the winter months from December to February, mostly off the edge of the continental shelf at depths of 400 to 600 meters. Male halibut become sexually mature at 7 or 8 years of age; females become sexually mature at 8 to 12 years. In the 1970s, 10-year old males averaged 9.1 kilograms, and females averaged 16.8 kilograms. Males can grow to approximately 35 kilograms and live up to approximately 30 years; females can grow to over 225 kilograms and live up to approximately 40 years. Females can produce up to 3 million eggs annually. Fertilized eggs float free for about 15 days before hatching. Larvae drift free for up to 6 months and can be carried great distances to shallow waters by prevailing currents. Most young halibut spend 5 to 7 years in shallow waters. At about 35 centimeters, these fish begin life as bottom dwellers. Up to age 10, halibut in the Gulf are highly migratory, generally migrating clockwise throughout the Gulf. Older halibut are much less migratory. Halibut prey on variety of fish, crab, and shrimp, at times leaving the bottom to feed on fish, such as herring and sand lance.

The catch of halibut in directed fisheries is managed under a treaty between the U.S. and Canada, through the International Pacific Halibut Commission. Pacific halibut are considered a single interrelated stock, but are regulated by quotas at the subarea level. Both commercial and recreational fisheries date back to the 1800s.

Currently, regulations limit catch of halibut as PSC. NOAA Fisheries annual sets PSC limits under 50 CFR 679.21 through the annual TAC-setting process. Halibut PSC limits are apportioned by gear group, fishery categories, and season to create more refined PSC limits.

Table 1 and Table 2 show the halibut PSC limits by gear, seasons, and fisheries. The purpose of the seasonal apportionment is to maximize the ability of the fleet to harvest the available groundfish TAC and to minimize halibut PSC. NOAA fisheries will base any seasonal apportionment of the halibut PSC on 1) seasonal distribution of halibut, 2) seasonal distribution of target groundfish species, 3) PSC bycatch needs on a seasonal basis, 4) expected variations in bycatch rates throughout the fishing year, 5) expected changes in directed groundfish fishing season, 6) expected start of fishing effort, and 7) economic effects of establishing seasonal halibut allocations on segments of the target groundfish industry.

For the GOA trawl fisheries, the halibut PSC limit is 2,000 metric tons. The 2,000 metric tons are then apportioned among seasons (currently five[17]) and fishery complexes (shallow water and deep water species) through the annual specification process. The shallow water fishery complex includes pollock, Pacific cod, flathead sole, Atka mackerel, and "other species." The deep water complex includes all rockfish species, rex sole, deep water flatfish, sablefish, and arrowtooth flounder. There is no apportionment between shallow-water and deep-water fishery complexes during the 5th season.

Unused seasonal apportionment of halibut PSC will be added to the respective seasonal apportionment for the next season during the current fishing year. If a seasonal apportionment of halibut PSC is exceeded, that amount of halibut limit will be deducted from the next season's apportionment during the current fishing year. Unused halibut PSC that has been allocated to a rockfish cooperative is added to the last seasonal apportionment for trawl gear after November 15 or after the effective date of a declaration to terminate fishing by the rockfish cooperative during that fishing year.

If, during the fishing year, NOAA Fisheries determines the trawl vessels will catch the halibut PSC limit for that fishery category, NOAA Fisheries will close the entire GOA or regulatory area to directed fishing with trawl gear for that species complex.[18] NOAA Fisheries currently apportions 800 metric tons of

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[17] Season 1: January 20 – April 1; Season 2: April 1 – July 1; Season 3: July 1- September 1; Season 4: September 1 – October 1; Season 5: October 1 – December 31.

[18] Trawl vessels fishing for pollock with pelagic gear may continue despite closure of shallow-water fisheries.

halibut PSC to the deep-water complex. This apportionment is split among the five seasons, with the third season (starting in July, when the rockfish fisheries open) being apportioned 400 metric tons.

Prior to implementation of the rockfish program, if the halibut mortality limit was reached prior to catch of the rockfish TAC, the rockfish fisheries were closed for the season and reopened when the next apportionment came available in September. Since implementation of the pilot program, cooperatives receive exclusive allocations of halibut PSC from the third quarter deep water apportionment that constrain their fishing activity. Participants in the limited access fishery (who elected not to join a cooperative) are subject to the same limitation as participants in the rockfish fisheries prior to the pilot program. In other words, if the third season halibut PSC apportionment is fully used prior to harvest of the applicable limited access rockfish TAC, that fishery will be closed until the next season's apportionment comes available in September.

Table 1 Final 2009 and 2010 Pacific halibut PSC limits, allowances, and apportionments (all values are in metric tons)

Trawl gear		Hook-and-line gear [1]			
		Other than DSR		DSR	
Season	Amount	Season	Amount	Season	Amount
January 20–April 1	550 (27.5%)	January 1–June 10	250 (86%)	January 1–December 31	10 (100%)
April 1–July 1	400 (20%)	June 10–September 1	5 (2%)		
July 1–September 1	600 (30%)	September 1–December 31.	35 (12%)		
September 1–October 1	150 (7.5%)	n/a	n/a		
October 1–December 31	300 (15%)	n/a	n/a		
Total	2,000 (100%)	n/a	290 (100%)		10 (100%)

[1] The Pacific halibut PSC limit for hook-and-line gear is allocated to the demersal shelf rockfish (DSR) fishery and fisheries other than DSR. The hook-and-line sablefish fishery is exempt from halibut PSC limits.

Table 2. Final 2009 and 2010 apportionment of Pacific halibut PSC trawl limits between the trawl gear deep-water species complex and the shallow-water species complex (values are in metric tons)

Season	Shallow-water species complex	Deep-water species complex [1]	Total
January 20–April 1	450	100	550
April 1–July 1	100	300	400
July 1–September 1	200	400	600
September 1–October 1	150	Any remainder	150
Subtotal January 20–October 1	900	800	1,700
October 1–December 31 [2]	n/a	n/a	300
Total	n/a	n/a	2,000

[1] Vessels participating in cooperatives in the Central Gulf of Alaska Rockfish Pilot Program will receive a portion of the third season (July 1–September 1) deep-water category halibut PSC apportionment. At this time, this amount is unknown but will be posted later on the Alaska Region Web site at *http://www.alaskafisheries.noaa.gov* when it becomes available.
[2] There is no apportionment between shallow-water and deep-water fishery complexes during the 5th season (October 1–December 31).

Estimated annual halibut catch and mortality for catcher processors and catcher vessels in the CGOA rockfish fisheries from 1996 to 2006 are provided in Table 3.

Table 3. Halibut mortality of trawl vessels in the Central Gulf directed rockfish fishery (1996-2006)

Year	Catcher processors			Catcher vessels		
	Halibut PSC mortality (pounds)	Catch of primary rockfish (tons)	Pounds of halibut PSC mortality per ton of primary rockfish retained catch	Halibut PSC mortality (pounds)	Catch of primary rockfish (tons)	Pounds of halibut PSC mortality per ton of primary rockfish retained catch
1996	117,064.3	4,456.4	26.3	204,983.7	3,445.9	59.5
1997	328,198.8	5,899.6	55.6	109,215.9	3,297.9	33.1
1998	322,643.2	6,680.7	48.3	191,447.5	5,156.5	37.1
1999	372,511.3	8,532.4	43.7	274,097.9	5,877.8	46.6
2000	105,732.6	4,591.2	23.0	300,861.8	8,577.5	35.1
2001	243,916.9	6,301.8	38.7	454,742.8	6,656.4	68.3
2002	244,909.0	4,782.1	51.2	209,657.5	8,051.9	26.0
2003	144,423.1	4,148.7	34.8	340,930.7	9,728.1	35.0
2004	107,653.0	4,977.7	21.6	474,015.4	8,548.7	55.4
2005	150,053.8	5,506.0	27.3	306,010.6	7,445.8	41.1
2006	127,343.3	5,558.0	22.9	165,482.1	6,839.4	24.2

Source: CP data from Catch Accounting/Blend and CV data from ADF&G Fish Tickets

In 2007, the CGOA Rockfish Pilot Program was implemented. The intention of the program is to enhance resource conservation and improve economic efficiency for harvesters and processors who participate in the program. Under the pilot program, allocations of the primary rockfish (Pacific ocean perch, Northern Rockfish, and Pelagic rockfish) and important incidental catch species (i.e., sablefish, Pacific cod, shortraker and rougheye rockfish, and thornyhead rockfish) are divided between the catcher vessel sector and the catcher processor sector. In addition, each sector is also allocated halibut PSC based on historic catch of halibut in the target rockfish fisheries. Under the program, participants in each sector can either fish as part of a cooperative or in a competitive, limited access fishery. As seen from Table 4, annual halibut catch and mortality in the CGOA rockfish fishery has declined since the implementation of the pilot program in 2007 and 2008.

In the years leading up to the pilot program, vessels in the rockfish fishery averaged in excess of 20 pounds of halibut mortality for each metric ton of primary rockfish species. In the first two years of the program, vessels fishing in cooperatives and the limited access fishery under the program cut halibut mortality rates substantially. Vessels in the catcher processor limited access fishery reduced their catch to approximately 13 pounds of halibut per ton of primary rockfish catch in 2007, while in 2008 the halibut mortality rate was 16.5 pounds per ton of primary rockfish catch.[19] For catcher processor cooperative, the single vessel fishing in 2007 reduced its halibut mortality to less than 9 pounds of halibut per metric ton of primary rockfish catch, while the two participating vessels in 2008 had a halibut mortality of 10.5 percent. The catcher vessel sector reduced its halibut mortality to slightly more than 4 pounds of halibut per ton of primary rockfish species catch in 2007, while the halibut mortality in 2008 for this sector was roughly 8 pounds per metric ton of primary rockfish.[20]

[19] In assessing the change in catch rate in the catcher processor limited fishery access, it should be borne in mind that (although not fishing as a cooperative) the vessels fishing in that fishery did not compete for the allocations of pelagic shelf rockfish, reducing the pressure to race for fish.

[20] These calculations include all halibut mortality of vessels fishing allocations under the program, including mortality in trips targeting Pacific cod and sablefish.

Table 4. Halibut mortality of vessels in the Central Gulf rockfish pilot program (2007 and 2008)

Year	Fishery	Vessels	Halibut PSC mortality (pounds)**	Catch of primary rockfish (tons)	Pounds of halibut PSC mortality per ton of primary rockfish catch	Allocation including transfer of halibut PSC mortality (pounds)	Unused allocation (pounds)
2007	Catcher processor limited access	3	26,312.8	2,063.3	12.8	NA	NA
	Catcher processor cooperative*	1	16,623.3	1,933.1	8.6	77,760.7	61,137.3
	Catcher vessel cooperative	25	32,710.1	7,746.0	4.2	309,816.8	277,106.7
	Total	29	75,646.3	11,742.4	6.4	387,577***	338,244+
2008	Catcher processor limited access	4	47,624.4	2,892.1	16.5	NA	NA
	Catcher processor cooperative*	2	19,332.0	1,836.4	10.5	44,092.0	24,760.0
	Catcher vessel cooperative	23	60,622.0	7,446.7	8.1	331,906.9	271,284.9
	Total	29	127,578.4	12,175.2	10.5	375,998.9***	298,044.9+

Source: NMFS Catch Accounting Data

*Data are not confidential because of disclosure in cooperative reports.

** Includes all halibut mortality under the primary program (i.e., excludes entry level fishery).

*** Includes allocation to catcher processor cooperative that did not fish. No allocation is made to the limited access fishery.

+ Includes all allocations and only catches by vessels subject to those allocations.

The drastic reduction in halibut mortality (particularly in the catcher vessel sector) likely arises from several factors. First, vessels have exclusive allocations, allowing them to move from areas of high halibut catch without risking loss of catch of the primary rockfish. Second, exclusive allocations also increase the incentive for participants to communicate with each other concerning catch rates, improving information concerning areas of high halibut incidental catch in the fleet, and preventing repeated high halibut mortality among vessels exploring fishing grounds. Third, several vessels have begun employing new pelagic gear that limits bottom contact and halibut incidental catch. These gear changes are apparent when comparing the percentage of catch using pelagic trawl gear and non-pelagic gear in the first two years of the program with catch by those gear types in the preceding years (see Table 5). In the second year of the program over 40 percent of primary rockfish catch was with pelagic trawl, in comparison to less than 25 percent in 2006 and 6 percent or less in the preceding years. In the second year of the program, nearly 85 percent of the catcher vessel fleet used pelagic gear for some of its catch, in comparison to slightly more than half of that fleet in 2006 and less than 20 percent in the proceeding years. In the catcher processor sector, two of the four active vessels used pelagic gear in the first year of the program, in comparison to no pelagic trawl gear prior to implementation of the program. Catch data by gear type cannot be revealed for the catch processor sector because of confidentiality protections. Participants in the program report that a primary motivation for these changes in gear types is constraining halibut allocations, which could jeopardize cooperative catches in the event that halibut bycatch exceeds allocations.

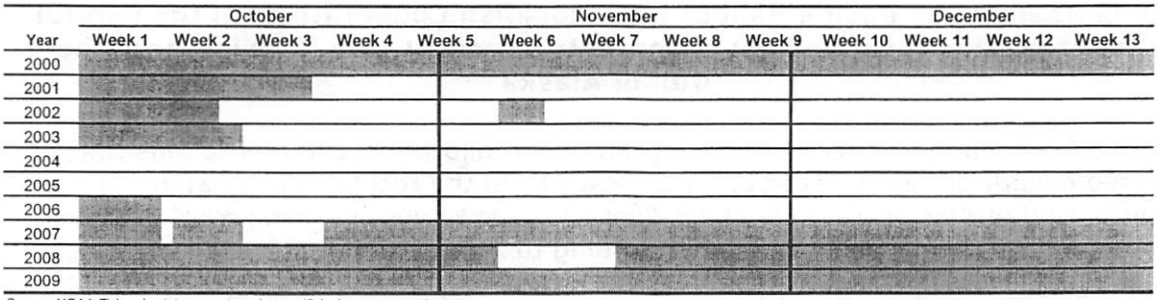
Table 5. Catch by gear by sector in the Central Gulf of Alaska rockfish fishery (2003-2008)

Year	Catcher processors		Catcher vessels					
	Non-pelagic trawl	Pelagic trawl	Non-pelagic trawl			Pelagic trawl		
	Number of vessels	Number of vessels	Number of vessels	Catch of primary rockfish species (in metric tons)	Percentage of catch of primary rockfish species	Number of vessels	Catch of primary rockfish species (in metric tons)	Percentage of catch of primary rockfish species
2003	5	0	31	9,396.6	99.0	1	95.6	1.0
2004	6	0	28	7,875.0	100.0	0	0.0	0.0
2005	6	0	24	6,702.4	94.0	4	429.2	6.0
2006	4	0	23	5,153.2	76.4	13	1,590.0	23.6
2007	4	2	24	4,813.0	62.1	19	2,933.0	37.9
2008	6	1	26	4,230.2	56.8	22	3,216.5	43.2

Source: NMFS Catch Accounting.

The incentive for halibut mortality reductions is increased by the rollover of saved halibut mortality to other fisheries late in the year, allowing the trawl sector as a whole (including vessels that did not qualify for the pilot program) to benefit from these halibut mortality reductions. As seen in the three years of the pilot program, any unused halibut PSC that has been allocated to the cooperatives that has not been used by a cooperative before November 15 or after a declaration to terminate fishing by the cooperative, will be added to the last seasonal apportionment for trawl gear during the current fishing year. On November 13, 2007, 128 metric tons of unused rockfish cooperative halibut PSC was reallocated to the trawl gear, on November 13, 2008, 135 metric tons was reallocated, and on November 15, 2009, 139 metric tons was reallocated. In all three years, the reallocation of halibut PSC from the rockfish pilot program to the GOA trawl fisheries allowed the trawl GOA groundfish fisheries to remain open until December 31. As demonstrated in Table 6, in the five years previous to implementation of the rockfish pilot program, the trawl GOA groundfish fisheries were closed to directed fishing prior to the end of the season so as not to exceed the halibut PSC limit. In two of those years, 2004 and 2005, the trawl GOA groundfish fishery was closed to direct fishing on October 1.

Table 6. Season duration of the trawl Central Gulf of Alaska groundfish fisheries from October 1 to December 31, 2000 to 2009



Source: NOAA Fishereis status reports and groundfish closure summaries

* Gaps are approximate closure periods

Catch of groundfish late in the year has fluctuated both before and after implementation of the rockfish pilot program. Table 7 below shows vessel count, total catch, and halibut PSC by target for trawl vessels during the October 1 to December 31 period from 2000 to 2009. As seen in the table, in the two years preceding the program, no harvest of groundfish occurred, as all fisheries were closed because no halibut PSC was available. In earlier years, halibut PSC was primarily caught in the shallow-water flatfish, Pacific cod, and arrowtooth flounder fisheries. Smaller amounts of halibut PSC were caught in the rex sole and flathead sole fisheries. In years since the rockfish pilot program, halibut PSC was primarily caught in the shallow-water flatfish fishery, while a smaller amount of halibut PSC was caught in the Pacific cod and arrowtooth flounder fisheries. The rollover, 128 metric tons in 2007, 135 metric tons in 2008, and 139 metric tons in 2009 has clearly supported additional fishing activity, but the degree of the change is uncertain and appears to depend on target preferences, which have varied year-to-year.

Table 7. Vessel count, total catch, and halibut PSC by target for trawl vessels in central and western GOA during the 5th season (Oct 1 – Dec 31) from 2000 - 2009

Species Complex	Target		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Shallow-water	Shallow-water flatfish	Vessel Count	16	9	26	2	0	0	7	7	7	24
		Target catch	1,711	183	3,518	*	0	0	1,776	3,204	5,773	5,970
		Halibut PSC	82	9	213	*	0	0	210	208	238	138
	Pacific cod	Vessel Count	1	53	9	3	0	0	3	6	9	6
		Target catch	*	10,166	170	*	0	0	*	710	2,170	392
		Halibut PSC	*	437	6	*	0	0	*	15	56	7
	Flathead sole	Vessel Count	2	4	2	2	0	0	1	0	2	5
		Target catch	*	194	*	*	0	0	0	0	*	1,320
		Halibut PSC	*	4	*	*	0	0	0	0	*	13
Deep-water	Rex sole	Vessel Count	4	1	2	1	0	0	1	1	0	3
		Target catch	1,353	*	*	*	0	0	*	*	0	*
		Halibut PSC	38	*	*	*	0	0	*	*	0	*
	Arrowtooth	Vessel Count	2	1	8	13	0	0	7	6	8	8
		Target catch	*	*	2,702	6,700	0	0	2,095	1,808	2,025	1,098
		Halibut PSC	*	*	70	186	0	0	122	38	45	12
	Deep-water flatfish	Vessel Count	2	0	0	0	0	0	0	0	0	0
		Target catch	*	0	0	0	0	0	0	0	0	0
		Halibut PSC	*	0	0	0	0	0	0	0	0	0
	Rockfish	Vessel Count	0	0	0	1	0	0	3	7	5	4
		Target catch	0	0	0	*	0	0	*	973	1,392	458
		Halibut PSC	0	0	0	*	0	0	*	9	23	1
Days open during 5th season**			92	20	16	14	0	0	7	82	82	92

Source: Target catch was from Blend data/Catch Accounting, while halibut PSC was from NMFS PSC data

* Withheld for confidentiality

** All closures during the 5th season were to prevent exceeding halibut PSC limit

Information Bulletin 07-115
Sustainable Fisheries Division
907-586-7228

November 19, 2007
3:15 p.m.

NMFS Reallocates Pacific Halibut from Rockfish Cooperatives in the Central Gulf of Alaska Rockfish Pilot Program to Vessels Using Trawl Gear in the Gulf of Alaska

The National Marine Fisheries Service (NMFS) is reallocating 128 metric tons (mt) of unused halibut prohibited species catch (PSC) from the rockfish cooperatives in the Central Gulf of Alaska (GOA) Rockfish Pilot Program to vessels using trawl gear in the open-access fishery in the GOA, according to James W. Balsiger, Administrator, Alaska Region, NMFS.

The following table summarizes the reallocation in metric tons:

	CURRENT SHARE	**THIS ACTION**	**REVISED SHARE**
Halibut rockfish cooperatives	176	- 128	48
Trawl gear	1,824	+ 128	1,952

This action is necessary to provide the opportunity to vessels using trawl gear to harvest available GOA groundfish total allowable catch (TAC) under existing PSC limits, and is issued pursuant to 50 CFR 679.21(d)(5)(iii)(B). This action does not imply any change in the status of the fisheries.

Information Bulletin 08-130
Sustainable Fisheries Division
907-586-7228

November 13, 2008
4:00 P.M.

NMFS Reallocates Pacific Halibut from Rockfish Cooperatives in the Central Gulf of Alaska Rockfish Pilot Program

The National Marine Fisheries Service (NMFS) is reallocating 135 metric tons (mt) of unused halibut prohibited species catch (PSC) from the rockfish cooperatives in the Central Gulf of Alaska (GOA) Rockfish Pilot Program. to vessels using trawl gear in the GOA, according to Robert D. Mecum, Acting Administrator, Alaska Region, NMFS.

The following table summarizes the reallocation in metric tons:

PACIFIC HALIBUT	CURRENT SHARE	THIS ACTION	REVISED SHARE
Rockfish Cooperatives	171	- 135	36
Trawl Gear	1,829	+ 135	1,964

This action is necessary to provide the opportunity to vessels using trawl gear to harvest available GOA groundfish total allowable catch (TAC) under existing PSC limits, and is issued pursuant to 50 CFR 679.21(d)(5)(iii)(B). This action does not imply any change in the status of the fisheries.

Appendix IV. CASE STUDY: Observer Program Restructuring.

Excerpts from Observer Program Restructuring June 2010 Public Review Draft

Halibut Fisheries (p.10-12)

In addition to the lack of observer coverage in the less than 60' fleet, there is no observer coverage in the halibut fisheries. Halibut fisheries are only observed incidentally to groundfish operations. In 2008, 3,141 permit holders fished halibut and sablefish IFQ using 1,157 vessels.[21] There are a number of potential bycatch issues pertaining to the halibut fleet of concern to managers that could be addressed with some level of observer coverage. Most of the information gathered for management of halibut vessels (and vessels <60') currently takes place at shoreside processors, which may provide adequate catch accounting for target species and retained incidental catch species. However, discards are self-reported for all vessels in these sectors. NMFS does not currently have a verifiable measure to account for these discards, nor does it have a method for assessing the accuracy of its management decisions. Additionally, current self-reporting requirements do not include information about vessel fishing behavior.

In addition, in 1998, the U.S. Fish and Wildlife Service (USFWS) prepared a Biological Opinion (BiOp) on the commercial Pacific halibut hook-and-line fishery in the GOA and BSAI, and its effects on the short-tailed albatross *(Phoebastria albatrus)* (USFWS 1998). The USFWS concluded:

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of short-tailed albatrosses which will result from this action.

1) The research plan required by the reasonable and prudent measures of the June 12, 1996 biological opinion on the BSAI/GOA groundfish fishery will apply also to this fishery, and will be implemented.

2) Initial indications are that a given halibut vessel is far more likely to encounter a short-tailed albatross during a given unit of fishing effort than is a BSAI/GOA groundfish fishing vessel. Data supporting or refuting this supposition do not exist. ***The NMFS shall prepare and implement a plan to investigate all options for monitoring the Pacific halibut fishery in waters off Alaska. It will then institute changes to the fishery appropriate to the results of this investigation.***

3) The NMFS has done an admirable job in making commercial fishers aware of the plight of endangered birds and marine mammals. They shall continue to educate commercial fishers about seabird avoidance measures, short-tailed albatross identification, the importance of not taking short-tailed albatrosses, and ways to avoid taking them when they are sighted near bait.

In order to be exempt from the prohibitions of section 9 of the Act, the NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Terms and conditions must include reporting and monitoring requirements that assure adequate action agency oversight of any incidental take [50 CFR §402.14(I)((1)(iii) and (I)(3)]. The monitoring must be sufficient to determine if the amount or extent of take is approached or exceeded, and the reporting must assure that the USFWS will know when that happens. The NMFS must provide for monitoring the actual number of short-tailed albatrosses taken, and assure that the reasonable and prudent measures are reducing the effect of the fishery to the extent anticipated. If the anticipated level of incidental take is exceeded, the action agency must immediately stop the action causing the take and reinitiate formal consultation.

Under these terms and conditions, the NMFS must:

1) Apply the groundfish fishery seabird avoidance evaluation research plan (required by the reasonable and prudent measures of the June 12, 1996 biological opinion on the BSAI/GOA

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[21] In the CDQ halibut fisheries, 278 vessels fished 6 CDQ permits.

groundfish fishery) to this fishery, with changes appropriate to reflect differences in the timing and methodologies between the two fisheries.

2) Implement the above seabird avoidance evaluation research plan. Implementation of this plan shall begin no later than 1999. The seabird avoidance evaluation shall be comprised of experiments to test the effectiveness of seabird deterrent devices and methods, and shall use observers to monitor the effectiveness of deterrent devices and methods used by the vessels participating in the evaluation. The NMFS will report to the USFWS on the parts of the plan that have been implemented concurrent with their implementation. A final report of this seabird avoidance device and methods evaluation will be made to the USFWS by December 31, 2000.

3) The NMFS will institute changes to the Pacific halibut fishery in waters off Alaska deemed appropriate based upon the evaluation of the seabird deterrent devices and methods. ***Changes may range from requiring minimal observation of the fishery due to the effectiveness of the deterrent devices to requiring extensive observer coverage and expanded or modified use of seabird deterrent devices and methods*** *(emphasis added).*

Section 3.3.2 Background (p. 110-112)

Effective fisheries management requires that the quantity of catch be known. This information can be garnered from industry in the form of landings (fish tickets) or at-sea production reports. Quantity of retained catch represents the most basic form of catch information. Because fisheries are not 100% efficient, industry reported data may not include information on at-sea discards or interactions with species of special concern such as marine mammals or seabirds. Deduction of non-marketable catch or prohibited species catch from individual catch quotas introduces economic incentive to misreport such information. When reported values systematically differ from true values, bias may result.

The domestic observer program was established in 1990 to address the need for unbiased data on catch and biological interactions from the North Pacific groundfish fishery. The program was set up as an industry-funded "pay-as-you-go" system. Consequently, rules specifying the coverage requirements (i.e., proportion of days required to be observed) were initially set according to vessel length overall according to what was considered "fair" by industry and government representatives at the time. Based on these initial rules, vessels less than 60' LOA were not required to be observed when fishing, vessels 60' – 125' LOA were required to have observers onboard for 30% of their fishing days and one-full trip per fishery (defined by target species), and vessels >125' LOA were required to have observers onboard for 100% of their fishing days.[22] Likewise, shore-based facilities processing 500 mt - 1,000 mt per month are required to have an observer present at the facility at least 30% of the days they receive or process groundfish during that month, and facilities processing over 1,000 mt are required to be observed for 100% of their days.

The way the system is designed, for vessels and processors required to have 30% observer coverage, industry decides which fishing or processing days are to be observed to meet mandated coverage requirements in regulation. Since there is a cost associated with each day observed, vessels with low profit margins may be tempted to reduce coverage costs through non-representative fishing. Two of the most common sources of bias that can be introduced into catch estimates are fishing in non-representative areas, and fishing at non-representative times.[23] Both of these types of bias appear driven by economic incentives, as non-representative trips are commonly taken close to shore (reducing time and fuel costs) and gear is hauled immediately before and after midnight (achieving two days coverage for less than 24 hours effort).[24] In addition, the current length-based system for categorizing vessels for coverage rates

[22]Throughout this implementation plan, staff commonly refers to fleets that are required to have these at-sea coverage levels as the 'less than 60 fleet,' 'the 30% fleet,' and 'the 100% fleet.'

[23]NPFMC, 2008. Public review draft: Regulatory impact review/initial regulatory flexibility analysis for a regulatory amendment to revise administrative and procedural aspects of the North Pacific Groundfish Observer Program. Accessed 07/13/2009 and available at http://alaskafisheries.noaa.gov/npfmc/current_issues/observer/Observer408.pdf

[24] The definition of observer day is scheduled to change (likely 2010) to prohibit this latter practice.

imposes an economic incentive to alter original vessel size, especially if near 60' or 125' LOA, since observer coverage rates (and incurred vessel cost) will change by 70% from 125' to 124' and by 100% from 60' to 59'. Since the inception of the observer program, management needs have amended the original rules regarding observer coverage, resulting in a complicated set of conditions for compliance (Appendix 1). Nonetheless, the core structure of a 0%, 30%, and 100% fleet, and industry control of observer deployment in the 30% fleet, has remained in place.

Over nearly two decades, the observer program has grown into one of the largest in the world; in 2008, aggregate observer days billed to industry exceeded 39,000.[25] The Fisheries Monitoring and Analysis Division (FMA) of the Alaska Fishery Science Center is responsible for oversight of the observer program and conducts the training and debriefing of observers and the maintenance of an observer database called NORPAC. The primary objective of FMA is to provide accurate and precise data on total catch (retained catch and bycatch), and biological information for conservation and management of groundfish resources and the protection of marine mammals, seabirds, and protected species. Specifically, observer data is prioritized to meet data requirements for in-season management, stock assessment, bycatch monitoring, and regulatory compliance (MRAG 2000). The importance of verifiable independent estimates of total catch is highlighted by amendments made to the MSA in 2007 that require fishery management plans to establish mechanisms for specifying annual catch limits (ACL) at such levels that overfishing does not occur.

Catch estimation and monitoring of quotas is the responsibility of the NMFS Alaska Region Office. North Pacific fisheries have been cited as among the best managed in the world (Worm et al. 2009), and a complex suite of rules to control fishing have been enacted by the Council and NMFS that include: limited entry, trip limits, quota sharing systems (including community development, cooperative, and individual quotas), and catch limits. NMFS' catch accounting system (CAS) estimates total removals within each fishery (defined by target species, area, gear, management program, and time) whereby retained catch is added to discarded catch.

Catch sampling and estimation of total catch by the CAS has recently been documented by Cahalan et al. (2010). Briefly, the CAS uses observer-derived data in conjunction with industry-derived data. For catcher processors and motherships, the data source used to estimate retained catch is dependent on reporting requirements and observer coverage rates specified by Federal regulations that vary greatly by vessel type (50 CFR 679.50). Landing reports (fish tickets or production reports) are required from all processors that are required to have a Federal Processing Permit and which receive groundfish from catcher vessels that are issued a Federal Fisheries Permit. Processors may be at-sea (motherships), floating, or shoreside types. The collection period for a landing report is a trip (defined as the period from when fishing begins to the time of delivery) for CVs delivering to floating and shoreside processors, and a day for each catcher vessel that delivers to a mothership. In contrast to landings reports derived from CVs, catcher processors and motherships must submit at-sea production reports if issued a Federal Fisheries Permit. Production reports are required daily for both shoreside processors and the at-sea fleet.

Information about non-retained species that were caught or otherwise impacted by fishing operations from industry landings and production reports are unverifiable or absent altogether. In general, the CAS estimates retained catch from observer data collected on CPs and motherships with ≥100% observer coverage (in cases where the observer has access to flow scales) and uses landing and production reports of retained catch on CVs delivering shoreside or CPs and motherships with less than 100% observer coverage. For the same reason, the CAS uses at-sea discard rates estimated from observer data obtained from observed vessels that are fishing with similar gear, areas and/or times, and applies this rate to industry landing reports to estimate at-sea discards. At-sea discards from vessels with 100% or greater observer coverage are estimated from observer data. Total catch used for quota management is then the sum of retained and discarded catch (Cahalan et al. 2010).

[25]As determined from embark-disembark dates in NORPAC database.

The regulatory nature governing observer deployment (i.e., coverage requirements) facilitates the introduction of bias into observer data through non-representative fishing. Given the use of observer data in the CAS, and the subsequent use of CAS data in stock assessments, this issue can undermine the validity of data used to manage North Pacific groundfish fisheries. What follows serves to provide the rationale and means to reduce the bias introduced by industry control over observer coverage for fishing operations with less than 100% observer coverage requirements, should the Council recommend restructuring the observer program such that NMFS controls the deployment of observers in the North Pacific groundfish and halibut fisheries.

Section 3.3.6 Recent review of deployment and observer effects (p. 115)

While past reviews have highlighted the potential for bias to be introduced into observer data through non-representative fishing, it has remained difficult to document whether or not such potential bias is actually present. Differences in the dynamics of observed and unobserved trips can be manifested in two ways. In the first, *the selection of fishing operations to be observed* is such that those trips are not representative of unobserved trips (i.e., the "deployment effect"). In the second, a change in the fishing behavior of vessels *when they are observed* results in trips with characteristics of fishing operations (e.g., location, timing, duration) that are not representative of unobserved fishing operations (i.e., the "observer effect"). Analyses of the 30% catcher vessel fleet landings in 2008 are presented in **Appendix 8**. These analyses indicate that the current regulatory nature of observer deployment results in a skewed, non-random deployment of observers (evidence of a deployment effect), and that in some fisheries an observer effect is also present.

Section 4.3.1 Benefits from improved observer data under Alternatives 2 – 5 (p 142)

Additional benefits, compared to the status quo, are expected to varying degrees under Alternatives 2 – 5, in which the deployment and funding mechanism of the observer program is restructured. Under the proposed restructuring alternatives, the greatest increase in improvement in the collection of observer data would be expected in the sectors that currently have either 30% observer coverage requirements or no observer coverage requirements.

Reducing sources of bias

Under the existing observer program, vessels required to carry observers 30% of their fishing days choose when and where to carry observers provided that they meet the minimum coverage requirement of 30% of fishing days per quarter and at least one observed fishing trip for each target fishery. Many vessel owners prefer to carry their required coverage later rather than earlier during each quarter for several reasons. First, when vessels carry observers later in the quarter or fishing season they may have a better idea of how many coverage days will actually be needed to meet the regulatory requirement than vessels carrying observers during the start of a fishing season. Therefore, vessels carrying observers later in each quarter or season are better able to avoid exceeding their coverage requirement and paying for additional observer days that are not required. Second, some vessel owners may prefer to carry observers later in each quarter so that they can first earn revenues required to pay for observer coverage and other expenses.

The preference for coverage later in the quarter is tempered to some extent by observer providers who have observers under contract and must keep their observers deployed in order to minimize unpaid downtime. Consequently, there is a constant give and take between observer providers and vessel owners in the existing 30% coverage fleet over when and where to carry observer coverage. However, these types of coverage decisions are generally driven by the observer provider's desire for efficiency and the vessel owner's desire for predictability, with little or no regard given to scientific or management objectives. This is because NMFS does not decide when and where observers are deployed in the 30% coverage fleet. Because catch and bycatch rates fluctuate by season and area, biased decisions about when and where to deploy observers in the 30% coverage fleet has the potential to greatly affect the quality and reliability of observer data. Refer to Sections 0 and 0 of the sample design, and Appendix 8 for a more detailed treatment of this issue.

Under Alternatives 2 - 5, the existing 30% coverage requirements in regulation would be eliminated, and NMFS would determine when and where to deploy observers and how much coverage is necessary for each fishery in those sectors required to have <100% coverage. (The only exception is under Alternative 2, which proposes to restructure the observer program for the GOA groundfish and halibut fisheries and the <60' groundfish sector and halibut sector in the BSAI. Under this alternative, vessels ≥60' in the BSAI would continue under the status quo, and thus, the 30% coverage regulation would still exist for vessels operating in the BSAI that are currently subject to the 30% requirement.) Under Alternatives 2 – 5, NMFS would also have the ability to better 'match' observers' skills and experience to the deployment of observers in all fisheries, whether they are <100% covered or ≥100% covered. Fishery managers would be able to address these and other known sources of bias, to the benefit of the resulting data.

Recent examinations of the North Pacific Groundfish Observer Program have focused on operational aspects of the program and have dealt with such issues as sampling protocols, reducing bias, estimate expansion, and the statistical properties of estimates (e.g. Jensen et al. 2000, Dorn et al. 1997, Volstad et al. 1997, Pennington 1996, and Pennington and Volstad 1994). These and other studies suggest that sources of bias can be reduced and the statistical reliability of observer data improved through improvements in the manner in which observers are deployed. In particular, bias can be reduced by changing the current system, in which 30% coverage vessels can chose when and where to take observers, to a new system in which NMFS is responsible for the sample design that governs the deployment of observers among vessels in a more statistically sound manner.

Finally, in a March 2004 report, the U.S. Department of Commerce, Office of Inspector General (OIG) recommended that NMFS work with the Council to establish requirements for an observer program that includes a vessel selection process that is scientifically valid and unbiased. NOAA concurred that improved vessel selection procedures are needed for scientific data collection, and indicated that they were working with the Council to address these biases. A follow-up memorandum from the OIG to NMFS' Assistant Administrator in September 2008, documented that the OIG recommendation for this issue remains open, as fishery managers still cannot control when and where observers are placed in the North Pacific groundfish fisheries. All other recommendations in the 2004 OIG report for improving data quality, performance monitoring, and outreach efforts in NMFS observer programs have been addressed.

Lack of data in 30% sectors and sectors without coverage requirements

The current groundfish observer program throughout Alaska is one in which groundfish vessels less than 60' are not required to carry observers and vessels 60' – 125' LOA are required to carry and pay for their own observers 30% of their fishing days, regardless of gear type or target fishery.[26] These two size categories make up the majority of vessels fishing in the GOA and out of ports other than Dutch Harbor and Akutan in the BSAI. Observers on vessels greater than 60' estimate total catch for a portion of the hauls or sets, and sample these hauls or sets for species composition. These data are extrapolated to make estimates of total catch by species for the entire fishery, including unobserved vessels. Observer data from observed vessels are assumed to be representative of the activity of all vessels, and are used to estimate total catch of prohibited species for the entire fishery.[27] On average, vessels less than 60' harvested 27% of the total GOA groundfish catch from 2003 – 2007, and all of this catch was unobserved.

In addition to the lack of observer coverage in the less than 60' fleet, there is no observer coverage in the halibut fisheries. Halibut fisheries are only observed incidentally to groundfish operations. In 2008, 3,141 permit holders fished halibut and sablefish IFQ using 1,157 vessels.[28] There are a number of potential bycatch issues pertaining to the halibut fleet.[29] Most of the information gathered for management of

[26] Unless participating in a limited access quota program as described previously, which may require additional coverage.

[27] This has resulted in additional data problems owing to fishing behavior by some boat operators, when an observer is aboard, that is clearly not representative of fishing practices when unobserved. Referred to as "fishing for observer coverage", these resulting data, when extrapolated to other vessels that are unobserved, compound the potential catch and bycatch estimation errors, but to an unknown degree.

[28] Includes CDQ halibut fisheries.

[29] Note that NMFS and the IPHC are currently working through an NPRB grant to evaluate the potential for EM systems on these vessels.

halibut vessels (and vessels <60') currently takes place at shoreside processors, which may provide adequate catch accounting for target species and retained incidental catch species. However, discards are self-reported for all vessels in these sectors. NMFS does not currently have a verifiable measure to account for these discards, nor does it have a method for assessing the accuracy of its management decisions. Additionally, current self-reporting requirements do not include information about vessel fishing behavior.

Under Alternatives 2 - 5, the existing 30% coverage requirements in regulation would be eliminated, and NMFS would determine when and where to deploy observers and how much coverage is necessary for each fishery. (The only exception is under Alternative 2, which proposes to restructure the observer program for the GOA groundfish and halibut fisheries and the <60' groundfish sector and halibut sector in the BSAI. Under this alternative, the 30% coverage regulation would still exist for vessels operating in the BSAI that are currently subject to the 30% requirement.) In addition, the <60' groundfish sector and halibut sector, for both the GOA and BSAI, are included under every alternative to restructure the observer program (Alternatives 2 – 5).

Targeting coverage to address data needs

An additional benefit to a restructured program for fisheries with <100% coverage needs is the ability of NMFS to target coverage to address specific data needs. Under Alternatives 2 - 5, fishery managers would have the flexibility to adjust coverage as necessary to fill data gaps and address specific conservation or management issues for the fisheries included in the preferred alternative. For example, if questions arise about catch or bycatch by vessels operating in a specific area or time of year, NMFS would have the ability to develop the sampling design such that observers are deployed on vessels during specific times or into specific areas to address those questions. In addition, because NMFS would have greater control over the deployment of specific observers, observers could be directed and trained to engage in more specialized data collection or research than is possible today. These types of specialized projects could include more intensive data collection on specific species or species groups, data collection on gear performance and gear interactions, and more intensive data collection on interactions with marine mammals and other protected species.

Proposals for models to be used in the 2010 Pacific cod assessments

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Overview

In its December 2009 minutes, the SSC made the following recommendation:

> "The SSC recommends that proposals for model configurations be submitted to the assessment author in April. These proposals will be reviewed the Plan Team(s) and recommendations for future model runs will be vetted by the SSC in June. During the summer months, the stock assessment authors will run the selected models and will present preliminary results to the Plan Team(s) in September. The Plan Teams will then select their preferred suite of models for October SSC review based on model performance. The authors can reserve the right to bring forward additional models for the final SAFE as needed."

Accordingly, the following call for proposals was published in the February 2010 NPFMC *News & Notes*:

> "Following a recommendation from its SSC in December 2009, the Council is calling for proposals from the public for models to be considered for inclusion in the BSAI and GOA Pacific cod stock assessments. Model proposals may be as brief or as detailed as the proposers would like to make them. Proposals are to be submitted to Grant Thompson (Grant.Thompson@noaa.gov), author of the BSAI and GOA Pacific cod stock assessments, by close of business on Monday, April 19. These proposals will be collated by Dr. Thompson and circulated to the Groundfish Plan Teams for a two week review period. The Teams will convene via teleconference/web at 12:30 pm (Alaska time), May 6 to review proposals from the public, as well as previous requests for model runs from the Groundfish Plan Teams and SSC.
>
> "The purpose of the meeting is for the Plan Teams to provide their recommendations to the author and SSC; the agenda and opportunities for public participation will be structured to facilitate Plan Team discussions. The meeting will be open to the public and proposers will be permitted to summarize their proposals. Late proposals will NOT be reviewed by the Plan Teams. The SSC will review all proposals and recommendations from the author and Plan Teams in June 2010 and provide direction to Dr. Thompson for which models to include in the stock assessments for Plan team review in September 2010 and SSC review in October 2010. Contact Jane DiCosimo or Dr. Thompson for more information."

As of the April 19 deadline, proposals for Pacific cod models were received from the GOA Groundfish Plan Team, Teresa A'mar, Mark Maunder, the BSAI Groundfish Plan Team, the Freezer Longline Coalition, and the SSC.

The set of current models is shown immediately below. The next three sections show the list of proposals specific to the GOA assessment, the list of proposals specific to the BSAI assessment, and the list of proposals directed at both assessments. Under the final subheading, I have included some ideas of my own. Throughout, I have also included a few comments (shown in italic font surrounded by square brackets) to indicate relationships between proposals.

Current models

CM1) GOA Model B1.
CM2) BSAI Model B1.

The full assessments can be found at http://www.afsc.noaa.gov/refm/docs/2009/GOApcod.pdf and http://www.afsc.noaa.gov/refm/docs/2009/BSAIpcod.pdf.

Proposals specific to the Gulf of Alaska assessment

<u>GOA Groundfish Plan Team's recommendations for the GOA assessment (Nov. 2009)</u>

GPT1) Include a model run without age data. It was noted that developing a totally age-free model may be difficult and that some things may require constraining (e.g., variability in length-at-age).

GPT2) As a low priority, it may be useful to evaluate a model run from the preferred configuration but only advanced by one year for comparison with projections. For example, for the preferred 2010 assessment model, re-run with (expected) catch for 2010 and 2011 as new data inputs as if the assessment was being conducted in 2011. The idea being to compare projected numbers at age (for the same catch assumptions) with modeled numbers at age in 2011.

The full GOA Groundfish Plan Team minutes are shown in Attachment 1.

<u>Teresa A'mar's recommendations for the GOA assessment (Mar. 2010)</u>

TA1) Set the plus group to age 15, as there have not been any fish of that age or older seen in the NMFS bottom trawl survey.

TA2) Shorten season 1 from 5 months to 3 months, based on the data in the in-season management reports from 2002 on.

TA3) Set up the selectivity-at-age curves for the NMFS 27+ cm bottom trawl survey to be asymptotic or more dome shaped rather than dropping off to < 0.2 at age 8.

TA4) Put a cap on q for the NMFS < 27 cm bottom trawl survey, as the value for q in 1996 was 0.5+.

TA5) Decrease the weight on the fishery length comps for season 1, as these data may be less representative of the whole stock than the fishery length comps for the other seasons.

TA6) Decrease the lower bound for the beta5 and beta6 parameters in the double normal selectivity curves, from -10 to -20 or -30.

Mark Maunder's recommendations for the GOA assessment (Apr. 2010)

MM1) Model B2 (from the 2009 SAFE report) without mean size at age data. [*This is similar to GPT1, if variability in length at age is constrained in GPT1.*]

MM2) Model MM1 and estimating the two parameters describing the variation in length-at-age. [*This is similar to GPT1, if variability in length at age is* not *constrained in GPT1.*]

A fuller discussion of these two proposals, along with a discussion of some other models considered but not proposed, is given in Attachment 2.

Proposals specific to the Bering Sea and Aleutian Islands assessment

BSAI Groundfish Plan Team's recommendations for the BSAI assessment (Nov. 2009)

BPT1) Current Model B1. [*This is the same as CM2.*]

BPT2) Model B1 with data-based estimates of ageing bias from the radiocarbon study if available.`

BPT3) Model B2 without mean length at age data and with maturity a function of length rather than age.

The full BSAI Groundfish Plan Team minutes are shown in Attachment 1.

Freezer Longline Coalition's recommendations for the BSAI assessment (Apr. 2010)

FLC1) Model B2 (from chapter 2 of the 2009 SAFE report) without mean size at age data. [*This is similar to BPT3, except that BPT3 also calls for describing maturity as a function of length rather than age.*]

FLC2) Model FLC1 and estimating the two parameters describing the variation in length-at-age.

FLC3) Model FLC2, eliminating the cohort specific growth, and estimating annual deviations in the three growth model parameters with the same standard deviation (0.04) as was used for the cohort specific deviates.

A fuller discussion of these three proposals, along with a discussion of some other models considered but not proposed, is given in Attachment 3.

Proposals directed at both assessments

SSC's recommendations for both assessments (Dec. 2009)

SSC1) Evaluate incorporating age conditioned on length rather than age composition and mean size-at-age.

SSC2) Evaluate the use of informative priors on selectivities to alleviate convergence problems and constrain selectivity parameters to preserve a reasonable shape.

SSC3) Exclude fishery age composition data unless a reasonable spatial distribution of samples becomes available.

SSC4) The IPHC survey does not appear to inform the model and should be removed. [*This actually applies only to the BSAI model, because only the BSAI model currently includes IPHC data.*]

SSC5) Evaluate spatial temporal variation in fishery CPUE trends for next year (time permitting).

The part of the SSC minutes that addresses both assessments together is shown in Attachment 1.

<u>My list of possible ideas to pursue for both assessments</u>

GT1) Consider using a finer scale for structuring length bins. The current structure, which uses 3-cm bins for lengths between 9 and 45 cm and 5-cm bins for lengths greater than 45 cm, was adopted in about 1993 when a maximum of 25 length bins was allowed. Rick Methot has suggested that the current bin structure may be too coarse for accurate estimation of growth parameters in particular. It should be noted, however, that changing the bin structure in the BSAI model may necessitate deleting the pre-1982 portion of the bottom trawl survey time series, because the original size composition files may no longer exist.

GT2) Consider using a different seasonal structure. As with the length bin structure described above, the current structure was adopted in about 1993, when a maximum of 3 seasons was allowed. The original seasonal structure was requested by industry representatives, but a different structure may better reflect current fishing practices. [*This is similar to TA2, but more general.*]

GT3) Consider trying to estimate catchability internally (again). Now that the SSC has withdrawn its opposition to the use of informative priors for selectivity parameters [*see SSC2*], estimation of catchability may be somewhat less problematic than was previously the case. The current method of fixing the product of selectivity and catchability across the 60-81 cm size range at the value estimated by Nichol et al. (2007, *Fisheries Research* 86:129-135) implies a high degree of certainty in that estimate, but the data actually imply a huge amount of *un*certainty (2009 BSAI assessment, Attachment 2.1).

BSAI Groundfish Plan Team (November, 2009)

Pacific cod Grant Thompson reviewed the alternative models during the joint team meeting. The joint teams discussed the advisability of using the age composition data and the reliability of the bias correction procedure. At the opening of the BS/AI discussion, Dana Hanselman put forth that the bias correction, although not based on any external data, was effective, as shown by its success in bringing the survey modes and mean lengths at age into line. Mike Sigler agreed. Grant Thompson pointed out that in fact the model predictions matched the survey modes without the bias correction; the real benefit was a better fit to the age composition data. Dave Barnard supported model B1. Bill Clark commented that even Model B2 used the questionable bias correction to fit mean length at age along with length composition data, so it was also suspect. A majority of the team favored Model B1, while others supported Model A2, mostly due to concerns about the age data.

Kerim Aydin pointed out that the key issue that resulted in the very large number of model runs is the applicability of the age data. Tom Helser, AFSC, plans to complete a bomb radiocarbon study with IPHC within the next year to aid in resolution of the issue of whether to use the age data in the model.

The team adopted the ABC and OFL values produced by Model B1 without dissent. Two industry representatives suggested that the team adopt a rollover of the 2009 ABC in view of the projected sharp increase in biomass in 2011. Mike Sigler replied that model projections change each year as the assessment model is updated with new data. Grant Thompson clarified that the team could not adopt an ABC that is above the maximum permissible ABC produced by the accepted model.

<u>Request to the assessment author</u> The Team requested that the lead author analyze three alternative models for the September 2009 meeting:

1) *current Model B1,*
2) *Model B1 with data-based estimates of aging bias from the radiocarbon study if available, and*
3) *Model B2 without mean length at age data and with maturity a function of length rather than age.*

<u>Request to the AFSC</u> The team considered new operational policies to avoid the large number of models that have characterized the assessment for the last several years, which overloads the lead author and team each year. The team requests the AFSC adopt an earlier deadline than exists for public requests for specific model runs so that assessment author(s) have time to evaluate these model runs for consideration by the team at the September meeting. The team further requests the AFSC filter those proposals, along with SSC and Plan Team requests, for alternative cod models so as to schedule selection of final model runs at the September Plan Team meeting (and October SSC meeting). This would facilitate examination of likely preferred alternative model runs by the team each November (and by the SSC each December). This would better notify the public of likely outcomes for determination of ABC each cycle.

GOA Groundfish Plan Team (November, 2009)

Grant Thompson provided a review of ageing data as implemented in GOA Pacific cod assessment. In September, Tom Helser presented issues surrounding age-determinations including the "edge-effect." This effect deals with otolith growth past the deposition of an annulus. This information led the Plan Team in September to ask Grant to apply a bias correction term to better accommodate using age data, which he did. In the 2008 assessment, the age data for most models were heavily down-weighted. The Team discussed developments of the model and endorsed B1, which did not down-weight the age data, for ABC recommendation purposes. The category of "A" models retained a number of issues identified last year (though the Team appreciated having them presented for comparative purposes).

Paul Spencer noted that the bias correction factor estimate may not be having the desired effect and may be due to spurious model factors rather than specific age-error bias. The Team encouraged pursuit of age-validation studies for young Pacific cod so that the correction factor can be better evaluated.

The Team discussed key differences from the "A" set of models including: cohort-specific growth, not allowing selectivity to be estimated in final year. The Team's choice of model B1 was due to discomfort in ignoring age data (particularly since some resolution of the edge-effect has been achieved). While the bias correction as applied may be imperfect, the Team recognizes this is a step in the right direction and works within the constraints of the software being used. The Team anticipates future work with ageing and application of the age data.

Population trends indicate that, based on survey results and anecdotal reports, the abundance of pre-recruit- sized Pacific cod is high. As such, the near term projections are for an increasing population biomass.

Grant provided ideas for model evaluations in future: to re-evaluate q and M (jointly), investigate alternative stock-recruit relationships, evaluate fuller specifications of process errors, and examine weights given to datasets. Mark Maunder commented on whether redefining harvest control rules so that harvest rate remained constant was tenable since if the goal of attaining B40% (or Bmsy) should occur without changing the harvest rate. This may be a Tier 1 qualification issue but could also be reexamined in conjunction with revised control rules for ACL analysis (anticipated to occur in the next few years).

The Team recommends use of model B1 for specifications for 2010 and 2011. The Team recommends use of the same apportionment methodology as per previous years by averaging the biomass distribution from the three most recent surveys.

Plan Team recommendations for the next assessment:

1) *Include a model run without age data. It was noted that developing a totally age-free model may be difficult and that some things may require constraining (e.g., variability in length-at-age).*
2) *As a low priority, it may be useful to evaluate a model run from the preferred configuration but only advanced by one year for comparison with projections. For example, for the preferred 2010 assessment model, re-run with (expected) catch for 2010 and 2011 as new data inputs as if the assessment was being conducted in 2011. The idea being to compare projected numbers at age (for the same catch assumptions) with modeled numbers at age in 2011.*

SSC (December, 2009)

GOA & BSAI Pacific cod

Grant Thompson (NMFS-AFSC) presented the GOA and BSAI stock assessments for Pacific cod. Mark Maunder and Kenny Down (Freezer Longliner Coalition) provided public testimony on concerns with the current model and recommended a number of alternative model configurations. Gerry Merrigan (Prowler Fisheries) suggested a rollover of the 2009 ABC in view of the projected sharp increase in biomass in 2011.

The stock assessments for Pacific cod in both the BSAI and GOA continue to go through a number of changes to improve model fit to survey abundance and size and age composition information. Changes to model structure, additions of data to the model, and comparisons of model sensitivity were well presented and documented. The SSC commends the authors of this assessment for responding to requests from the SSC, plan teams, and the public for numerous model runs.

A revised reference model B1 was developed for both BSAI and GOA stocks. Model B1 incorporated a number of changes based on recommendations from the Plan team and SSC. This is the first time cohort-specific growth and an adjustment for an apparent ageing bias was included in the model to address a potential bias in the age data. Because it is not currently possible to estimate bias within the model, the bias adjustment was estimated iteratively and incorporated into the ageing error matrix. Although there are concerns over how this was accomplished (based upon best fit of the model), the bias adjustment did improve model fit to the age data. At the September 2009 team meeting Tom Helser (NMFS-AFSC) presented information regarding the age reading data, but there remain a number of questions that will require additional analyses to fully understand the uncertainty concerning the age readings. Hypotheses about the existence of ageing bias include: 1) age samples and length samples are taken from survey hauls with spatially distinct growth characteristics; 2) growth is highly variable and changes rapidly, particularly for younger ages showing pronounced ontogenetic structure; and 3) the age determination methods introduce a bias. The SSC encourages studies to evaluate the causes for the mismatch between survey length modes and estimated mean length at age of younger fish in the Bering Sea and difficulty of fitting age compositions in the Gulf of Alaska.

The SSC recommends that proposals for model configurations be submitted to the assessment author in April. These proposals will be reviewed the Plan Team(s) and recommendations for future model runs will be vetted by the SSC in June. During the summer months, the stock assessment authors will run the selected models and will present preliminary results to the Plan Team(s) in September. The Plan Teams will then select their preferred suite of models for October SSC review based on model performance. The authors can reserve the right to bring forward additional models for the final SAFE as needed.

SSC Recommendations to the assessment author:

- *Evaluate incorporating age conditioned on length rather than age composition and mean size-at-age.*
- *Evaluate the use of informative priors on selectivities to alleviate convergence problems and constrain selectivity parameters to preserve a reasonable shape*
- *Exclude fishery age composition data unless a reasonable spatial distribution of samples becomes available.*
- *The IPHC survey does not appear to inform the model and should be removed.*
- *Evaluate spatial temporal variation in Fishery CPUE trends for next year (time permitting).*

The SSC has identified the following research priorities for Pacific cod:

1) Catchability estimation, including a comparison of net efficiencies between the Bering Sea and Gulf of Alaska survey gear.
2) Estimation of natural mortality independent of the model.
3) Recruitment dynamics to better understand the factors that result in strong recruitment events.

$$p(\theta | y) = \begin{Bmatrix} \textbf{Q} \\ \textbf{R} \\ \textbf{A} \end{Bmatrix} \begin{matrix} \textit{uantitative} \\ \textit{esource} \\ \textit{ssessment} \end{matrix}$$

LLC

Quantitative Resource Assessment LLC
San Diego, CA
USA.

This document outlines a set of proposed models for the GOA cod assessment. The rationale for the proposed models is based on several model runs that are detailed in this document and on previous model runs and reports by the assessment authors and by industry scientists.

Proposed Models

1) Model B2 (from the 2009 SAFE report) without mean size at age data
2) Model (1) and estimating the two parameters describing the variation in length-at-age

The models proposed above should be viewed in the context of other proposed models and the intent to avoid using age data until the aging issue is resolved. Therefore, modification of these proposals may be appropriate. The characteristics of these proposed models should be considered for any other proposed models as well.

The value of 0.04 for the standard deviation of the annual deviations in the growth model parameters was chosen to be consistent with the assumption used for the cohort specific deviates. No attempt was made to estimate these values. The values could be estimated in the same way as the value was estimated for the cohort specific deviates.

A model with a more flexible growth curve would also be desirable, but an appropriate growth curve is currently not available in Stock Synthesis.

Rationale for excluding the age data

We have argued for several years that the evidence suggests that the aging data is biased and should not be used in the assessment until the issue has been resolved. A presentation at the September Plan Team provided additional evidence that the age data may be biased. There are several arguments against using the age data in the assessment model.

1) The explicit inclusion of a correction factor for aging bias in the assessment model and the request by the Plan Team to include the bias correction factor provides recognition that there is an issue with the aging data.

2) The fit to the mean size-at-age data is better when no age composition data is included (B2) compared to when the age composition data is included (B1). This indicates an inconsistency between the age composition data and the mean size-at-age data.

3) The models that use age data apply a correction factor to adjust for the apparent aging error. This correction factor uses a constant amount of bias (0.4) for all ages 2 and above. The correction factor was determined by trying a range of values over different ages and comparing the fit based on the likelihood. The aging error is likely to be more complicated than a simple bias. The variance in the aging error is also likely to be affected and it is probably not symmetrical as assumed in the model. Therefore, it is unclear if the correction factor appropriately adjusts for the aging error.

Summary of results

We investigate several different model scenarios based on the B2 model from last year. All the B2 models DO NOT use the mean size at age data to be consistent with the intent of the B2 model. The characteristics investigated include: estimating temporal deviates in the growth model parameters rather than having cohort specific growth, estimating natural mortality, estimating an age-specific natural mortality, and estimating the variation of length at age. The definitions describing the models are reported in table 1. The results of the B2 models are presented in table 2. The main results are discussed below. It should be noted that the GOA assessment model has convergence issues and no systematic evaluation of the convergence was carried out.

When the mean size at age data is removed from the B2 model, the estimated growth parameters are only slightly different. The fit to both the size composition data and the survey abundance indices are better. The estimated population size is larger and less depleted.

The model changes that stand out as making the most difference in the fit to the data are the estimation of the parameters that describe the variation of length-at-age, replacing cohort specific growth with annual deviates in the three parameters of the von Bertananffy growth curve (Gdev), and estimating age specific natural mortality. For all of these changes the biggest improvement comes in the fit to the length-frequency data. The estimated parameters for the variation of length at age and the growth parameters are reasonable (Figure 1). However, the model with growth deviates did not have a positive definite hessian (this suggests that the estimates may not have been the best estimates). It is difficult to determine the statistical significance of the growth deviates because they should be treated as random effects. None of the three parameters treated independently fit the data as well as the cohort specific growth (which has the same number of parameters). Therefore, it is difficult to determine if variability in the growth parameters is better than the cohort specific growth.

Age specific natural mortality had parameters estimated at ages 1, 2, and 8. Ages 2 and 8 represent the age when individuals first start to become mature and when they are nearly all mature. When a single natural mortality is estimated, the estimate is slightly higher than the assumed value and very precise. The model with age-specific natural mortality estimate ages 1 and 2 mortality close to zero and age 8 at 0.52. These results do not provide a clear indication of how M should be structured or if M can be reliably estimated. Further investigation is needed.

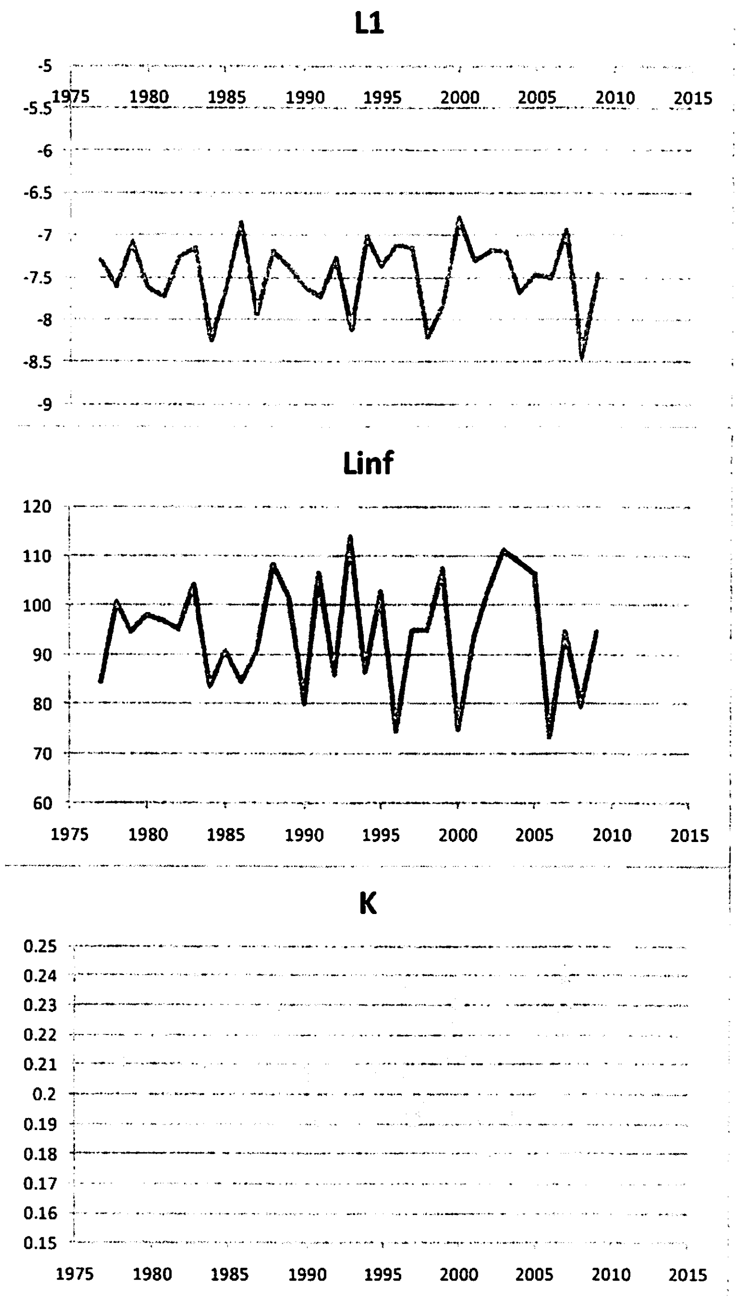

Figure 1. Annual estimates of the three parameters of the growth model using model B2.

Table 1. Definitions of acronyms to define model scenarios

Gdev	Estimate temporal deviates in growth parameters and no cohort specific (sd=0.09)
Mage	Estimate age specific M
Mest	Estimate M
Lsd2	Estimate both parameters for the standard deviation of length at age
L1dev	Estimate temporal deviates in the mean length at age zero and no cohort specific (sd=0.09)
L2dev	Estimate temporal deviates for the L-infinity parameter and no cohort specific (sd=0.09)
Kdev	Estimate temporal deviates in the growth rate parameter and no cohort specific (sd=0.09)

Table 2. Results of the models based on the original model B2. "nohess" indicates that the hessian was not positive definite.

	B2	B2 No mean size	Lsd2	Gdev (nohess)	Kdev	L1dev	L2dev (nohess)	Mest	Mage
S0	527561	566825	587087	470212	488468	608333	452265	568694	618967
S2009	214605	300197	334075	292374	279003	267346	292828	302280	315750
S2009/S0	0.41	0.53	0.57	0.62	0.57	0.44	0.65	0.53	0.51
Parameters									
M	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.42	
Lmin	-3.86	-3.62	-4.07	-7.45	-7.68	-10.50	-6.15	-4.03	-2.95
Lmax	100.86	98.81	92.55	94.67	98.78	97.34	93.79	99.57	103.16
K	0.18	0.18	0.21	0.21	0.19	0.20	0.20	0.18	0.17
Cvmin	1.87	1.87	1.36	1.87	1.87	1.87	1.87	1.87	1.87
Cvmax	6.53	6.53	8.71	6.53	6.53	6.53	6.53	6.53	6.53
R0	12.42	12.54	12.60	12.63	12.58	12.54	12.66	12.82	11.15
R1	-0.47	-0.28	-0.25	-0.09	-0.33	-0.39	-0.12	-0.11	-0.05
Finit	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Qenv	0.79	0.73	0.62	0.63	0.62	0.72	0.44	0.58	0.59
Q27plus	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Qsub27	-2.01	-2.19	-2.14	-2.22	-2.20	-2.15	-2.25	-2.39	-1.37
Like									
TOTAL	1530.39	1120.16	1075.49	1070.18	1180.45	1251.53	1123.28	1117.62	1075.52
Equil_catch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Survey	-5.52	-10.91	-15.20	-8.97	-8.43	-6.24	-9.35	-12.40	-14.96
Length_comp	1249.30	1131.35	1076.88	1048.65	1170.30	1228.32	1116.35	1132.84	1093.02
Age_comp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Size_at_age	271.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recruitment	-17.35	-14.08	-6.57	-20.36	-20.06	-22.30	-18.71	-15.99	-17.83
Parm_softbounds	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.06	0.00
Parm_devs	32.48	13.74	20.33	50.80	38.58	51.69	34.94	13.12	15.23

$$p(\theta \mid y) = \begin{Bmatrix} \mathbf{Q} \\ \mathbf{R} \\ \mathbf{A} \end{Bmatrix} \begin{matrix} \textit{uantitative} \\ \textit{esource} \\ \textit{ssessment} \end{matrix}$$

LLC

Quantitative Resource Assessment LLC

San Diego, CA

USA.

This document outlines a set of proposed models for the BS cod assessment. The rationale for the proposed models is based on several model runs that are detailed in this document and on previous model runs and reports by the assessment authors and by industry scientists.

Proposed Models

1) Model B2 (from chapter 2 of the 2009 SAFE report) without mean size at age data
2) Model (1) and estimating the two parameters describing the variation in length-at-age
3) Model (2), eliminating the cohort specific growth, and estimating annual deviations in the three growth model parameters with the same standard deviation (0.04) as was used for the cohort specific deviates.

The models proposed above should be viewed in the context of other proposed models and the intent to avoid using age data until the aging issue is resolved. Therefore, modification of these proposals may be appropriate. The characteristics of these proposed models should be considered for any other proposed models as well.

The value of 0.04 for the standard deviation of the annual deviations in the growth model parameters was chosen to be consistent with the assumption used for the cohort specific deviates. No attempt was made to estimate these values. The values could be estimated in the same way as the value was estimated for the cohort specific deviates.

A model with a more flexible growth curve would also be desirable, but an appropriate growth curve is currently not available in Stock Synthesis.

Rationale for excluding the age data

We have argued for several years that the evidence suggests that the aging data is biased and should not be used in the assessment until the issue has been resolved. A presentation at the September Plan

Team provided additional evidence that the age data may be biased. There are several arguments against using the age data in the assessment model.

1) The explicit inclusion of a correction factor for aging bias in the assessment model and the request by the Plan Team to include the bias correction factor provides recognition that there is an issue with the aging data.

2) The fit to the mean size-at-age data is better when no age composition data is included (B2) compared to when the age composition data is included (B1). This indicates an inconsistency between the age composition data and the mean size-at-age data.

3) The effective sample size estimated for the age composition data is lower than assumed in the model indicating that the age composition data should be further down weighted.

4) The 2008 fishery age data has larger size at age than the survey age data even though it is collected five months earlier.

5) The models that use age data apply a correction factor to adjust for the apparent aging error. This correction factor uses a constant amount of bias (0.4) for all ages 2 and above. The correction factor was determined by trying a range of values over different ages and comparing the fit based on the likelihood. The aging error is likely to be more complicated than a simple bias. The variance in the aging error is also likely to be affected and it is probably not symmetrical as assumed in the model. Therefore, it is unclear if the correction factor appropriately adjusts for the aging error.

Summary of results

We investigate several different model scenarios based on the B1 and B2 models from last year. All the B2 models DO NOT use the mean size at age data to be consistent with the intent of the B2 model. The characteristics investigated include: using the fishery CPUE data, estimating the survey catchability, estimating temporal deviates in the growth model parameters rather than having cohort specific growth, estimating natural mortality, estimating an age-specific natural mortality, estimating the variation of length at age, using maturity at length rather than maturity at age, dropping the cohort specific growth, and using the Richards growth curve. The definitions describing the models are reported in table 1. The results of the B1 models are presented in table 2. The results of the B2 models are presented in table 3 and for those with annual deviates in the growth model parameters in table 4. Estimates of age-specific natural morality for the relevant models are presented in table 5. The main results are discussed below.

When the mean size at age data is removed from the B2 model, the estimated growth parameters are different as might be expected. The fit to the size composition data is considerably better and the fit to the survey abundance indices is worse. The estimated population size is larger and less depleted.

The two model changes that stand out as making the most difference in the fit to the data are the estimation of the parameters that describe the variation of length-at-age (EstLsd and EstLsd2) and replacing cohort specific growth with annual deviates in the three parameters of the von Bertananffy growth curve (Gdev). For both of these changes the biggest improvement comes in the fit to the length-frequency data. The estimated parameters for the variation of length at age and the growth parameters are reasonable (Figure 1). Estimated mean length at age shows more variability under the model with annual variation in growth model parameters than for cohort specific growth (Figure 2). It is difficult to determine the statistical significance of the growth deviates because they should be treated as random effects. However, based on the substantial reduction in the negative log-likelihood, both of these changes appear appropriate. It should be noted that the annual growth deviates may explain variation caused by other processes, model misspecification, or sampling error. The latter is particularly relevant since the sample sizes for the composition data and the standard deviation for the survey indices of abundance are fixed. It should be noted that when using methods that allow growth to change over time (either the cohort method or the annual deviations in the growth model parameters) a decision needs to be made about the growth model parameters used to calculate the unexploited biomass and this decision can influence the management quantities (e.g. S/S0).

Estimating natural mortality also provides a moderate improvement in the fit to the data, particularly the three parameter age-structured natural mortality. Age specific natural mortality had parameters estimated at ages 1, 2, and 8. Ages 2 and 8 represent the age when individuals first start to become mature and when they are nearly all mature. When a single natural mortality is estimated, the estimate is slightly higher than the assumed value and very precise. All models with age-specific natural mortality estimate age 2 mortality higher than age 8. Model B1 estimates age 1 very high, while the B2 models estimate age 1 mortality lower than age 2. This pattern in natural mortality estimated by the B2 models is different than expected. However, the estimate of natural mortality for age 1 is very imprecise and the value could be much higher. In fact, the value of natural mortality for age 1 does not appear to influence the results (not shown). It is interesting to note that for model B1 the fit to the size composition is worse when estimating M while the fit to the age and mean size at age data is better. If natural mortality is estimated as a random walk with age, the natural mortality has a declining trend to very low values at old ages (Figure 3). However, there is very little information about the natural mortality for ages greater than age five. The estimate for age four is unrealistically high, but precisely estimated, indicating that there is some form of model misspecification related to this age. This is also the case for model B1. These results do not provide a clear indication of how M should be structured or if M can be reliably estimated. Further investigation is needed.

Combining scenarios so that multiple additional parameters are estimated still improves the fit to the data. For example, estimating annual variation in the growth parameters, age-specific natural mortality, and the variation of length at age for the oldest age improves the fit substantially over leaving one of these parameters out.

The estimate of the length at age zero is negative indicating that the growth model may not be flexible enough to represent growth for this species. Using the Richards curve as implemented in Stock Synthesis is problematic because it has numerical problems when age zero length is negative. A constrained Richards curve (length at age zero is constrained to be positive) fits the data substantially worse than the von Bertalanffy model. The models underestimate the mean size of the oldest individuals. Including a more flexible growth curve in stock synthesis should be a priority. At a minimum the Richards curve in Stock Synthesis should be improved so that negative lengths at ages not used in the model fitting (e.g. age zero) are allowed. A growth curve that allows age-specific deviations around the von Bertalanffy or Richards curve for a user defined set of ages would be an even better option and should be implemented in Stock Synthesis.

The model that fits to all the fishery CPUE and survey abundance data tends to fit the Jan-May CPUE better for all fisheries (the estimated standard deviations used in the likelihood function were moderate(around 0.20 or less) for these fisheries while the other fisheries tended to be 0.3 or higher). However, it is interesting to note that for the trawl and longline fisheries, there is a breakdown in the fit in the early 2000s (Figure 4).

Estimating catchability for the surveys has only a small improvement in the fit compared to the other model changes. The estimated catchability is higher for both the early and late surveys.

Using maturity at length rather than at age only has a small influence on the spawning biomass and spawning biomass depletion estimates.

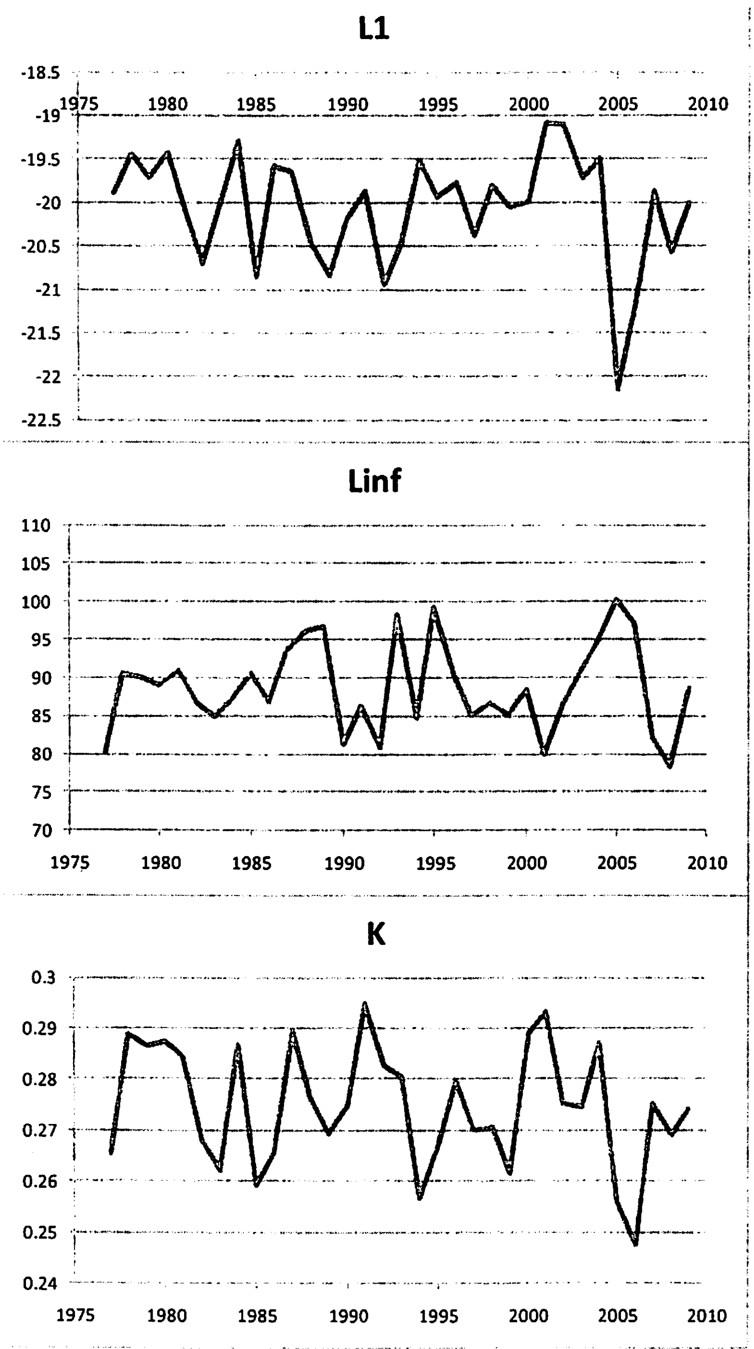

Figure 1. Annual estimates of the three parameters of the growth model using model B2.

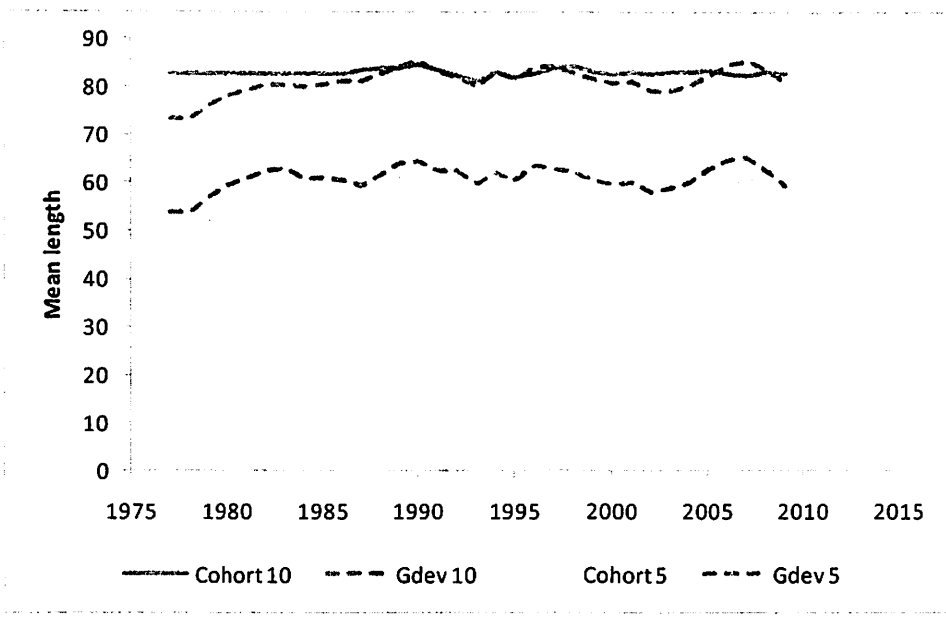

Figure 2. Mean length at ages 5 and 10 years for the B2 models with cohort specific growth (Cohort) and annual variation on the growth model parameters (Gdev).

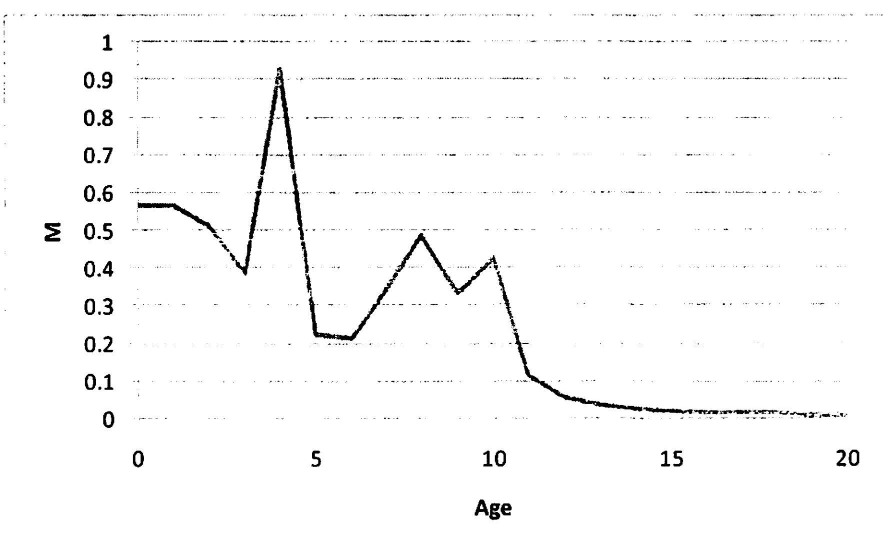

Figure 3. Estimates of natural mortality at age from model B2 when treated as a random walk.

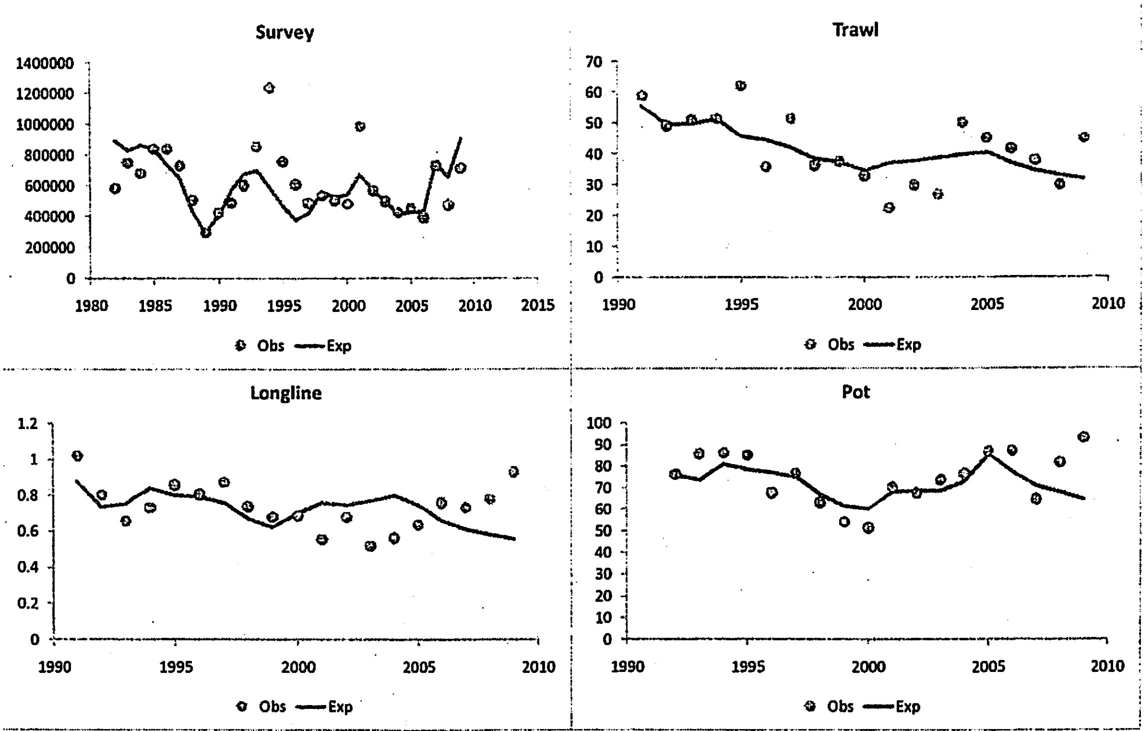

Figure 4. Fits of the model to the survey and Jan-May fisheries CPUE data for model B2CPUE.

Table 1. Definitions of acronyms to define model scenarios

CPUE	Use all fishery CPUE and survey abundance index data and estimate the standard deviations for the respective likelihood functions for the fishery CPUE and survey data.
estq	Estimate catchability for the post 1981 survey
Gdev	Estimate temporal deviates in growth parameters and no cohort specific
Mage	Estimate age specific M
Mest	Estimate M
EstLsd	Estimate the parameter for the standard deviation of length at age for the oldest individuals
EstLsd2	Estimate both parameters for the standard deviation of length at age
MatLength	Use maturity at length rather than maturity at age
NoCohortG	Cohort specific growth not used
Richards	Use the Richards 4 parameter growth curve

Table 2. Results of the models based on the original model B1

	B1	CPUE	estq	Gdev	Mage	Mest	EstLsd	EstLsd2
like	2604.15	2462.66	2598.85	2529.56	2591.73	2596.55	2164.08	2087.86
S0	1819010	1898950	1697750	1685870	1649040	1709370	1518160	1597160
S2009	626435	704180	529752	641882	496337	560355	558654	580723
S2009/S0	0.34	0.37	0.31	0.38	0.30	0.33	0.37	0.36
Parameters								
M	0.340	0.340	0.340	0.340	NA	0.360 (0.005)	0.340	0.340
L1	-15.0	-15.0	-14.8	-15.3	-14.9	-14.7	-14.0	-13.2
L2	95.9	96.2	96.6	96.4	96.4	96.8	95.9	100.5
K	0.22	0.22	0.21	0.22	0.22	0.21	0.21	0.20
sd1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	3.67556
sd2	8.68	8.68	8.68	8.68	8.68	8.68	12.50	9.36
R0	13.37	13.40	13.29	13.38	14.93	13.47	13.20	13.21
R1	-0.92	-1.06	-1.00	-1.02	-0.94	-0.91	-1.32	-1.39
InitF	0.06	0.07	0.07	0.08	0.07	0.06	0.15	0.16
lnQ1	0	0	0.29	0	0	0	0	0
lnQ2	-0.26	-0.26	-0.16	-0.26	-0.26	-0.26	-0.26	-0.26
Likelihoods								
Eq catch	0.00	0.01	0.01	0.01	0.01	0.00	0.02	0.02
Survey	-21.83	-163.71	-24.91	-16.37	-24.09	-22.95	-3.33	-4.18
Size	1526.48	1540.61	1535.25	1494.87	1533.81	1537.96	1410.85	1398.16
Age	160.78	158.46	158.96	154.29	152.52	157.99	137.01	131.70
mean size	897.29	885.74	885.94	781.81	889.80	882.95	567.15	506.86
Recruit	9.08	9.54	9.60	8.44	9.50	7.54	20.92	23.07
Bounds	0.03	0.04	0.03	0.03	0.03	0.03	0.04	0.04
Dev	32.33	31.99	33.98	106.48	30.15	33.04	31.44	32.20

Table 3. Results of the models based on the original model B2

	B2	Nomeansize (Model 1)	CPUE	Estlsd	Estlsd2 (Model 2)	Estq	Mage	MageLsdest	MatLength	Mest	MestLsdest	NoCohortG
Like	2619.85	1564.92	1409.08	1452.39	1448.69	1562.18	1537.03	1435.86	1564.92	1562.18	1443.07	1740.34
S0	1881910	1997180	2110510	1759910	1761020	1793390	1691500	1512070	2030820	1896630	1552630	2021790
S2009	691476	801030	860226	709657	703573	636420	471485	477663	831292	741156	590264	806809
S2009/S0	0.37	0.40	0.41	0.40	0.40	0.35	0.28	0.32	0.41	0.39	0.38	0.40
Parameters												
M	0.340	0.340	0.340	0.340	0.340	0.340	NA		0.340	0.357 (0.007)	0.382	0.340
L1	-15.2	-18.9	-19.6	-16.6	-16.0	-19.2	-19.4	-17.1	-18.9	-19.1	-16.8	-20.0
L2	94.7	91.2	91.0	91.3	92.4	91.9	90.5	91.9	91.2	92.0	93.7	91.3
K	0.22	0.26	0.26	0.24	0.24	0.26	0.26	0.25	0.26	0.26	0.24	0.26
sd1	0.01	0.01	0.01	0.01	0.571258	0.01	0.01	0.01	0.01	0.01	0.01	0.01
sd2	8.68	8.68	8.68	10.33	9.87	8.68	8.68	10.28	8.68	8.68	10.46	8.68
R0	13.41	13.44	13.48	13.34	13.33	13.31	13.99	13.47	13.44	13.51	13.52	13.45
R1	-0.84	-0.73	-0.79	-0.92	-0.95	-0.81	-0.79	-0.97	-0.73	-0.77	-1.05	-0.65
InitF	0.05	0.04	0.04	0.06	0.06	0.05	0.06	0.08	0.04	0.04	0.08	0.04
lnQ1	0	0	0	0	0	0.16	0	0	0	0	0	0
lnQ2	-0.26	-0.26	-0.26	-0.26	-0.26	-0.11	-0.26	-0.26	-0.26	-0.26	-0.26	-0.26
Likelihoods												
Eq catch	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
Survey	-24.10	-19.83	-166.47	-25.25	-26.17	-21.74	-26.14	-27.86	-19.83	-19.97	-25.27	-20.08
Size	1723.78	1549.03	1536.93	1433.43	1430.13	1548.11	1525.10	1421.07	1549.03	1548.03	1428.48	1742.22
age	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
mean size	878.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
recruit	8.40	7.98	9.29	14.62	14.78	8.16	13.19	16.42	7.98	6.91	12.14	6.41
bounds	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Dev	33.33	27.72	29.30	29.56	29.91	27.61	24.85	26.19	27.72	27.18	27.68	11.75

Table 4. Results of the models based on the original model B2 with annual deviates for the growth parameters

	nomeansize	Gdev	GdevLsdest	GdevLsdest2 (Model 3)	GdevLsdestMest	GdevLsdestMage	GdevLsdest2Mage	RichardsLsd2
Like	1564.92	1376.59	1329.07	1328.82	1321.38	1310.42	1309.03	1478.71
S0	1997180	1404030	1343500	1347410	1192000	1065210	1055150	1726910
S2009	801030	785087	734793	736087	610682	448944	444029	695524
S2009/S0	0.40	0.56	0.55	0.55	0.51	0.42	0.42	0.40
Parameters								
M	0.340	0.340	0.340	0.340	0.377			0.340
L1	-18.9	-20.0	-18.5	-18.3	-18.4	-18.5	-18.2	0.0
L2	91.2	88.5	89.0	89.2	91.1	88.6	90.0	87.6
K	0.26	0.27	0.26	0.26	0.26	0.27	0.26	0.32
sd1	0.01	0.01	0.01	0.151275	0.01	0.01	0.397194	1.70634
sd2	8.68	8.68	9.77	9.66	9.86	9.68	9.41	10.12
R0	13.44	13.46	13.40	13.40	13.55	13.47	13.65	13.32
R1	-0.73	-0.41	-0.61	-0.62	-0.70	-0.97	-0.59	-0.94
InitF	0.04	0.04	0.06	0.06	0.07	0.08	0.08	0.06
lnQ1	0	0	0	0	0	0	0	0
lnQ2	-0.26	-0.26	-0.26	-0.26	-0.26	-0.26	-0.26	-0.26
Likelihoods								
Eq catch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Survey	-19.83	-27.27	-28.38	-28.11	-29.35	-31.76	-31.27	-23.73
Size	1549.03	1316.60	1280.27	1279.58	1274.63	1265.71	1263.59	1452.34
age	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
mean size	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
recruit	7.98	2.07	6.67	6.56	5.50	7.03	6.59	15.16
bounds	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Dev	27.72	85.16	70.48	70.75	70.57	69.40	70.08	34.91

Table 5. Estimates of age specific natural mortality

	B1	B2			
Age			MageLstest	GdevLsdestMage	GdevLsdest2Mage
1	1.189 (0.481)	0.482 (0.481)	0.250 (0.499)	0.374 (0.515)	0.316 (0.505)
2	0.431 (0.032)	0.611 (0.032)	0.533 (0.036)	0.587 (0.039)	0.576 (0.041)
8	0.329 (0.014)	0.247 (0.014)	0.297 (0.021)	0.257 (0.022)	0.275 (0.026)

JOINT MEETING OF THE BSAI AND GOA GROUNDFISH PLAN TEAMS
May 6, 2010

Members of the Plan Teams present for the meeting included those shown in bold below.

Loh-Lee Low	AFSC REFM (BSAI chair)	**Jim Ianelli**	**AFSC REFM (GOA co-chair)**
Mike Sigler	**AFSC (BSAI Vice chair)**	**Diana Stram**	**NPFMC (GOA co-chair)**
Kerim Aydin	**AFSC REFM**	**Sandra Lowe**	**AFSC REFM**
Lowell Fritz	AFSC NMML	**Jeff Fujioka**	**AFSC ABL**
David Carlile	**ADF&G**	**Jon Heifetz**	**AFSC ABL**
Alan Haynie	**AFSC REFM**	**Mike Dalton**	**AFSC REFM**
Jane DiCosimo	**NPFMC (Coordinator)**	Cleo Brylinsky	ADF&G
Henry Cheng	**WDFW**	Tom Pearson	NMFS AKRO Kodiak
Brenda Norcross	UAF	**Nick Sagalkin**	**ADF&G**
Mary Furuness	NMFS AKRO Juneau	**Paul Spencer**	**AFSC**
Grant Thompson	**AFSC REFM**	Leslie Slater	USFWS
Dave Barnard	ADF&G	**Nancy Friday**	**AFSC NMML**
Leslie Slater	USFWS	**Henry Cheng**	**WDFW**
Dana Hanselman	**AFSC ABL**	Ken Goldman	ADF&G
Bill Clark	**IPHC**	Bob Foy	AFSC Kodiak
		Sarah Gaichas	**AFSC REFM**
		Steven Hare	**IPHC**

Others in attendance: Pat Livingston, Anne Hollowed, Farron Wallace, Martin Dorn, Tom Helser, Chris Lunsford, Teresa A'Mar, Delta Anderl, Kenny Down, Mark Maunder, Julie Bonney.

Mike Sigler chaired the joint meeting of the groundfish Plan Teams. The objective of the meeting was to review proposals for GOA and BSAI Pacific cod stock assessment models. The goal was to recommend no more than six models for each area assessment for Fall 2010. The proposers deferred to Grant Thompson and the Teams for the review of their proposals, but were invited to participate in the discussion of their proposal.

Twenty one proposals were received from the GOA Groundfish Plan Team, Teresa A'mar, Mark Maunder, the Freezer Longline Coalition, the BSAI Groundfish Plan Team, and the Scientific and Statistical Committee (SSC). Grant Thompson reviewed new model proposals collectively for the GOA, the BSAI, and for both areas, as well as his own suggestions for model changes.

The Teams reviewed a draft spreadsheet that was prepared by Mike Sigler, which grouped the proposals by nineteen categories (types of recommended model changes), including the current model (Model 1) for each area assessment. Dave Carlile suggested that the teams consider combining model proposals for each category listed in the table. Jim Ianelli suggested that this could be achieved by adding columns to the draft spreadsheet. Grant Thompson revised the table as the teams reached consensus.

Exclude mean length-at-age data and exclude age composition data

Bill Clark noted that all models that would exclude length-at-age data also would exclude age composition data, so these proposals were reviewed together. Jim Ianelli endorsed the suggestion to put all the age related ideas into a single model. Grant Thompson agreed with Bill, noting that current practice is to omit survey length composition data in years for which survey age composition data are used, which implies that inclusion of length-at-age data is essential for meaningful estimation of cohort-specific growth parameters when age composition data are used (otherwise, the only data available for estimation of cohort-specific growth parameters would be the length composition data from the fisheries, which generally do not include the young ages at which cohort-specific growth is easiest to detect). The teams agreed to recommend that one model exclude both age composition data and length-at-age data for both assessment areas.

Jon Heifetz questioned whether these assumptions lead to a realistic model, or whether the teams were simply exploring sensitivities to baseline assumptions. Jim Ianelli clarified that Model 1 would form the baseline against which other models would be compared. Dana Hanselman responded that the teams would be recommending at most five alternate model configurations to the baseline model.

Recommendation: The teams recommended adding this component to models 4, 5, and 6.

Estimate the two parameters describing variation in length-at-age

Bill Clark asked why this model configuration was proposed. Mark Maunder responded that including these parameters improves the fits to the data. He noted that the variability in length at age of year 1 fish is at age is fairly well determined, but is less well determined for older fish. Bill suggested that length-at-age data might be adequate for external estimation of these parameters, even if the data are biased.

Grant Thompson referred to slide 13 of his Powerpoint presentation, which depicted a good fit between standard deviation of length at age and mean length at age. Mark Maunder voiced concern about using length-at-age data if bias is showing up in only the older fish, resulting in more variability than expected; therefore he prefers to exclude the length-at-age data in one model run. He was particularly concerned if the model creates this bias inside the model. Grant agreed that using length-at-age data to estimate variability in length at age would not result in a model that is completely independent of all data relating to age; however, if the Teams wanted to include a model that was "almost" completely independent of age data, this would probably be the first compromise they would want to make. Mark continued that if you are going to exclude all age-related data, then you need to estimate the variance of age data in the model itself. Jim Ianelli replied that this assumption seems reasonable, but was concerned about estimating variability in length at age within the model when the length-at-age data themselves have been excluded. He shared Grant's concern that any improvement in the model's fit could result from misspecification(s) elsewhere in the model. Kenny Down noted that internal estimation of variability in length at age, without using length-at-age data, would be a logical extension of the Freezer Longline Coalition's previous requests to eliminate age composition data from the model. Mike Sigler noted that the proposal was worth recommending for technical reasons. Grant responded that the Teams could approve one model that estimates variability in length at age internally, and another that does so externally.

Recommendation: The Teams recommended adding this component to models 5 and 6.

Eliminate cohort-specific growth & add time-varying growth

Grant Thompson noted that use of cohort-specific growth was a new feature in the BSAI model last year; and it became the preferred model. Bill Clark said he was hesitant to accept the proposed model change unless it fits the data better. He preferred a model that has constant growth unless there is clear evidence for a cohort-specific effect. Mark Maunder recommended treating time-varying growth like a random effect. Grant offered that Rick Methot has suggested interpreting cohort-specific growth as being roughly equivalent to cohort-specific K. Thus, cohort-specific growth adds one parameter to be estimated for each cohort, whereas time-varying growth (as implemented by Mark) adds three parameters to be estimated for each year.

Mike Sigler said that Model 6 is the same as Model 5 with cohort specific growth replaced by time-varying growth. As a new alternative, he proposed that the teams add a model with constant growth. Mark Maunder asked if the teams felt there was evidence of time varying growth, and suggested Pacific cod growth does not have a consistent trend like Pacific halibut. The trend for cod varies greatly; he referred to page 5 of his proposal for more discussion on this issue.

Dana Hanselman clarified that since the current model already uses cohort-specific growth, going to more parameters might be too much. He suggested that the proposals are general and the plan teams can modify them (e.g., vary only K, and not L1 and L2). He recommended maintaining cohort-specific growth assumptions in the model; he was concerned about making the model more complex by varying growth while there may be other model misspecifications.

The Teams deleted Mike Sigler's suggestion related to cohort growth, to not allow a growth matrix that is constant in time. The base model has cohort-specific growth. Time-varying growth will only be implemented in BSAI (Model 6) due to the quantity of age data in the GOA. Bill Clark asked why go to annual deviations of growth (or age?) data. Mark Maunder responded that cohort specific growth did not explain everything he wanted it to; incorporating time-varying growth substantially improved the likelihood. Model 6 is based on models that do not include mean length at age data. While the teams are trying to limit the number of models requested from the author this fall, the teams discussed the need for requesting this model relative to other priorities. The team ultimately agreed to request this model as it was the only request by industry different from other team or SSC requests (i.e., adds only one model beyond the models requested by the SSC or teams).

Recommendation: The teams recommended adding this component to Model 6 (BSAI only).

Age conditioned on length

Farron Wallace said that the SSC thought that this proposal might resolve the issue where mean size at age does not match the size modes in the BTS. Jim Ianelli responded that this approach is not used in any other AFSC assessment and that residuals should be carefully examined. Farron agreed and recommended that the author take another look at this approach in future assessments to see if it improves model fits. Jim concurred.

Recommendation: The Teams did not recommend adding this component to any of the models until age determination issues are resolved.

Finer length bins

After some discussion the teams felt this was a routine housekeeping change to the model. Grant Thompson noted that this might result in the loss of the pre-1982 portion of the EBS bottom trawl survey time series, because the original size composition files for those years appear to have been lost. Mark Maunder noted that Stock Synthesis allows the user to specify different bin structures for different data sets (including different years), so continued use of the pre-1982 survey time series should not be a problem after all.

Recommendation: The teams agreed that the author was free to test and implement minor changes to the model as he felt appropriate. The Teams recorded this as a change to models 2 through 6.

Maturity as a function of length rather than age and ageing bias from radiocarbon study

The Teams discussed these two proposed model changes. It was noted that basing maturity on length rather than age would be more consistent for those models that did not use age data. It was also noted that the sample size (10) used in the radiocarbon study would not be sufficient to construct an ageing bias matrix.

Recommendation: The Teams recommended adding maturity as a function of length rather than age to models 4, 5, and 6. The teams recommended no change related to the radiocarbon study.

Priors on selectivity, estimate catchability

Dana Hanselman asked about the history of estimating selectivity; e.g., had Grant "tried everything" and the priors were fixed now? Grant responded that the current models use uniform priors only, but he prefers using informative priors on any parameters where some prior information is available. Mark Maunder was concerned that, in December, the SSC could reject an entire model because of its use of informative priors, even if the other features of the model constitute significant improvements. Grant and Mike Sigler suggested that Team and SSC review of any proposed priors in September/October should minimize this possibility (i.e., priors that the Teams/SSC accept in September/October would likely be accepted in November/December).

Grant reported that while, it is difficult to estimate catchability inside the model, he is concerned that the point estimate of catchability from the 11 cod tagged by Dan Nichol might not be correct. He would like to continue his modeling attempts in this area. Dana Hanselman suggested that tightening up priors on selectivity should help with improving catchability estimates. A separate model using these components was suggested.

Recommendation: The Teams recommended adding these components as the main new features of Model 3.

Exclude IPHC data

Cod data from the IPHC halibut survey have been used in the BSAI model, but not in the GOA model. The SSC has recommended that the data no longer be used in BSAI (the BSAI Plan Team made no recommendation on its use last year), because the relative abundance data from the IPHC survey turned out to be inversely correlated with the abundance estimates from all 14 models in last year's assessment. Bill Clark noted that the survey coverage was much greater in the GOA than in the BSAI and so the GOA data could be more useful due to overlapping halibut and cod habitat there. Steven Hare noted that, except for Area 3B, there is good survey coverage in both areas. The request for length composition data from this year's IPHC survey has already been withdrawn, and it is too late to change the IPHC survey methods this year. Kenny Down recommended that cod length data collection in the IPHC halibut survey be reinitiated in 2011.

The Teams recommended leaving the IPHC data in the BSAI assessment and asked Grant to determine whether inclusion of IPHC data would be a useful addition to the GOA model.

Bill Clark asked Grant whether it would be appropriate to leave the IPHC size composition data out of the model. Sandra Lowe recommended that the GOA Groundfish PT should request IPHC data for the GOA assessment. The summary table will reflect the teams' recommendation to incorporate IPHC data for the GOA.

Recommendation: The Teams rejected the proposal and recommended that the IPHC data be considered for use in both the BSAI and GOA model as well.

Evaluate spatial-temporal variation in fishery CPUE

Sandra Lowe noted that the analysis for evaluating the catch data is more complex than can be completed in 2010, given the new modeling requests. This requested evaluation could be planned for Sept 2011. In response to Bill Clark's question of why analysis of fishery CPUE is being requested, Farron Wallace said that the SSC was interested in spatial variation of fishery catches and recommended leaving it on the list as a research item.

Recommendation: The Teams recommended that the SSC proposal to evaluate spatial-temporal variation in fishery CPUE be included in the next set of research priorities.

Advance model one year, compare with projections

No action was taken.

Other GOA proposals

Mike Sigler suggested that Teresa A'Mar test her proposed changes to the GOA base model as an appendix. Several of them are addressed by other proposals. Ms Lowe pointed out that Teresa's assignments did not include further development of the GOA cod model. Clark and Ianelli thought many of the proposals had merit. Teresa conceded that if the assessments will already address them, then there was no need to proceed with separate examinations. Grant suggested they should be examined in both areas if they were to be addressed. The Team recommended to treat the seasonal proposal under models 2 through 6, but not to address the plus group proposal. The catchability and selectivity-at-age proposals are treated under Model 3 (see "prior" proposals). No recommendations were made on the remaining two proposals (weight, lower bound).

Other issues

Anne Hollowed and Henry Cheng asked whether the Teams intend that Grant prepare *a factorial design is required to compare model alternatives.* The Teams responded that a factorial design would not be requested. Given that 10 new alternatives are being proposed for consideration in the GOA and 11 in the BSAI, a full factorial design would require consideration of 1,024 models in the GOA and 2,048 models in the BSAI.

Jim Ianelli noted that Grant still has discretion to add or delete aspects of the model if he discovers a productive line of modeling.

Group	Feature(s)	Proposal(s)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Current models	Keep all features of current models	CM1, CM2, BPT1	x					
Age and length	Exclude mean length-at-age data	GPT1, MM1, BPT3, FLC1				x	x	x
	Exclude all age composition data	GPT1, MM1, BPT3, FLC1				x	x	x
	Estimate variation in length-at-age internally	GPT1(?), MM2, FLC2					x	x
	Omit cohort-specific growth, add time-varying growth	FLC3						x (BSAI)
	Use age conditioned on length	SSC1						
	Use finer length bin structure	GT1		x	x	x	x	x
	Describe maturity as a function of length, not age	BPT3				x	x	x
	Estimate ageing bias from radiocarbon study	BPT2						
	Decrease emphasis on season 1 fishery sizecomps	TA5						
	Reduce "plus" age from 20 to 15	TA1						
	Exclude fishery (but not survey) age composition data	SSC3	(SSC3 was inadvertently omitted from Team discussions.)					
Selectivity and Q	Use informative priors or other constraints on selectivity	SSC2, TA3			x			
	Estimate catchability internally	GT3			x			
	Put a cap on catchability for sub-27 survey in the GOA	TA4						
	Decrease lower bound for selectivity parameters	TA6						
Other	Exclude IPHC data	SSC4						
	Examine spatial-temporal variation in fishery CPUE	SSC5						
	Advance model one year, compare with projections	GPT2						
	Re-evaluate seasonal structure	TA2, GT2		x	x	x	x	x

Executive Summary

NMFS requests that the North Pacific Fishery Management Council (Council) review a proposal to remove the requirement for American Fisheries Act (AFA) cooperatives participating in the directed fishery for pollock in the Bering Sea to prepare and submit to the Council the preliminary annual report described in 50 CFR 679.61(f). Requirements for the cooperatives to submit a single annual report to the Council would be retained.

This regulatory impact review (RIR) provides a cost-benefit analysis of proposed changes to regulations, addressing the statutory requirements of the Presidential Executive Order 12866 (E.O. 12866).

Ten cooperatives have developed as a result of the AFA: seven inshore catcher vessel cooperatives, one cooperative for catcher vessels delivering to catcher/processors, one for catcher/processors, and one for catcher vessels delivering to motherships. Each of these cooperatives is required to submit an annual report to the Council. The impact of the proposed action would be twofold: (1) cooperatives would no longer be required to submit a preliminary annual report, in addition to a final report, reducing their preparation and filing costs; and (2) the Council would incur reduced administrative costs, since it would no longer have to receive and process a preliminary and a final report. If the Council determines that there is no longer an administrative need for the preliminary report, its elimination would impose no costs. Thus, the proposed action would have positive net benefits.

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1 Regulatory Impact Review[1]

Introduction

The National Marine Fisheries Service (NMFS) requests the North Pacific Fishery Management Council (Council) to consider whether it is appropriate to remove the requirement for American Fisheries Act (AFA) cooperatives participating in the directed fishery for pollock in the Bering Sea to prepare and submit to the Council the preliminary annual report described in 50 CFR 679.61(f).

This document provides a cost-benefit analysis of these proposed changes to regulations. The analysis addresses the statutory requirements of Presidential Executive Order 12866 (E.O. 12866, 58 FR 51735, September 30, 1993). The requirements for all regulatory actions specified in E.O. 12866 are summarized in the following statement from the order:

> *In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nonetheless essential to consider. Further, in choosing among alternative regulatory approaches agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.*

E.O. 12866 further requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant." A significant regulatory action is one that is likely to --

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, local or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

Statutory Authority

NMFS manages the U.S. groundfish fisheries of the Bering Sea and Aleutian Islands in the Exclusive Economic Zone off Alaska under the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (FMP). The FMP was prepared by the North Pacific Fishery Management Council (Council), under the authority of the Magnuson-Stevens Act Fishery Conservation and Management Act. Regulations implementing the FMP appear at 50 CFR part 679. The pollock fishery in the Bering Sea (BS) also is managed under the American Fisheries Act (AFA) (16 U.S.C. 1851 note). General regulations that pertain to U.S. fisheries appear at subpart H of 50 CFR part 600.

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[1] Environmental review requirements under the National Environmental Policy Act will be addressed in a separate categorical exclusion. Regulatory Flexibility Act requirements will be met by a certification that the proposed action does not have significant impacts on a substantial number of small entities.

Background

In October 1998, Congress enacted the AFA, which "rationalized" the BS pollock fishery by identifying the vessels and processors eligible to participate in the fishery and allocating pollock among those eligible participants. Under the AFA, a portion of the BS pollock total allowable catch is allocated among the Western Alaska Community Development Quota (CDQ) Program, the inshore sector, the catcher/processor sector, and the mothership sector. Implementing regulations for the AFA are found at 50 CFR part 679, Subpart F.

The AFA allowed for the formation of fishery cooperatives within the non-CDQ sectors. The purpose of these AFA cooperatives is to further subdivide each sector's or inshore cooperative's pollock allocation among participants in the sector or cooperative through private contractual agreements. The cooperatives manage these allocations to ensure that individual vessels and companies do not harvest more than their agreed upon share. The cooperatives also facilitate transfers of pollock among the cooperative members, enforce contract provisions, and participate in the intercooperative agreement (ICA) to reduce salmon bycatch.

Each year, catcher vessels eligible to deliver pollock to the seven eligible AFA inshore processors may form inshore cooperatives associated with a particular inshore processor. NMFS permits the inshore cooperatives, allocates pollock to them, and manages these allocations through a regulatory prohibition against an inshore cooperative exceeding its pollock allocation. Inshore catcher vessels are not required to join an inshore cooperative. Those that do not join an inshore cooperative are managed by NMFS under the "inshore open access fishery."

The AFA catcher/processor sector is made up of the catcher/processors and catcher vessels eligible under the AFA to deliver to catcher/processors. Owners of the catcher/processors that are listed by name in the AFA and still active in the BS pollock fishery have formed a cooperative called the Pollock Conservation Cooperative. The remaining catcher/processor, the F/V *Ocean Peace*, is not listed by name in the AFA, but is eligible to harvest up to 0.5 percent of the allocation of BS pollock to the catcher/processor sector. This portion of the catcher/processor sector's allocation of BS pollock is reserved for "unlisted" catcher/processors that meet certain requirements, which only the F/V *Ocean Peace* meets. Owners of the catcher vessels eligible to deliver pollock to the catcher/processors have formed a cooperative called the High Seas Catcher's Cooperative.

The AFA mothership sector is made up of three motherships and the catcher vessels eligible under the AFA to deliver pollock to these motherships. These catcher vessels have formed a cooperative called the Mothership Fleet Cooperative (MFC). The MFC does not include the owners of the three motherships. The primary purpose of the cooperative is to sub-allocate the mothership sector pollock allocation among the catcher vessels authorized to harvest this pollock, to manage these allocations, and to participate in the salmon bycatch reduction ICA.

Problem Statement

Currently, all AFA cooperatives are required to submit preliminary and final annual written reports on directed pollock fishing activity to the Council. The AFA annual reporting requirements were implemented under a final rule (67 FR 79692; December 30, 2002) implementing Amendment 61 to the FMP. The purpose of the annual reports as described in the final rule, is "to assist the Council and NMFS in meeting the requirements of section 210(a)(1) of the AFA, which requires that NMFS make such information available to the public in a manner that NMFS and the Council decide is appropriate."

The preliminary AFA cooperative report is due to the Council by December 1 of the year in which the pollock fishing occurred. The final AFA cooperative report is due by February 1 of the following year. The AFA cooperative annual reports are required to provide information about how the cooperative distributed pollock and other groundfish species allocations, and prohibited species allowances, among the vessels in the cooperative; the catch of these species, by area, for each vessel in the cooperative; information about how the cooperative monitored fishing by its members; and a description of any actions taken by the cooperative to penalize vessels that exceeded the catch allocations and prohibited species catch allowances made to the vessel by the cooperative.

The Council originally recommended both a preliminary and a final annual report, because it wanted to have this report available for its December Council meeting when it adopts annual groundfish harvest specifications for the upcoming fishing year. The Council recognized that, because the pollock fisheries close on November 1, one month may not be enough time for the AFA cooperative representatives to compile all of the required information for the annual report. In addition, it was possible that some of the catch and bycatch data would be updated after the end of the year. Therefore, the Council recommended that NMFS require a preliminary report to provide as much information as was available by December 1, and a final report by February 1 of the following year to update or add any information that became available after December 1.

In more recent years, the Council may not be relying on the preliminary cooperative annual report to develop its recommendations on final groundfish specifications as much as it originally thought it would. Therefore, NMFS requests the Council assess whether the existing final annual report submitted after the fishing year is completed is sufficient for the Council's and public's needs for information under section 210(a)(1) of the AFA. If the preliminary annual report is no longer necessary, regulations requiring its submission by December 1 would be removed from §679.61(f). Regulations requiring the submission of a single annual report would be retained. Under the proposed rule to implement Amendment 91 to the FMP (75 FR 14016; March 23, 2010), the Council and NMFS proposed that the deadline for the AFA cooperative annual report would be moved from February 1 to April 1 of the following year. No additional action is needed by the Council to change the deadline of the final annual report.

The Alternatives

The alternatives under consideration for this action are:

Alternative 1. No action

Alternative 2. Revise regulations to remove the requirement for AFA cooperatives participating in the directed pollock fishery to prepare and submit the preliminary annual report described in 50 CFR 679.61(f).

Given the objective of this action, no additional alternatives are available.

Cost and Benefit Analysis

Ten cooperatives have developed as a result of the AFA: seven inshore catcher vessel cooperatives, one cooperative for catcher vessels delivering to catcher/processors, one for catcher/processors, and one for catcher vessels delivering to motherships. Each of these is required to submit an annual report.

The impact of this action would be twofold: (1) cooperatives would no longer be required to submit a preliminary report and a final report, thus reducing their preparation and filing costs; and (2) the Council would incur reduced administrative costs, because it will no longer have to receive and process a preliminary and a final report.

NMFS estimates that nine AFA cooperative reports are submitted per year (the catcher/processors' cooperative, and the cooperative for the catcher vessels that deliver to them, file a joint report). The total time required for a firm to prepare and file both its preliminary and final reports is estimated to be 32 hours for each respondent. Thus, the total estimated cost for submitting the reports currently is $21,600.[2] This action should permit some reduction in these costs, although the total reduction would be considerably less than half (since the requirement for a full report would remain). If the savings were a quarter of the current costs (which may be high, because there is no change in the actual information required), the total savings would be $5,400. This is provided as a rough estimate of the likely upper bound cost savings. The Council is estimated to incur $275 in costs for processing these preliminary reports. There would be some savings here, as well.

In summary, if the Council determines that there is no longer an administrative need for the preliminary report, its elimination would impose no costs. Thus, the proposed action would have a net benefit.

2 Preparers and Persons Consulted

Preparers:

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Consulted:

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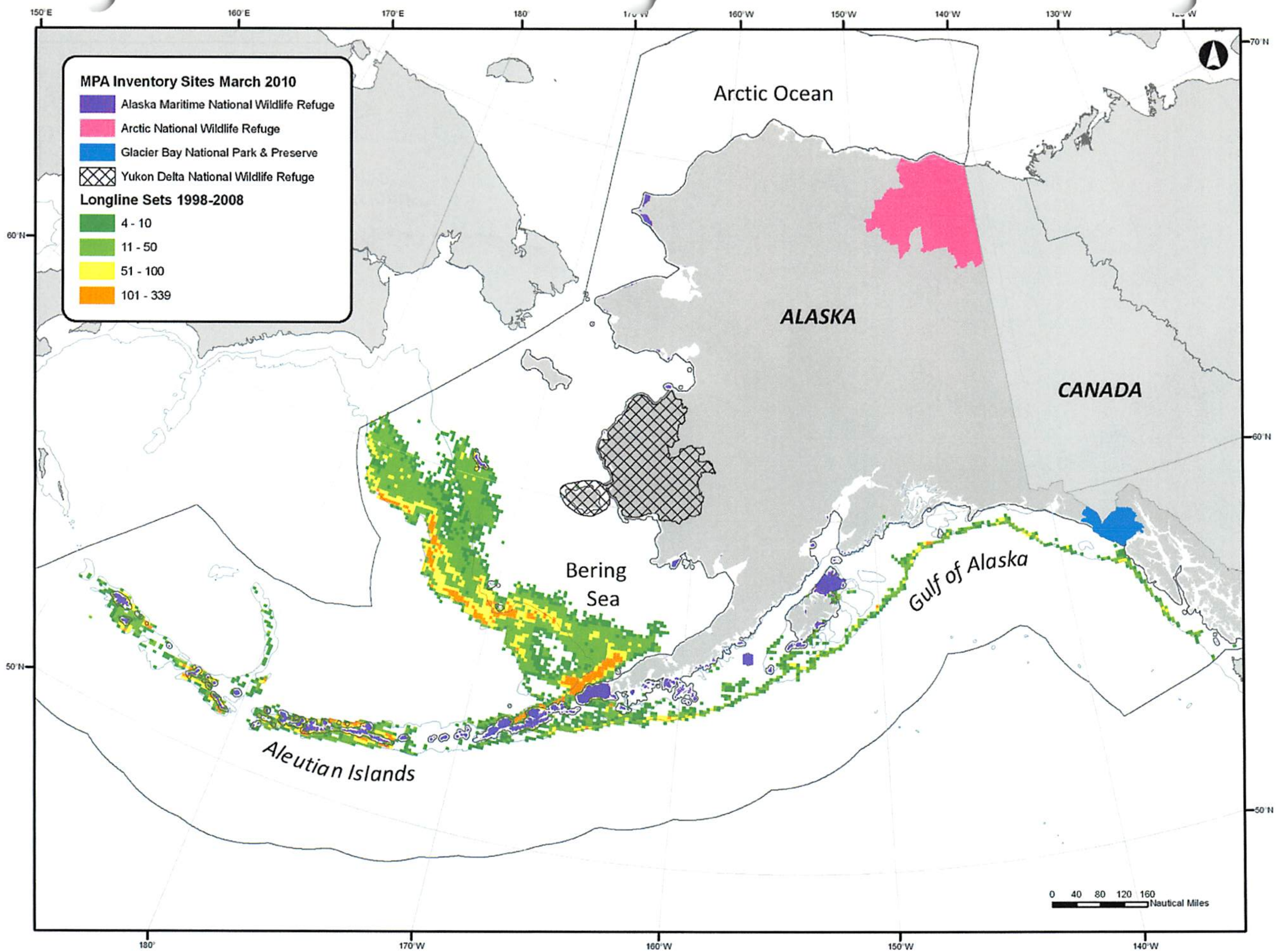
Juneau, AK

Sally Bibb
NMFS Sustainable Fisheries Division, AKR
Juneau, AK

[2] A labor cost of $75/hour has been assumed to take account of the involvement of management personnel in the preparation of the reports. Cooperatives are also estimated to incur *de minimus* ($30) costs for photocopying and postage.



MPA Inventory Sites March 2010
Alaska Maritime National Wildlife Refuge
Arctic National Wildlife Refuge
Glacier Bay National Park & Preserve
Yukon Delta National Wildlife Refuge
Longline Sets 1998-2008
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11 - 50
51 - 100
101 - 339
Arctic Ocean
ALASKA
CANADA
Bering Sea
Gulf of Alaska
Aleutian Islands
0 40 80 120 160
Nautical Miles
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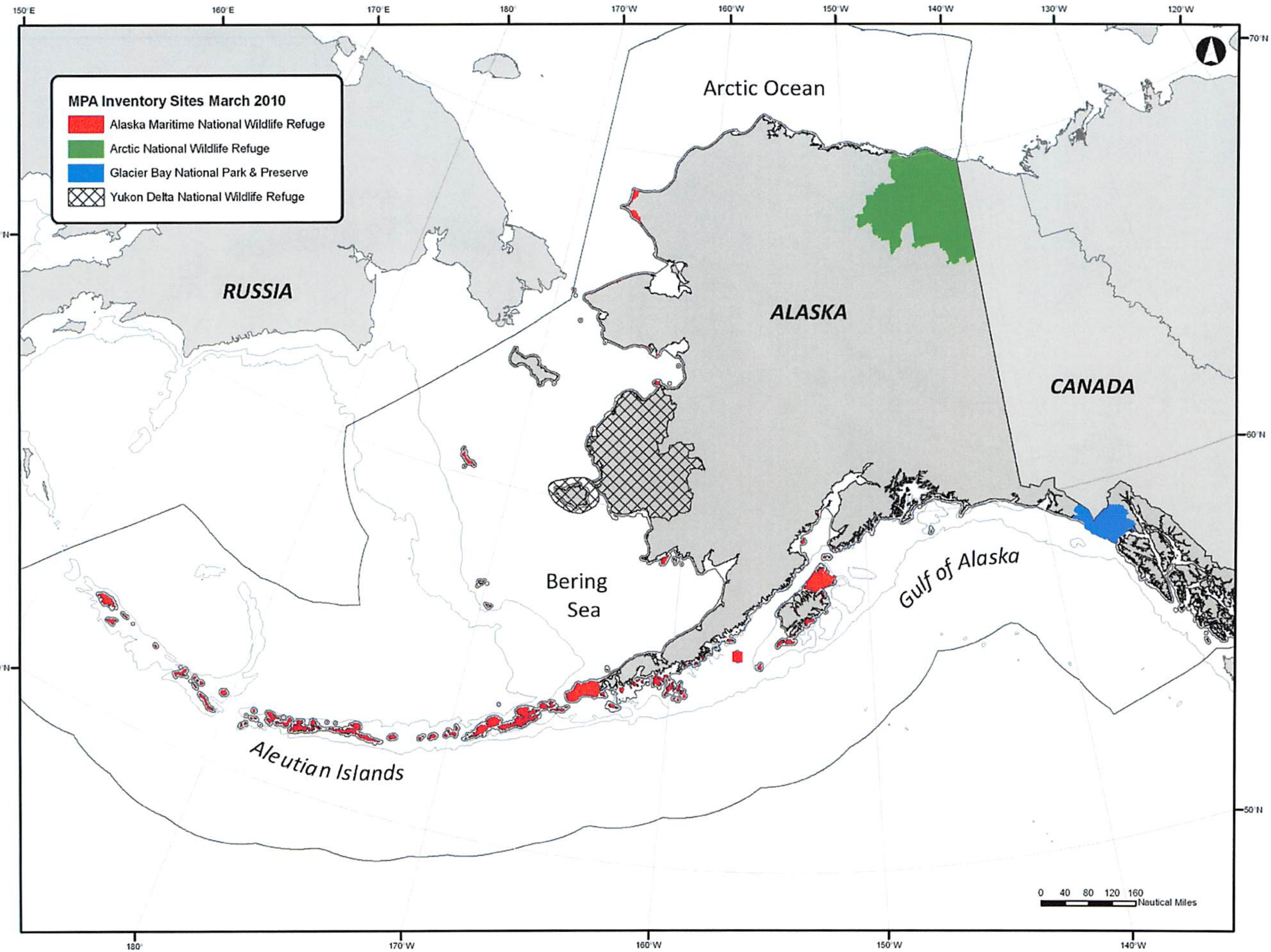

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Yukon Delta National Wildlife Refuge
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Bering Sea
Gulf of Alaska
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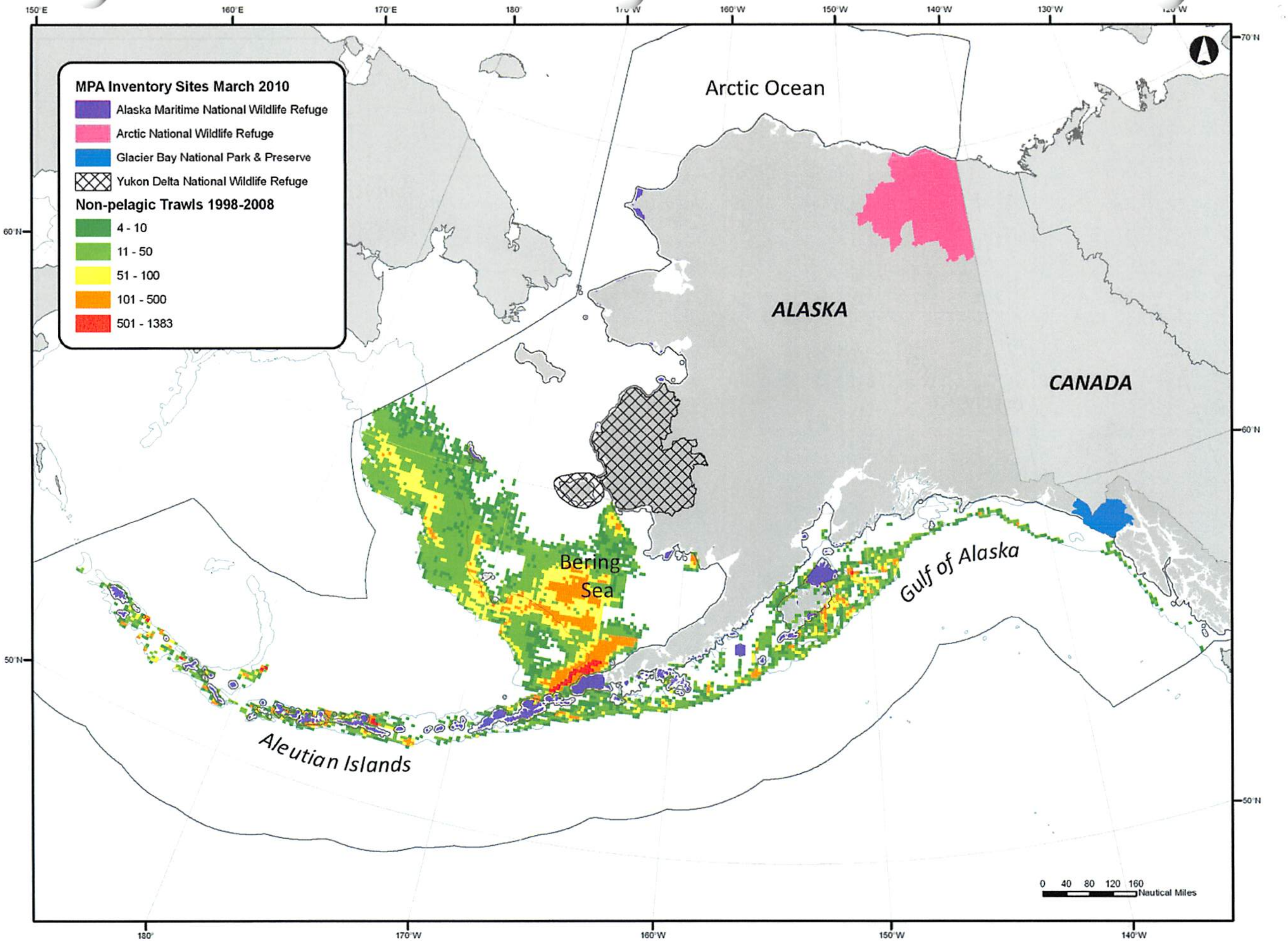
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Glacier Bay National Park & Preserve
Yukon Delta National Wildlife Refuge
Non-pelagic Trawls 1998-2008
4 - 10
11 - 50
51 - 100
101 - 500
501 - 1383
Arctic Ocean
ALASKA
CANADA
Bering Sea
Gulf of Alaska
Aleutian Islands
0 40 80 120 160
Nautical Miles
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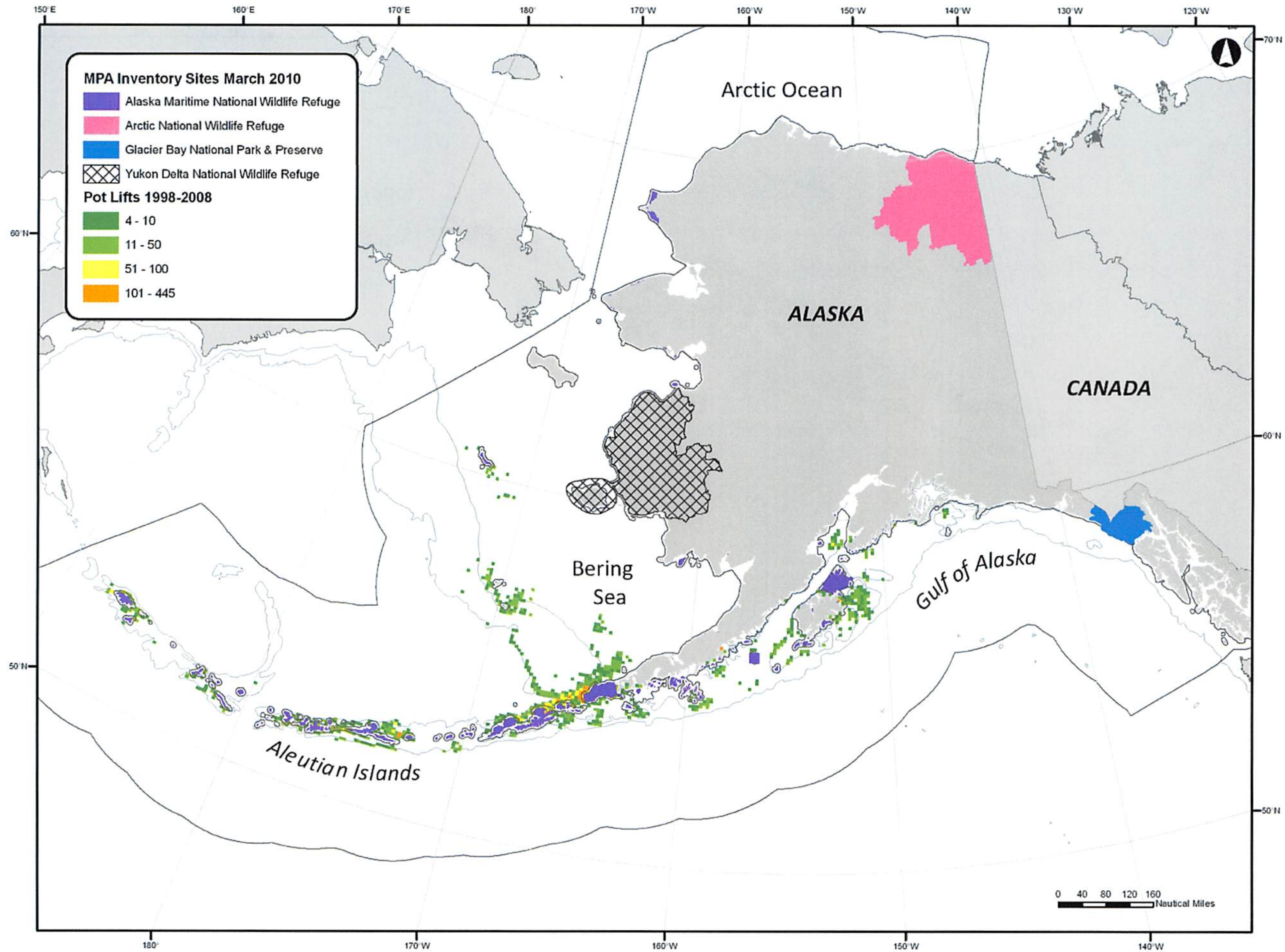
170°W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101 - 445
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ALASKA
CANADA
Bering Sea
Gulf of Alaska
Aleutian Islands
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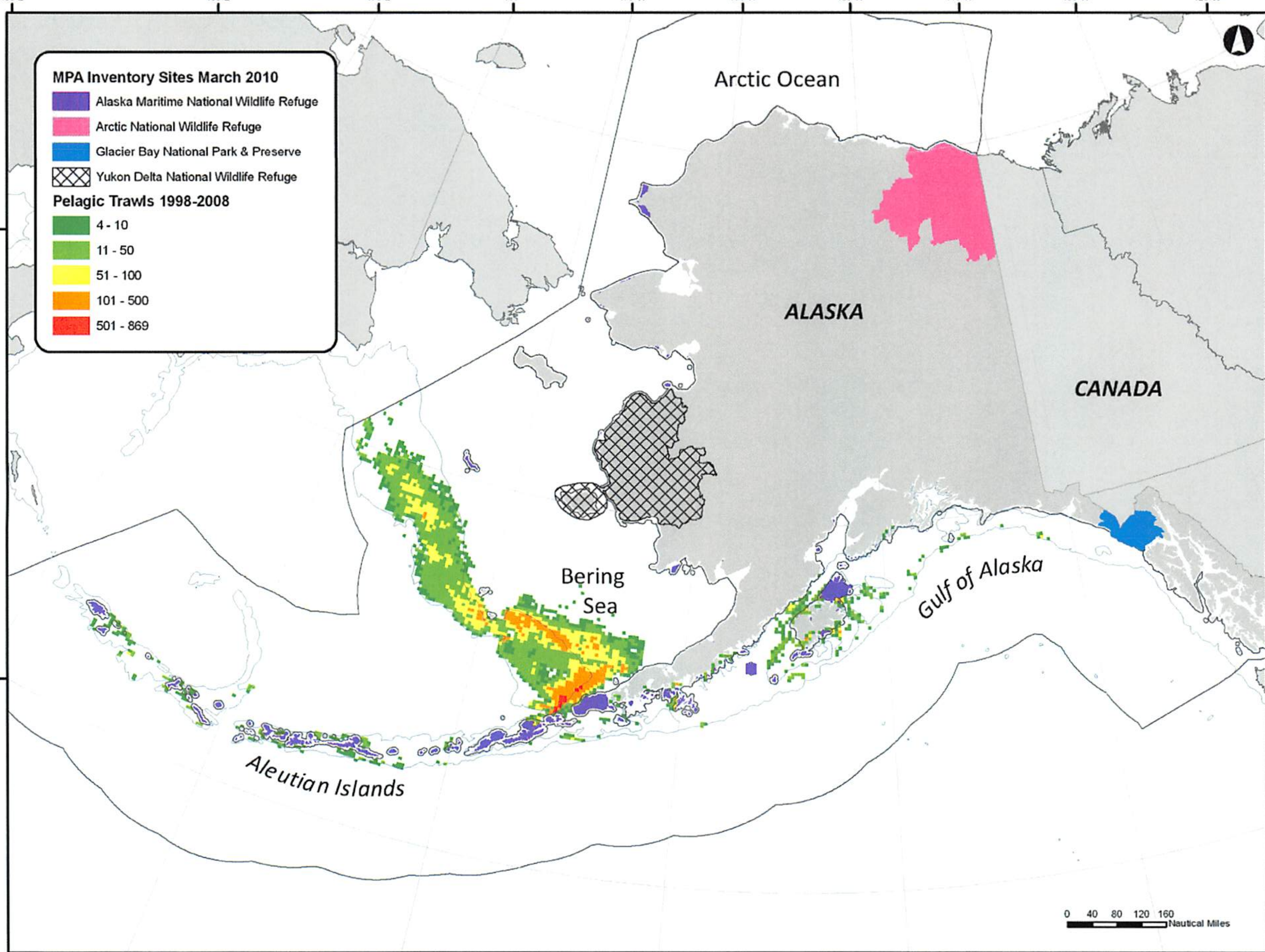
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Bering Sea
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Aleutian Islands
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International Pacific Halibut Commission
Bycatch Workshop
Hotel Deca, Seattle, WA
September 29, 2009

DRAFT 10/1/09

Note: The meeting and presentations were broadcast live on the internet through Webinar.

Dr. Bruce Leaman welcomed the attendees and noted that the Commission staff was not intending to propose any new policy changes for this meeting or for implementation during the 2010 season. Rather, there are some issues related to incidental catch (bycatch) of Pacific halibut that need to be addressed and discussed. This meeting is to present the information that is available now and to look at information needs for future management decision-making.

Dr. Leaman noted that the morning's presentations would address impacts of bycatch, both local and non-local and how it is dealt with in the IPHC stock assessment. The afternoon session would then include an open discussion of issues with audience participation, with potential follow-up at the IPHC Annual Meeting in January.

Mr. Gregg Williams presented *Bycatch History and Status* which described the historical context of bycatch and its management from the late 1950s through the present, and the fisheries involved.

In response to questions from the audience, Mr. Williams explained observer coverage requirements in Alaska and noted that because coverage is based on vessel size, and given that vessel size may vary by fishery among other things, not all fisheries are observed to the same degree. An audience participant commented that for example, there are very few vessels greater than 100 feet in length in the Gulf of Alaska resulting in observer coverage of around 30%, whereas the majority is larger than 100 feet in the Bering Sea, thus most vessels are observed 100%.

Another issue questioned by audience members was the cause of the apparent bycatch decrease in recent years. Mr. Williams explained that cooperatives in Bering Sea trawl fisheries in Alaska have recently been given allocations that they can manage individually. These have resulted in catches well below the proposed caps. As well, lower rates in the Bering Sea hook and line fishery are likely due to reduced encounter rates.

There was a request by an audience participant to also present historical groundfish catch alongside bycatch by region to give a better perspective of true bycatch rates in relation to various fisheries and areas.

Dr. Steven Hare presented a history of *Methods of Accounting of Bycatch Impacts*. In response to audience questions, Dr. Hare explained that when considering yield loss of a halibut that is less than 32 inches (U32) in length, the abundance of the bycaught fish is projected forward using natural mortality rate and the target fishing mortality rate, and the future (lost) yield is calculated according to the sizes at age for that area. He further explained that in some analyses to be presented later, not only is the projected yield loss calculated, but also of consideration is whether that fish would have migrated from the area or stayed resident.

Regarding growth rates and potential yield loss, Dr. Hare explained that for smaller/younger halibut, the growth rate is greater, and then lessens with greater size and age. The result is a yield loss of greater than one for smaller fish and less than one for larger fish where mortality outweighs growth.

Regarding how the wastage calculation is done, and the fact that the U32 wastage is calculated from the top 1/3 producing survey stations in a given area, an audience participant suggested groundtruthing that estimate by looking at the top 1/3 CPUEs in an area and comparing to commercial catch. The argument was that in some areas (i.e., Area 2C), the commercial and survey CPUE are similar and if the IPHC is highgrading the stations in those areas to include only the top 1/3, then it would produce a bias if those indices aren't correlated.

Following a break, Dr. Juan Valero presented *Effects of migration on evaluating impacts of bycatch on U32 halibut*. Dr. Leaman explained how the now 5-year-old PIT tagging program has been conducted and how results are used to interpret rates of migration.

As a response to direct comparisons of bycatch over time in Dr. Valero's presentation, there were audience queries regarding the validity of bycatch figures from 1985 since that groundfish fishery was made up largely with foreign and joint venture vessels compared to the present day domestic fishery. Dr. Leaman responded that there was observer coverage in 1985 as well as extended national jurisdictions and monitoring is thought to have been adequate at the time. One difference since 1985 is the lower growth rate of fish, particularly in the Gulf of Alaska, which might mean that fish are in areas more vulnerable to trawling mortality for longer periods than in previous years when growth rates were higher.

An audience participant requested that the catch and bycatch figures be broken down by management areas so that Bering Sea, Gulf of Alaska, Canadian, and U.S. West Coast fisheries are looked at separately. He argued that by aggregating, it was more difficult to see significant progress on a fishery level as well as those areas and fisheries that continue to be problematic.

A discussion took place regarding the pollock fishery and the gear currently used versus historically. The comment was made by an audience participant that although the pollock fishery is supposed to be all mid-water now, there are many who are fishing hard on bottom. Catch that used to take one or two tows to accomplish is now taking three to four days. Another participant countered that the pollock boats carry two observers each and all fishing is accounted for. A report is submitted on a vessel by vessel basis annually as part of the pollock cooperative rules.

A participant commented that regulations requiring that all trawl catch be put into tanks and available to observers, are counterproductive to survival of halibut. Dr. Leaman agreed that the issue of increasing survival of halibut becomes a conflict in goals between different programs. He added that initiatives from industry to look at different tools and Council action to provide an appropriate regulatory environment, such as individual bycatch quotas, are likely to produce the best solutions .

Dr. Steven Hare presented material explaining what information on removals by each sector is known and not known, and how different removals are handled in the stock assessment. It was noted that not all fisheries are sampled equally and therefore quality of data from different fisheries varies. For example, the subsistence and sport fisheries are not sampled entirely and not every year so proxies are used for modeling. Dr. Leaman added that quality of all data used will need evaluating before moving forward.

A query from the audience addressed the possibility of fishery induced evolution. Dr. Leaman explained that the large change in growth rate was a concern, but since it has happened before in in the 1920s and the growth rate subsequently increased, and more recently over a short (8 year) time period, it is most likely environmentally or density-driven and not indicative of a geneticchange.

Dr. Hare presented the issue of size limit adjustments including no size limit and how removals might be accounted for in the stock assessment. A discussion ensued on how that might affect the characteristics of the stock. It was noted that a fishery that shifts towards capturing more immature fish is a risk.

There was discussion about the frequency of highgrading in the commercial fishery. It was explained that when comparing O32 halibut from the survey to size distributions of the commercial catch in each area, the catch of larger fish is quite a bit higher in the commercial component. The exception is Area 2B where the catch is fully observed. A participant pointed out that in the Bering Sea for example, the fish naturally stratify by size and fishers intentionally target the larger fish aggregations, therefore in this case larger does not necessarily mean highgrading. Another point was made that regulations require that U32 halibut be released outside the roller (Editorial note: this is incorrect, IPHC regulations state that fish may be brought aboard to measure). To be on the safe side, fishers are likely releasing anything that looks close, resulting in the release of some borderline but legal sized fish.

An audience participant asked if the discard mortality rate used for the fishery would be different with different size limits and the staff responded that, in general, discard mortality was higher for smaller fish. However, staff noted that that information has yet to be examined.

Dr. Hare continued the presentation on how each removal is currently treated in the stock assessment. He noted that in treating sport catch the same as bycatch, there are discrepancies because U32 bycatch is generally 40-60 cm lengths and U32 sport catch is 60-80 cm lengths, and each represents different components of the stock.

Some discussion took place regarding different size limit scenarios. Dr. Hare commented that in a 26-inch size limit scenario, sport and subsistence would then be treated the same but U26 bycatch would be treated differently. There was also a suggestion to look at keeping the 32-inch size limit, but treating the 26-32 inch halibut differently with the result that the bycatch would be treated the same as sport catch and would be factored into the harvest rate. The result would be that wastage and 1-2M pounds of bycatch would be moved to the CEY calculation. This could have major effects on directed halibut yield in some regulatory areas.

A participant commented that while 87% of all groundfish fishing in the Bering Sea is observed, only 15-16% in the Gulf of Alaska is observed. He noted that it will be difficult to make substantive changes in the prosecution of these fisheries until there is more information, and that the state of Alaska could set the example by requiring observer coverage in the state run fisheries.

Dr. Leaman pointed out that the halibut fishery is also largely unobserved, making it one of the last large fleets without observers, and that is likely to change in the near future. An audience member urged the Commission to act as a catalyst in giving the fleet results of the recent work on cameras and viable options, given that many of the boats in the halibut fleet are small.

Several audience members had suggestions for action items which included:

1) The staff revisit the validity of the low 1985 bycatch figures and to further examine what is working now such as co-ops, group caps, and individual control.

2) Suggesting that the Commission reconvene the Bycatch Working Group to set new targets and update the current state of fisheries.

3) Looking at data comparing Canada vs. GOA vs. BS and index where the stock are going and where they are now. Perhaps look at how much halibut would be caught in trawlers if no excluder devices or selective fishing was taking place. It was further noted that the bycatch limit for the Bering Sea trawl fleet will be reduced 50 metric tons per year over 4 years. Dr. Leaman commented that the staff will break out the comparisons by area.

4) A suggestion to present exploitable biomass over time when talking about bycatch over time.

5) Creating a research plan that addresses the migration issue over time. Audience members further noted that the PIT tag project was a two year snapshot and there should be plans

to revisit the issue every few years since it likely changes. Dr. Leaman commented that the IPHC is currently doing research looking at different tag technologies to get at specific migratory questions.

There was a discussion of what would happen if the U32 and O32 bycatch were treated the same. Dr. Hare commented that right now, the CEY is reduced in the area of capture by the mortality of the O32 fish. If the U32 halibut were added to that, it would likely eliminate the directed fishery in the Bering Sea.

Following a short break, Dr. Leaman fielded closing remarks. It was suggested again that the Commission keep current on the migration issue, and that both approaches of conserving the resource we have now as well as opening up other avenues of harvest (i.e., lowering the size limit) be considered fully. Another participant questioned what a wastage figure would look like for the sport fishery.

Several participants thanked the Commission and staff for their work in putting together the workshop.

Workshop was concluded.

Staff participants:

Bruce Leaman – Executive Director
Claude Dykstra
Heather Gilroy
Steven Hare
Steve Kaimmer
Tom Kong
Michael Larsen
Lauri Sadorus
Eric Soderlund
Juan Valero
Evangeline White
Jay Walker
Ray Webster
Gregg Williams

Commissioners

Ralph Hoard
Larry Johnson
Laura Richards

Phillip Lestenkof (by webcast)
Gary Robinson (by webcast)

Audience participants

Kenny Down
Stefanie Moreland
Jeff Kauffman
Jay Ginter
Wes Erikson
Dan Tonnes
Renee Rensmeyer
Peggy Murphy
Jennifer Hagen
Tory O'Connell
Dan Falvey
Julianne Curry
Douglas Daugert
Chuck Ashcroft
Gary Williamson
Chris Sporer
Marlene Bellman
Dan Erickson
Anne Vanderhoeven
Jay Hebert
Tom Wilderbuer
Jackie King
Rob Jones
Sarah Williams
Brett Norton
Devona Adams
Jim Lane
Steve Joner
Nick Delaney
Rob Wurm
Paul McGregor
Brent Paine

Major Questions or Comments raised at the IPHC Bycatch Workshop, September 2009 and IPHC staff responses

Question 1. What is the percentage of catch covered by observers in AK; what is the target percentage by sector or target species? Probably need to define the metric of coverage here (e.g., vessel-days, catch, etc.).

Question 2. What is the number breakdown of the vessels creating bycatch in AK by size category (60-125, >125).

Observer coverage in the groundfish fishery operating off Alaska is measured by the number of days that an observer is aboard a fishing vessel. Once aboard the vessel, observers conduct a sampling of the catch from randomly selected hauls or sets. Coverage requirements are specified for specific types and size of vessel, and the sector of vessel operation. The following summarizes the major observer coverage requirements:

Catcher/processors and catcher vessels:

1. A vessel 125 ft (38.1 m) Length Over All (LOA) or longer must carry an observer during 100 percent of its fishing days.
2. A vessel equal to or greater than 60 ft (18.3 m) LOA, but less than 125 ft (38.1 m) LOA, that participates for more than 3 fishing days in a directed fishery for groundfish in a calendar quarter, must carry an observer during at least 30 percent of its fishing days in that calendar quarter and at all times during at least one fishing trip in that calendar quarter.
3. A vessel fishing with hook-and-line gear that is required to carry an observer under paragraph (c)(1)(v) of this section must carry an observer during at least one entire fishing trip using hook-and-line gear in the Eastern GOA regulatory area during each calendar quarter in which the vessel participates in a directed fishery for groundfish in the Eastern GOA Regulatory Area using hook-and-line gear.

Motherships:

1. A mothership of any length that processes 1,000 mt or more in round-weight equivalent of groundfish during a calendar month is required to have an observer aboard the vessel each day it receives or processes groundfish during that month.
2. A mothership of any length that processes from 500 mt to 1,000 mt in round-weight equivalent of groundfish during a calendar month is required to have an observer aboard the vessel at least 30 percent of the days it receives or processes groundfish during that month.
3. Each mothership that receives pollock harvested by catcher vessels in the catcher vessel operational area during the second pollock season that starts on September 1 is required to have a second observer aboard, for each day of the second pollock season until the chum salmon savings area is closed, or October 15, whichever occurs first.

Shore plants and stationary floating processors:

1. A shore plant or stationary floating processor that processes 1,000 mt or more in round-weight equivalent of groundfish during a calendar month is required to have an observer present at the facility each day it receives or processes groundfish during that month.

2. A shore plant or stationary floating processor that processes 500 mt to 1,000 mt in round-weight equivalent of groundfish during a calendar month is required to have an observer present at the facility at least 30 percent of the days it receives or processes groundfish during that month.

There are additional requirements for groundfish vessels fishing pot gear, for vessels fishing in certain specific areas, and in certain specified target fisheries. In general, these former situations result in higher levels of coverage. In addition, requirements for several fishery sectors stipulate two observers on board, so that virtually all hauls/sets are sampled. This higher level of monitoring includes fishery cooperatives and all vessels fishing Community Development Quota (CDQ) allocations.

NMFS regulations on the Alaska groundfish observer coverage requirements can be found at: http://www.fakr.noaa.gov/regs/679e50.pdf

Observer coverage levels

The most recent reporting by NMFS of observer coverage examines 2004-2007. Based on the amount of observed vs. total catch, coverage has been highest in the Bering Sea, with 86-88% of the catch observed annually. Coverage is even higher in the Aleutian Islands region, where 94-96% of the catch is observed each year. These high levels of coverage occur because the fisheries and vessels fishing those areas typically have 100% or greater coverage requirements.

In contrast, the Gulf of Alaska areas (e.g., eastern, central, and western subareas) have much lower levels of observer coverage. During 2004-2007, the percent observed catch ranged mainly from 28 to 38%. These levels are much lower than what is seen in the Bering Sea because of the overall smaller vessel sizes which have lower observer coverage requirements.

The NMFS report on coverage levels for 2004-2007 by region, sector (shore-based vessels vs. catcher processor), gear and target can be found at:
http://www.fakr.noaa.gov/sustainablefisheries/inseason/percent_observed.pdf

Notable observations from this report:

1. Catcher/processors (CP/M) generally have higher coverage than shore-based (SH) vessels, with CP/M over 125 feet LOA usually near or at 100% coverage. This is especially true in the Bering Sea.
2. In the Bering Sea trawl fishery for cod, observer coverage was somewhat lower for SH vessels (37-40%) than for catcher processor/motherships (CP/M) (38-56%).
3. Coverage in the pollock trawl fisheries was highest in the CP/M sector, usually approaching 100% in the major areas. On the other hand, coverage in the SH sector was quite variable but usually in the 30-40% range, due to the dominance of the 60-124 ft vessels in that sector.
4. Coverage in the shallow water flatfish fishery (target "H") in the CGOA by the SH sector was quite variable. It was less than 20% in 2005 and 2006, but 34% in 2004 and 26% in 2007.
5. Coverage in the trawl fishery for arrowtooth flounder (target "W") in the CGOA by the SH sector ranged from 20-26% during 2004-2007.
6. Coverage in the hook and line fishery for cod was near or almost always at 100% for the CP/M sector, whereas the SH sector was significantly lower in all areas. For example, in the CGOA, roughly 80% of the SH cod catch was taken by vessel <60 ft, which were completely

unobserved. In the WGOA, almost all of the cod taken in the SH sector was caught by unobserved vessels.

Halibut bycatch by region, sector, gear and vessel size

The Alaska Region office of NMFS provides access to historical reports of halibut bycatch on its web site (http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm). The reports present bycatch estimates by sector, area, week, and gear, but not by vessel size class. Information on bycatch by vessel size is not available. Interested reviewers are encouraged to visit the NMFS web site to examine the reports.

Question 3. Is the CPUE of the top 1/3 of survey stations used to calculate wastage greater than the commercial CPUE by area? Similarly, how do commercial and survey CPUE compare when only the top third of survey stations are used.

To answer this question we selected the top 1/3 of survey stations (ranked by O32 weight per skate, WPUE) and computed the average WPUE for those stations, over the period 2001-2009 (Fig. 1). The magnitude and correlation between the top 1/3 survey stations and commercial WPUE is very strong in all areas, with a few exceptions. One exception is for Area 2C where the top 1/3 survey WPUE was 1.5 to 2.0 times as large as commercial WPUE up until 2008. For the last two years the values have been nearly identical. The other major exception is Area 2A, where commercial WPUE is approximately double the top 1/3 survey station WPUE, however the trend over time matches well between the two.

These results generally support use of the top 1/3 survey stations as a proxy for commercial catch rates for the purposes of estimating U32 wastage mortality. Areas 2A and 2C may require a different level of top stations so as to better match the commercial WPUE. This will be further investigated and implemented in the next year, if warranted.

Question 4. How do survey and commercial catches compare when only fish larger than 85 cm are considered?

Commercial length frequency distributions (LFDs) are larger than survey LFDs in all areas as illustrated by data collected in 2008 (Fig. 2.1). Limiting the comparison to fish larger than 82 cm (close to the commercial legal size limit of 32 inches = 81.28 cm) still shows larger fish in commercial LFDs than in survey LFDs for most areas, excepting areas 2A and 2B (Fig. 2.2), where LFD are similar. When a similar figure was presented during the Bycatch Workshop, a member of the audience suggested that in some areas fishermen may be overcautious with fish too close to the size limit and therefore the comparison should be made only for size classes a bit larger than the size limit. Limiting the comparison to fish larger than 87 cm (34 in) still shows larger fish in commercial LFDs than in survey LFDs (Fig. 2.3), although the differences are smaller for some areas. In order to properly interpret differences between survey and commercial LFDs we need to understand the processes that create them. Possible processes leading to those differences are fishing ground selection, season, differences in gear, discards of fish smaller than the size limit, and highgrading of fish larger than the size limit. While the survey LFD reflects every fish that is caught, the commercial LFD reflects only the fish that are landed, so the potential exists for fish to be caught in the commercial fishery but not be included in the LFD if they are not landed.

Irrespective of the processes leading to the differences in LFDs, the result is that larger fish are more likely to be represented in commercial LFDs than in survey LFDs. This difference is handled in the assessment by estimating different selectivity curves for commercial and survey data. Adjusting for differences in selectivity results in more similar LFDs for most areas (Figs. 2.4 and 2.5). Commercial and survey LFDs of Areas 2A and 2B are more similar with no adjustment for differences in selectivity, suggesting that smaller fish are more likely to be landed in those areas than elsewhere. This pattern is seen not only on fish larger than the size limit but also on landed fish smaller than the size limit: both Areas 2A and 2B have a larger fraction (around 9% in number) of landed fish smaller than the size limit (Fig. 2.1) than the other areas (less than 2% in number). Although the ultimate cause of differences between commercial and survey selectivities (and therefore resulting LFDs) may be difficult to determine with currently available data, limiting the comparisons to stations deeper than 100 fm (Fig. 2.6) reduces differences between survey and commercial LFDs (particularly for Area 3A and to a lower degree for other areas). This suggests that some of the differences between commercial and survey LFDs may result from spatial differences between survey and commercial operations. More research on this topic is being carried out by staff, particularly on implications for evaluating the impact of different size limits.

Comment 5. Treat bycatch the same as sport catch. ***Already presented at meeting***

Comment 6. Use 26 in size limit and treat 26-32 in bycatch the same as directed removals.

See last point on re-evaluation of the IPHC Harvest Policy

Comment 7. Present halibut bycatch and groundfish catches, with abundance of halibut at same time periods, and bycatch breakdown separately by Bering Sea and the Gulf of Alaska regions.

This is a reasonable request, since the two areas are different in the composition of the target species and the fisheries which target them. The presentation "Bycatch Policy Matters" from the workshop has been updated to include this more spatially resolved approach and posted to the IPHC website:

http://www.iphc.washington.edu/halcom/meetings/workshop2009/bwback2009.htm

The trends of halibut bycatch mortality and the ratio of bycatch mortality to groundfish catch differ considerably between the Bering Sea and the Gulf. The Bering Sea has been characterized by largely stable ratios of lbs of halibut mortality per mt of groundfish catch, despite substantial fluctuations in groundfish catch. This ratio ranged from as high as 7.13 in 1962 to a low of 1.82 in 1975, averaging 3.96 lb/mt over the period of observation. In contrast, ratios of halibut mortality to groundfish catch in the Gulf of Alaska have varied substantially, from a high of 53.07 in 1970 to a low of 1.96 in 1985, averaging 24.5 lb/mt over the 1962-2008 period.

There is clearly reason to consider the quality of the data used to estimate halibut mortality over the period examined. Prior to 1978, estimates were provided by observers (many of them IPHC observers) but the coverage was not comprehensive and the extrapolations to total halibut bycatch mortality are of course subject to error. However, if we examine these data in light of experience with other partial-coverage bycatch estimation schemes, the estimates from partial coverage generally underestimate those from comprehensive (i.e., 100%) coverage. As such, these estimates can be considered minimal estimates. Subsequent to 1978, observer coverage in the foreign and joint-venture fisheries off Alaska was much higher and the estimates are likely to be more realistic. Nonetheless, there were persistent concerns about systematic misreporting by these vessels, some indicated by documentation on methods to deceive observers, such that even estimates after 1978 may be biased low. Indeed, U.S. management agencies took action to restrict catches by Japanese vessels after considerable documentation indicating coordinated actions to under-report groundfish catches was found in the early 1980s. Fraudulent reporting of groundfish catches (and presumably halibut bycatch), primarily in the Bering Sea/Aleutian Islands, involved tens of thousands of tons of the target groundfish catches. These problems were reportedly addressed by the mid 1980s, through increased observer coverage and more active enforcement.

One practical implication of potentially biased estimates is the effect on target levels for reduction of halibut bycatch mortality. The targets identified by the 1991 IPHC Halibut Bycatch Work Group should be re-examined along with any evidence of bias in mortality estimation for the period in question and revised, if required. However, we also note that remedial measures to reduce halibut bycatch mortality while retaining similar levels of groundfish catch have been successful, when appropriate incentives and penalties are provided. This success has clearly indicated that much reduction in halibut bycatch mortality is both possible and necessary.

A last component of the question concerns the relationship of halibut bycatch mortality and halibut abundance. Plots of bycatch mortality ratio vs. an index of halibut recruitment (numbers of 6-yr old fish) do not show strong linkages of bycatch and abundance. Instead, increasing halibut abundance follows a decrease in halibut bycatch mortality in the Gulf of Alaska. The relationship is less clear for the same indices in the Bering Sea although we do not have a unique long-term index of recruitment for that area.

Question 8. What are data and assumptions about migration rates?

The effects of migration on impacts of U32 halibut mortality were illustrated during the Bycatch workshop using two alternative scenarios. One scenario is where movement of fish of all sizes was assumed to be based on results of the IPHC PIT tag experiment that is described in several IPHC documents (see Webster, 2009). Another scenario included different movement rates for fish of different sizes. The movement of fish larger than 65 cm was characterized by the IPHC PIT tag experiment results, while the movement of fish smaller than 65 cm was assumed to be based on model results of a juvenile tagging program started in 1980 (Hilborn et al. 1995). A report is being prepared for this year's RARA presenting results in more detail and analyzing sensitivity to varying assumptions on migration rates.

Quest ion 9. How much of signs of overexploitation in Area 2 is due to excess harvest and how much due to missing recruits from bycatch in B.S. and GOA?

The principal sign of overexploitation in Area 2 is the relative lack of older fish, particularly those aged 20 and older. Annual removals in Area 2 have been on the order of 20 to 30 million pounds of halibut annually with annual harvest rates greater than 40% in several recent years. The estimated coastwide loss of annual yield due to U32 bycatch has been on the order of seven million pounds. However, much of the lost yield is upstream of Area 2 and at most half of the lost yield is from Area 2. Thus, while there is undoubtedly some impact on Area 2 population numbers due to bycatch of halibut "upstream", the commercial, recreational and personal use catches taking place in Area 2 account for the large majority of removals and the relative lack of older fish. The widget (Valero and Hare 2009) that has been developed to explore the impacts of fishing and migration is a tool well suited to exploring questions of this nature.

Question 10. How do we update migration rate schedules – can we/should we? [Probably should present alternative approaches to dealing with variability in rates].

The migration rates used in simulations presented during the two Apportionment Workshops and this year's Bycatch Workshop were not allowed to vary by age, year, or sex. Only during the Bycatch Workshop were different migration rates used for fish of different sizes (see answer to Question 8 of this document). Variability in migration rates (e.g., by age, sex, size, maturity) has been explored by staff when assessing sensitivity to assumed base case migration rates in simulation studies. The ability to estimate variability in migration rates by size and time (at least for the years since the start of the PIT tag study) from the PIT tag study is limited, as illustrated by new analyses to be presented in the upcoming 2009 RARA.

The PIT tag study has produced estimates of migration rates among regulatory areas, and it has been suggested that these be integrated explicitly into the stock assessment. While the estimates of migration rates have been extremely important in helping us understand the potential degree of migration of O32 fish that occurs, these estimates have their limitations. Migration rates for some areas cannot be estimated because of sparse release or recovery data, in particular Areas 4B and 2A. Where we do have estimates of rates, precision is not always high. Previous analyses reported rates that were not a function of sex or length, nor were migration rates allowed to change with time, which was a further limitation on their usefulness as part of the stock assessment. New analyses presented in Webster (2010) model the probability that a fish emigrates from a regulatory area as a linear function of year and length on the logistic scale. The likelihood is very flat (i.e., there are several combinations of model parameters that produce very similar results) and parameters of the logistic model are estimated poorly. Although we must be cautious in our interpretation of the estimates, the results (Figs. 3 and 4), suggest heterogeneity in migration among fish of different sizes and over time. Ideally, we would incorporate such heterogeneity in migration into any subsequent analysis that makes uses of the PIT tag results, but not only are these estimates imprecise, they are highly model-dependent. For example, while we selected a linear model for year and length effects, in reality the process is likely to be more complex, and would include interactions of year and length, as well as unmeasured variables like sex. Further, that migration rates seem to be a function of time means that this study can only be considered a brief snapshot, and estimated rates produced from it are not necessarily applicable to years beyond the duration of the study.

Barring the conduct of new tagging studies, updates to the current estimates of migration rates are unlikely. However, the effect of potential long-term changes in migration rates could be explored by further analyses of results from previous long-term IPHC tagging programs which used external wire tags (with the caveats of differences in tagging design, spatial and temporal scope, reporting rate issues, and data quality).

Question 11. Do we know of longline fisheries that have collapsed/had problems because of catch of immature fish?

A more challenging question would be, "Do we know of fisheries which have collapsed that did not have catches of immature fish?". Catches of immature fish are one of the common characteristics of collapsing stocks. In terms of longline fisheries, Atlantic swordfish and bluefin tuna stocks have collapsed as a result of excessive fishing pressure. In the case of swordfish, the fishery was almost exclusively longline and much of the bluefin tuna fishery was also longline. These changes and similar ones for other tuna fisheries have been well documented by the International Commission for the Conservation of Atlantic Tunas, the Inter-American Tropical

Tuna Commission, and the Commission for the Conservation of Southern Bluefin Tuna. These longline fisheries have also had severe negative effects on shark populations in the north Atlantic Ocean (Baum et al. 2003), with documented collapses of several populations. Longline fisheries on sharks in the eastern Atlantic show juvenation (decreasing average age) of populations and catches composed primarily of immature fish as stocks collapse (Coelho and Erzini 2008). An additional concern is that any increased level of complexity in fish populations (e.g., sub-stocks) will tend to increase the sensitivity of the population to collapse (Hutchinson 2008). Juvenation of populations under exploitation is a classic symptom of population collapse and has been seen worldwide, from Peruvian anchoveta, to northern Atlantic cod, to northeast Pacific rockfishes. Populations that rely on fewer numbers of age groups are also less resilient to other forms of population stress, such as natural downturns in recruitment, changes in food supplies, or increases in abundance of competing species.

The simple point here is that any fishing method can apply fishing mortality sufficient to cause stock collapse and longlining is certainly no exception. When stocks receive excessive fishing mortality, one of the significant symptoms is juvenation of the catch and subsequent increase in catches of immature fish – for those gears where those fish are present with adults (or on fishing grounds) and vulnerable to capture. The juvenation of halibut stocks that we have seen in Area 2 is consistent with high fishing mortality. While juvenation can also occur with increased recruitment, the estimated high exploitation rates and the steady increase in fishing intensity (gear per square naut. mi.) indicates convincingly that the cause of the juvenation in Area 2 is excessive fishing mortality, not increased recruitment.

Comment 12. Groundtruth wastage estimates if they are to be deducted from CEY.

In response to Question 3 above, it was demonstrated that use of the top 1/3rd survey stations produced WPUE values generally comparable to commercial WPUE across both time and regulatory areas. These top stations are then used to estimate wastage mortality resulting from the catch of U32 fish. The estimates rely on the assumption that the ratio between U32 and O32 catch of halibut is the same in both the top survey stations and the commercial fleet. There is a secondary assumption that the mortality rate (16%) of released U32 halibut is also the same. A full groundtruthing of commercial wastage estimates would require sampling aboard commercial vessels operating in commercial harvest mode. While such an investigation would likely refine wastage estimates, such an undertaking would be expensive and difficult for IPHC staff to conduct in a representative manner across all areas, because of spatial and temporal variation in commercial fishing. However, the survey covers a similar broad spatial pattern and is conducted during the periods when most commercial fishing occurs. As observation systems (e.g., cameras and/or observers) begin to be implemented in the commercial fleet, analyses to estimate commercial U32 wastage will continue to evolve.

Comment 13. What would the target harvest rate be if there was no reduction in recruitment for U32 bycatch and U32 wastage losses?

See last point on re-evaluation of the IPHC Harvest Policy

Comment 14. How would the target harvest rate change if U32 wastage was directly taken from the CEY and not factored into the harvest rate calculations?

See last point on re-evaluation of the IPHC Harvest Policy

Comment 15.Recalculate the HR in relation to egg loss and SBio loss.

See last point on re-evaluation of the IPHC Harvest Policy

Comment 16. Need wastage estimates and size composition for all removals.

Indeed. The primary missing components are wastage estimates for all sport fisheries, size composition estimates for all subsistence fisheries, and size composition estimates for many sport fisheries. For sport and subsistence fisheries, the Commission uses the size frequency from the IPHC setline surveys as a proxy for the size composition of the catch in those fisheries. While this may provide a reasonable estimate of the size composition of the catch by these fisheries, it may be a less reliable estimate of the landings in the sport fisheries because there is no requirement to retain catch. Sport anglers can and do release halibut that may be of an undesirable size, so there will be measurable wastage in this fishery. This is less likely to the case in subsistence fisheries, where individuals are fishing for direct consumption rather than a recreational experience.

Calculating size composition and wastage for recreational fisheries in Alaskan waters

There is no comprehensive estimation of the size composition for halibut catches or landings for Alaskan sport fisheries. At present, sport fisheries off Alaska have relatively good biological sampling programs conducted by the Alaska Department of Fish and Game for landings by harbour or ramp-based charter fisheries but limited or no sampling programs for lodge-based or remote charter fishing landings. For those fish encountered, a relatively high number are sampled (42% of observed fish were sampled in 2007). Similar sampling exists for landings by harbour or ramp-based unguided fishing in Alaska. From these sampling programs, we obtain estimates of the size composition of sport-caught landings. For the sampled fisheries in most areas, the average size of sport-caught halibut is near the legal limit for commercially-caught halibut (81.3 cm). However, some areas such as Craig/Klawock and Juneau have a high percentage of fish (20-40%) in the 65-75 cm range, which may reflect high exploitation pressure and local depletion so that fisheries are largely dependent on incoming recruitment. Average size of halibut captured in these areas is approximately 74 cm in recent years. The lack of sampling programs for most lodge and remote operations limits our ability to characterize total sport landings and provides no ability to characterize catches.

The Statewide Harvest Survey (SWHS) is a mail survey posted to a large sample of licensed anglers annually. This survey is well designed and conducted by the standards normally seen for this type of survey nationally (NRC 2006). Error checking and non-response bias correction are well developed, and validation with creel census estimation is routinely conducted. Estimates of retained and released fish by species are collected on this survey, as well as on the Alaska Department of Fish and Game logbook survey. Validation of the numbers of released fish is not well developed for either program.

Preliminary work on estimating discard mortality for halibut released by recreational fisheries has been completed (Meyer 2007). Meyer's report forms a reasonable basis for estimating discard mortality and no subsequent work concerning halibut has been conducted or is pending. While we have a working value of discard mortality with which to estimate wastage in the recreational fisheries off Alaska, there remains considerable uncertainty concerning an estimate of the numbers of fish that may be discarded, particularly with changes in daily bag limits. As such, detailed wastage estimation for Alaskan recreational fisheries is not currently possible. However, with significant assumptions, wastage estimation may be possible.

Personal use fisheries in Alaskan waters

There is no biological sampling program for subsistence fishing in Alaska. Estimates of average weights of halibut are derived from self-reported landings and weights by subsistence harvesters. From these self-reports, total estimated landings are derived. However, some validation of self-reporting occurs through community visits by Alaska Department of Fish and Game staff throughout the harvesting season. Average weights reported for these removals are similar to average weights on the IPHC setline survey. Wastage is not currently considered to be an issue of concern for this sector, although a detailed review has not been conducted.

Calculating size composition and wastage for recreational fisheries in Canadian waters

Size composition (or average weight) sampling of the recreational fishery in British Columbia is inconsistent and comprised of a mixture of data from self-reporting by lodge/charter, DFO creel census, and contracted creel census. In addition, size composition or average weight data used for catch estimation are a mixture of current year or up to two previous year's data, depending on area. Self-reported data are not independently validated and the landings estimation process includes all data, regardless of source, and the proportions of verified and unverified data are not reported. The aggregated nature of the reporting for data used in the estimation of sport landings in Area 2B renders evaluation difficult but as much as one-third or more of the estimation data may be unverified.

No comprehensive sampling program for discard data currently exists for Area 2B recreational halibut fisheries. The quinquennial DFO national angler survey does collect data on numbers of fish released but the infrequency of this program renders it of limited value for estimating annual numbers of discarded fish. The former Tidal Diary program in Area 2B did collect discard information but that program was discontinued in the 1990s. Some but not all current creel programs collect information on numbers of fish discarded but not their sizes. Wastage estimation for recreational fisheries in Area 2B does not currently appear to be possible.

Personal use fisheries in Canadian waters

We are not aware of any biological sampling of halibut landed for personal use by First Nations in Area 2B. However, similar to Alaskan fisheries, an assumption of similarity between the characteristics of these removals and those of the Commission's setline surveys is a reasonable assumption. Similarly, we believe that wastage in this sector's removals is not a significant issue, given the direct consumption nature of the fishery.

Calculating size composition and wastage for recreational fisheries in Area 2A

Both Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife maintain creel sampling programs for recreational fisheries and provide length frequency sampling from all categories of recreational removals. Length frequencies are converted to weights in order to calculate average weight in the catch, for in-season management. Sampling rates are relatively high; generally about 30% of the fish in landings are measured. Both national (MRFSS) and state programs collect data on all species released at sea, along with estimated sizes of those fish. Some on-water validation of the release data occurs, although the main focus of release monitoring concerns release of unmarked fish for mark-only salmon fisheries. Nonetheless, it may be possible to derive estimates of the numbers and sizes of released fish in Area 2A recreational fisheries. There have been no discard mortality studies for recreational fisheries on halibut in Area 2A.

Personal use fisheries in Area 2A

Personal use fisheries in Area 2A are restricted to Ceremonial and Subsistence (C&S) fisheries for Native American tribes. Removals under by this sector are governed by the Catch Sharing Plan developed by the Pacific Fishery Management Council and endorsed by the IPHC. The C&S fisheries in Area 2A are allocated a relatively small proportion of the annual catch limit for Area 2A; removals by this fishery in recent years were in the range of 30-35,000 lb annually. No separate biological sampling of these removals occurs. Similar to other personal use fisheries, wastage is not considered to be an issue of concern for these removals.

17. Investigate implications of changing the size limit more thoroughly.

See last point on re-evaluation of the IPHC Harvest Policy

Re-evaluation of IPHC Harvest Policy

A number of questions in this document (Q6, Q13, Q14, Q15, Q17) focus on requests for updates or potential changes to the size limit currently in use, the target harvest rate, or the treatment of different types of removals (e.g. bycatch, wastage). Those topics (together with others such as the determination of biomass reference points) constitute the basis of the current IPHC harvest policy. The performance of the current harvest policy has been recently evaluated (see Clark and Hare 2006) including sources of uncertainty such as density dependent growth response, changes in recruitment (in space and time), and changes in size limit. However, one of the main assumptions on the understanding/modeling of halibut dynamics (that halibut were assumed to effectively cease migrating after the age at which they enter the commercial fishery) has been discounted by new data from the IPHC PIT tag experiment. These data show that halibut do not stop migrating but continue to do so at rates high enough to impact how we understand and model halibut dynamics under exploitation. During the last two years, several IPHC workshops have focused on how the change in understanding of migration affects particular topics such as the spatial scope of the stock assessment, apportionment of catches between the areas, and the impacts of bycatch. The significant impacts of migration on aspects of the harvest policy that have been evaluated so far, and the potential impacts on processes that have not been evaluated yet, merit a comprehensive re-evaluation of the policy. It is not prudent to merely update particular processes/topics (such as size-limit, target harvest rate, bycatch impacts) in isolation and under the structure of the old paradigm (no migration of recruited fish) until we understand the implications of the new paradigm (halibut keep migrating after recruitment) and evaluate those processes/topics together in the re-evaluated harvest policy. Staff is currently developing the building blocks for the re-evaluation of the harvest policy, which will entail a major modeling endeavor that is set to begin next year.

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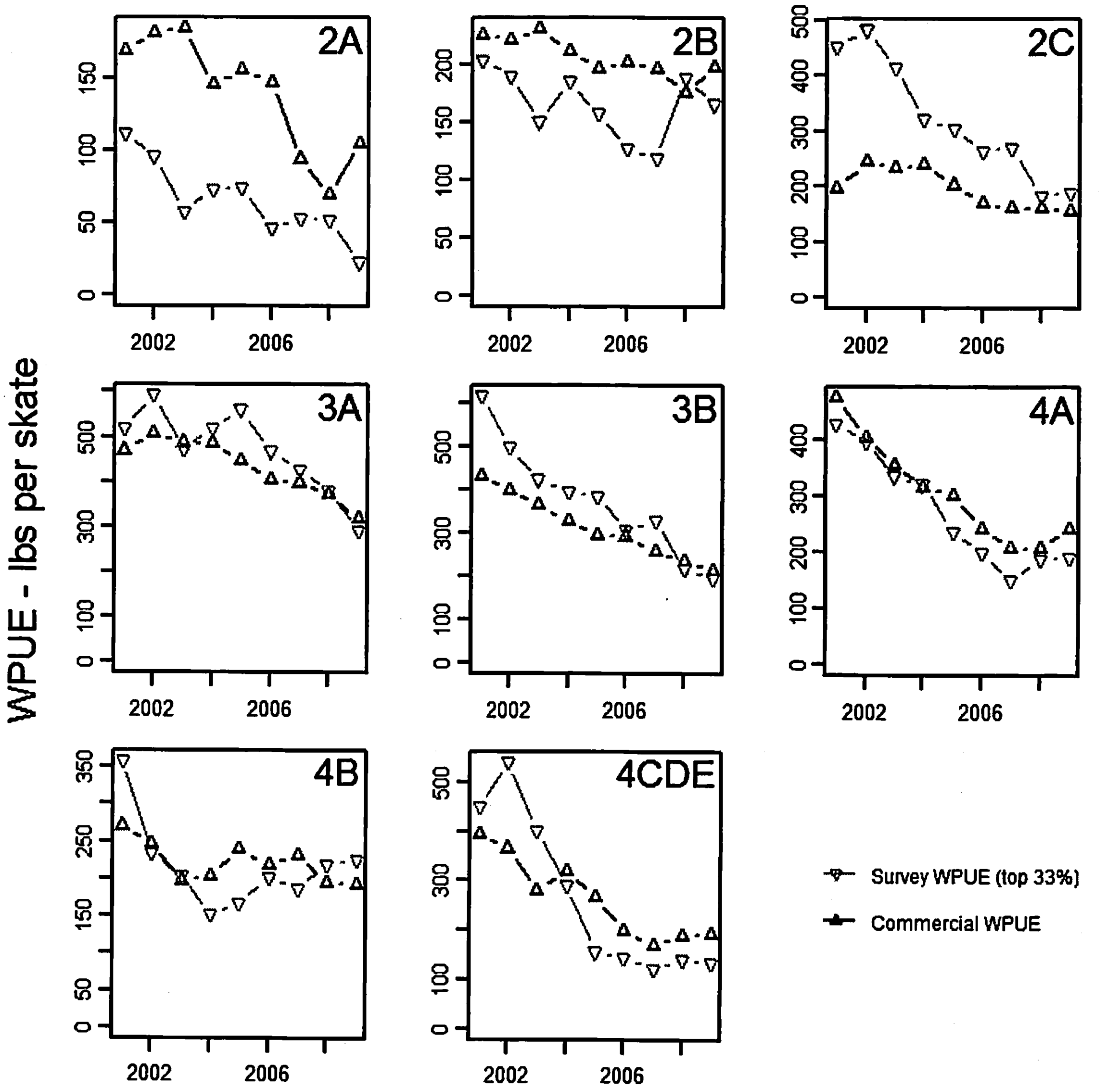

Figure 1. A comparison of mean catch rates (weight per unit effort, WPUE - lbs per skate) between the commercial fleet and the survey, using just the top 1/3 survey stations (in terms of WPUE).

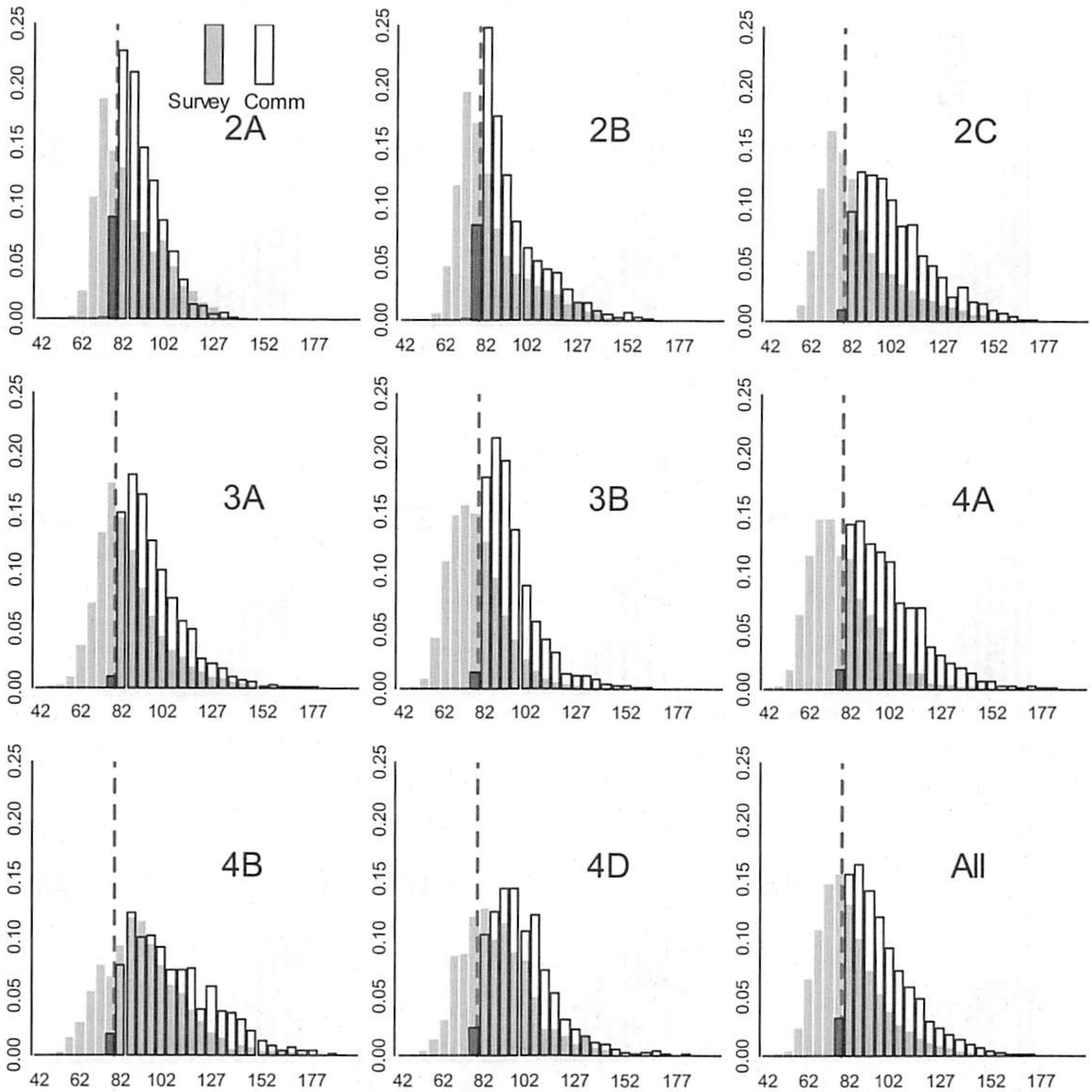

Figure 2.1. Survey (grey) and Commercial (white) length frequency distributions for the year 2008, unadjusted for differences in selectivity. The red dashed vertical line shows the size limit, the red bars represent fish under the size limit that were landed in the commercial fishery during 2008.

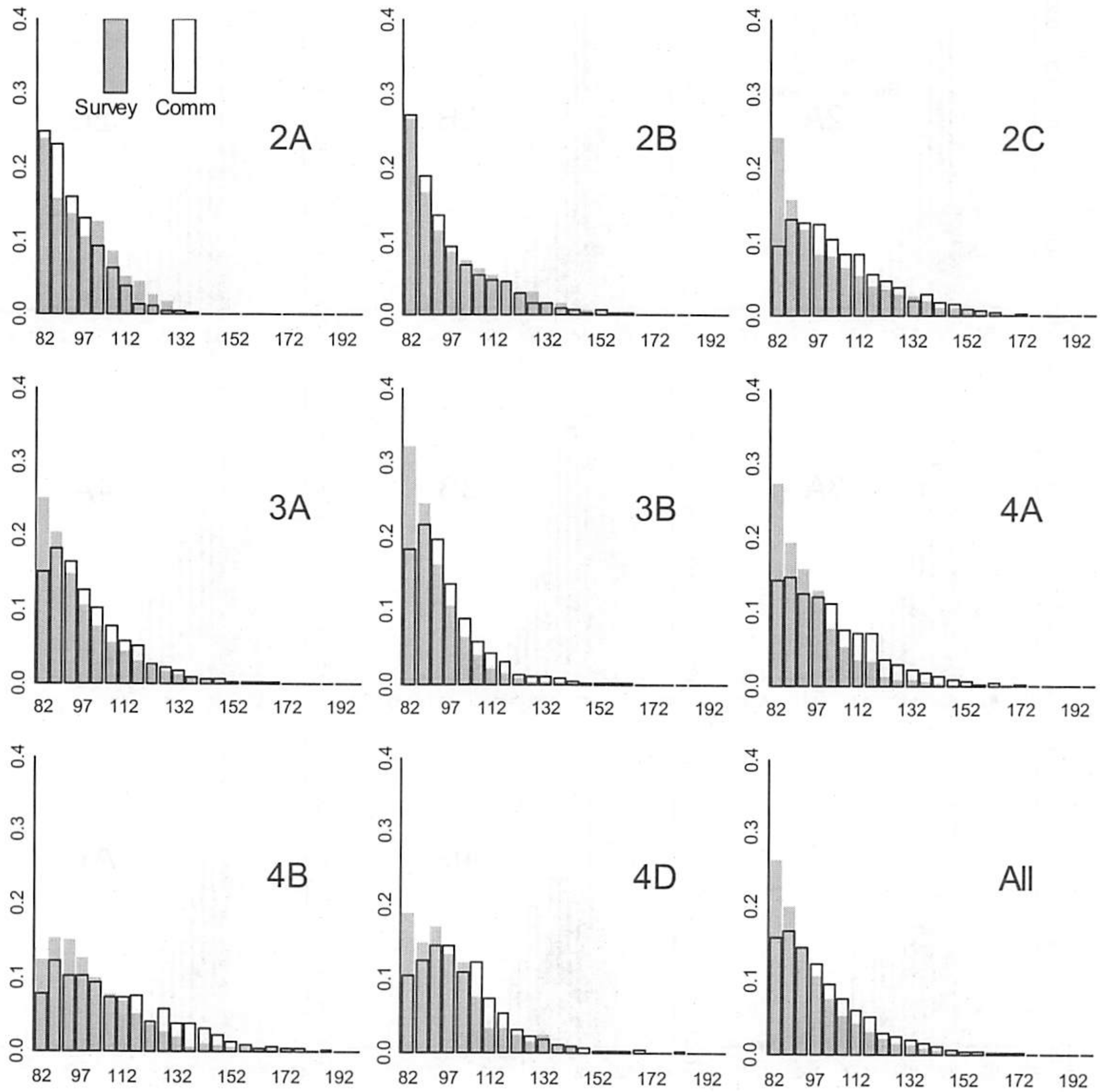

Figure 2.2. Survey (grey) and Commercial (white) length frequency distributions unadjusted for differences in selectivity. Only fish larger than 82 cm shown.

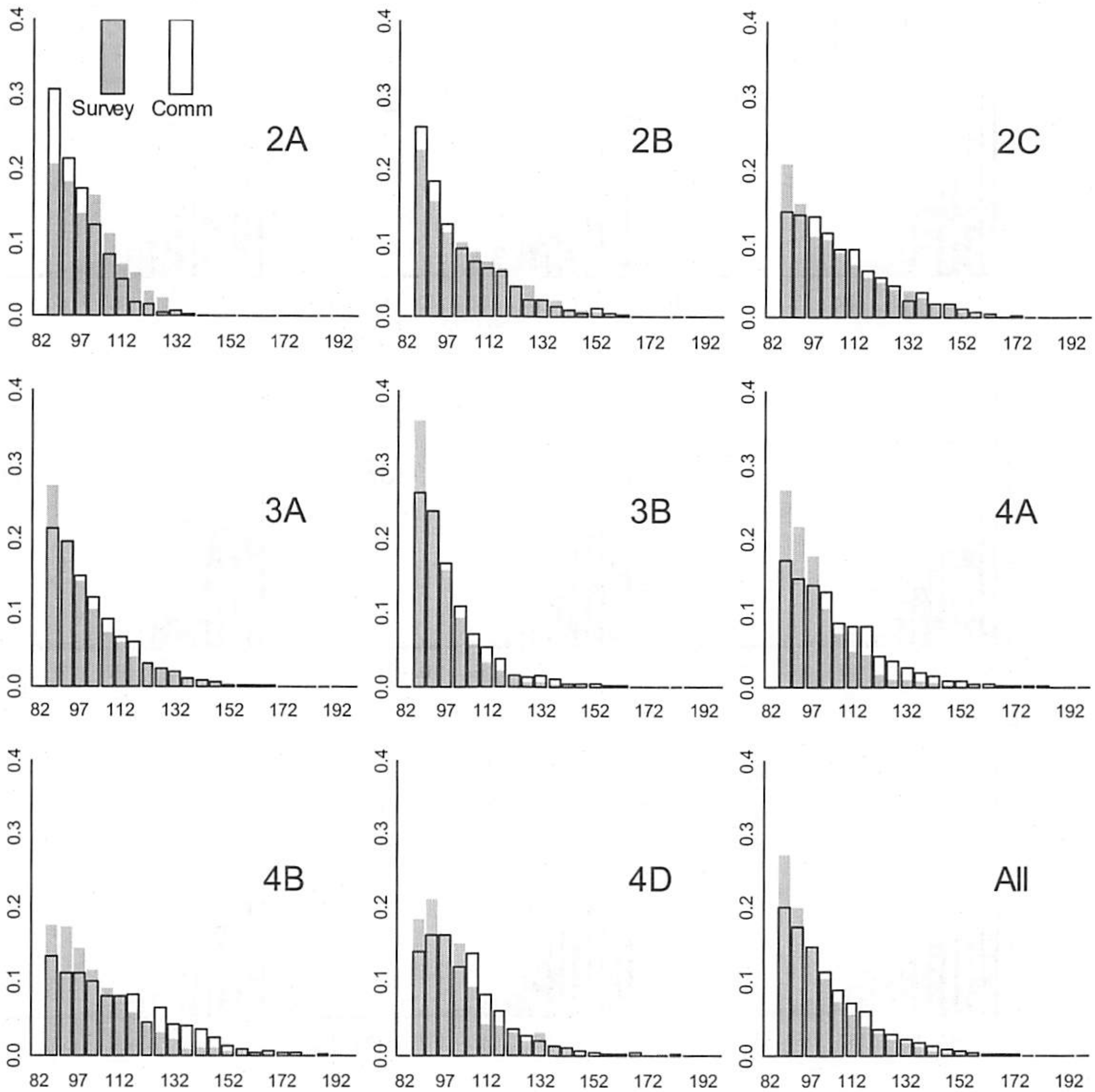

Figure 2.3. Survey (grey) and Commercial (white) length frequency distributions unadjusted for differences in selectivity. Only fish larger than 87 cm shown.

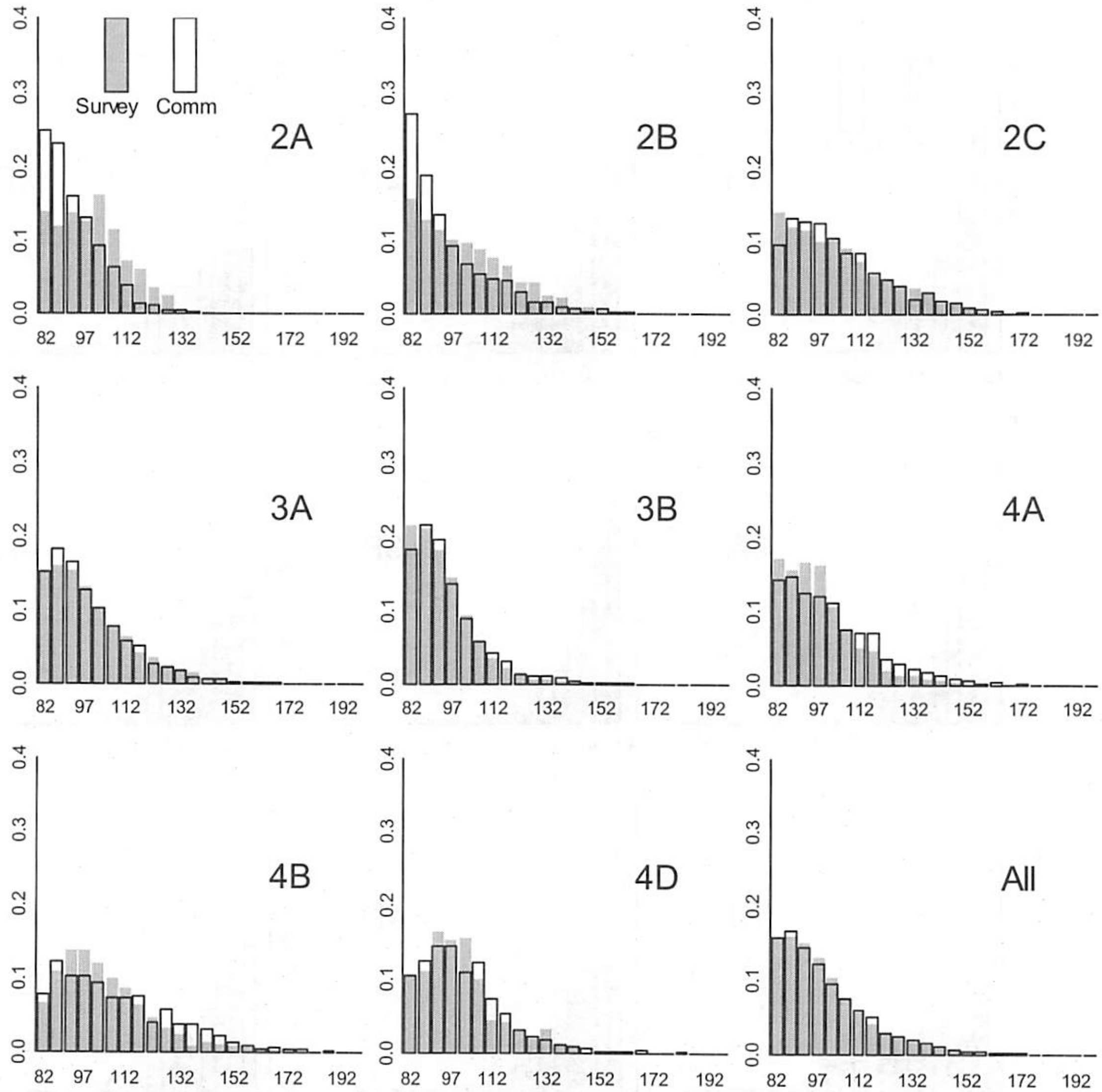

Figure 2.4. Survey (grey) and Commercial (white) length frequency distributions (LFD), Survey LFD adjusted by differential selectivity between Survey and Commercial operations. Only fish larger than 82 cm shown.

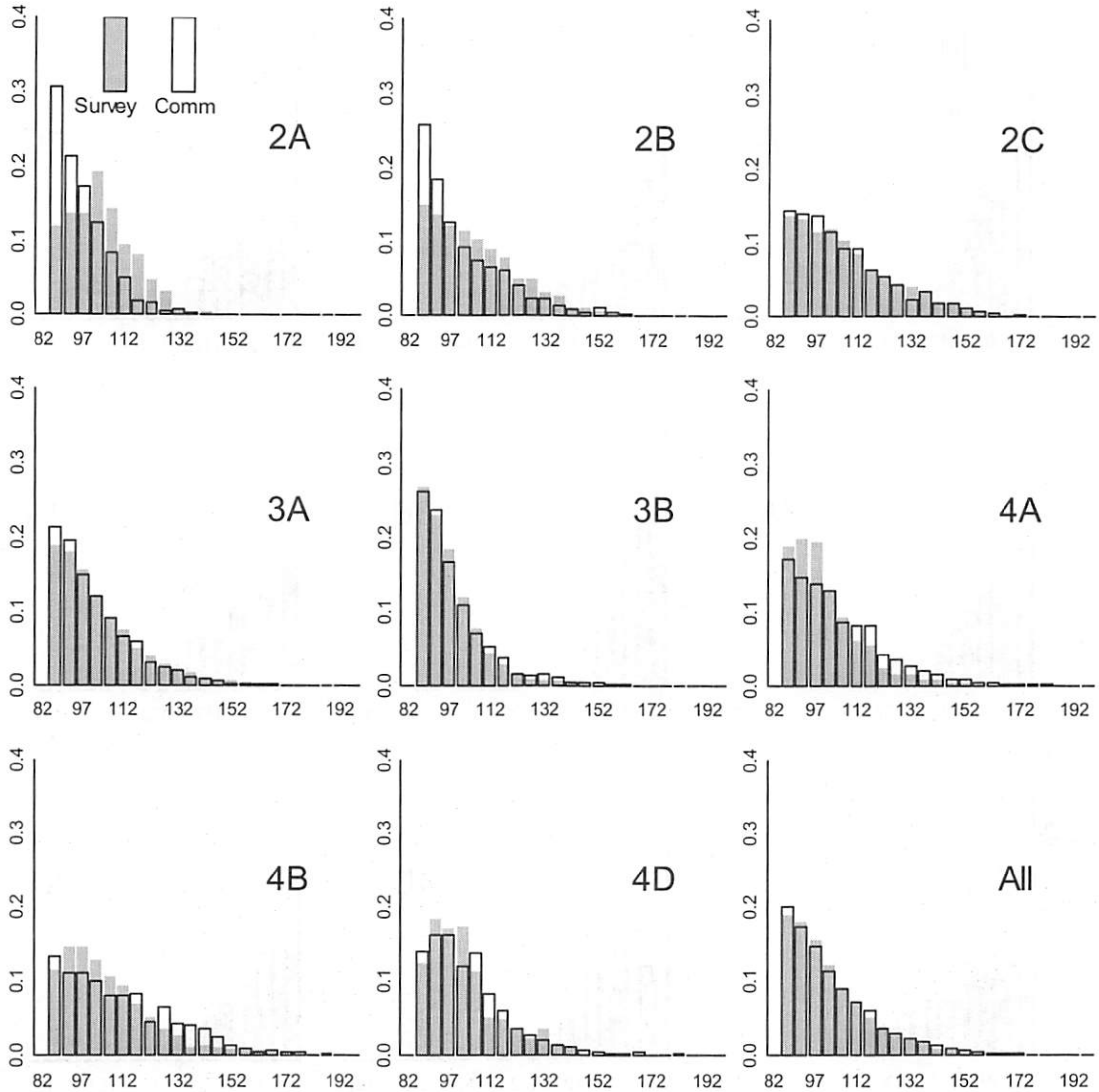

Figure 2.5. Survey (grey) and Commercial (white) length frequency distributions (LFD), Survey LFD adjusted by differential selectivity between Survey and Commercial operations. Only fish larger than 87 cm shown.

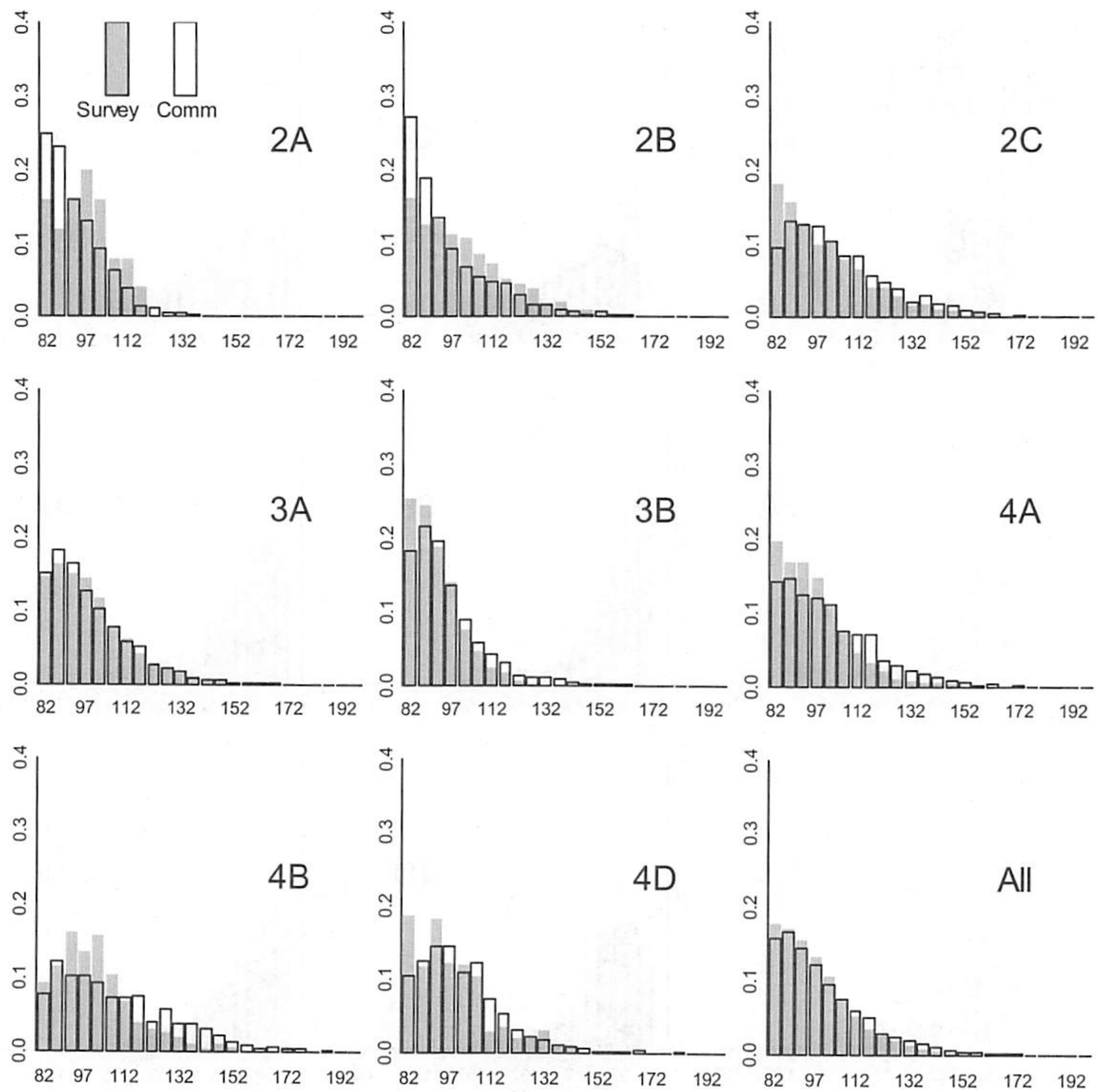

Figure 2.6. Survey (grey) and Commercial (white) length frequency distributions (LFD) unadjusted for differences in selectivity. Survey LFD limited to stations deeper than 100 fm.

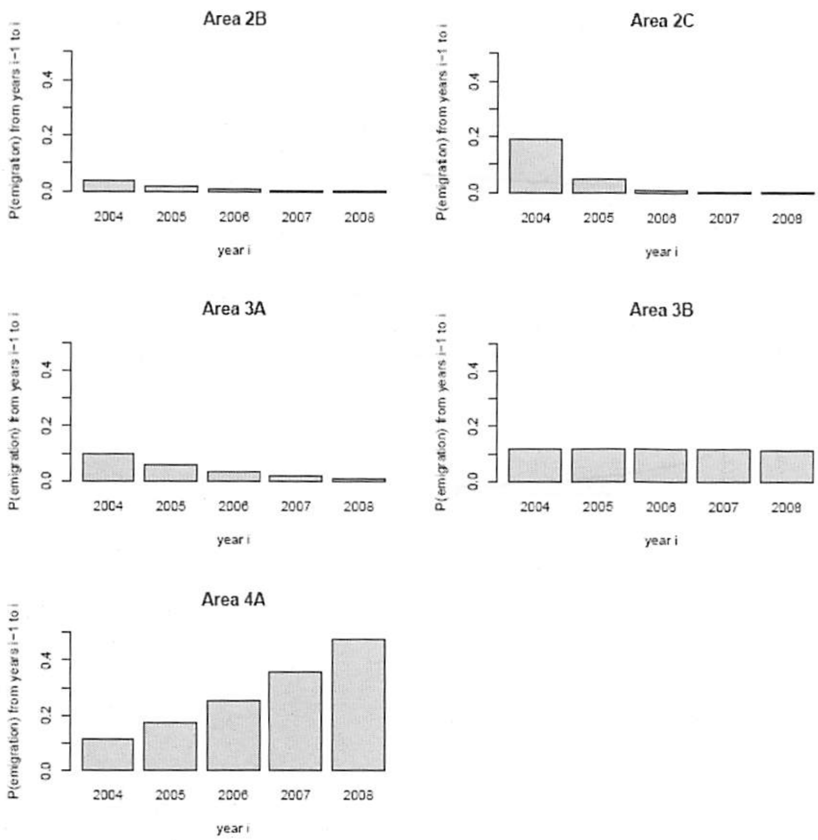

Figure 3. Change in probability of emigration by tagged fish from area of tagging, by year and IPHC Regulatory Area.

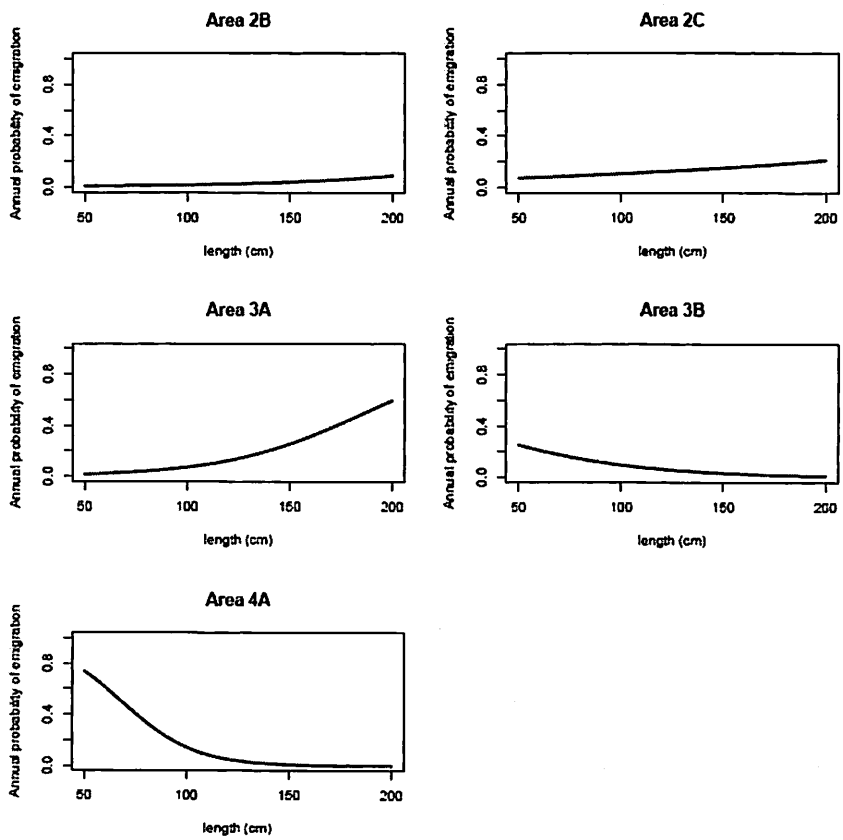

Figure 4. Changes in the probability of tagged fish emigrating, by length and IPHC Regulatory Area.

AGENDA D-2(a)
Supplemental
JUNE 2010

Polar Star, Inc.

Patrick J. Pikus, President
P.O. Box 2843 Kodiak, AK 99615
907-486-5258 pikus@acsalaska.net

June 1, 2010

Eric Olson, Chair
North Pacific Fishery Management Council
605 W. 4th Ave. Suite 306
Anchorage, AK 99501

RE: Agenda item D-2a, Discussion paper on halibut PSC limits

Dear Chair Olson:

I own and operate the 58-foot F/V Polar Star, which fishes for salmon, sablefish, P-cod, halibut and Tanner crab here in the Gulf of Alaska. I am greatly concerned about the health of the halibut stocks. Recent studies conducted by the IPHC indicate that trawl bycatch mortality of U32 halibut in the BSAI and in the Gulf of Alaska is having a significant impact on the halibut stocks and on commercial halibut yields throughout Alaska. The halibut quotas have been in a significant decline for a number of years now. Yet, the trawl fishery continues to utilize the same 2000 mt of halibut PSC they have had since 1989. Also, I believe that the actual bycatch mortality of halibut in the non-pelagic trawl fisheries is significantly higher than is reported. The trawl sector in recent Council meetings has indicated that they have made improvements in their ability to avoid halibut. I believe that it is past time to take a look at reducing the halibut PSC limits in the GOA and the BSAI. I urge the council to initiate an action to reduce halibut PSC limits.

Sincerely,

Patrick J. Pikus
Polar Star, Inc.

PUBLIC TESTIMONY SIGN-UP SHEET

Agenda Item: D-2(a) GOA PSC (Halibut)

	NAME (*PLEASE PRINT*)	TESTIFYING ON BEHALF OF:
1	Tad Fujioka	Sitka Fish & Game Advisory Com.
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NOTE to persons providing oral or written testimony to the Council: Section 307(1)(I) of the Magnuson-Stevens Fishery Conservation and Management Act prohibits any person " to knowingly and willfully submit to a Council, the Secretary, or the Governor of a State false information (including, but not limited to, false information regarding the capacity and extent to which a United State fish processor, on an annual basis, will process a portion of the optimum yield of a fishery that will be harvested by fishing vessels of the United States) regarding any matter that the Council, Secretary, or Governor is considering in the course of carrying out this Act.

Sitka Fish and Game Advisory Committee
304 Lake Street, Rm 103 Sitka, AK 99835

January 21, 2009

Chairman Olson
North Pacific Fishery Management Council
605 West 4th, Suite 306,
Anchorage, Alaska 99501-2252

Dear Chairman Olson,

The Sitka Fish and Game Advisory Committee (SFGAC) is composed of 17 citizens who advise the Alaska Department of Fish & Game and Alaska Boards of Fish & Game on issues relating to state fish and wildlife management. Over the years we have used this forum to comment to numerous Federal, State, Native, and international resource management bodies concerning conservation, research, funding for, and management of wildlife resources in the greater Sitka area. For example, the Sitka Sound Local Area Management Plan (LAMP) implements measures to reduce competition for halibut in Sitka Sound. The Sitka Sound LAMP restricts commercial fishing boats and charter boats from halibut fishing in Sitka Sound to allow personal use fishermen and non-guided sport fishermen greater opportunity to catch halibut in the waters near Sitka. The Sitka Sound LAMP helps maintain a healthy halibut resource. The Sitka Sound Halibut Task Force created the LAMP through a consensus-based process that was lead by the SFGAC. Our membership includes representation of the following user groups: subsistence, conservation, salmon hand troll, hunting, trapping, salmon power troll, seining, fish processing, sport fish, charter, guide, shellfish, longline, and at-large.

We are writing you today to emphasize the importance of the halibut resource to our coastal community and urge you to take action to reduce bycatch in the trawl fisheries in the Bering Sea and Gulf of Alaska. Halibut is an important part of our history and is a major economic force in Sitka. Halibut is utilized by subsistence users, local families, commercial fishermen, sport fishermen, and the charter industry and is a large part of the production run through our x processing facilities.

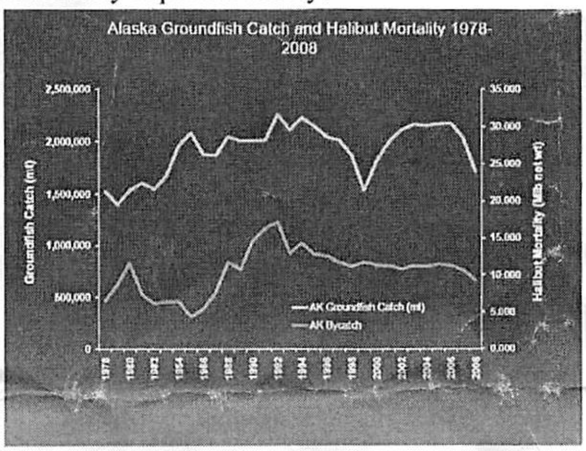
According to a NOAA report (NOAA Fisheries Reducing Bycatch 2005 Report):

> Reduction of marine fisheries bycatch is central to several of NOAA Fisheries' governing statutes, including the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Endangered Species Act (ESA), and the Marine Mammal Protection Act (MMPA). In March 2003, NOAA Fisheries launched its National Bycatch Strategy aimed at building upon previous efforts to address bycatch to forge new ground in the areas of bycatch monitoring and reduction.

We believe the NPFMC has failed in its approach because of a policy that assigns a high bycatch cap to the trawl fleet. The programs that were in place to reduce foreign trawl bycatch were removed with the Americanization of the fishery. Although we know of several successful studies (some federally funded) to develop trawl gear that reduces the bycatch rate of halibut, the current policy of the NPFMC assigns a huge amount of halibut (6,675 mt) for use as trawl bycatch rather than assigning this fish to the directed fisheries for the species. The new halibut migration information shows that trawl bycatch in the Bering Sea has a significant down-stream effect on all other

areas. It also now seems apparent that there is significant unreported trawl bycatch in trawl fisheries that do not have adequate observer coverage. The associated mortality on young fish is negatively impacting the recovery of the halibut stocks and has significant impacts on the coastal communities around the Gulf of Alaska.

Halibut caught in trawl bycatch is predominately immature fish. According to NMFS the halibut discard mortality rate in trawl fisheries in the Gulf and Bering Sea range from 70 percent to 90 percent. According to the IPHC in 2008 1,835 mt of halibut bycatch were taken in the GOA trawl fishery and 2, 483 mt were taken in the BSAI. Although this catch is lower in total tonnage than in the past, the bycatch of halibut has not declined commensurate with declines in target groundfish catch (see figure below from IPHC website). The exploitable halibut stocks in the eastern gulf have been in a steep downward trajectory in recent years and our community cannot understand a policy that places discard and bycatch as a higher priority than the directed fisheries for this historically important fishery.



In Canada they are now managing their trawl bycatch with area-specific Individual Bycatch Quotas (IBQs) and have mandatory observer coverage. Once an IBQ for an area is caught further fishing is prohibited for the year. Bycatch mortality has since been reduced from 1.9 million pounds per year to 0.3 million pounds per year and individual vessels take less than 60% of their IBQ. Clearly the skill and technology exist for trawlers to greatly reduce their halibut bycatch if the management policy goal is to reduce bycatch and discard mortality.

The 2010 IPHC staff recommendations for the commercial halibut quota in area 2C represent a 26% reduction in quota from 2009, on top of 54% reduction between 2007 and 2009. This is the lowest 2C quota since 1984! The GHL for charter fishing is 788,000, the lowest level in their tier.

Our community is depending on the NPFMC to take action to reduce trawl bycatch at your February meeting. In Alaska we have a long history of sustainable fisheries management. It makes no sense to have a fixed trawl cap for halibut. The trawl bycatch of halibut should be set as a rate with the overall level moving up and down with abundance of halibut. The goal should be to reduce trawl bycatch to as low a level as possible to protect the resource and allow the directed halibut fisheries (including the subsistence fishery) to benefit from increases in halibut production.

Sincerely,

Tad Fujioka
Chairman

Cc Phillip Lestenkof US Chairman, Bruce Leaman, Director IPHC
CC Alaska Governor Parnell
CC ADFG Commissioner Lloyd