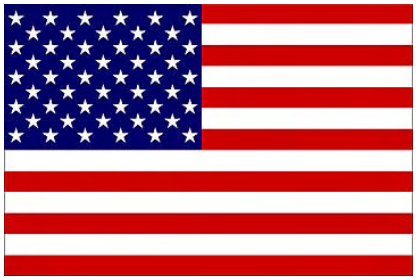


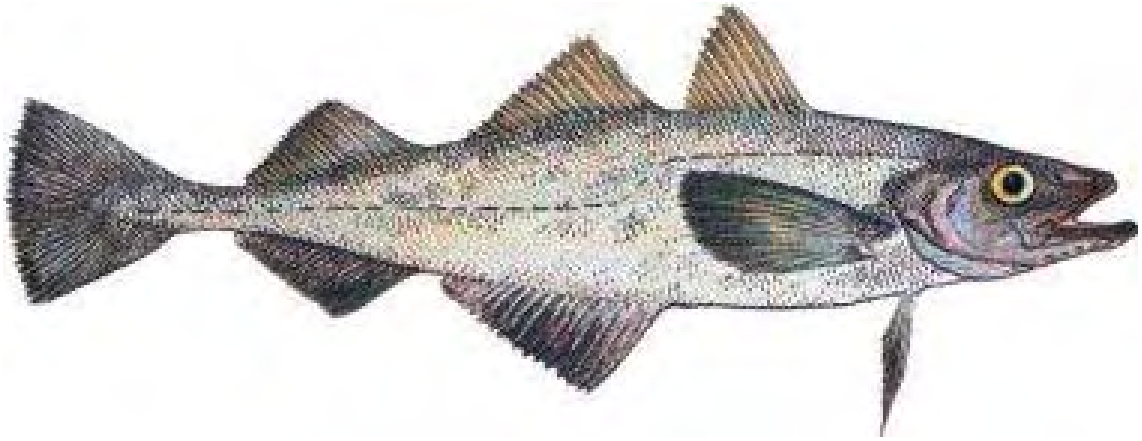
Information for Discussions

by the Scientific and Technical Committee

submitted by the

United States Party to the

13th Annual Conference of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea



September 1-3, 2008

Kaliningrad, Russia

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Table 1. All-nation historical catch of pollock from the Bering Sea, in metric tons, 1977-2008

Year	Olyotorskiy-Karagin (W of 170W)	Navarin Region (E of 170W)	Donut Hole	Bogoslof	Aleutian Region	Eastern Bering Sea	Total Bering Sea
1977	265,000				7,625	978,370	1,250,995
1978	417,000				6,282	979,431	1,402,713
1979	546,000				9,504	935,714	1,491,218
1980	825,000				58,156	958,280	1,841,436
1981	1,133,000				55,516	973,502	2,162,018
1982	976,000				57,978	955,964	1,989,942
1983	1,006,000				59,026	981,450	2,046,476
1984	252,000	503,000	181,200		81,834	1,092,055	2,110,089
1985	134,000	488,000	363,400		58,730	1,139,676	2,183,806
1986	297,000	570,000	1,039,800		46,641	1,141,993	3,095,434
1987	349,000	463,000	1,326,300	377,436	28,720	859,416	3,403,872
1988	475,000	852,000	1,395,900	87,813	30,000	1,228,721	4,069,434
1989	345,000	684,000	1,447,600	36,073	15,531	1,229,600	3,757,804
1990	582,000	232,000	917,400	151,672	79,025	1,455,193	3,417,290
1991	326,000	178,000	293,400	264,760	78,649	1,217,301	2,358,110
1992	282,000	315,000	10,000	160	48,745	1,164,440	1,820,345
1993	288,000	389,000	1,957	885	54,074	1,198,790	1,932,706
1994	204,000	288,900	NA	556	53,224	1,197,224	1,743,904
1995	79,000	427,300	Trace	264	60,184	1,169,614	1,736,362
1996	34,000	753,000	Trace	389	26,597	1,102,579	1,916,565
1997	30,000	735,000	Trace	163	24,721	1,036,789	1,826,673
1998	25,000	719,000	Trace	8	22,053	1,058,288	1,824,349
1999	46,000	639,000	Trace	1	965	889,561	1,575,527
2000	15,000	507,000	Trace	29	1,174	1,019,067	1,542,270
2001	25,000	526,000	0	61	788	1,247,305	1,799,154
2002	8,000	370,000	0	22	1,134	1,331,416	1,710,572
2003	14,600	411,200	0	24	1,653	1,491,356	1,918,833
2004	6,200	424,500	0	0	1,150	1,493,394	1,925,244
2005	4,400	446,800	0	0	1,622	1,483,398	1,936,220
2006	3,900	462,500	0	0	1,736	1,486,414	1,954,550
2007	62,600	587,900	0	0	2,519	1,354,091	2,007,110
2008*	2,510	115,830	0	0	1,086	690,560	809,986

Sources of Data

Reported by the Parties to the Convention

* US data through 2 August 2008: Russian Federation data through 31 July 2008

Table 2. Estimated Biomass (mt) of Pollock in the Aleutian Basin region of the Convention Area based on assumption that the Bogoslof Survey biomass represents sixty percent of the Aleutian Basin biomass.

Year	Bogoslof Biomass from Surveys, mt	Basin Biomass (Extrapolated Biomass)	Catch mt	Exploitation Rate (%)
1984			181,200	?
1985			363,400	?
1986			1,039,800	?
1987			1,326,300	?
1988	2,396,000	3,993,333	1,395,900	35
1989	2,084,000	3,473,333	1,447,600	42
1990			917,400	?
1991	1,283,000	2,138,333	293,400	14
1992	888,000	1,480,000	10,000	1
1993	631,000	1,051,667	1,957	0
1994	490,000	816,667	0	0
1995	1,020,000	1,700,000	0	0
1996	582,000	970,000	0	0
1997	342,000	570,000	0	0
1998	432,000	720,000	0	0
1999	393,000	655,000	0	0
2000	270,000	450,000	0	0
2001	208,000	346,667	0	0
2002	227,000	378,333	0	0
2003	198,000	330,000	0	0
2004	No survey		0	0
2005	253,000	421,667	0	0
2006	240,000	400,000	0	0
2007	292,000	486,667	0	0
2008	No Survey		1	

Table 3. Summary of Trial Fisheries on Pollock in the Central Bering Sea Donut Hole Area

Year	Dates	Nation	No. Vessels	Vessel Name	Vessel Days	Data Source (Annual Conference Report)	Catch (KG)	Catch Number
2008								
2007								
2006	Jul 20-Aug 20	Korea	1	Oriental Angel (Keuk Dong Co				
2006	Jul 20-Aug 20	Korea	1	Nambuk Ho (Nambuk Fish Co				
2006	Jul 22-Aug 22	Korea	1	Joosung Ho (Hansung Enterprise Co)				
2003	Mar 12-26	Korea	2	Man Jeck No. 21, O Yang Ho - 2	27	9th	2.6	2
2003	Oct - Nov	Korea	1	O-Ryong 503	15	9th	0.0	2
2003	Nov 15-27	Russia	1	Pioner Nikolayeva	13	9th	1.6	1
2001	Nov 11-14	China	2	Ming Zhu, Kai Feng	8	7th	0.0	0
2001	Jun 7 - Jul 14	China	1	Kai Tuo	38	6th	*~24.0*	16
2000	Jan 12 - Feb 3	Korea	1	Oriental Discoverer	23	5th	0.0	0
2000	May 11-20	Korea	1	Oriental Angel	10	5th	0.0	0
2000	May 20 - Jun 28	China	1	Kai Chuang	40	5th	*~64.5*	43
1999	Aug 17-30	Poland	1	Homar	14	5th	2.3	2
1999	Apr 29 - May 3	Poland	1	Acamar	5	4th	2.8	2
1998	Sep 3-8	Poland	1	Acamar	6	4th	3.0	2
1997	Oct 12-15	Poland	1	Acamar	4	STC, Sep. 1998	0.0	0
1997	Aug 16-19	Russia	1	?	4	2nd	0.0	0
1997	Jun & Aug	China	2	?	8	2nd	*< 900.0*	*< 600*
1996	?	China	1	?	?	2nd	?	?
1996	Sep 1-11	Poland	1	Acamar	11	2nd	*~276.0*	184
1995	Oct 18 - Nov 12	Poland	2	Homar, Acamar	54	1st	?	?
1993	Jul 2 - Sep 4	Poland	1	Adm. Arciszewski	65	unpub ms	?	?
1993	Jul 2 - Sep 4	Poland	1	Adm. Arciszewski	63	Bull. SFI. 2(138) 1996	?	?
1993	Jun 6-14	Japan	1	?	9	unpub ms	?	?
1993	Jul 13-22	Japan	1	?	10	unpub ms	?	?
1993	Nov 12-17	Japan	1	?	6	unpub ms	?	?
1993	Dec 8-17	Japan	1	?	6	unpub ms	?	?

? indicates unknown

Italics indicate non-reported estimated numbers

Table 4. United States Pollock Catches in metric tons, 1993-2008

Year	E. Bering Sea	Aleutians	Bogoslof	Gulf of Alaska
1993	1,198,790	54,074	885	108,066
1994	1,197,224	53,224	556	110,890
1995	1,169,614	60,184	264	73,248
1996	1,102,579	26,597	389	37,106
1997	1,036,789	24,721	163	89,893
1998	1,058,288	22,053	8	123,805
1999	889,561	965	1	93,422
2000	1,019,067	1,174	29	23,643
2001	1,247,305	788	61	70,485
2002	1,331,416	1,134	22	50,712
2003	1,491,356	1,653	24	48,573
2004	1,493,394	1,150	50	60,929
2005	1,483,398	1,622	0	80,040
2006	1,486,414	1,736	0	68,950
2007	1,354,091	2,519	0	60,928
Through 2 Aug 2008	690,580	1,086	1	28,810
Catch Quota for 2008	1,000,000	19,000	10	51,940
Remaining Quota	309,420	17,914	9	23,130

Note: (Data from http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm)

Table 5. Pollock assessment numbers determined for management of the U.S. 2008 pollock fisheries

Area	OFL	ABC	TAC	TAC/ABC
Eastern Bering Sea	28,200	1,000,000	1,000,000	1.00
Aleutians Region	19,000	29,400	19,000	0.65
Bogoslof	58,400	7,970	10	0.00
Gulf of Alaska	72,110	51,940	51,940	1.00

Notations: OFL = Overfishing Level, ABC = Acceptable Biological Catch, TAC = Total Allowable Catch

Table 6. Summary of more recent studies of genetic stock structure in walleye pollock
(Table updated by Mike.Canino@noaa.gov, August 2008)

Study	Area	Marker	Results
Mulligan et al. 1992	Eastern BS and GOA	mtDNA RFLP	• significant genetic heterogeneity. Donut Hole and Bogoslov more similar than Adak or GOA
Shields and Gust 1995	BS, Aleutians, GOA	mtDNA sequence	• no genetic heterogeneity among samples. Pooled samples Western BS differentiated from Eastern BS, Donut Hole (n = 8)
Kim et al. 2000	Korea -Bogoslov	mtDNA RFLP	• no significant genetic heterogeneity
Olsen et al. 2002	Western north Pacific, Eastern BS, GOA, PWS	mtDNA RFLP allozyme microsatellites	• east -west heterogeneity between Asian and N American populations • regional heterogeneity among GOA samples (PWS vs SHEL) • Discordant results between BS and GOA - significant differentiation observed with allozymes and mtDNA but in different years
O'Reilly et al. 2004	Western north Pacific, North Central BS, Eastern BS, GOA, Puget Sound	microsatellites	• weak structuring (global F_{ST} = 0.004) • genetic isolation by distance over moderate scales (~1500 km) • sign. genetic differentiation between NCBS and GOA
Brykov et al. 2004	Northwestern Bering Sea	mtDNA RFLP	• sample from Anadyr Gulf (northernmost site) differentiated from Ozernoi Bay, Olyutorskyi Bay, Koryak shelf, and Navarin region.
Shubina et al. 2004	Northwestern Bering Sea	microsatellites	• genetic differentiation among Shirshov, Olyutor, and Navarin 'stocks'
Canino et al. 2005	Western north Pacific, North Central BS, Eastern BS, GOA, Puget Sound	pantophysin (*Pan* I) locus	• stronger differentiation than observed with microsatellites (global F_{ST} = 0.038) • north-south cline in *Pan* I allele frequencies correlated with water temperature • North Central BS sample differentiated from Eastern BS and PWS sample
Grant et al. 2006	reanalysis of mtDNA data from first 4 studies above, plus new mtDNA sequence data from Puget Sound	mtDNA	• Five haplotypes gave range of F_{ST} estimates from 0.011-0.058. • most common haplotype showed north-south cline and was correlated with water temperature and geographic distance • haplotype numbers and homozygosity revealed widespread departures from neutrality, suggesting the effects of temperature-mediated selection in the EBS and North Pacific
Grant et al. In press	Japan, Western north Pacific, North Central BS, Eastern BS, GOA, Puget Sound\	mtDNA	• Overall F_{ST} = 0.030, with most of the divergence due to differences between Asian and North American populations (F_{ST} = 0.064,). Population differentiation within these two groups was minimal (F_{ST} = 0.006). • Within the Bering Sea and northeast Pacific, high levels of dispersal and population cycles driven by short-term climatic variability produces a shifting balance stock structure that prevents the appearance of stable, genetically discrete stocks.

Update on the Status of Pollock Resources of the Eastern Bering Sea, Aleutians, and Bogoslof Regions (through 2007)

(Extracted from SAFE Report, NPFMC, Anchorage)

The standard time period for updating the status of pollock resources for meeting the schedule of the North Pacific Fishery Management Council is in November of each year when the Groundfish Plan Teams of the Council meet. The last update was conducted in November 2007 when the status of Pollock resources was assessed for application for management of the 2008 fishery. The detailed assessments of the stocks off Alaska can be found at:

http://www.afsc.noaa.gov/REFM/stocks/assessments.htm

The summary of the Pollock assessments is shown below:

Status and catch specifications (t) of walleye pollock in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2007 and 2008 are those recommended by the Plan Team. Catch data are current through 10/27/07.

Area	Year	Age 3+ Biomass	OFL	ABC	TAC	Catch
Eastern Bering Sea	2006	8,050,000	2,090,000	1,930,000	1,485,000	1,486,413
	2007	6,360,000	1,640,000	1,394,000	1,394,000	1,350,530
	2008	4,360,000	1,440,000	1,000,000	n/a	n/a
Aleutian Islands	2006	130,000	39,100	29,400	19,000	1,735
	2007	229,000	54,500	44,500	19,000	2,488
	2008	197,000	34,000	28,200	n/a	n/a
Bogoslof	2006	253,000	50,600	5,500	10	0
	2007	240,000	48,000	5,220	10	0
	2008	292,000	58,400	7,970	n/a	n/a

Eastern Bering Sea

Changes from the previous assessment made in November 2006
New data in the 2007 year's assessment include the following:

1. Updated total catch for 2006 and a preliminary estimate of the 2007 catch.
2. Biomass estimates from the 2007 bottom trawl survey and the 2007 echo-integration trawl EIT) survey. The estimate from the bottom trawl survey was 4.3 million t, up 42% from the 2006 estimate. The estimate from the EIT survey was 1.88 million t, up 20% from last year's survey. Although both survey estimates are higher than last year's, both are substantially below the long-term means for their respective time series.
3. Age composition data from the 2007 bottom trawl survey, updated age composition data from the 2006 EIT survey, and preliminary age composition data from the 2007 EIT survey (based on the age-length key from this year's bottom trawl survey). The 2007 survey age compositions give evidence of a large 2006 year class.
4. Age and size composition data and weight-at-age data from the 2006 fishery. The new weight-at-age data resulted in a significant decrease in the 2006 mean weights at age relative to the values used in last year's assessment.
5. Sample sizes specified in the model were re-evaluated using a bootstrap approach.

Changes in model structure include the following:

1. Length composition data (not just age composition data) can now be used in the model.
2. Relative abundance at age 1 in the EIT survey is now estimated separately (as an independent recruitment index) from the other age groups.
3. The survey abundance index used for tuning the model was changed from age 1+ numbers to age 2+ numbers.
4. The catch/biomass ratio used in applying the Tier 1 harvest control rules now uses "fishable biomass" (the sum of the product of selectivity-, weight-, and numbers-at-age) for the denominator instead of age 3+ biomass. This makes the computation less sensitive to fluctuations in incoming year class strength.

Spawning biomass and stock status trends

1. Consistent with the estimates produced in last year's assessment, abundance of EBS walleye pollock has declined steadily since 2003 due to poor recruitment from the 2001-2005 year classes.2.
2. This string of five consecutive poor year classes is unprecedented in the known history of the stock. Spawning biomass is estimated to be 4% above B_{MSY} in 2007 but projected to be 28% below B_{MSY} in 2008. The age 3+ biomass for 2007 is estimated to be the lowest in the time series since 1980. Although preliminary indications are that the 2006 year class is well above average, spawning biomass is unlikely to exceed B_{MSY} until 2010.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

1. The SSC has determined that reliable estimates of B_{MSY} and the probability density function for F_{MSY} exist for this stock. Therefore, EBS walleye pollock qualify for management under Tier 1. The Plan Team concurs with the assessment authors' conclusion that the Tier 1 reference points continue to be reliably estimated.
2. The updated estimate of B_{MSY} from the present assessment is 1.88 million t, compared to 2.06 million t from last year's assessment. Projected spawning biomass for 2008 is 1.38 million t, placing EBS walleye pollock in sub-tier "b" of Tier 1. As in recent assessments,

the maximum permissible ABC harvest rate was based on the ratio between MSY and the equilibrium biomass corresponding to MSY. The harmonic mean of this ratio from the present assessment is 0.341, significantly higher than last year's value of 0.243. The difference is due to a change in the biomass measure used in the denominator of the ratio, from age 3+ biomass (in last year's assessment), to fishable biomass (in this year's assessment). The lead author noted that this method change results in the same average yield but with less inter-annual variability.

3. The harvest ratio of 0.341 is scaled according to the Tier 1b formula and then multiplied by the geometric mean of the projected fishable biomass for 2008 (4.77 million t) to obtain the maximum permissible ABC for 2008, which is 1.17 million t. This ABC is more than double the 2008 yield of 555,000 t that would correspond to a Tier 3b strategy based on a $B_{40\%}$ value of 2.63 million t and an $F_{40\%}$ value of 0.51.
4. A range of ABC values from 555,000 – 1,170,000 t was discussed by Plan Team, with arguments offered in support of candidate values spanning the full range. Arguments in support of setting the 2008 ABC at 1.17 million t included the following:
    a. The stock qualifies for management under Tier 1, so the maximum permissible Tier 1 ABC should have priority unless there is a compelling reason to set a lower ABC.
    b. The Tier 1 harvest control rules already have a built-in precautionary adjustment for stocks that fall below B_{MSY}.
    c. Uncertainty is already factored into the Tier 1 harvest control rules. A 2008 ABC of 1.17 million t would already constitute a very large (16%) reduction from the 2007 ABC of 1.394 million t and would result in greater short-term catch stability than a lower ABC.
    d. Biomass is expected to rebuild to B_{MSY} under the maximum permissible ABC about as fast as it would under more conservative strategies.

5. Arguments in support of an ABC lower than 1.17 million t included the following:
    a. A 2008 ABC of 1.17 million t would imply an all-time high spawning exploitation rate. Keeping the 2008 ABC at or below about 1 million t would not exceed the all-time high spawning exploitation rate.
    b. There are many examples of strong year classes being produced when biomass is near $B_{40\%}$, but only one strong year class has been produced at a biomass lower than the projected 2008 value, implying that it would be desirable to increase biomass sooner rather than later.
    c. The stock rebuilt successfully from a similarly low level in the late 1970s and early 1980s when catches were limited to 1 million t or less.
    d. The possibility of a retrospective bias calls for additional precaution. The five-year string of consecutive poor recruitments spawned between 2001 and 2005 is unprecedented, also calling for additional precaution.

After lengthy discussion, the Plan Team voted to support the authors' recommendation of a 1 million t ABC for 2008. The decision was not unanimous, with some Plan Team members voting for lower values (specifically, 976,000 t and 555,000 t). The Plan Team emphasized that its recommendation is intended to constitute a precautionary ABC, and that if next year's assessment does not confirm the current estimated strength of the 2006 year class, further reductions may be necessary. A 2008 ABC of 1 million t would correspond to a harvest ratio of 0.21 and an $F_{39\%}$ harvest rate (compared to Tier 1A ABC rate of $F_{32\%}$). The current projection for maximum permissible ABC in 2009 given a 2008 catch of 1 million t is 1.07 million t

The OFL harvest ratio under Tier 1a is 0.422, the arithmetic mean of the ratio between MSY and the equilibrium fishable biomass corresponding to MSY. The product of this ratio, rescaled according to the Tier 1b formula, and the geometric mean of the projected fishable biomass for 2008 gives the OFL for 2008, which is 1.44 million t. A 2008 OFL of 1.44 million t would correspond to a harvest ratio of 0.30. The current projection for OFL in 2009 given a 2008 catch of 1 million t is 1.32 million t. The walleye pollock stock in the EBS is not overfished and is not approaching an overfished condition.

Aleutian Islands

Changes from the previous 2006 assessment

Model 2B is similar to the model accepted by the SSC last year and is recommended by the authors again this year.

Spawning biomass and stock status trends

Age 2+ biomass is estimated to have increased from 1999 to 2004, after which it has been stable. Spawning biomass is estimated to have been increasing slowly since 1999. The 2000 year class is estimated to have been well above average (third largest in the time series), and preliminary indications are that the 2005 and 2006 year classes may be slightly above average. Spawning biomass for 2008 is projected to be 82,300 t.

Tier determination/Plan Team discussion and resulting ABCs and OFLs

The SSC has determined that this stock qualifies for management under Tier 3. Given that spawning biomass has been increasing and is above the $B_{40\%}$ value of 51,500 t, the Plan Team concurs with the authors' recommendation to set 2008 ABC at the maximum permissible value (Tier 3a, with $F_{40\%}$=0.20) of 28,200 t. Assuming a 2008 catch equal to the ABC, the maximum permissible ABC for 2009 is projected to be 22,700 t.

Following the Tier 3a formula with $F_{35\%}$=0.24, OFL for 2008 is 34,000 t. The projected OFL for 2009 is 26,100 t. The walleye pollock stock in the Aleutian Islands is not overfished and is not approaching an overfished condition.

Bogoslof

Changes from the previous 2006 assessment

No changes in analytic approach were made in this assessment.

Spawning biomass and stock status trends

Survey biomass estimates since 2000 have all been lower than estimates prior to 2000, ranging from a low of 198,000 t in 2003 to a high of 301,000 t in 2000. The 2007 estimate is the highest since the 2000 estimate.

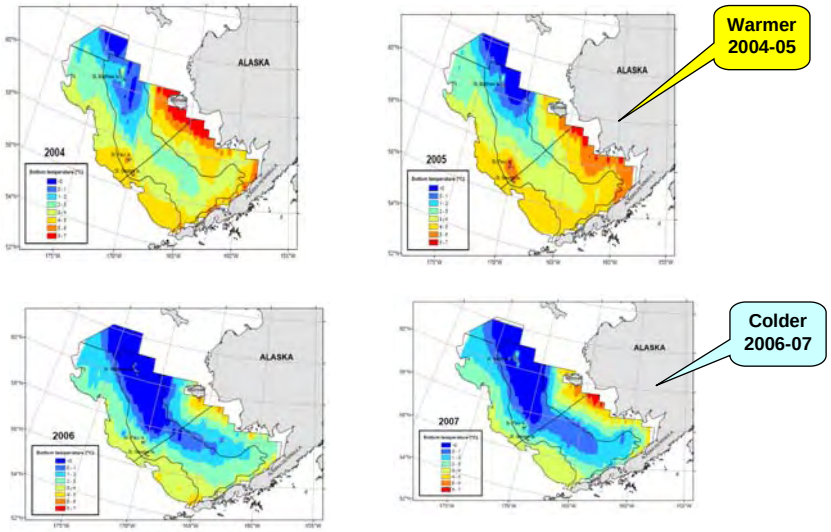
Tier determination/Plan Team discussion and resulting ABCs and OFLs

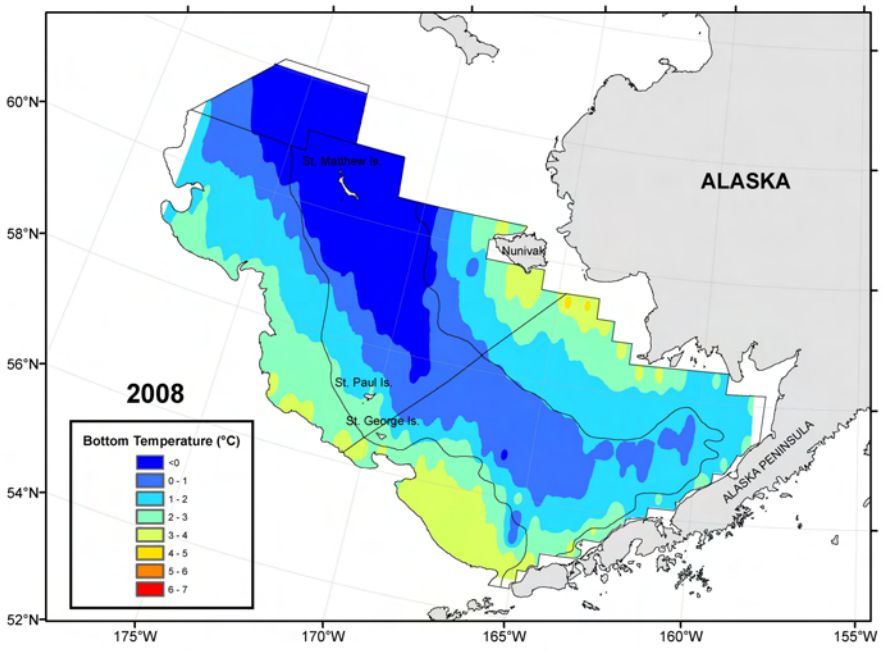
The SSC has determined that this stock qualifies for management under Tier 5. Traditionally, the ABC for this stock has been set using a formula similar to the Tier 3 formula, but substituting a reference biomass level of 2 million t for $B_{40\%}$. The Plan Team concurs with the authors' recommendation to continue this practice. Given $F_{40\%}$=0.27, this results in F_{ABC}=0.022 and a 2008 ABC of 7,970 t. The projected ABC for 2009 is the same.

Following the Tier 5 formula with M=0.20, OFL for 2008 is 58,400 t. The OFL for 2009 is the same. As a Tier 5 stock, it is not possible to determine whether Bogoslof pollock is overfished or is approaching an overfished condition.

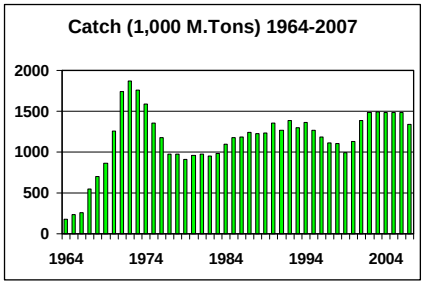
Power Point Slides on Status of Pollock Stocks:

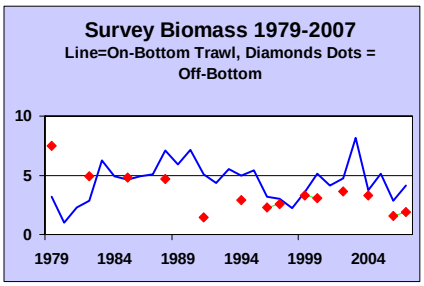
Sea Bottom Temperature Profiles from Surveys, 2004-2007

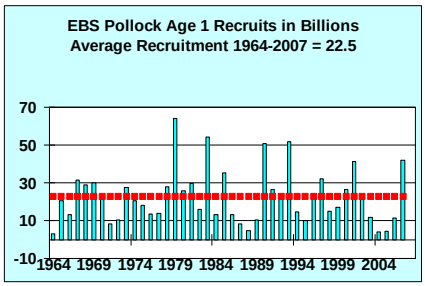


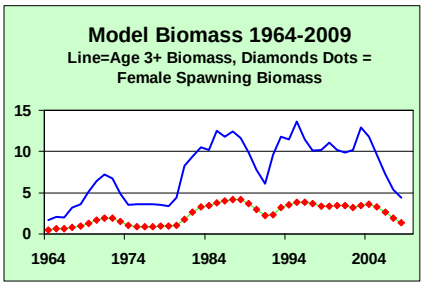


C1 - EBS Pollock Stock Assessment, Dec 2007









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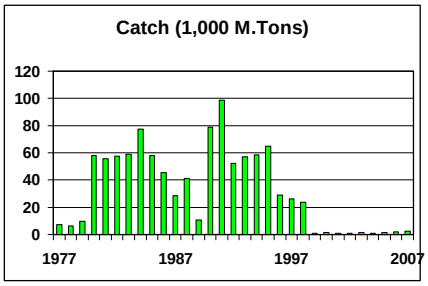
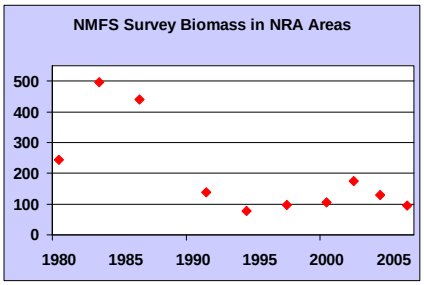
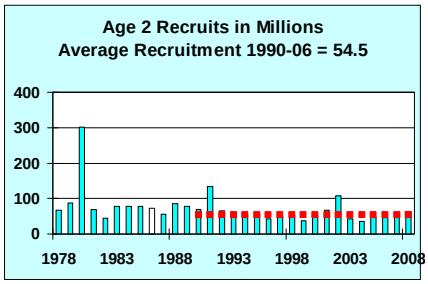
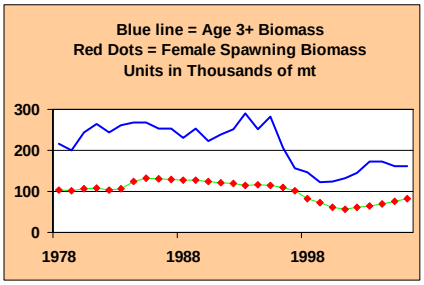
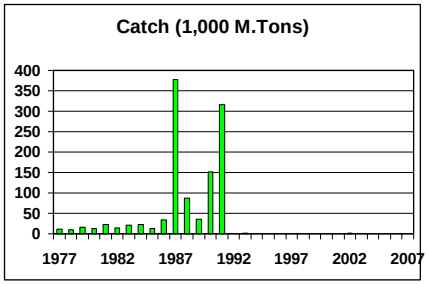


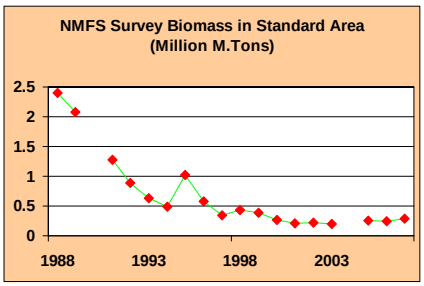


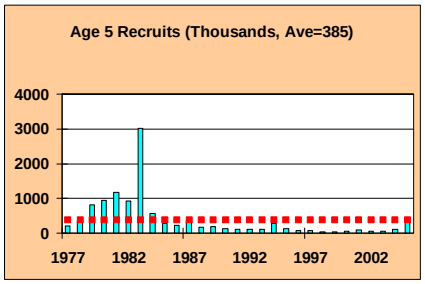


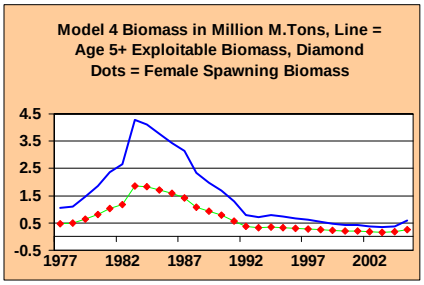


C1b - Bogoslof Island Pollock Assessment, Dec 2007

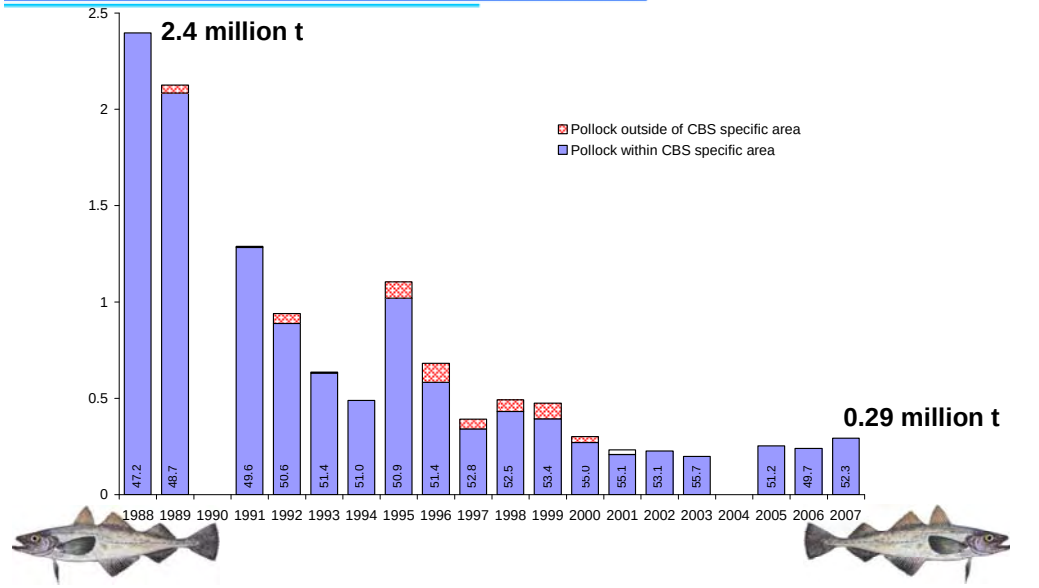




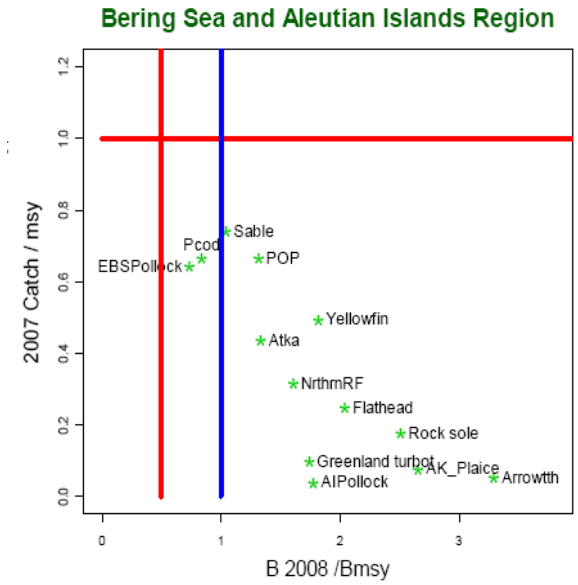




EIT Survey Biomass



Dec 2007 Update



Approaches for setting ABC in the Bogoslof Region under US Fishery Management practices

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(August 2007)

Approaches

Stock status summary

The National Marine Fisheries Service has conducted echo-integration-trawl (EIT) surveys for Aleutian Basin pollock spawning in the Bogoslof Island area annually since 1988, with three exceptions: a Bogoslof Island area EIT survey was not conducted in 1990, 2004 and in 1999 the survey was conducted by the Fisheries Agency of Japan. The annual Bogoslof Island area EIT survey results (Fig. 1) suggest that the spawning population can be described in three periods with regards to geographic distribution, dominant year class, and total biomass. In the first period,1988-93, pollock covered a wide area surrounding Bogoslof Island and the population was dominated by the 1978 year class. The average estimated biomass in the "specific area" was 1.456 million t. During the second period, 1994-99, the primary spawning location shifted to inside Samalga Pass, and the population was dominated by the 1989 year class. The average estimated biomass declined to 0.543 million t. During the third period, 2000- present, the primary spawning locations were Samalga Pass and to a lesser extent, northeast Umnak Island. Year-class dominance has alternated between the 1989 and younger year classes (1992, 1996, and 2000) and the average biomass is about 0.241 million t (Honkalehto et al 2005).

The 1989 year class moved into the Bogoslof Island area and was partly responsible for the 1995 increase (Fig. 2), but the abundance of all ages increased between 1994 and 1995. The decrease between 1995 and 1996 was followed by a continued decline in 1997. This suggests that the 1995 estimate may have been over-estimated, or that conditions in that year affected the apparent abundance of pollock. The summary Bogoslof Island area EIT survey biomass estimates, 1988-2007, are shown in Table 1. The 2006 Bogoslof EIT survey shows a 38% increase in the numbers of pollock under 50 cm FL from the 2005 survey with the largest increase in fish between 43 and 49 cm FL. This size range is consistent with the large 2000 year class observed in the 2005 and 2006 age data. The 2007 survey saw an additional increase in the proportion of fish greater than 50 cm FL and is believed to reflect the continued growth of the 2000 year class and low recruitment in the latter year classes. The current population levels on the eastern Bering Sea shelf, and the absence of extremely large year classes, suggests that pollock distribution throughout the Bering Sea has shifted. The extent that this is due to environmental causes is unclear.

The information available for pollock in the Aleutian Basin and the Bogoslof Island area indicates that these fish belong to the same "stock". The pollock found in winter surveys are generally older than age 5 and are considered distinct from eastern Bering Sea pollock. Data on the age structure of Bogoslof-Basin pollock show that a majority of pollock in the Basin originated from year classes that were also strong on the shelf -- 1972, 1978, 1982, 1984, 1989, 1992, 1996, and 2000 (Fig. 3). There has been some indication that there are strong year classes appearing on the shelf that have not been coincidentally as strong (in a relative sense) in the Bogoslof region (Ianelli et al., 2001). The conditions leading to strong year classes of pollock in the Basin appears to be density related and may be functionally related to abundance on the shelf. Additional information relating the

total mortality of the 1992 cohort shows that the estimate is much higher than expected in the Bogoslof region compared to the EBS shelf (Fig. 4).

Differences in spawning time and fecundity have been documented between eastern Bering Sea pollock and Aleutian Basin pollock. Pollock harvested in the Bogoslof Island fishery (Area 518) have noticeably different age compositions than those taken on the eastern Bering Sea shelf. For example, the average number of age 15 and older pollock observed from the Bogoslof EIT survey since 1988 is 18% while for the same period in the EBS region, age 15 and older averages only 2% (by number for all fish older than age 7). Pollock in the northern shelf have a similar size at age as Aleutian Basin pollock although a very different age composition. However, Aleutian Basin pollock may not be an independent stock. Very few pollock younger than 5 years old have ever been found in the Aleutian Basin including the Russian portion. Recruits to the basin are coming from another area, most likely the surrounding shelves either in the US or Russian EEZ.

Computation of ABC and OFLs

Since 1999 the North Pacific Fishery Management Council (NPFMC) has generally been presented with a number of alternative methods for computing ABC values for the Bogoslof region. These have included:

1) Using a biomass-adjusted harvest rate rule (with 2,000,000 ton estimate as a target stock size) with an estimate of a F_{ABC} based on growth, natural mortality, and maturation rate.
2) Using a harvest rate as a simple fraction of natural mortality rate (e.g., F_{ABC} =0.75M) .

3) An approach using a simple age-structured model.

The NPFMC Science and Statistical Committee (SSC) considered the third approach using an age-structured model to be inappropriate since it covered only part of the stock. The approach 1) and 2) above are provided below for comparison (along with alternative assumptions about F_{ABC} level for 1). The section included in this document reviews the details of the current NPFMC's Tier system for setting ABCs and OFLs.

Using method 1) above and given the survey estimate of exploitable biomass of 0.292 million t and M = 0.2 and considering of a target stock size of 2 million tons, the F_{ABC} level is computed as:

$$F_{abc} \le F_{40\%} \bullet \left({}^{B}_{2007} / {}^{B}_{40\%} - 0.05 \right)\left(1 - 0.05\right)$$

Assuming that $F_{40\%}$ = 0.27 (as in past assessments), this gives a fishing mortality rate of 0.0273 that translates to an exploitation rate of 0.0269. This value multiplied by 292,000 t, gives a **2008 ABC of 7,967 t for the Bogoslof region.** The value assumed for $F_{40\%}$ that is critical for this calculation was based on uncertain assumptions about selectivity, natural mortality, growth, and maturation. Some of these assumptions were reevaluated here using a simple knife-edged selectivity at age 4 and age 5. Female pollock were specified to be 50% mature by age 5 and immature for younger pollock and 100% mature for older pollock with a natural morality of 0.3. This results in an $F_{40\%}$ level of 0.22 for age-4 knife edge assumption and $F_{40\%}$ = 0.33 for the age-5 knife-edge assumption. These two scenarios provide ABCs for 2008 that would be 6,492 t or 9,737 t for the age-4 and age-5 knife edge assumptions, respectively. Clearly, these rules are sensitive to assumptions about expected selectivity, assumed growth, natural mortality, and maturation rates.

The approach for computing ABC levels under 2) above (a Tier 5 computation) simply uses the most recent survey biomass estimate applied to an adjusted natural mortality. Given a value of $M=0.3$ then the ABC level would be (2007 survey biomass × M × 0.75) of **65,700 t** at a biomass of 292,000 t. With $M = 0.2$, the ABC would be 43,800 t.

Further work on developing a simple age-structured model tuned to the EIT winter survey data (Fig. 5) suggest that, by the same NPFMC rules used for setting groundfish ABCs, the current Bogoslof stock size is about 75% of the target level ($B_{40\%}$) and that the "unfished" level (given observed recruitment at age 6 to this region) is approximately 330,000 t (female spawning biomass). This is substantially lower than the 1 million t "target" currently in use. Forward simulations using this model result (and fishing using the maximum permissible ABC) shows that the 90 percentile range of female SSB is between about 50,000 t and 430,000 t while under a no-fishing scenario, this range increases to nearly 1 million t (Fig. 6). This reflects the main characteristic that seems to prevail for basin pollock: they are highly susceptible to year-class variability.

Summary of Survey Biomass of Pollock Resources in the Specific Area , commonly referred to as the Bogoslof Island Area

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The U.S. Party to the Convention has been conducting an annual survey of Pollock resources in the Bogoslof Island region to estimate the pollock biomass as an indirect measure of the status of pollock stocks in the Aleutian Basin region. This is a proxy estimation assumed in Annex Part 1 (b) of the Convention for the Conservation and Management of Pollock Resources in the Central Bering Sea. The assumption is made that the biomass of pollock in the "Specific Area" (commonly referred to as the Bogoslof Island Area) is deemed to represent 60 percent of the Aleutian Basin pollock biomass.

These surveys were conducted annually by the Alaska Fisheries Science Center of NOAA Fisheries between 1988 and 2007 with the exception of 1990, 1999 and 2004. The 1999 survey was conducted by the Japanese Party to the Convention.

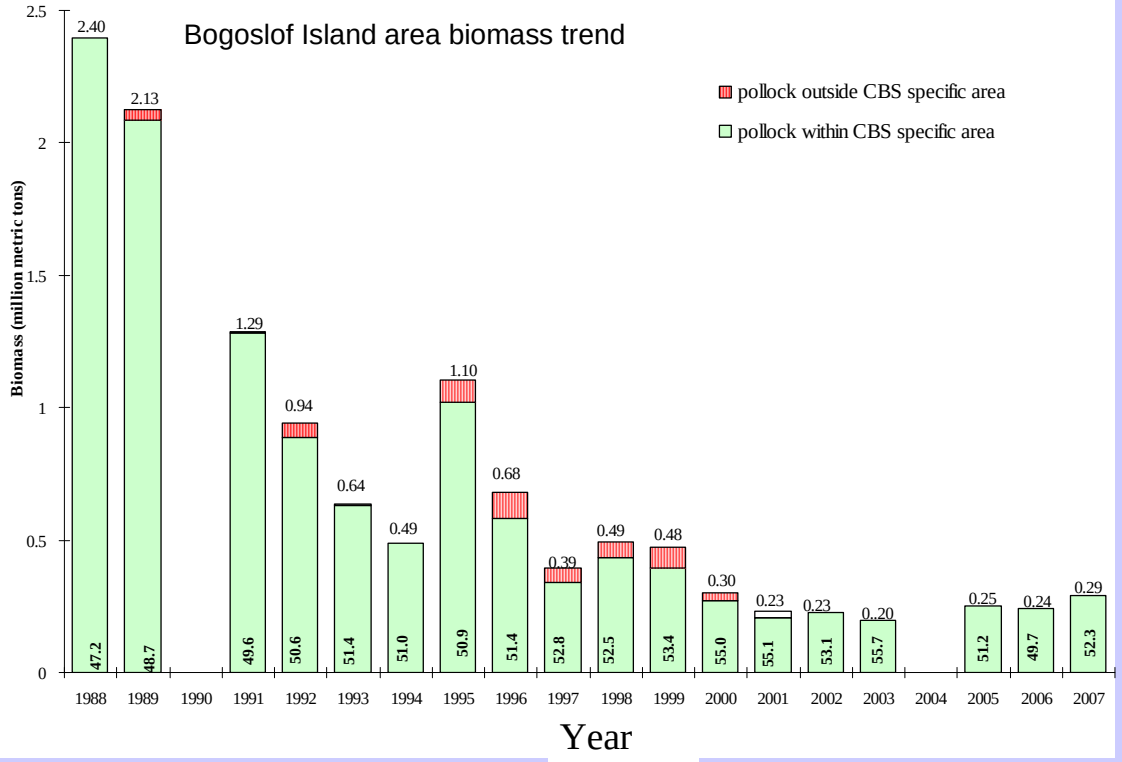
The results of these historical surveys are shown below:

Table 1.--Estimates of walleye pollock biomass (in metric tons (t)) by survey area and management area from February-March echo integration-trawl surveys in the Bogoslof Island area between 1988 and 2007.

	Bogoslof Survey Area			Convention Specific Area	
Year	**Biomass (million t)**	**Area (nmi2)**	**Relative Estimation error (%)**	**Biomass (million t)**	**Relative Estimation error (%)**
1988	2.396	-	-	2.396	-
1989	2.126	-	-	2.084	-
1990	-	No survey	-	-	-
1991	1.289	8,411	11.7	1.283	-
1992	0.940	8,794	20.4	0.888	-
1993	0.635	7,743	9.2	0.631	-
1994	0.490	6,412	11.6	0.490	-
1995	1.104	7,781	10.7	1.020	-
1996	0.682	7,898	19.6	0.582	-
1997	0.392	8,321	14.0	0.342	-
1998	0.492	8,796	19.0	0.432	19.0
1999	0.475	Conducted by Japan Fisheries Agency		0.393	-
2000	0.301	7,863	14.3	0.270	12.7
2001	0.232	5,573	10.2	0.208	11.8
2002	0.226	2,903	12.2	0.226	12.2

2003	0.198	2,993	21.5	0.198	21.5
2004	-	No survey	-	-	-
2005	0.253	3,112	16.7	0.253	16.7
2006	0.240	1,803	11.8	0.240	11.8
2007	0.292	1,871	11.5	0.292	11.5

The figure of the survey biomass trend is shown as follows:



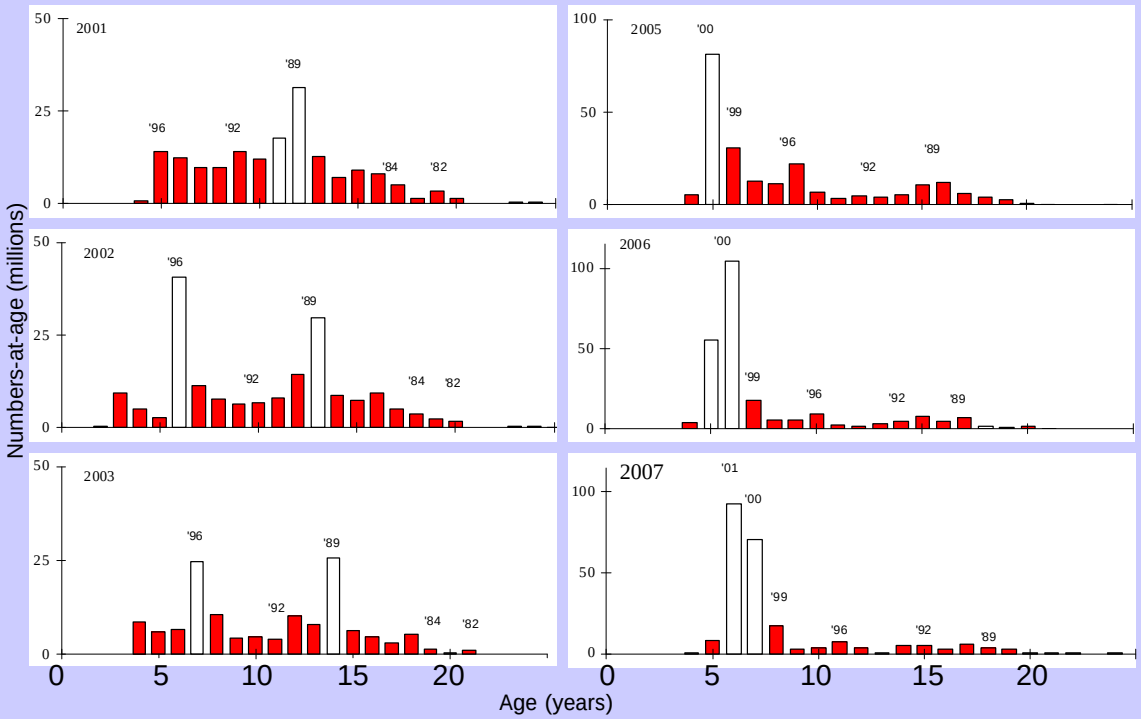
Biomass estimates (top of bars) and average fork lengths (cm, inside bar) from Bogoslof area pollock EIT surveys, 1988-2007.

At the annual Conference of the Parties in 2007, the U.S. Party indicated that the surveys will be switched from an annual event to once every two years. Thus the U.S. had intended to survey the Bogoslof Island region in 2009, 2011, 2013, and so on.

For the annual conference of the Parties in 2008, there was no survey scheduled, thus there is no updated estimate of the biomass of Pollock resources in the Bogoslof region. As such, the Parties can only depend on the results of the 2007 survey or another reliable method to estimate biomass of pollock in the Aleutian Basin. The results of the 2007 survey appear in the following report: HONKALEHTO, T., D. McKELVEY, and K. WILLIAMS. 2008. Results of the March 2007 echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) conducted in the southeastern Aleutian Basin near Bogoslof Island, Cruise MF2007-03. AFSC Processed Rep. 2008-01, 37 p. Alaska Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE,

Seattle WA 98115. View Online at http://www.afsc.noaa.gov/Publications/ProcRpt/PR2008-01.pdf . (pdf is 2MB).

This report updated the age composition data from the surveys that were not previously reported to the parties at the 2007 annual conference. The figure below shows that the dominant year classes of Pollock from the 2007 survey were ages 6 and 7 fish. The time series also indicates that Pollock tend to recruit into the Specific Area at about age 5.



Numbers-at-age estimates (millions) of pollock from EIT Bogoslof surveys 2001-2007. Major year classes on the EBS shelf are indicated. *No surveys in 2004 or 2008*.

At previous annual conferences, the Parties had agreed that there is no direct way to estimate Pollock biomass in the Aleutian Basin. This situation remains the same at this annual conference in 2008. Thus, the 2007 survey biomass of Pollock in the Bogoslof Specific Area remains the best proxy of Pollock biomass in the Aleutian Basin.

According to Annex Part 1(b) of the Convention, the Specific Area biomass of Pollock was estimated at 292,000 t. Assuming that this biomass represented 60% of the Aleutian Basin biomass, the Aleutian Basin pollock biomass was estimated at 486,667 t.