Status of the U.S. petrale sole resource in 2008

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Executive Summary

Please note that the PFMC chose to change the proxy harvest rate and relative biomass reference points after the final acceptance of this stock assessment. This document uses the previously defined reference points: Bmsy target of B40%, the MSST of B25%, and the Fmsy proxy of F40%. Additioanl documents from the STAR panel review of this assessment, the PFMC SSC and council decisions describe the process that lead to a redefinition of the proxy harvest rate and relative biomass reference points. The Bmsy target is now B25%, the MSST is B12.5%, and the Fmsy proxy is F30%.

Stock

This assessment reports the status of the petrale sole (*Eopsetta jordani*) resource off the coast of California, Oregon, and Washington using data through 2008. While petrale sole are modeled as a single stock, the spatial aspects of the coast-wide population are addressed through geographic separation of data sources/fleets where possible and consideration of residual patterns that may be a result of inherent stock structure. There is currently no genetic evidence suggesting distinct biological stocks of petrale sole off the U.S. coast. The limited tagging data available to describe adult movement suggests that petrale sole may have some homing ability for deepwater spawning sites but also have the ability to move long distances between spawning sites and seasonally.

Catches

The earliest catches of petrale sole are reported in 1876 in California and 1884 in Oregon. Recent annual catches during 1981–2008 range between 1,244–2,854 mt (Table a, Figure a). Petrale sole are almost exclusively caught by trawl fleets. Non-trawl gears contribute less than 2% of the catches. Based on the previous 2005 assessment, subsequent OYs were reduced due to 2499 mt. From the inception of the fishery through the war years, the vast majority of catches occurred between March and October (the summer fishery), when the stock is dispersed over the continental shelf. The post-World War II period witnessed a steady decline in the amount and proportion of annual catches occurring during the summer months (March-October). Conversely, petrale catch during the winter season (November–February), when the fishery targets spawning aggregations, has exhibited a steadily increasing trend since the 1940's. Since the mid-1980s, catches during the winter months have been roughly equivalent to or exceeded catches throughout the remainder of the year (Figure a).

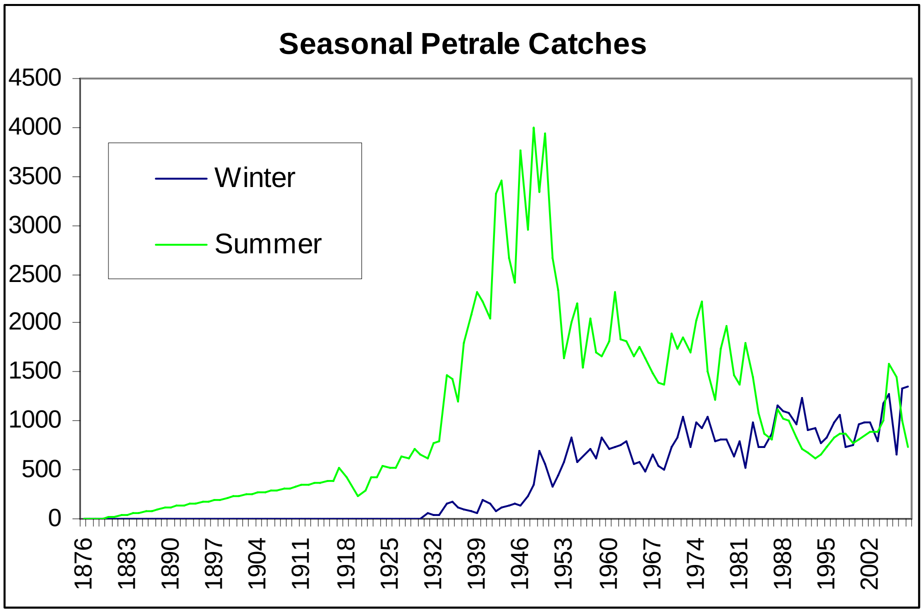

Figure a. Petrale sole catch history by season, 1876-2008.

Table a. Recent commercial fishery catches (mt) by combined summer and winter fleets.

Fishing year	Washington trawl	Oregon trawl	California trawl	Total
1999	443	517	560	1,520
2000	668	460	650	1,778
2001	675	584	579	1,838
2002	861	481	536	1,877
2003	837	408	441	1,686
2004	1,234	511	445	2,191
2005	1,319	661	874	2,854
2006	871	641	590	2,102
2007	635	732	963	2,329
2008	466	585	1,028	2,079

Data and Assessment

The previous stock assessment for petrale sole was developed during 2005 using Stock Synthesis 2. This assessment uses the Stock Synthesis 3 (SS-V3.03a-SAFE, 04/30/09) integrated length-age structured model. Due to higher wintertime catches in recent decades the assessment is based on winter (November to February) and summer (March to October) fishing seasons with the fishing year starting on November 1 and ending on October 31. The fisheries are divided into WA-Winter, WA-Summer, OR-Winter, OR-Summer, CA-Winter, and CA-Summer fisheries. The model includes catch, length- and age-frequency data from the trawl fleets described above as well as standardized CPUE indices developed by Sampson and Lee (1999) for the Oregon fleets from 1987–1997. The impact of rapidly changing regulations in the trawl fishery after these dates makes the fishery-based CPUE indices unreliable. Biological data are derived from both port and on-board observer sampling programs. The National Marine Fisheries

Service (NMFS) triennial bottom trawl survey (1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001, and 2004) and Northwest Fisheries Science Center (NWFSC) trawl survey (2003–2008) relative biomass indices and biological sampling provide fishery independent information on relative trend and demographics of the petrale sole stock.

The base case assessment model includes parameter uncertainty from a variety of sources, but likely underestimates the uncertainty in recent trend and current stock status. For this reason, in addition to asymptotic confidence intervals (based upon the model's analytical estimate of the variance near the converged solution), results from models that reflect alternate states of nature regarding the estimate of 2009 spawning biomass are presented as a decision table.

Stock biomass

Petrale sole were lightly exploited during the early 1900s but by the 1950s the fishery was well developed and showing clear signs of depletion and declines in catches and biomass (Figures a, b). The rate of decline in spawning biomass accelerated through the 1930s–1970s reaching minimums generally around or below 10% of the unexploited levels during the 1980s and 1990s (Figure b). The petrale sole spawning stock biomass is estimated to have increased slightly from the late 1990s, peaking in 2005, in response to above average recruitment (Table b, Figure b). However, this increasing trend has reversed since the 2005 assessment and the stock has been declining, most likely due to strong year classes having passed through the fishery (Table b). The estimated relative depletion level in 2009 is 11.6% (~95% asymptotic interval: ±4.8%, ~ 75% interval based on the range of states of nature: 9.4-13.8%), corresponding to 2937.6 mt (~95% asymptotic interval: ±832.7 mt, states of nature interval: 2407.8-3468.1 mt) of female spawning biomass in the base model (Table b). The base model indicates that the spawning biomass has been below 25% of the unfished level continuously since 1953.

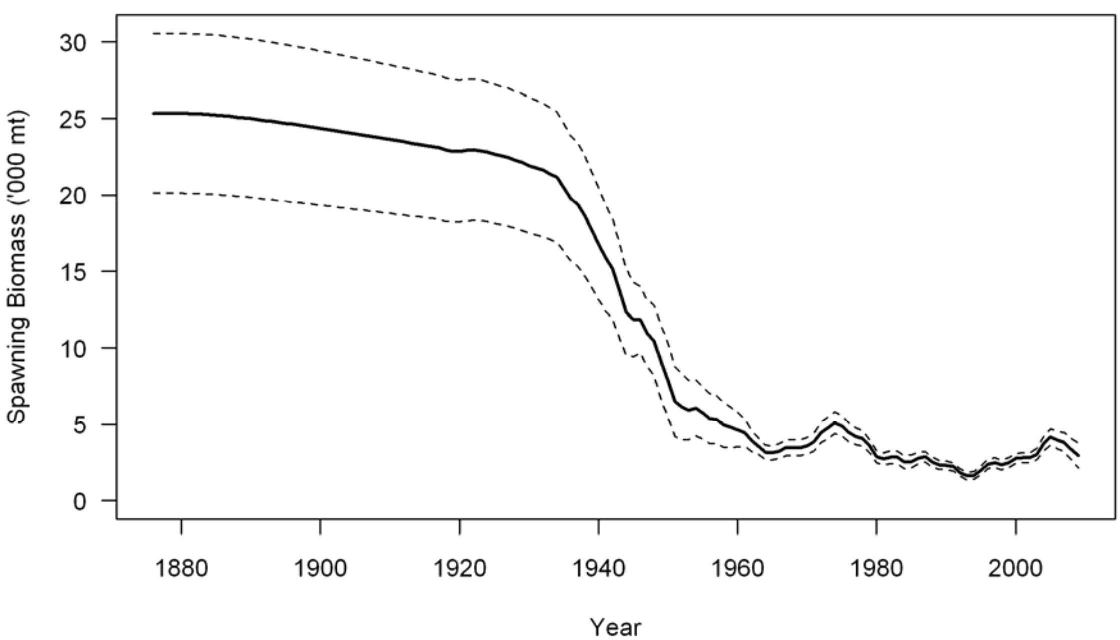

Figure b. Estimated spawning biomass time-series (1876-2009) for the base case model (solid line) with approximate asymptotic 95% confidence interval (dashed lines).

Table b. Recent trend in estimated petrale sole female spawning biomass and relative depletion.

Fishing year	Spawning biomass (mt)	~95% confidence interval	Range of states of nature	Estimated depletion	~95% confidence interval	Range of states of nature
2000	2,765.2	±329.7	2743.9-2776.9	10.9	±3.4	10.7-11.1
2001	2,810.3	±328.3	2781.5-2829.5	11.1	±3.4	10.8-11.3
2002	2,798.4	±333.6	2759.3-2827.8	11.0	±3.4	10.7-11.3
2003	3,030.0	±381.0	2969.1-3080.3	12.0	±3.8	11.5-12.3
2004	3,706.4	±463.0	3605.0-3796.5	14.6	±4.7	14.0-15.1
2005	4,160.7	±529.5	4002.0-4308.6	16.4	±5.2	15.5-17.2
2006	3,949.8	±576.0	3720.7-4169.9	15.6	±5.1	14.5-16.6
2007	3,818.0	±624.1	3507.4-4122.5	15.1	±5.1	13.6-16.4
2008	3,349.6	±704.6	2940.8-3755.2	13.2	±4.8	11.4-14.9
2009	2,937.6	±832.7	2407.8-3468.1	11.6	±4.8	9.4-13.8

Recruitment

Annual recruitment was treated as stochastic, and estimated as annual deviations from log-mean recruitment where mean recruitment is the fitted Beverton-Holt stock recruitment curve. The time-series of estimated recruitments shows a weak relationship with the decline in spawning biomass, punctuated by larger recruitments (Figure c). The four weakest recruitments since 1939 are estimated to be in 1972, 1985-1986, 1991 and 2003. The four strongest recruitments since 1939 are estimated to be in 1939-1940, 1960, 1965, and 1997-1998 (Figure c). The most recent above average recruitment event, is estimated to be in 2005, and is about 20% smaller than of the 1997–1998 recruitment event (Table c).

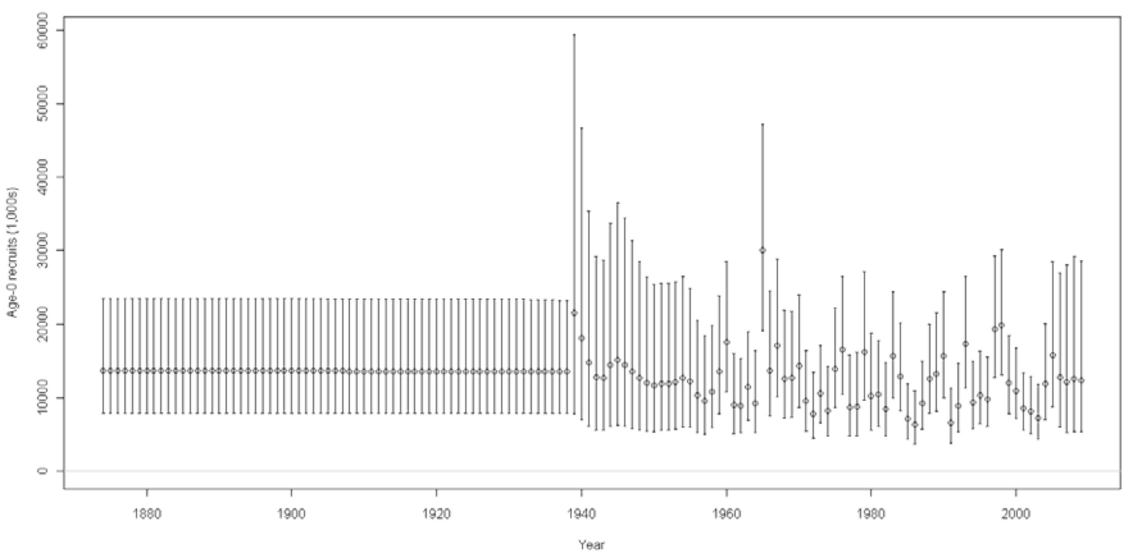

Figure c. Time series of estimated petrale sole recruitments for the base case model (round points) with approximate asymptotic 95% confidence interval (vertical bars).

Table c. Recent estimated trend in petrale sole recruitment.

Fishing	Estimated	~95%	Range of states of

year	recruitment (1000s)	confidence interval	nature
2000	10,903.2	±4,721.5	10,022.7-11,679.2
2001	8,562.7	±3,816.7	7,674-9,382.8
2002	8,161.0	±3,805.4	7,040.9-9,241.4
2003	7,164.5	±3,606.0	5,965.2-8,354.8
2004	11,897.1	±6,338.7	9,554.3-14,285.1
2005	15,770.9	±9,522.5	12,415.7-19,223.9
2006	12,740.4	±9,912.5	10,911.6-14,269.5
2007	12,048.8	±10,655.9	11,335.2-12,513
2008	12,508.7	±11,097.5	11,826.7-12,947.8
2009	10,903.2	±4,721.5	10,022.7-11,679.2

Reference Points

Unfished spawning stock biomass was estimated to be 25,334 mt in the base case model (Figure b). The target stock size ($SB_{40\%}$) is therefore 10,134 mt which gives a catch of 2060 mt (Table i, Figure b). The estimates of unfished spawning biomass, and therefore the $SB_{40\%}$ reference points were very sensitive to the assumption of stock-recruitment relationship (see section 2.9.1). Model estimates of spawning biomass at MSY and MSY yield were more robust to the assumption of stock-recruitment relationship (see section 2.9.1). Maximum sustained yield (MSY) applying recent fishery selectivity and allocations was estimated in the assessment model at 2376 mt, occuring at a spawning stock biomass of 4796 mt (SPR = 0.20) (Table i, Figures d,h,i) , which is 18.9% of the unfished level.

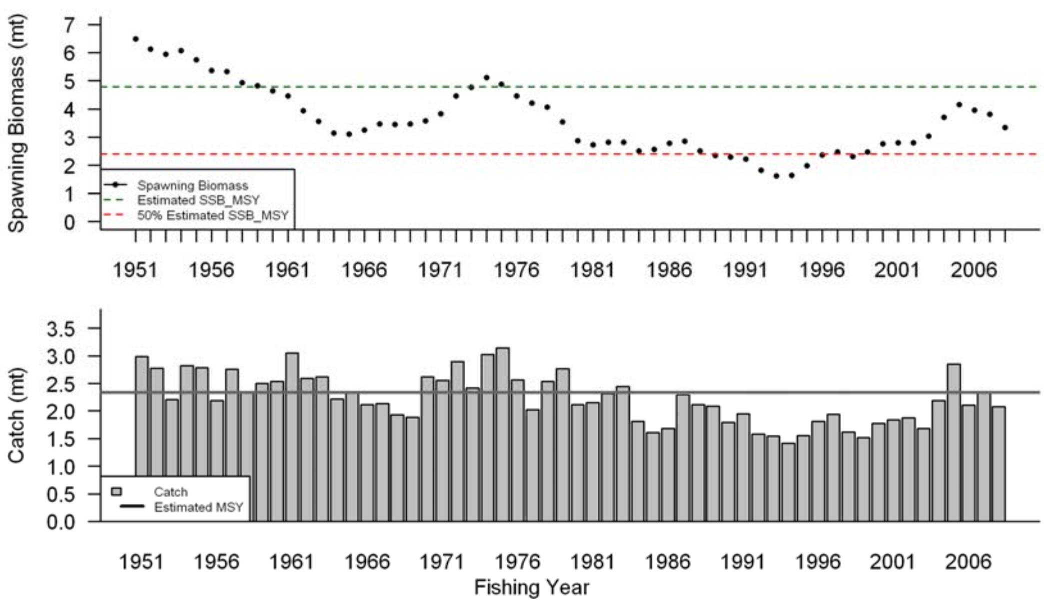

Figure d. Time series of catches startin in 1950 in comparison to the model estimated time series of spawning biomass and summary (age 3+) biomass. The solid horizontal line is the estimated MSY catch and the dashed line is the estimated spawning biomass at MSY.

Exploitation status

The abundance of petrale sole was estimated to have dropped below the $SB_{40\%}$ management target in 1949 and the overfished threshold in 1953. Beginning in 1980 the stock size was around 10–12% of unfished spawning biomass and in 1988 the stock dropped below 10% of the unfished spawning biomass (Figure e). Since 2000 the stock has increased, reaching a peak of 16.4% of unfished biomass in 2005, followed by a decreasing trend through 2009. Fishing mortality rates in excess of the current F-target for flatfish of $SPR_{40\%}$ are estimated to have begun in the late 1930s and persisted through 2008 (Table d, Figures f,g). Current F (catch/biomass of age-3 and older fish) is estimated to have been 0.29 in 2008 (Table d, Figure f).

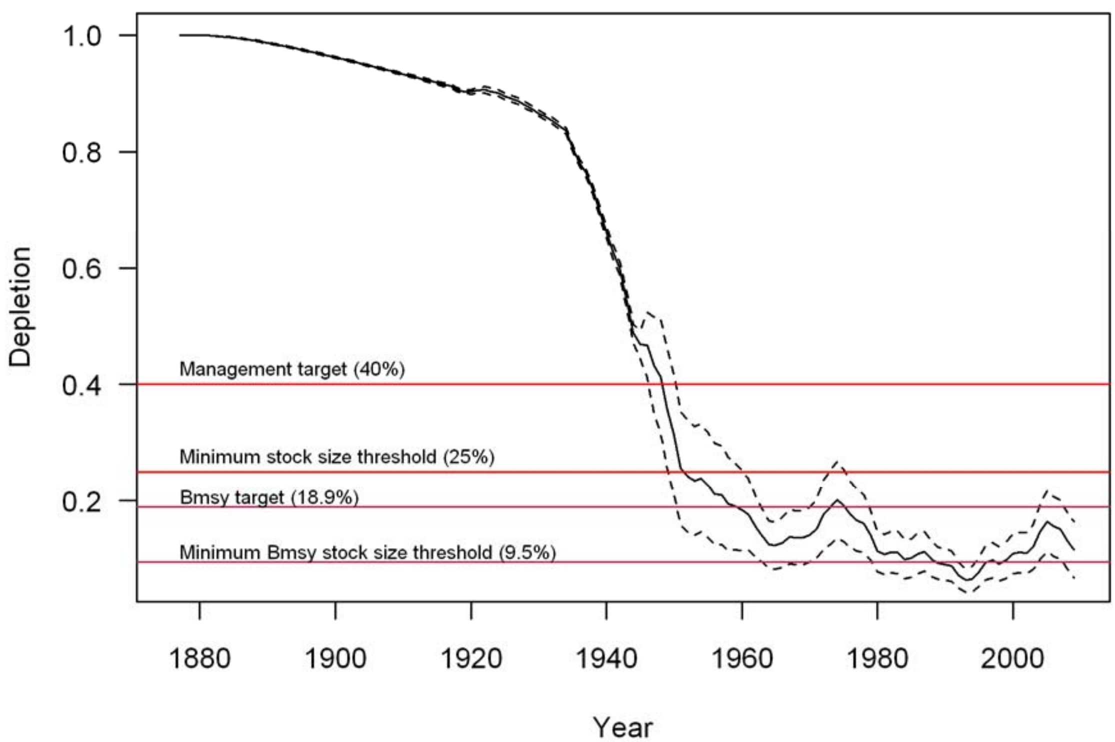

Figure e. Time series of depletion level as estimated in the base case model (round points) with approximate asymptotic 95% confidence interval (dashed lines) and alternate states of nature (light lines).

Table d. Recent trend in spawning potential ratio (1-SPR) and relative exploitation rate (catch/biomass of age-3 and older fish).

Fishing year	Estimated 1-SPR (%)	Range of states of nature	F	Range of states of nature
2000	0.86	0.86-0.86	0.28	0.28-0.27
2001	0.87	0.87-0.86	0.27	0.27-0.27
2002	0.86	0.87-0.86	0.26	0.27-0.26
2003	0.82	0.83-0.81	0.21	0.22-0.21
2004	0.83	0.84-0.83	0.25	0.26-0.24
2005	0.87	0.87-0.86	0.32	0.34-0.31
2006	0.83	0.85-0.82	0.27	0.29-0.25

2007	0.85	0.87-0.83	0.31	0.34-0.28
2008	0.85	0.87-0.83	0.29	0.34-0.26
2009	0.90	0.93-0.87	0.36	0.45-0.31

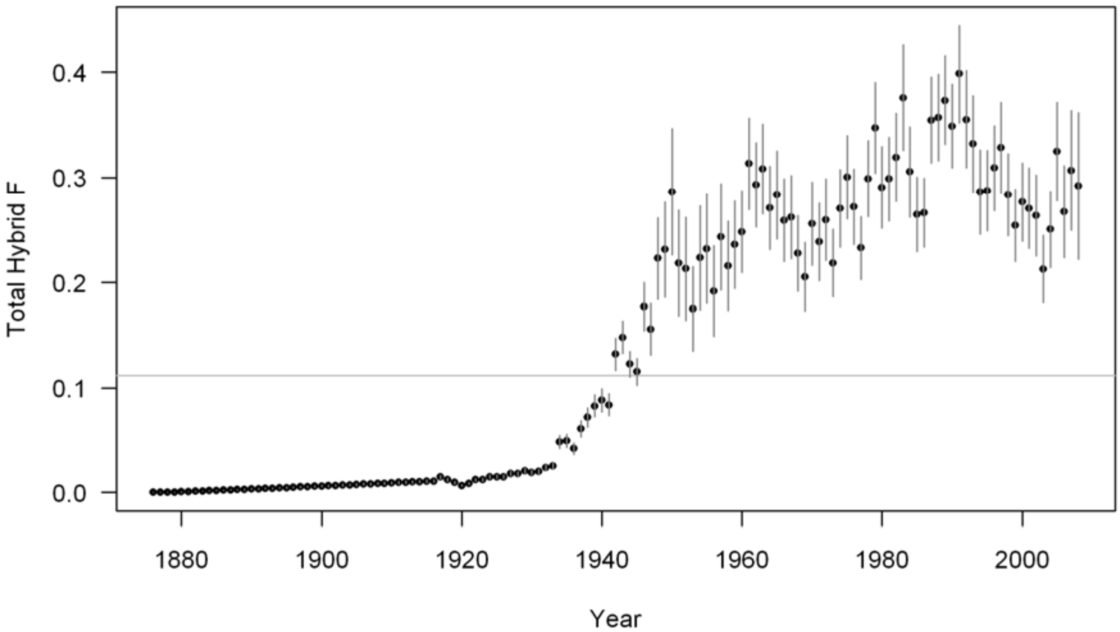

Figure f. Time series of estimated relative exploitation rate (catch/age 3 and older biomass) for the base case model (round points). Values of relative exploitation rate in excess of horizontal line are above the rate corresponding to the overfishing proxy from the base case.

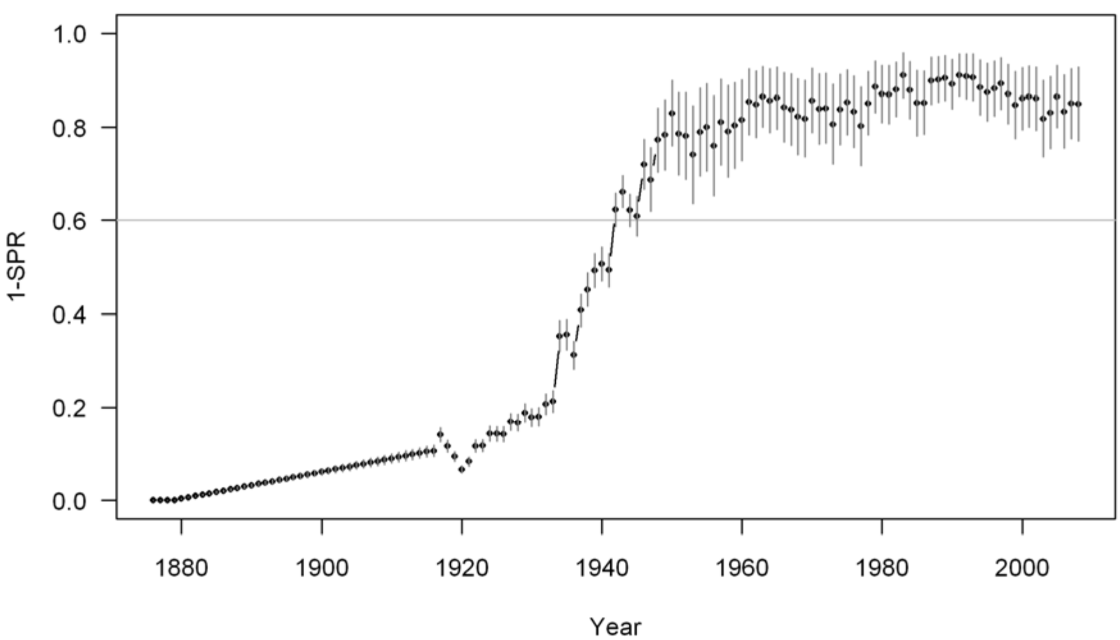

Figure g. Estimated spawning potential ratio from the base case model. One minus SPR is plotted so that higher exploitation rates occur on the upper portion of the y-axis.

Management performance

The most recent 2005 assessment of petrale sole stock assessment split the stock into two areas, the northern area that included U.S. Vancouver and Columbia INPFC areas and the southern area that included the Eureka, Monterey and Conception INPFC areas (Lai et al. 2006). In 2005 petrale sole were estimated to be at 34 and 29 percent of unfished spawning stock biomass in the northern and southern areas, respectively. Based on the 2005 stock assessment coast-wide ABCs were set at 3025 mt and 2919 mt for 2007 and 2008, respectively, with an OY of 2499 mt for both years (Table e). Recent coast-wide annual landings have not exceeded the ABC except for 2005 when the ABC was exceeded by 92 mt, 3.3%. The 2005 stock assessment estimated that petrale sole have been below the Pacific Council's minimum stock size threshold of 25 percent of unfished biomass from the mid-1970s until recently with estimated harvest rates in excess of the target fishing mortality rate of F40%. The 2005 assessment estimated the spawning stock biomass in 1998 at 12 percent of unfished stock biomass. The current assessment estimates that petrale sole have been below the $SB_{40\%}$ management target since 1949 and below the overfished threshold since 1953 (Table b, Figures e) with fishing mortality rates in excess of the current F-target for flatfish of $SPR_{40\%}$ since the late 1930s (Table d, Figure h). Using reference points based on the model estimates of Bmsy from the base case model suggests that the petrale sole fishery has been fishing at or near the management targets for a large portion of the time (Figure i). A summary of recent trends in the fishery and petrale sole population can be found in Table h.

Table e. Recent trend in estimated total petrale sole catch and commercial landings (mt) relative to management guidelines.

Fishing year	ABC (mt)	OY (mt)	Commercial Landings (mt)	Estimated[1] Total Catch (mt) for the Annual Year	Estimated Total Catch (mt) for the Fishing Year
1999	2,700	2,700	1,520	1,617	1,591
2000	2,950	2,950	1,778	1,888	1,856
2001	2,762	2,762	1,838	1,975	1,934
2002	2,762	2,762	1,877	2,066	2,024
2003	2,762	2,762	1,686	1,786	1,809
2004	2,762	2,762	2,191	2,273	2,284
2005	2,762	2,762	2,854	2,948	2,960
2006	2,762	2,762	2,102	2,173	2,183
2007	3,025	2,499	2,329	2,372	2,376
2008	2,919	2,499	2,079	2,114	2,117

[1] Total annual catches reflect the commercial landings plus the model estimated annual discard biomass (commercial landings * retained catch/total catch). The total amounts of discard may differ from those reported in the NWFSC reports on total catch for some of these years.

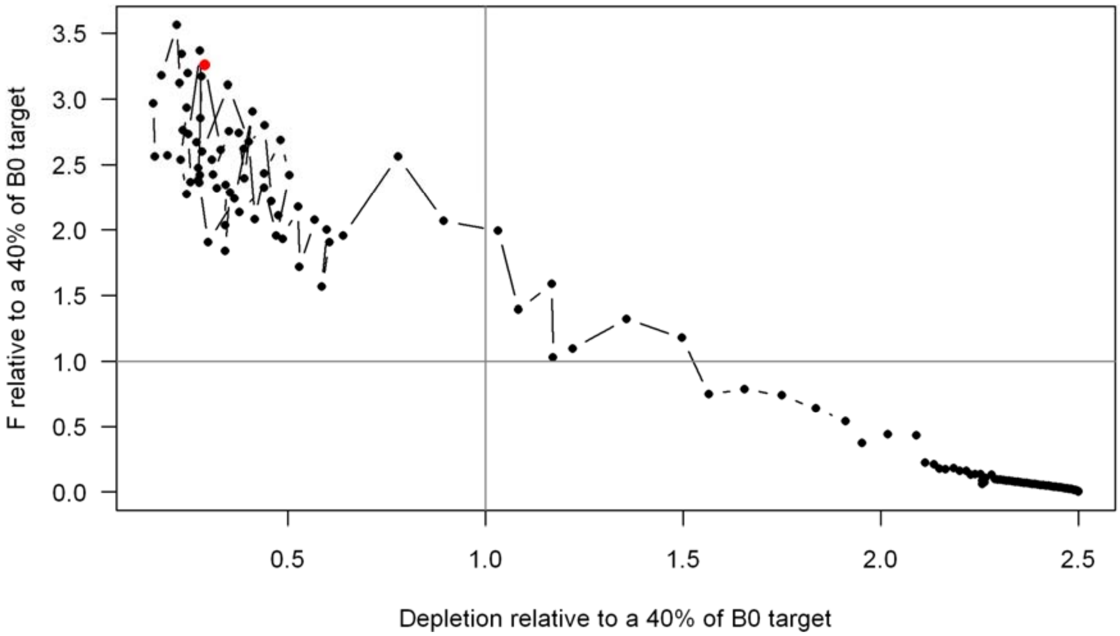

Figure h. Phase plot of estimated fishing intensity vs. relative spawning biomass for the base case model. Fishing intensity is the relative exploitation rate divided by the level corresponding to the overfishing proxy. Relative spawning biomass is annual spawning biomass relative to virgin spawning biomass divided by the 40% rebuilding target. The red point is 2009.

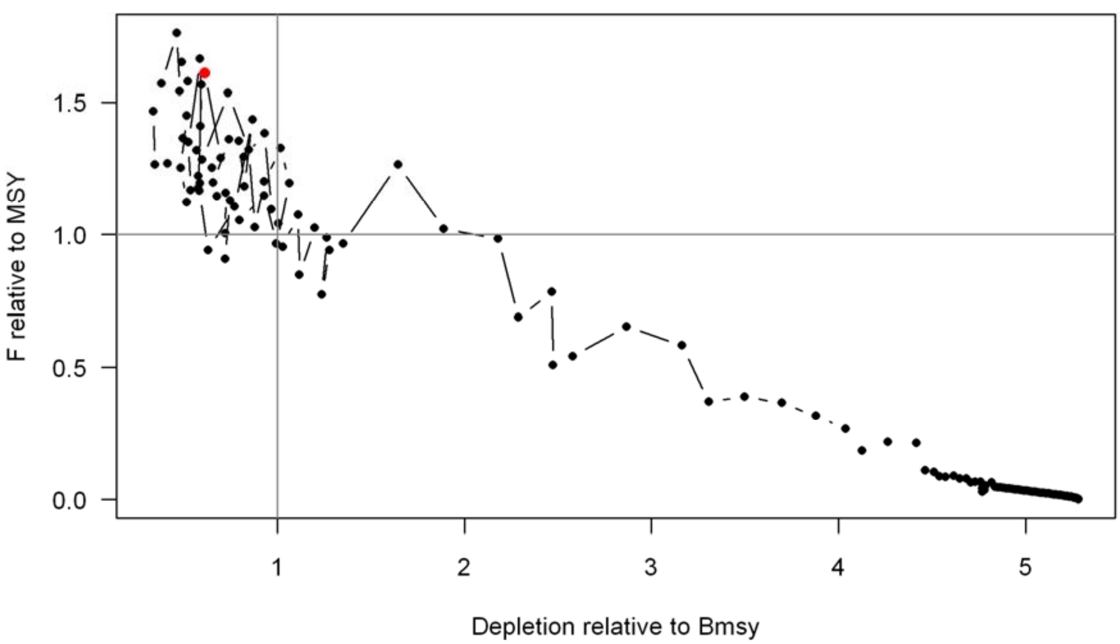

Figure i. Phase plot of estimated fishing intensity vs. relative spawning biomass for the base case model. Fishing intensity is the relative exploitation rate divided by the level corresponding to Fmsy. Relative spawning biomass is annual spawning biomass relative to the model estimate of Bmsy. The red point is 2009.

Unresolved problems and major uncertainties

Parameter uncertainty is explicitly captured in the asymptotic confidence intervals reported throughout this assessment for key parameters and management quantities. These intervals reflect the uncertainty in the model fit to the data sources included in the assessment, but do not include uncertainty associated with alternative model configurations, weighting of data sources (a combination of input sample sizes and relative weighting of likelihood components), or fixed parameters.

There are a number of major uncertainties regarding model parameters that have been explored via sensitivity analysis using both the model submitted to the STAR panel and variations which were evaluated during the STAR meeting. The most notable explorations involved the sensitivity of model estimates to the specification of the stock-recruitment relationship.

The comparability of age data within and between age-reading laboratories over time due to changes in ageing methods, a variety of ageing methods being applied to the same sample, inadequate otolith sampling, and between-laboratory variation is a major source of uncertainty. The application of the 'combo' age reading method for petrale, where petrale up to approximately age 10 are surface read and those otoliths thought to be greater than age 10 are broken and burned leads to a high level of variability in the age data, especially at older ages, when the 'combo' method is applied. Recent bomb radiocarbon analysis shows that the best ages for petrale are obtained using the break and burn method. The break and burn method should be used for ageing petrale sole.

There are problems with the Oregon commercial age data from 1981–1999. Ages from this period were aged using a combination of methods and non-randomly (i.e. one individual aged all males and another individual aged all females). While age reader information exists it is not currently in the PacFIN database, making it impossible to closely examine the impact of varying ageing methods and non-random reader design. This leads to large levels of ageing error for ages from this period of the Oregon fishery. If possible, these otoliths should be re-aged and age reader information needs to routinely be included in PacFIN.

Forecasts

The forecast of stock abundance and yield was developed using the base model. The total catch in 2009 and 2010 are set at 2433 and 2393 mt. The exploitation rate for 2011 and beyond is based upon an SPR of 40%. The 40:10 control rule reduces forecasted yields below those corresponding to $F_{40\%}$ because the stocks are estimated to be lower than the management target of $SB_{40\%}$ (Table f). The 2008 exploitation rate was used to distribute catches among the fisheries. Uncertainty in the forecasts is based upon the three states of nature agreed upon at the STAR panel. The high and low states are differentiated from the base case by the size of the 2009 spawning biomass, assuming values that were 1.25 standard deviations higher and lower, respectively, than the base case.. Manipulation of the amount of NWFSC survey biomass in 2008 was used to achieve these alternative sizes for the 2009 spawning biomass. Each forecast scenario includes random variability in future recruitment deviations (Table g). Current medium-term forecasts predict a declining trend in abundance and catch through 2011, with OY values for 2011 set at zero catch under the 40-10 harvest policy. This decline is followed by increasing abundance and catches, with the stock moving above the minimum stock size threshold of $SB_{25\%}$ in 2015. The following table shows the projection of expected petrale sole catch, spawning biomass and depletion from the base model using the 40-10 control rule (Table f).

Table f. Projection of potential petrale sole ABC, OY , spawning biomass and depletion for the base case model based on the SPR= 40% fishing mortality target used for the last plan (OY) and $F_{40\%}$ overfishing limit/target (ABC). Assuming the OYs of 2433 and 2393 mt are attained in 2009 and 2010.

Year	ABC (mt)	OY (mt)	Age 3+ biomass (mt)	Spawning biomass (mt)	Depletion
2009	2,499	2,433	7,151	2,938	11.6%
2010	2,499	2,393	6,776	2,400	9.5%
2011	535	0	6,468	2,171	8.6%
2012	802	311	8,646	3,427	13.5%
2013	1,068	680	10,680	4,712	18.6%
2014	1,301	997	12,358	5,843	23.1%
2015	1,489	1,311	13,675	6,778	26.8%
2016	1,631	1,489	14,678	7,503	29.6%
2017	1,735	1,621	15,437	8,037	31.7%
2018	1,812	1,718	16,022	8,431	33.3%
2019	1,870	1,794	16,482	8,740	34.5%
2020	1,917	1,838	16,850	8,991	35.5%

Decision table

Relative probabilities of each state of nature are based on the 2009 estimate of spawning biomass. Landings in 2009–2010 are 2,433 and 2,393 mt for all cases. Selectivity and fleet allocations are projected based on 2008 values.

Table g. Decision table of 12-year projections for alternate states of nature (columns) and management options (rows) beginning in 2011. There are two values for depletion, the first calculates depetion using the SB40% Bmsy proxy and the second calculates depletion relative to the model estimate of Bmsy. Relative probabilities of each state of nature are based on identifying low and high values from the model-estimated distribution of 2009 spawning biomass, those high and low values for 2009 were achieved through changing the size of the 2008 NWFSC survey biomass. Landings in 2009–2010 are 2433 mt

			State of nature								
			Low 2009 Spawning Biomass (-1.25 SD)			Base case			High 2009 Spawning Biomass (+1.25 SD)		
Relative probability			0.25			0.5			0.25		
			Depletion		Spawning biomass (mt)	Depletion		Spawning biomass (mt)	Depletion		Spawning biomass (mt)
Management decision	Year	Catch (mt)	SB0	Bmsy		SB0	Bmsy		SB0	Bmsy	
Catches Near Zero (3 mt)	2011	3	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	3	9%	50%	2,380	14%	74%	3,572	19%	100%	4,786
	2013	3	14%	75%	3,600	20%	105%	5,012	26%	134%	6,426
	2014	3	19%	104%	4,976	26%	136%	6,514	32%	168%	8,033
	2015	3	25%	134%	6,423	32%	167%	8,025	38%	200%	9,589
	2016	3	31%	164%	7,856	37%	198%	9,493	44%	231%	11,068
	2017	3	36%	192%	9,217	43%	227%	10,884	50%	260%	12,452
	2018	3	41%	219%	10,511	48%	254%	12,197	55%	286%	13,739
	2019	3	46%	245%	11,766	53%	280%	13,440	59%	311%	14,933
	2020	3	50%	271%	12,984	58%	305%	14,613	64%	334%	16,034
Half 40-10 catches from base case	2011	0	5%	50%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	156	9%	37%	2,382	14%	75%	3,574	18%	95%	4,554
	2013	340	14%	29%	3,524	19%	103%	4,932	24%	127%	6,090
	2014	499	18%	50%	4,710	25%	130%	6,239	30%	156%	7,493
	2015	656	23%	73%	5,861	29%	155%	7,451	35%	182%	8,750
	2016	745	27%	98%	6,893	34%	178%	8,520	39%	205%	9,837
	2017	810	30%	122%	7,796	37%	197%	9,460	43%	225%	10,785
	2018	859	33%	144%	8,604	41%	215%	10,297	46%	242%	11,615
	2019	897	36%	163%	9,365	44%	231%	11,060	49%	257%	12,349
	2020	919	39%	179%	10,097	46%	245%	11,763	52%	271%	13,004
40-10 catches from base case	2011	0	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	311	9%	50%	2,382	14%	75%	3,574	19%	100%	4,788
	2013	680	13%	72%	3,444	19%	101%	4,849	25%	130%	6,258
	2014	997	17%	93%	4,439	24%	124%	5,959	30%	156%	7,469
	2015	1,311	21%	110%	5,291	27%	143%	6,871	34%	176%	8,418
	2016	1,489	23%	123%	5,918	30%	158%	7,576	36%	190%	9,095
	2017	1,621	25%	133%	6,358	32%	169%	8,096	38%	200%	9,579
	2018	1,718	26%	139%	6,669	33%	177%	8,480	39%	207%	9,920
	2019	1,794	27%	144%	6,923	35%	183%	8,782	40%	212%	10,161
	2020	1,838	28%	149%	7,152	36%	188%	9,026	41%	215%	10,331

Table g continued.

			State of nature								
			Low 2009 Spawning Biomass (-1.25 SD)			Base case			High 2009 Spawning Biomass (+1.25 SD)		
Relative probability			0.25			0.5			0.25		
			Depletion		Spawning biomass	Depletion		Spawning biomass	Depletion		Spawning biomass
Management decision	Year	Catch (mt)	SB0	Bmsy	(mt)	SB0	Bmsy	(mt)	SB0	Bmsy	(mt)
Constant 500 mt	2011	500	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	500	8%	44%	2,134	13%	69%	3,314	18%	94%	4,522
	2013	500	12%	64%	3,056	18%	93%	4,455	23%	122%	5,861
	2014	500	16%	86%	4,109	22%	118%	5,639	28%	149%	7,153
	2015	500	20%	109%	5,228	27%	142%	6,833	33%	175%	8,397
	2016	500	25%	132%	6,342	32%	167%	7,997	38%	200%	9,578
	2017	500	29%	154%	7,403	36%	190%	9,104	43%	223%	10,687
	2018	500	33%	176%	8,418	40%	212%	10,157	47%	244%	11,723
	2019	500	37%	196%	9,415	44%	233%	11,165	51%	265%	12,694
	2020	500	40%	217%	10,401	48%	253%	12,129	54%	284%	13,599
Constant 1500 mt	2011	1,500	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	1,500	6%	34%	1,649	11%	58%	2,802	16%	83%	3,995
	2013	1,500	8%	41%	1,979	13%	70%	3,341	19%	99%	4,728
	2014	1,500	9%	49%	2,367	15%	81%	3,874	21%	112%	5,375
	2015	1,500	11%	58%	2,791	17%	92%	4,407	24%	125%	5,973
	2016	1,500	12%	67%	3,210	19%	103%	4,926	26%	136%	6,534
	2017	1,500	14%	75%	3,599	21%	113%	5,424	28%	147%	7,062
	2018	1,500	15%	83%	3,968	23%	123%	5,907	30%	158%	7,564
	2019	1,500	17%	91%	4,348	25%	133%	6,388	32%	168%	8,050
	2020	1,500	18%	99%	4,752	27%	143%	6,869	34%	178%	8,519
Constant 2/3 Fmsy	2011	36	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	86	9%	50%	2,375	14%	74%	3,555	19%	100%	4,781
	2013	166	14%	75%	3,576	20%	103%	4,948	25%	133%	6,400
	2014	274	19%	102%	4,905	25%	132%	6,354	32%	166%	7,960
	2015	447	24%	131%	6,261	30%	161%	7,703	38%	196%	9,421
	2016	582	29%	157%	7,517	35%	186%	8,930	43%	224%	10,721
	2017	714	34%	180%	8,629	39%	209%	10,000	47%	247%	11,856
	2018	837	37%	200%	9,602	43%	228%	10,918	51%	267%	12,825
	2019	949	41%	218%	10,473	46%	244%	11,706	54%	284%	13,641
	2020	1,020	44%	235%	11,252	49%	258%	12,376	57%	298%	14,314
Ramp down catches between 2/3 Fmsy at Bmsy and 0 catch at 50%Bmsy	2011	0	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	354	9%	50%	2,382	14%	75%	3,574	18%	93%	4,478
	2013	764	14%	75%	3,603	19%	101%	4,826	24%	123%	5,921
	2014	977	19%	100%	4,795	23%	123%	5,888	29%	152%	7,307
	2015	1,161	23%	121%	5,819	27%	142%	6,807	34%	176%	8,421
	2016	1,280	26%	139%	6,650	30%	158%	7,585	37%	194%	9,306
	2017	1,379	28%	153%	7,320	32%	171%	8,224	40%	209%	10,030
	2018	1,461	31%	164%	7,868	35%	183%	8,754	42%	221%	10,618
	2019	1,530	32%	174%	8,354	36%	192%	9,211	44%	231%	11,100
	2020	1,574	34%	184%	8,801	38%	200%	9,610	46%	240%	11,494

Research and data needs

Progress on a number of research topics and data issues would substantially improve the ability of this assessment to reliably and precisely model petrale sole population dynamics in the future:

1. The estimate of the NWFSC survey catchability in the base case model is higher than expected. This may be due to the use of the total area within each strata during the expansion of the survey data rather than the trawlable areas only. At this time there are no area estimates for trawlable and untrawlable areas. However the petrale sole population is most likely well surveyed by the trawl survey and expanding using areas that include untrawlable areas may not be appropriate.
2. In the past many assessments have derived historical catches independently. Since 2005 each of the states has undertaken comprehensive historical catch reconstructions. At the time of this assessment only a partial reconstruction was available for Washington, and no catch reconstruction was available from Oregon Department of Fish and Wildlife. Completion of the Washington and Oregon catch reconstructions would provide the best possible estimated catch series that accounts for all the catch and makes sense for flatfish as a group.
3. Due to limited data, new studies on both the maturity and fecundity relationships for petrale sole would be beneficial.
4. Increased collection of commercial fishery age data from California would help reduce uncertainty. No recent age data are available from the California fleet. However, the greatest landings by state have come from California in the most recent two years. Without age data, the ability to estimate year-class strength and the extent of variation in recruitment is compromised.
5. The comparability of ages between agencies is unknown. A common set of otoliths should be aged by each agency to be able to compile between agency age error information.
6. Where possible historicalotoliths should be re-aged using the break-and-burn method.
7. Effect of fishery regulations. The impacts of trip-limits and other management approaches, such as closed areas, on discards and fishery selectivity requires further study.
8. Studies on stock structure and movement of petrale sole, particularly with regard to the winter-summer spawning migration of petrale sole.
9. Continue and if possible increase the recent collection of length compositions for discarded petrale sole for both the winter (Nov–Feb) and summer (Mar–Oct) fisheries.

Table h. Summary of recent trends in estimated petrale sole exploitation and stock levels from the base case model; all values reported at the beginning of the fishing year.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Commercial landings (mt)	1778	1838	1877	1686	2191	2854	2102	2329	2079	
Total catch (mt)	1895	1987	2088	1793	2276	2951	2176	2373	2115	
ABC (mt)	2950	2762	2762	2762	2762	2762	2762	3025	2919	2433
OY	2950	2762	2762	2762	2762	2762	2762	2499	2499	2499
1-SPR	0.86	0.87	0.86	0.82	0.83	0.87	0.83	0.85	0.85	0.9
Exploitation rate (catch/age 3+ biomass)	0.28	0.27	0.26	0.21	0.25	0.32	0.27	0.31	0.29	0.36
Age 3+ biomass (mt)	6846.92	7337.86	7912.96	8422.52	9079.6	9082.01	8132.41	7735.76	7240.22	7150.57
Spawning biomass (mt)	2,765.20	2,810.30	2,798.40	3,030.00	3,706.40	4,160.70	3,949.80	3,818.00	3,349.60	2,937.60
~95% Confidence interval	±329.7	±328.3	±333.6	±381.0	±463.0	±529.5	±576.0	±624.1	±704.6	±832.7
Range of states of nature	2743.9-2776.9	2781.5-2829.5	2759.3-2827.8	2969.1-3080.3	3605.0-3796.5	4002.0-4308.6	3720.7-4169.9	3507.4-4122.5	2940.8-3755.2	2407.8-3468.1
Recruitment	10,903.20	8,562.70	8,161.00	7,164.50	11,897.10	15,770.90	12,740.40	12,048.80	12,508.70	10,903.20
~95% Confidence interval	±4,721.5	±3,816.7	±3,805.4	±3,606.0	±6,338.7	±9,522.5	±9,912.5	±10,655.9	±11,097.5	±4,721.5
Range of states of nature	10,022.7-11,679.2	7,674-9,382.8	7,040.9-9,241.4	5,965.2-8,354.8	9,554.3-14,285.1	12,415.7-19,223.9	10,911.6-14,269.5	11,335.2-12,513	11,826.7-12,947.8	10,022.7-11,679.2
Depletion (%)	10.9	11.1	11	12	14.6	16.4	15.6	15.1	13.2	11.6
~95% Confidence interval	±3.4	±3.4	±3.4	±3.8	±4.7	±5.2	±5.1	±5.1	±4.8	±4.8
Range of states of nature	10.7-11.1	10.8-11.3	10.7-11.3	11.5-12.3	14.0-15.1	15.5-17.2	14.5-16.6	13.6-16.4	11.4-14.9	9.4-13.8

Table i. Summary of petrale sole reference points from the base case model. Values are based on 2008 fishery selectivity and allocation.

Quantity	Estimate	~95% Confidence interval
Unfished spawning stock biomass (SB_0, mt)	25,334	±5,209
Unfished 3+ biomass (mt)	39,211	±5296
Unfished recruitment (R_0, thousands)	13,604	±7,590
Reference points based on $SB_{40\%}$		
MSY Proxy Spawning Stock Biomass ($SB_{40\%}$)	10,134	±2084
SPR resulting in $SB_{40\%}$ ($SPR_{SB40\%}$)	0.408	±0.0178
Exploitation rate resulting in $SB_{40\%}$	0.112	±0.0197
Yield with $SPR_{SB40\%}$ at $SB_{40\%}$ (mt)	2,060	±162
Reference points based on SPR proxy for MSY		
Spawning Stock Biomass at SPR (SB_{SPR})(mt)	9,928	±2,476
$SPR_{MSY\text{-}proxy}$	0.4	NA
Exploitation rate corresponding to SPR	0.115	±0.0263
Yield with $SPR_{MSY\text{-}proxy}$ at SB_{SPR} (mt)	2,080	±203
Reference points based on estimated MSY values		
Spawning Stock Biomass at *MSY* (SB_{MSY}) (mt)	4,796	±582
SPR_{MSY}	0.200	±0.07
Exploitation Rate corresponding to SPR_{MSY}	0.23	±0.03
MSY (mt)	2,376	±86

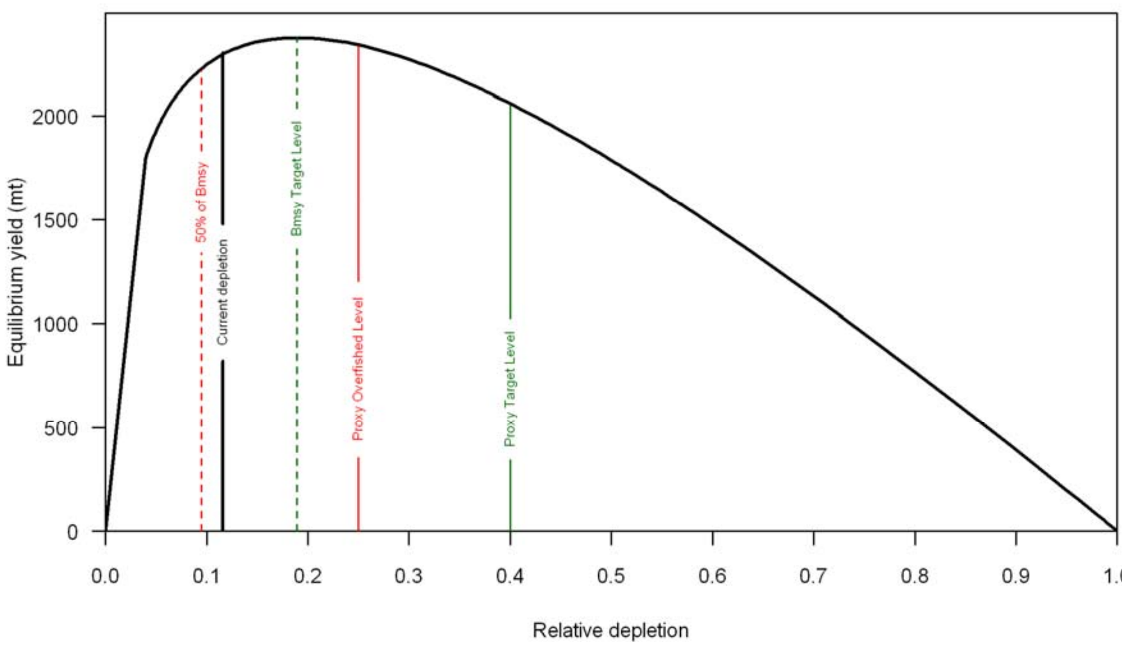

Figure j. Equilibrium yield curve (derived from reference point values reported in table i) for the base case model. Values are based on 2008 fishery selectivity and allocation. The depletion is relative to unfished spawning biomass

1. Introduction

1.1 Distribution and Stock Structure

Petrale sole (*Eopsetta jordani*) is a right-eyed flounder in the family Pleuronectidae ranging from the western Gulf of Alaska to the Coronado Islands, northern Baja California, (Hart 1973; Kramer et al. 1995; Love et al. 2005) with a preference for sand and mud bottoms at depths ranging from 0-550m (Love et al. 2005). Common names include brill, California sole, Jordan's flounder, cape sole, round nose sole, English sole, soglia, petorau, nameta, and tsubame garei (Smith 1937; Hart 1973; Gates and Frey 1974; Love 1996; Eschmeyer and Herald 1983). In northern and central California petrale sole are dominant on the middle and outer continental shelf (Allen et al. 2006). PacFIN fishery logbook data show that adults are caught in depths from 18 to 1,280 m off the U.S. west coast with a majority of the catches of petrale sole being taken between 70–220 m during March through October, and between 290–440 m during November through February.

There is little information regarding the stock structure of petrale sole off the U.S. Pacific coast. No genetic research has been undertaken for petrale sole and there is no other published research indicating separate stocks of petrale sole within U.S. waters. Tagging studies show adult petrale sole can move up 350 - 390 miles, having the ability to be highly migratory with the possibility for homing ability (Alverson 1957; MBC Appl. Environ. Sci. 1987). Juveniles show little coast-wide or bathymetric movement while some studies suggest that adults generally move inshore and northward onto the continental shelf during the spring and summer to feeding grounds and offshore and southward during the fall and winter to deep water spawning grounds (Hart 1973; MBC Appl. Environ. Sci. 1987; Horton 1989; Love 1996). Adult petrale sole can tolerate a wide range of bottom temperatures (Perry et al., 1994).

Tagging studies indicate limited mixing of adults between different spawning groups. DiDonato and Pasquale (1970) reported that five fish tagged on the Willapa Deep grounds during the spawning season were recaptured during subsequent spawning seasons at other deepwater spawning grounds, as far south as Eureka (northern California) and the Umpqua River (southern Oregon). However, Pederson (1975) reported that most of the fish (97%) recaptured from spawning grounds in winter were originally caught and tagged on those same grounds.

Mixing of fish from multiple deep water spawning grounds likely occurs during the spring and summer when petrale sole are feeding on the continental shelf. Fish that were captured, tagged, and released off the northwest coast of Washington during May and September were subsequently recaptured during winter from spawning grounds off Vancouver Island (British Columbia, 1 fish), Heceta Bank (central Oregon, 2 fish), Eureka (northern California, 2 fish), and Halfmoon Bay (central California, 2 fish) (Pederson, 1975). Fish tagged south of Fort Bragg (central California) during July 1964 were later recaptured off Oregon (11 fish), Washington (6 fish), and Swiftsure Bank (southwestern tip of Vancouver Island, 1 fish) (D. Thomas, California Department of Fish and Game, Menlo Park, CA, cited by Sampson and Lee, 1999).

Off British Columbia, the highest densities of spawning adults, as well as of eggs, larvae and juveniles, are found in the waters around Vancouver Island. Adults may utilize nearshore areas as summer feeding grounds and non-migrating adults may stay there during winter (Starr and Fargo, 2004).

Past assessments completed by Demory (1984), Turnock et al. (1993), and Sampson and Lee (1999) considered petrale sole in the Columbia and U.S. Vancouver INPFC areas a single stock. Sampson and Lee (1999) assumed that petrale sole in the Eureka and Monterey INPFC areas represented two additional distinct socks. The most recent 2005 petrale sole assessment assumed two stocks, northern (U.S. Vancouver and Columbia INPFC areas) and southern (Eureka, Monterey and Conception INPFC areas), to maintain continuity with previous assessments. Three stocks (west coast Vancouver Island, Queen Charlotte Sound, and Heceta Strait) are considered for petrale sole in the waters off British Columbia, Canada (Starr and Fargo, 2004). This assessment integrates the previously separate north-south assessments, providing a status evaluation through 2008. The decision to conduct a single-area assessment is based on strong evidence of a mixed stock from tagging studies, a lack of genetic studies on stock structure, and due to the fact that the limited evidence for differences in growth between the 2005 northern and southern assessment area are confounded with differences in data collection between Washington, Oregon, and California.

Fishing fleets are separated both geographically and seasonally to account for spatial and seasonal patterns in catch given the coast-wide assessment area. The petrale sole fisheries possess a distinct seasonality, with catches peaking during the winter months, so the fisheries are divided into winter (November-February) and summer (March-October) fisheries (Figure 1). Note that the "fishing year" for this assessment (November 1 to October 31) differs from the standard calendar year. The U.S.-Canadian border is the northern boundary for the assessed stock, although the basis for this choice appears to be largely due to current management needs. Given the lack of clear information regarding the status of distinct biological populations, this assessment treats the U.S. petrale sole resource from the Mexican border to the Canadian border as a single coast-wide stock.

1.2 Life history and ecosystem interactions

Petrale sole spawn during the winter at several discrete deepwater sites (270-460 m) off the U.S. west coast, from November to April, with peak spawning taking place from December to February (Harry 1959; Best 1960; Gregory and Jow 1976; Castillo et al. 1993; Carison and Miller 1982; Reilly et al. 1994; Castillo 1995; Love 1996; Moser 1996a; Casillas et al. 1998). Females spawn once each year and fecundity varies with fish size, with one large female laying as many as 1.5 million eggs (Porter, 1964). Petrale sole eggs are planktonic, ranging in size from 1.2 to 1.3 mm, and are found in deep water habitats at water temperatures of 4–10^{o}C and salinities of 25–30 ppt (Best 1960; Ketchen and Forrester, 1966; Alderdice and Forrester 1971; Gregory and Jow 1976). The duration of the egg stage can range from approximately 6 to 14 days (Alderdice and Forrester 1971; Hart 1973; Love 1996, Casillas et al. 1998). The most favorable conditions for egg incubation and larval growth are 6–7^{o}C and 27.5–29.5 ppt (Ketchen and Forrester, 1966; Alderice and Forrester, 1971; Castillo et al., 1995). Predators of petrale sole eggs include planktonic invertebrates and pelagic fishes (Casillas et al. 1998).

Petrale sole larvae are planktonic, ranging in size from approximately 3 to 20 mm, and are found up to 150 km offshore foraging upon copepod eggs and nauplii (Hart 1973; Moser 1996a; MBS Appl. Env. Sci 198; Casillas et al. 1998). The larval duration, including the egg stage, spans approximately 6 months with larvae settling at about 2.2cm in length on the inner continental shelf (Pearcy 1977). Juveniles are benthic and found on sandy or sand-mud bottoms (Eschmeyer and Herald 1983; MBS Appl. Environ. Sci. 1987) and range in size from approximately 2.2 cm to the size at maturity, 50% of the population is mature at approximately 38 cm and 41 cm for males and females, respectively (Casillas et al. 1998). No specific areas have been identified as nursery grounds for juvenile petrale sole. In the waters off British Columbia, Canada larvae are usually found in the upper 50 m far offshore, juveniles at 19–82 m and large juveniles at 25–125 m (Starr and Fargo 2004). Juveniles are carnivorous, foraging on annelid worms, clams, brittle star, mysids, scuplin, amphipods, and other juvenile flatfish (Ford 1965; Casillas et al. 1998; Pearsall and Fargo In prep. (see Starr and Fargo 2004). Predators on juvenile petrale sole include adult petrale sole as well as other larger fish (Ford 1965; Casillas et al. 1998) while adults are preyed upon by marine mammals, sharks, and larger fishes (Trumble 1995; Love 1996; Casillas et al. 1998).

One of the ambushing flatfishes, adult petrale sole have diverse diets which become more piscivourous at larger sizes (Allen et al. 2006). Adult petrale sole are found on sandy and sand-mud bottoms (Eschmeyer and Herald 1983) foraging for a variety of invertebrates including, crab, octopi, squid, euphausiids, and shrimp, as well as anchovies. hake, herring, sand lance, and other smaller rockfish and flatfish (Ford 1965; Hart 1973; Kravitz et al. 1977; Birtwell et al. 1984; Reilly et al. 1994; Love 1996; Pearsall and Fargo In prep.). In Canadian waters evidence suggests that petrale sole tend to prefer herring (Pearsall and Fargo In prep.). On the continental shelf petrale sole generally co-occur with English sole, rex sole, Pacific sand dab, and rock sole (Kravitz et al. 1977). Adult petrale sole achieve a maximum size of around 50 cm and 63 cm for males and females, respectively (Best 1963; Pedersen 1975). The maximum length reported for petrale sole is 70 cm (Hart 1973; Eschmeyer and Herald 1983; Love et al. 2005) while the maximum observed break and burn age is 31 years (Haltuch et al. In prep.).

Ecosystem factors have not been explicitly modeled in this assessment, but there are several important aspects of the California current ecosystem that may impact petrale sole population dynamics. Castillo (1992) and Castillo et al. (1995) suggest that density-independent survival of early life stages is low and show that offshore Ekman transportation of eggs and larvae may be an important source of variation in year-class strength in the Columbia INPFC area. The effects of the Pacific Decadal Oscillation (PDO) on California current temperature and productivity (Mantua et al. 1997) may also contribute to non-stationary dynamics for petrale sole. The prevalence of a strong 1999 year-class for many west coast groundfish species suggest that environmentally driven recruitment variation may be correlated among species with relatively diverse life-history strategies. Although current research efforts along these lines are limited, a more explicit exploration of ecosystem processes may be possible in future petrale sole stock assessments.

1.3 Historical and Current Fishery

Petrale sole have been caught in the flatfish fishery off the U.S. Pacific coast since the late 19th century. The fishery first developed off California where, prior to 1876, fishing in San Francisco Bay was by hand or using set lines and beach seining (Scofield 1948). By 1880 two San Francisco based trawler companies were running a total of six boats, extending the fishing grounds beyond the Golden Gate Bridge northward to Point Reyes (Scofield 1948). Steam trawlers entered the fishery in 1888 and in 1889 four steam tugs based out of San Francisco were sufficient to flood market with flatfish (Scofield 1948). By 1915 San Francisco and Santa Cruz trawlers were operating at depths of about 45–100 m with daily catches averaging 10,000 lbs per tow or 3,000 lbs per hour (Scofield 1948). Flatfish comprised approximately 90% of the catch with 20–25% being discarded as unmarketable (Scofield 1948). In 1915 laws prohibited dragging in California waters and declared it illegal to possess a trawl net from Santa Barbara County southward (Scofield 1948). By 1934 twenty 56–72 foot diesel engine trawlers operated out of San Francisco fishing between about 55 and 185 m (Scofield 1948). From 1944-1947 the number of California trawlers fluctuated between 16 to 46 boats (Scofield 1948). Although the flatfish fishery in California was well developed by the 1950s and 1960s catch statistics were not reported until 1970 (Heimann and Carlisle 1970). In this early California report petrale sole landings during 1916 to 1930 were not separated from the total flatfish landings. During 1931–68, the landings of petrale sole averaged about 700 mt annually.

The earliest trawl fishing off Oregon began in 1884-1885, but the fishery did not become established until 1937, with the fishery increasing rapidly during WWII (Harry and Morgan, 1961). Initially trawlers stayed close to the fishing grounds adjacent to Newport and Astoria, operating at about 35–90 m between Stonewall Bank and Depoe Bay. Fishing operations gradually extended into deep water. For example, Newport-based trawlers were commonly fishing at about 185 m in 1949, at about 185–365 m by 1952, and at about 550 fm by 1953.

Alverson and Chatwin (1957) describe the history of the petrale sole fishery off of Washington and British Columbia with fishing grounds ranging from Cape Flattery to Destruction Island. Petrale catches off of Washington were small until the late 1930s with the fishery extending to about 365 m following the development of deepwater rockfish fisheries in 1950s.

By the 1950s the petrale sole fishery was showing signs of depletion with reports suggesting that petrale sole abundance had declined by at least 50% during 1942 to 1947 (Harry 1956). Sampson and Lee (1999) reported that three fishery regulations were implemented during 1957–67: 1) a winter closure off Oregon, Washington and British Columbia, 2) a 3,000 lb per trip limit, and 3) no more than two trips per month during 1957. With the 1977 enactment of the Magnuson Fishery Conservation and Management Act (MFCMA) the large foreign-dominated fishery that had developed since the late 1960s was replaced by the domestic fishery that continues today. Petrale sole are harvested almost exclusively by bottom trawls in the U.S. west coast groundfish fishery. Recent petrale sole catches exhibit marked seasonal variation, with substantial portions of the annual harvest taken from the spawning grounds during December and January. Evidence suggests that the winter fishery on the deepwater spawning grounds developed sporadically during the 1950s and 1960s as fishers discovered new locations (e.g., Alverson and Chatwin, 1957; Ketchen and Forrester, 1966). Both historical and current petrale sole fisheries have primarily relied upon trawl fleets.

Lai et al. (2005) reconstructed the historical U.S. petrale sole landings from 1876 to 2004 from a variety of sources. Subsequently California has completed a comprehensive catch reconstruction that shows peak catches occurred during the late 1940s and 1950s. Off of Washington and Oregon peak catches occurred during the 1940s and 1950s followed by declines and remained at historical lows until the mid-2000s. (Table 1, Figure 1). Total reconstructed historical catches from 1876 to 2008 peaked at a high of 4515 mt in 1950 followed by a decline to a low of 1417 mt in 1994 (Table 1, Figure 1).

1.4 Management History and performance

Beginning in 1983 the Pacific Fishery Management Council (PFMC) established coast-wide Acceptable Biological Catch (ABC) limits for the annual harvests of petrale sole in the waters off the US west coast (see, for example, PFMC, 2002). Previous assessments of petrale sole in the U.S. Vancouver and Columbia INPFC areas have been conducted by Demory (1984), Turnock et al. (1993), Sampson and Lee (1999), and Lai at al. (2005) (Figure 2). Based on the 1999 assessment a coastwide ABC of 2762 mt was specified and remained unchanged between 2001 and 2006 (Table 2).

The most recent 2005 assessment of petrale sole stock assessment split the stock into two areas, the northern area that included U.S. Vancouver and Columbia INPFC areas and the southern area that included the Eureka, Monterey and Conception INPFC areas (Lai et al. 2006) (Figure 2). While petrale sole stock structure is not well understood data on growth, CPUE, and geographical differences between states were used to support the use of two separate assessment areas. In 2005 petrale sole were estimated to be at 34 and 29 percent of unfished spawning stock biomass in the northern and southern areas, respectively. In spite of different models and data biomass trends were qualitatively similar in both areas, providing evidence for a coast wide stock. Based on the 2005 stock assessment ABCs were set at 3025 mt and 2919 mt for 2007 and 2008, respectively, with an OY of 2499 mt for both years (Table 2). Recent coast-wide annual landings have not exceeded the ABC except for 2005 when the ABC was exceeded by 4 mt (PFMC 2006) (Table 2).

The 2005 stock assessment estimated that petrale sole had been below the Pacific Council's minimum stock size threshold of 25 percent of unfished biomass from the mid-1970s until recently with estimated harvest rates in excess of the target fishing mortality rate of F40%. In comparison to the 1999 assessment of petrale sole, the 2005 assessment represented a significant change in the perception of petrale sole stock status. The stock assessment conducted in 1999 (Washington-Oregon only) estimated the spawning stock biomass in 1998 at 39 percent of unfished stock biomass. The 2005 assessment estimated the spawning stock biomass in 1998 at a similar size as the 1999 assessment but the estimate of unfished biomass increased resulting in the estimate of current stock size at 12 percent of unfished stock biomass. The change in status between the 1999 and 2005 analysis was due to the use of the complete reconstructed catch history in the 2005 stock assessment. The 1999 stock assessment used a catch history that started in 1977, after the bulk of the removals from the fishery had already taken place. Thus the 1999 stock assessment produced a more optimistic view of the petrale stock.

The most recent 2005 petrale sole stock assessment determined that the stock was in the precautionary zone and was not overfished (i.e. the spawning stock biomass (SB) was not below 25% of the unfished spawning stock biomass (SB_0)). The fishery for petrale sole (and groundfish in general) has been altered substantially by changes in fishery regulations implemented since 1998. Specifically, the PFMC implemented 2-month cumulative vessel limits to reduce discards in 1996. Beginning in 2000, restrictions were placed on the use of large footropes (more than 8”). Large footrope gear has been prohibited from the waters inside of 275 m (150 fm) following the advent of rockfish conservation areas delineated by depth-based management lines. Although the January and February months of the winter petrale sole fishery have not been subject to vessel landing limits until recently, the 2-month limits have restricted petrale sole landings from March through October, and more recently during November and December. The areas in which the winter petrale sole fishery has been allowed to operate have also been restricted by actions designed to reduce bycatch of slope rockfish.

Area closures have been used by the PFMC for groundfish management since 2001. Current area closures are: i) the Cowcod Conservation Area (CCA): agreed upon in 2000 and implemented in 2001; ii) the Yelloweye Rockfish Conservation Area (YRCA): agreed upon in 2002 and implemented in 2003; and iii) the Rockfish Conservation Areas (RCAs) for several rockfish species: agreed upon in 2002, implemented as an emergency regulation during fall of 2002 and through regulatory amendment in 2003. Since then, RCAs have been specified continuously for regions north and south of 40°10’N latitude for trawl and fixed-gear groups (Figure 2). The boundaries of the RCAs are delineated by depth-based management lines, and may be changed throughout the year in an effort to achieve fishery management objectives. The area between 180 m and 275 m has been continuously closed to most all bottom groundfish trawling since the implementation of the RCAs.

Vessels with exempt fishing permits (EFPs) issued under 50 CFR part 600 are allowed to operate in some conservation areas. Oregon EFP (Experimental Fishing Plan) vessels were allowed to fish in the RCA using more selective trawl gear from February–October during 2003 and 2004. Beginning in 2005, the modified “selective flatfish” trawl gear has been required shoreward of the RCA, north of 40°10’N latitude. This gear was found to reduce the catch-per-unit-effort of overfished rockfish relative to standard commercial gear in pilot experiments (King et al. 2004). The ABC/OYs for several species under Rebuilding Plans have resulted in limited harvests of other groundfishes in recent years.

Port sampling conducted by each state routinely sample market categories to determine the species composition of these mixed-species categories. Since 1967, various port sampling programs have been utilized by state and federal marine fishery agencies to determine the species compositions of the commercial groundfish landings off the U.S. Pacific coast (Sampson and Crone 1997). Current port sampling programs use stratified multistage sampling designs to evaluate the species compositions of the total landings in each market category, as well as for obtaining biological data on individual species (Crone 1995, Sampson and Crone 1997).

1.5 Fisheries in Canada and Alaska

Landings of petrale sole in the Canadian fishery had decreased substantially by the mid-1960s after the largest removals during the late 1940s to late 1950s (Starr and Fargo 2004). By the 1970s, analysis conducted by Pederson (1975) suggested that petrale abundance was low, primarily due to environmental factors, and abundance remained low into the 1990s. As of 2005 petrale sole off of British Columbia were treated as three "stocks" and were considered to be at low levels. Winter quarter landings of petrale sole were limited to 44,000 lb per trip during 1985–91; to 10,000 lb per trip during 1991–95; and to 2,000 lb per trip in 1996. Since 1996, the British Columbia trawl fishers have been limited to incidental harvests only (Fargo, 1997). The recent assessments for the Canadian stocks have been based on catch histories and limited biological data.

The most recent assessment of petrale sole in British Columbia uses a single area combined sex delay-difference stock assessment model with knife edge recruitment (at 6 or 7 years old) and tuned to fishery CPUE, mean fish weight of the commercial landings, and a number of fishery independent surveys beginning in the early 1980s (pers. comm., P. Starr). Stock predictions are based on average recruitment (pers. comm., P. Starr). This assessment suggests that the stock is currently above the target reference point and that there is some evidence for above average recruitment (about 10% above average) since about 1996 (pers. comm., P. Starr). Petrale sole in Canadian waters appear to have similar life-history characteristics (Starr and Fargo 2004).

In Alaska petrale sole are not targeted in the Bering Sea/Aleutian Island fisheries and are treated as a minor species in the "other flatfish" management complex.

2. Assessment

The following sources of data were used in building this assessment:

1) Fishery independent data including bottom trawl survey-based indices of abundance and biological data (age and length) from 2003-2008 (NWFSC survey) and 1980-2004 (Triennial survey)
2) Estimates of fecundity, maturity, length-weight relationships and ageing error from various sources
3) Commercial landings from 1876-2008
4) Estimates of the length frequencies, mean weight, and total biomass discarded in the fishery obtained from the West Coast Groundfish Observer Program (WCGOP) and the study by Pikitch et al (1988).
5) Fishery CPUE (Oregon, 1987-1998).

Data availability by source and year is presented in Table a-3b. A description of each of the specific data sources is presented below.

2.1 Fishery Independent Data

2.1.1 NWFSC trawl survey

Data from the NWFSC fishery-independent shelf and slope trawl survey has become available since the 2005 petrale sole stock assessment. Three sources of information are produced by this survey: an index of relative abundance, length-frequency distributions, and age-frequency distributions. Only years in which the NWFSC survey included the continental shelf are considered (2003-2006) since petrale sole are found on the continental shelf.

The NWFSC survey is based on a random-grid design; covering the coastal waters from a depth of 55 m to 1,280 m (Keller et al. 2007). This design uses four industry chartered vessels per year, assigned to a roughly equal number of randomly selected grid cells and is divided into two 'passes' of the coast which are executed from north to south. Two vessels fish during each pass, which have been conducted from late-May to early-October each year. This design therefore incorporates both vessel-to-vessel differences in catchability as well as variance associated with selecting a relatively small number (~700) of possible cells from a very large population of possible cells spread from the Mexican to the Canadian border. Much effort has been expended on appropriate analysis methods for this type of data, culminating in the west coast trawl survey workshop held in Seattle in November 2006 (see background materials).

The NWFSC survey commonly encounters petrale sole along the U.S. west coast, except south of Point Conception (Table 4, Figures 3-4). Figure 4 shows the density of petrale catch in the NWFSC survey. The survey did not fish shallower than 54 meters and no petrale sole were caught deeper than 537.5 meters in any year. Figure 5 shows that the percentage of positive tows and the catch rate over depth peak around 100 meters and decline as depth increases. Figure 5 also shows that the prevalence and density of petrale are generally higher in the northern latitudes.

Petrale sole are known to form winter spawning aggregations in deep water. It could therefore be expected that large-sized petrale sole would also appear more frequently in deep water. Figure 6 displays the mean fish length per tow of petrale sole against tow depth and shows that the mean length of females increases initially with depth and then levels out (even though the survey was conducted during the summer rather than winter). This trend of increasing size at depth is also apparent for male petrale sole. Given the ontogenetic shift of increasing size at depth, the 2005 assessment (Lai et al. 2005) re-stratified the survey data into three depth strata. We followed a similar approach and used piece-wise linear regression (Neter et al., 1985) of year- and sex-specific mean length and depth data to aid in choosing a depth stratum boundary (Appendix A). Based on this analysis the survey tows were stratified into three depth zones (54.864–100 m, 100–182.88 m and 182.88–548.64 m) for each INPFC area (Figure 2).

Two indices of abundance are available from this time series: a design-based estimator relying on the mean catch-per-unit-effort in each of several strata, and an index based on a Generalized Linear Mixed Model (GLMM) approach which was endorsed by the trawl survey workshop for use in west coast stock assessments. These two methods are based on fundamentally different approaches to interpreting the data. In the GLMM approach, vessel-specific differences in catchability (due to engine power, trawling experience of the skipper, etc.) are explicitly captured via inclusion of random effects. In contrast, the design-based estimator relies on the balance of the design (which may be difficult to assess, given that this balance must occur through random allocation of cells in quality habitat for the species of interest). Further, due to the presence of a large number of tows capturing none of a given species and a few tows showing very high catch rates, the design-based estimator may be very sensitive to one or a small number of very large tows. The GLMM approach explicitly models both the zero catches as well as allows for skewness in the distribution of catch rates through the use of a Gamma or lognormal error structure. These factors result in the GLMM approach being much more robust to a few large tows and likely more reflective of actual trends in population abundance.

When implementing the GLMM approach, it is recommended that there are at least three positive tows in each stratum/year combination. Since the Eureka Deep and Vancouver Deep strata had fewer than three observations in some years, the original stratification of five INPFC areas and three depth zones was collapsed. Because depth shows strong trends in catch rates and fish lengths, and catch rates are smaller in the Conception area, the five INPFC strata were collapsed into three areas by combining Vancouver with Columbia and Eureka with Monterey (Figure 2).

The biomass index based on both methods shows an increase up to the year 2005, peaking around 24 000 metric tons, followed by a steady decline to around 13 000 metric tons in 2008 (Table 5, Figure 7). The biomass by stratum, estimated from the GLMM, shows a decreasing trend in recent years for the middle and shallow depths (Figure 8).

Length bins from 12 to 62 cm in increments of 2 cm were used to summarize the length frequency of the survey catches in each year. Table 4 shows the number of lengths taken by the survey. The first bin includes all observations less than 14 cm and the last bin includes all fish larger than 62 cm. The length frequency distributions for the NWFSC survey from 2003-2008 generally show a strong cohort growing through 2005 and smaller fish in 2007 and 2008 (Figure 9). Age-frequency data from the NWFSC survey (Figure 10) were included in the model as conditional age-at-length distributions by sex and year. Individual length- and age-observations can be thought of as entries in an age-length key (matrix), with age across the columns and length down the rows. The approach consists of tabulating the sums within rows as the standard length-frequency distribution and, instead of also tabulating the sums to the age margin, instead the distribution of ages in each row of the age-length key is treated as a separate observation, conditioned on the row (length) from which it came. This approach has several benefits for analysis above the standard use of marginal age compositions. First, age structures are generally collected as a subset of the fish that have been measured. If the ages are to be used to create an external age-length key to transform the lengths to ages, then the uncertainty due to sampling and missing data in the key are not included in the resulting age-compositions used in the stock assessment. If the marginal age compositions are used with the length compositions in the assessment, the information content on sex-ratio and year class strength is largely double-counted as the same fish are contributing to likelihood components that are assumed to be independent. Using conditional age-distributions for each length bin allows only the additional information provided by the limited age data (relative to the generally far more numerous length observations) to be captured, without creating a ‘double-counting’ of the data in the total likelihood. The second major benefit of using conditional age-composition observations is that in addition to being able to estimate the basic growth parameters (L_{minAge}, L_{maxAge}, K) inside the assessment model, the distribution of lengths at a given age, governed by two parameters for the standard deviation of length at a young age and the standard deviation at an older age, are also quite reliably estimated. This information could only be derived from marginal age-composition observations where very strong and well-separated cohorts existed and where they were quite accurately aged and measured; rare conditions at best. By fully estimating the growth specifications within the stock assessment model, this major source of uncertainty is included in the assessment results, and bias due to size-based selectivity is avoided. Therefore, to retain objective weighting of the length and age data, and to fully include the uncertainty in growth parameters (and avoid potential bias due to external estimation where size-based selectivity is operating) conditional age-at-length compositions were developed using the NWFSC trawl survey age data.

Age distributions included bins from age 1 to age 17, with the last bin including all fish of greater age (Figure 9). Approximately 4,738 fish were sampled for age from more than 74% of the tows containing petrale sole, compared to 21,348 fish sampled for length (Table 4). These data show the growth trajectory of females reaching a maximum size near 56 cm and males reaching a maximum size of about 41 cm (Figure 11).

It is often useful to compute the marginal age-compositions to allow for easier visual tracking of strong cohorts (although this information is still imparted to the model using conditional age-at-length observations, it is harder to visualize) and offer a more familiar summary view of the data. The NWFSC age distributions show what is probably the strong 97-98 cohort ageing from years 2003 to 2007, with younger fish appearing in 2008 (Figure 10). The exception to this is the female composition in 2005, where only one female fish aged from the tow with the largest catch rate. The expansion of numbers to tow can greatly affect the marginal age distribution, but does not have as much affect on the conditional age-at-length data. This time series is short, and does not encompass the period when substantial reductions in the petrale sole population occurred, and so may be relatively uninformative in the assessment model, except for estimation of growth parameters.

2.1.2 Triennial trawl survey

The triennial shelf trawl survey conducted by NMFS starting in 1977 is the second source of fishery-independent data regarding the abundance of petrale sole (Dark and Wilkins 1994). The sampling methods used in the survey over the 21-year period are most recently described in Weinberg et al. (2002); the basic design was a series of equally spaced transects from which searches for tows in a specific depth range were initiated (Figure 12). In general, all of the surveys were conducted in the mid-summer through early fall: the survey in 1977 was conducted from early July through late September; the surveys from 1980 through 1989 ran from mid-July to late September; the survey in 1992 spanned from mid-July through early October; the survey in 1995 was conducted from early June to late August; the 1998 survey ran from early June through early August; and the 2001, 2004 surveys were conducted in May-July (Figure 13). Haul depths ranged from 91–457 m during the 1977 survey with no hauls shallower than 91 m. In all subsequent years the survey sampled depths from 55–366 m. Given the different depths surveyed during 1977 the results from the 1977 survey are not included in this assessment. Water hauls (Zimmermann et al., 2003) and tows located in Canadian and Mexican waters were also excluded for the analyses of this assessment. Also, the Conception area was removed from the analysis since it was not surveyed in the early years.

Similarly to the NWFSC trawl survey, petrale sole were encountered throughout the West Coast (Table 6, Figure 14). Larger catch rates were observed around depths of 100 m but no trend in catch rate was apparent over latitude, other than low catch rates in the Conception INPFC area which was only partially sampled (Figure 15). An analysis of the mean length by depth also showed evidence of an ontogenetic movement of petrale to deeper water (Figure 16) and the same depth stratification was used for the triennial survey (54.864–100 m, 100–182.88 m and 182.88–548.64 m).

Two indices of abundance are available from the Triennial trawl survey, one each from a design-based and a general linear mixed model (GLMM) based estimator. For the design-based approach, the catch-per-unit-effort (CPUE) index was created from the swept-area estimates of biomass (Gunderson and Sample 1980) using INPFC and depth as strata. To provide an adequate number of positive tows in the GLMM analysis, the two deeper strata were combined as well as the Monterey and Eureka INPFC areas and the Columbia and Vancouver INPFC areas. The estimated total biomass by stratum for each survey index is given in Table 5 and Figure 17. Both methods show a general increase in biomass from 1992 onwards and a very large increase in 2004.

Size distributions (fork length in cm) were calculated following the same procedures as the NWFSC survey. The numbers of fish and number of hauls represented in each year of the survey are presented in Table 6. The length frequency distributions generally show little trend, although there is evidence of small fish in 1992 and large fish in 2004 (Figure 18).

There are no petrale sole age data for the Triennial survey.

2.1.3 Other fishery independent data

A series of trawl surveys was conducted by the ODFW during 1971–74, the data from which are stored in the survey database at the Alaska Fishery Science Center (RACEBASE). However, the data from these surveys are not included in the assessment owing to their very limited temporal and spatial coverage.

2.2 Biological Data

The following section outlines a number of biological parameters estimated outside the assessment model from a variety of data sources.

2.2.1 Weight-Length

The weight-length relationship is based on the standard power function: $W = a\ (L^b)$ where *W* is weight in grams and *L* is length in centimeters. The parameters used are those used in both the 1999 and 2005 assessments (Sampson and Lee 1999; Lai et al. 2005). These assessments used length and weight data from ODFW (1971–86), WDFW market samples, and the ODFW flatfish surveys (1971–72; Demory et al., 1976) to estimate the following length-weight relationships for males, $W = 0.007168L^{3.1337}$, and females, $W = 0.003416L^{3.3462}$ (Figure 19). No new length and weight data have been collected since the mid-1980s so these length-weight relationships represent the most current information for west coast petrale sole. The previous analysis of the length-weight data did not show any temporal trends however it would be preferable to have more recent data.

More recent length weight parameters estimated for the British Columbia petrale sole suggest that petrale sole in British Columbia generally weigh less at a given size than petrale sole of the U.S. west coast (Starr and Fargo 2004).

2.2.2 Maturity and fecundity

Petrale sole maturity-at-length information is generally sparse in space and time, has not been collected in a systematic fashion across time, is of varying quality, and does not always agree between studies. It is possible that maturity may have changed over time. However, it is not possible to assess this quantitatively owing to differences in when historical samples on which maturity ogives could be based were taken, and how maturity stage (visual vs. histological) was determined. The 2005 petrale sole assessment used the most recent study for the west coast of the U.S. that was based on observations collected during 2002 from Oregon and Washington (Hannah et al. 2002). The maturity observations were fitted to a logistic model: $p_l - \frac{e^{B_0+B_l^1}}{1+e^{B_0+B_l^1}}$ where p_l is the proportion of natural fish at length *l*, and B_0 and B_1 are the regression coefficients. Parameter estimates from the Hannah et al. (2002) are: β_0= -24.593, β_1=0.743. The length at 50% maturity for females is 33.1 cm (Figure 19).

2.2.3 Natural Mortality

The instantaneous rate of natural mortality for a wild fish population is notoriously difficult to estimate. One accepted method is to examine the age distribution of an unexploited or lightly exploited stock. This method cannot readily be applied to petrale sole given the long history of exploitation off the US West Coast. Ketchen and Forrester (1966) estimated that the natural mortality coefficients were 0.18–0.26 yr^{-1} for males and 0.19–0.21 yr^{-1} for females based on a catch curve analysis of relatively early (1943–45) Washington trawl data from Swiftsure Bank, off the southwest corner of Vancouver Island. Starr and Fargo (2004) estimated the instantaneous rate of natural mortality (*M*) using Hoenig's method (Hoenig 1983): $\ln(M) = 1.44 - 0.984\ln(t_{\max})$ where *M* is natural mortality and t_{max} is the maximum age of petrale sole. *M* Values of 0.22 and 0.15 were estimated given maximum ages of 20 and 30 years, respectively. An archived set of commercial samples collected between the late 1950s and early 1980s from Northern California recently found that multiple samples were aged between 20-31 years old suggesting a similar range of M values for U.S. west coast petrale sole encompass a similar range. Past and current British Columbia and U.S. stock assessments assumed a value of *M* = 0.2 for both sexes.

2.2.4 Length at age

Sager and Summler (1982) summarize the growth of petrale sole in length using several growth functions. Female petrale sole can grow to 70 cm total length, with males being smaller. Petrale sole can live to at least 30 yrs, although more recent data show that few are aged to be older than 17 yrs. This information on growth is subject to error for two reasons: 1) growth determination is difficult because two ageing techniques (otolith surface and break-and-burn) were used in the past, and 2) the observed lengths of young fish may be positively biased due to gear selectivity. Pederson (1975) estimated growth parameters for several locations (see Table 6 of Turnock et al. (1993)). Sampson and Lee (1999) estimated the values of the parameters of the von Bertalanffy growth curve using data based on BB readings for petrale sole older than age 3, and ODFW survey observations (1970–74) for younger ages. In the 2005 stock assessment the mean-length-at-age data used to estimate parameters for the growth equation were obtained from the 2004 NMFS triennial survey. The empirical estimate of the CV of length at age in the 2004 survey, used in Lai et al. (2005), is 0.08, the same value that was used by Sampson and Lee (1999).

In the current, 2009 assessment, length at age was estimated inside the stock assessment model. Starting parameter values for the estimation were determined by fitting the von-Bertalanffy model ($L_i = L_\infty e^{(-k[t-t_0])}$) where L_i is length in cm at age i, t is age in years, k is the rate of increase in growth, t_0 is the intercept, and L_∞ is the maximum length to data from the 2003 - 2008 NWFSC survey (Figure 6).

2.2.5 Sex Ratios

Both the Triennial and NWFSC sex ratios for petrale sole are generally about 50% each males and females (Figure20). Canadian data from the most recent published stock assessment also suggests sex ratios of petrale sole in British Columbia are generally 50% males, 50% females (Starr and Fargo 2004).

2.2.6 Ageing Precision and Bias

Historically petrale sole have been aged using the otolith surface ageing technique by all three state agencies that provide age data (WA, OR, and CA). At some point during the 1980s the Oregon and Washington protocols for ageing petrale sole were: i) surface readings for all males, ii) surface readings for females up to age 10, and iii) BB readings for any females that appeared to be older than 10 years (Lai et al. 2005). However, age readers often failed to track gender, resulting the break and burn ages for males and females (Bob Hannah, ODFW, pers. comm.). Otoliths that were difficult to read and appeared older were also broken and burned, resulting in break and burn ages for fish younger than age 7 (Bob Hannah, ODFW, pers. comm.). The Cooperative Aging Project (between the Oregon and NMFS) formed in 1996 and started aging petrale sole for the 1999 stock assessment. During 1999, otolith samples collected by ODFW between 1981 and 1999 were aged by three different age readers in the Cooperative Ageing Lab (CAP) in Newport, Oregon using a combination of surface and break-and-burn (BB) techniques. The samples were not randomly distributed between age readers, that is, one reader aged all females, one reader aged primarily males (and some females), and one reader read both. Furthermore, while two of the age readers produced surface ages one age reader was using a ‘combination’ ageing method where otoliths that appeared to be younger than about 10 years were surface aged and those that appeared older were broken and burned. The multitude of problems with the age data for Oregon resulted in most of these data being removed from the 2005 northern area stock assessment during the STAR panel review (Lai et al. 2005). Oregon otoliths aged for the 2005 stock assessment were solely surface aged. The Washington Department of Fish and Wildlife (WDFW) continue to use the ‘combination’ ageing method for all commercial otolith samples.

An unpublished study in 1981–82 by W. Barss (ODFW, Newport) indicated that ages based on otolith surface readings are biased relative to ages based on break-and-burn readings for male petrale sole, with significant under-aging for males older than about 10 years. However, the same study suggested that ages based on surface and break-and-burn (BB) readings were similar for females. Turnock et al. (1993) reported differences between ages based on surface and break-and-burn readings for males and also argued that there was no apparent bias for females. This unpublished information informed the ageing error used in the 1993 and 1999 assessments (Turnock et al., 1993; Sampson and Lee, 1999). However, given the variety of ageing protocols for petrale sole the results from early ageing bias and precision studies need to be revisited.

More recent comparisons of surface and BB readings were conducted by the CAP laboratory as well as comparisons of the 'combination' and break and burn methods by the WDFW for the 2005 petrale sole stock assessment. Lai et al. (2005) concluded that CAP ages based on surface readings are younger than those based on BB readings, but the differences were not statistically significant. However, the results of the CAP study are not consistent with those from the WDFW data analyzed by Lai et al. (2005). Nevertheless, both data sets suggested that the differences in age estimates between the surface and break and burn techniques are smaller than implied by the ageing error matrix reported by Turnock et al. (1993). The September 2005 STAR Panel discussed the ageing error matrices used in the 2005 stock assessment and the implied ageing error coefficients of variation. It was concluded that the current ageing error matrices are not informative and should be used with caution because the ageing method is not standardized between agencies.

Oregon commercial samples from 2000 to 2004 and a limited number of the 2004 NWFSC survey otoliths were exclusively surface aged for the 2005 stock assessment. For the current assessment Oregon commercial samples from 2007-2008 and the 2003 and 2005-2008 NWFSC survey otoliths were aged using the break and burn method for most fish except those young fish for which they feel only need to be surface aged (generally age 0-3 year olds that are very clear) (pers comm. P. MacDonald). It is common procedure for the CAP lab to surface read young fish with clear otoliths, no matter the species. Otolith samples from the 2004 survey that were not aged for the 2005 assessment were aged using the surface read method to complete the age composition previously partially completed for the 2005 assessment.

In order to conduct a comprehensive estimation of ageing bias and imprecision this assessment has compiled and analyzed all of the available double-read data from the state of Oregon, the CAP, and the WDFW, as well as unpublished information from a bomb radiocarbon age validation study for petrale sole off the U.S. west coast (Table 7) (Haltuch et al. in prep). For the current analysis, all sources of ageing information were revisited both through inspection of the various cross- and double-read efforts as well as through simultaneous estimation of bias and imprecision for all studies in a rigorous statistical framework programmed in AD Model Builder (Otter Research Ltd. 2005) by A. Punt, University of Washington (Punt et al. 2008). This program estimates the underlying age distribution of a sample from up to four double- or cross-reads for each age structure, and can do this for multiple samples simultaneously. The most important assumption of the estimation technique is that at least one ageing method must be unbiased, so it is therefore not an age-validation. Functional forms can be explored for each method for both the bias (none, linear, type 2) and the imprecision (constant CV, or type 2 increase in CV with age). Because the technique requires that the underlying age structure of each sample be estimated, a reasonably large quantity of data spread over the entire range of ages present in the sample is needed (Punt et al. 2008). A few very old ages do not contribute appreciable information but require many more parameters in the underlying model and create instability during estimation. For this reason, each analysis must be truncated at a maximum age that is reasonably well represented in all samples.

Results from the bomb radiocarbon study shows that age reader #1 break and burn ages are unbiased (Figure 22). Therefore these ages are used as the unbiased 'radiocarbon' ages in the analysis. Sex information is available for some, but not all, of the double read samples. In order to increase the power of the analysis and reduce the total number of data sets in the analysis double-read samples are pooled over age reader and sex. It is important to compress the data down into the fewest number of data sets in each analysis because this reduces the number of age compositions that need to be estimated (these are essentially nuisance parameters). Table 7 shows the double-read data collected by agency and ageing method. Tables 8a-c shows the structure of the analysis as well as which estimates of ageing bias and imprecision are used in the stock assessment. Data sets with triple and quadruple reads were treated as double reads since the ageing error program handles multiple data sets with double read information better than data sets with triple reads. The model cannot deal with quadruple reads. Tables 9a-c show the different models fit to each data set as well as the likelihoods, the model with the best fit model is highlighted. A variety of models were explored for each dataset (Tables 9a-c). The analysis of the CAP data found that both the bias and standard deviation are linear for both the break and burn and surface read age methods (Table 9a). Linear bias and standard deviation were also chosen for the CAP combo method as the modeling found a strong trade off between fitting bias as a type 2 function and fitting the standard deviation as increasing with age (Table 9b). When the bias was modeled as nonlinear, the estimate of bias at older ages was unreasonably large and when the standard deviation was modeled as an increase in CV with age, the CV was unreasonable large (Table 9b). None of these models converged. The only model that fit the WDFW dataset found that the bias follows a type 2 function and that the standard deviation is linear (Table 9c).

Generally, all of the ageing methods applied to petrale sole are negatively biased (under ageing), particularly for older ages (Table 10, Figure 23). The CAP break-and-burn ages show the least bias, about 0.5 years. The CAP combo method is only slightly more biased (generally less that one year for ages less than 30) than the break-and-burn method, followed by the Oregon surface ages (1-2 years) (Table 10, Figure 23). The WDFW combination method was the most biased, over-ageing fish less than five years and under ageing fish older than 7 years by 1-2 years (Table 10, Figure 23). The estimated standard deviations for combo-age methods were largest, followed by the break-and-burn method, with the surface method being the least variable (Table 10, Figure 23).

2.2.7 Research removals

Catches of petrale sole for research purposes are very small in comparison to the trawl fishery catches and are therefore included in the total catches.

2.3 Fishery Dependent Data

2.3.1 Historical Catch Reconstruction

The 2005 stock assessment reconstructed the historical removals to more realistically reflect both the cumulative removals that have occurred from the coast-wide petrale sole population as well as to capture the variability during the time series (Lai et al. 2005). Recently new catch data have been provided by the NWFSC, CDFW and WDFW for some years previously reconstructed by Lai et al. (2005). These new catch data represent the best catch reconstructions available and are noted in the description of data sources (Table 1, Figure 1). See Appendix B for a comparison between the 2005 and 2009 catch histories. The catches used in this assessment begin in 1916 with the commercial landings data obtained from the following sources:

i) The PacFIN database (1981–2004);

ii) The Pacific Marine Fisheries Commission (PMFC) Data Series for 1956-1980 (PMFC, 1979) for Washington and Oregon. A comprehensive set of these data were not available for the 2005 stock assessment. The paper document was key punched after the 2007 round of assessments and is generally accepted as the best data currently available for catches during this period. The only exception to this is for the state of California, which has completed a comprehensive catch reconstruction for this period (pers comm. D. Pearson).

iii) State of California catch reconstruction extending from 1931-1980 (pers comm. D. Pearson). CDFG Fish Bulletins for 1916–1930 catches (Heimann and Carlisle, 1970) as reconstructed by Lai et al. (2005). The California fishery began in 1876 but no catch data are available from 1876-1915. Therefore a linear interpolation between catches of 1 ton in 1876 and the catches recorded for 1916 are used to filling this period. Lai et al. (2005) found that this early assumed increase in the petrale sole fishery did not impact the model;

iv) Oregon Fish Commission publications for 1943–1949 catches (Cleaver, 1951) and for 1950–1953 catches (Smith, 1956) as reconstructed by Lai et al. (2005);

v) WDFW catch reconstruction for 1935 (ref), 1939 and 1949– 1969 (pers. comm. T. Tsou and G. Lippert). These catches from WDFW are much larger than the catches used for Washington in the 2005 (Lai et al. 2005) stock assessment. Therefore catches for the early years that have not yet been reconstructed by WDFW are filled in by interpolating between the years with catch data;

Changes to the historical reconstruction from 1916 through 1980 are due to the digitizing of the Pacific Marine Fisheries Commission (PMFC) Data Series (PMFC, 1979) as well as the states individual efforts to provide better catch data. Catch data from 1981 – 2008 have been extracted from PacFIN as updates and corrections to the PacFIN database can cause small changes to this portion of the catch history. Monthly data are mostly unavailable for the early petrale fisheries. If monthly landings data were not available all landings are assumed to be from the summer fishery because it is likely that most of the fleets operating early in the development of the fishery did not fish in deep water during winter. All catches are compiled by the fishing year and use the PFMC regions. The Washington fleet includes catches from PSMFC areas 3A, 3B and 3S. The Oregon fleet includes catches from PSMFC areas 2A, 2B, and 2C. The California fleet includes catches from PSMFC areas 1A, 1B, and 1C.

Although they are not used in this assessment, the Canadian landings of petrale sole can be found in Starr and Fargo (2004).

2.3.2 Recent Landings (1981 to present)

Commercial landings estimates of petrale sole from 1981 to 2008 were generated from the PacFIN database (Extraction: March, 2009). Annual catches as used in the model are summarized by state in Table 1 and Figure 1. The landings of petrale sole by gear types other than groundfish-trawl have been inconsequential, averaging < 2% of the coastwide landings during 1981–89. The non-trawl landings are included in the trawl landings but the catches do not include discarded petrale sole (Table 11).

The post-World War II period witnessed a steady decline in the amount and proportion of annual catches occurring during the summer months (March-October). Conversely, petrale catch during the winter season (November–February), when the fishery targets spawning aggregations, has exhibited a steadily increasing trend since the 1940's. In the past few decades there has been a distinct seasonality in petrale sole landings that corresponds to the targeting of spawning aggregations during winter. Due to the seasonal harvesting pattern this assessment, similarly to previous assessments, separates the landings into two time periods: winter (November-February) and summer (March–October). The landings are divided into six fisheries (Table 3) based on the fleets from the states of Washington, Oregon, and California. The six fleets are Washington-Winter, Washington-Summer, Oregon-Winter, Oregon-Summer, California-Winter and California-Summer.

2.3.3 Discards

The catch statistics in Table 1 do not include discards. Prior to the 2001 implementation of the Northwest Fishery Science Center West Coast Groundfish Observer Program (NWFSC WCGOP) data on fishery discard for petrale sole was sparse and of mostly questionable quality. While several historical studies report discard estimates, in most cases the original data and estimation methods, which likely vary between studies, are not reported.

A limited 1950 study of Astoria, Oregon based trawlers estimated that 32.5% of the "number" of the petrale sole caught were discarded (Harry 1956). However, the details of the data collection as well as the original data are missing so this value is not used in the assessment. A 1977–81 study reported annual discard factors for the U.S Vancouver and Columbia INPFC areas (total catch weight / retained catch) that ranged from 1.1 to 1.4 with an average value of 1.21, or 17% by total catch weight was discarded (Demory 1984). However, Demory (1984) did not provide the data used to derive the discard factor, $f = 1 + Discard/Retained$, from which the discard rate is derived. Therefore the Demory measures of discard are not used. Scofield (1948) reported that 20–25% of the catches of sole in California were discarded during the 1940s and 1950s, but no specific date, data sources, or analyses were reported, so this value is not used in the assessment. Data collected by Pikitch et al. (1988) off the Oregon coast during 1986-1987 inform discard rates for the Oregon fisheries and were analyzed by Sampson and Lee (1999), producing a discard rate of 8.8%. These more recent Pikitch (1988) discard estimates are used as discard fraction in the Oregon fishery.

Discard observations for the trawl fleet from the WCGOP provide yearly discard rates and average weight of the discard based on at-sea observer data for 2002-2008 (2008 includes winter only, as summer data are not yet avaliable) (pers. comm. E. Heery) (Table 11, Figure 24). Recently the collection of length data for petrale sole has begun, providing length compositions of the discard for 2006-2007 and summer 2008 (Figures 25-27). These length compositions are used to estimate the retention curves for each of the fleets.

Several studies have reported retention curves for petrale sole. TenEyck and Demory (1975) reported that the age-at-50%-retention is 5.6 years for male petrale sole and 5.1 years for females, equivalent to a 30 cm length-at-50%-retention. Turnock et al. (1993) estimated a logistic length-retention curve using the unpublished data collected during a mesh-size study (Wallace et al., 1996), and reported that the length-at-50%-retention was 21.3 cm. Sampson and Lee (1999) estimated the length-at-50%-retention to be 28.6 cm for males and 29.5 cm for females, based on unpublished data from the discard study by Pikitch et al. (1988).

2.3.4 Foreign Catches

The impact of catches of petrale sole by foreign fishing fleets prior to the institution of the exclusive economic zone (EEZ) of the U.S. west coast are currently not quantified and remains an area for research.

2.3.5 Fishery Logbooks

Sampson and Lee (1999) used commercial logbook data from PacFIN to construct a delta GLM based standardized CPUE indices of abundance for the Oregon fleets from 1987-1997. This index was also used in the 2005 northern area stock assessment (Lai et al. 2005). The logbook data for the years prior to 1987 were not included because information on location is not available for these data. Beginning in 1998 the west coast groundfish fishery was impacted by a series of regulatory changes that make the generation of a standardized CPUE index in the stock assessment unreliable.

Lai et al. (2005) produced delta GLM-based indices of abundance for the 2005 southern area assessment using data filtered in a similar manner to Sampson and Lee (1999). However the southern area CPUE indices used more vessels that had been in the fishery a relatively short amount of time and extended the index to 2004, well beyond the time where regulatory changes began to restrict the groundfish fishery. These problems were noted during the 2005 STAR panel review.

This assessment uses only the CPUE indices of abundance from Sampson and Lee (1999) (Figure 28) for the reasons noted above. Additional indices for the winter fleets were not analyzed due to concerns regarding the potential for hyper-stability in winter catch rates due to the targeting of spawning aggregations. However plots of raw CPUE (lbs/hour) for all fleets were calculated for comparison with the fishery independent NWFSC survey index (Figure 29). The downturn in the NWFSC survey index (from the summer season) during the last three years is also apparent in the raw CPUE from the summer fisheries (Figure 29).

2.3.6 Fishery Biological Sampling

Commercial landings and the biological characteristics of these landings were not consistently sampled for scientific purposes until the mid-1950s. Statewide sampling of landed catches began in 1955 in Washington, 1966 in Oregon, and sporadically in 1948 in California. The first rigorous monitoring programs that included routine collection of biological data (e.g., sex, age, size, maturity, etc.) began in 1980. Currently, port biologists employed by each state fishery agency (California Department Fish and Game, Oregon Department of Fish and Wildlife - ODFW, and Washington Department of Fish and Wildlife - WDFW) collect species-composition information and biological data from the landed catches of commercial trawling vessels. The sampling sites are commonly processing facilities located at ports in California, Oregon and Washington. The monitoring programs currently in place vary between the states but are generally based on stratified, multistage sampling designs.

The PacFIN BDS database contains data from ODFW (1966–2008) and WDFW (1955–2008), but only 2001–2008 data from CDFG. The CDFG dataset for the years prior to 2000 was extracted and provided from CALCOM by Brenda Erwin (CDFG). Demory and Bailey (1967) provide length compositions for the Columbia INPFC area for 1949–51, 1960, and 1963–65. However no information is provided on the total size of the landings or sampling protocol, making it impossible to expand the raw length data. Therefore, the Demory and Bailey (1967) data are not used in the current assessment.

Commercial length-frequency distributions based on the fishing year were developed for each fleet for which observations were available, following the same bin structure as was used for research observations (Table 12). For each fleet, the raw observations (compiled from the PacFIN and CalCOM databases) were expanded to the sample level, to allow for any fish that were not measured, then to the trip level to account for the relative size of the landing from which the sample was obtained. The commercial composition data were summarized by PSMFC strata (Figure 2) since this is the finest resolution for which the data are available. The expanded length observations were then expanded by the catches in each PSMFC strata and combined within years for each fleet. Age frequencies were computed in the same manner. Length and age data collected from commercial landings for each fleet are summarized by the number of samples and the number of fish measured (Tables 12-13). Figures 30-35 show plots of the length and age composition data.

2.4 History of Modeling Approaches

2.4.1 Previous assessments

United States

Early stock assessments only assessed petrale sole in the combined U.S. Vancouver and Columbia INPFC areas, i.e. petrale in these areas were treated as a unit stock, using time series of data that began during the 1970s (Demory 1984, Turnock et al. 1993). The first assessment used stock reduction analysis and the second assessment used the length-based Stock Synthesis model (Methot 1989). The third petrale sole assessment utilized the hybrid length-and-age-based Stock Synthesis 1 model using data from 1977–1998 (Sampson and Lee 1999). During the 1999 stock assessment an attempt was made to include separate area assessments for the Eureka and

Monterey INPFC areas but acceptable models could not be configured due to a lack of data (Sampson and Lee 1999).

The previous, 2005, petrale sole assessment was conducted as two separate stocks, the northern stock encompassing the U.S. Vancouver and Columbia INPFC areas and the southern stock including the Eureka, Monterey and Conception INPFC areas, using Stock Synthesis 2, a length-age structured model (Methot 2000). Both the northern and southern area models defined the fishing year as beginning on November 1 and ending on October 31 with a winter fishery including November–February and a summer fishery from March–October. Catches prior to 1957 were assumed to be taken during the summer season when monthly data were not available to split the historical catches seasonally. The complete catch history was reconstructed for petrale sole for the 2005 stock assessment, leading the northern area model to start in 1910 and the southern area model in 1876.

Canada

Ketchen and Forrester (1966) conducted the first assessment of petrale sole off British Columbia. A recent series of petrale sole assessments in Canadian waters were conducted by Tyler and Fargo (1990), Fargo (1997, 1999), Fargo et al. (2000), Starr and Fargo (2004), and Starr (pers. comm.). The 2004 stock assessment of petrale sole was based on three areas: the west coast of Vancouver Island, Queen Charlotte Sound, and Hecate Strait (Starr and Fargo, 2004). In the most recent 2006 assessment in British Columbia petrale sole are assessed using a single area, combined sex, delay-difference stock assessment model with knife edge recruitment (at 6 or 7 years old). The model is tuned to fishery CPUE, mean fish weight of the commercial landings, and a number of fishery independent surveys beginning in the early 1980s (pers. comm., P. Starr). Stock predictions are based on average recruitment (pers. comm., P. Starr).

2.4.2 GAP and GMT input

The GMT representative on the petrale sole STAR panel has compiled a history of regulatory actions that impacted the petrale sole fishery, and more generally the groundfish fishery (Appendix D). The GAP representative provided ancillary information on the comparative catches of petrale sole by the fishery, indicating that during the 1980s catch rates were very poor but that recently catch rates have much improved (pers comm. B. Pettinger). The GAP representative as well as members of the fleet present at the STAR panel provided invaluable information regarding the history of the fishery and the impact of management regulations on fleet behavior.

2.4.3 Response to the review panel recommendations in 2005

Both the 1999 and 2005 STAR panel reports called for increased collection of biological data for petrale sole. Although the biological data collection has generally improved one notable, gap is the lack of recent age data from the California fleets, the most data poor fleet in the assessment. This is of particular concern because total landings of petrale sole from California waters during the past two years have surpassed those of Washington and Oregon.

The STAR and “Follow-up” panel reports from 2005 outlined a number of research and modeling recommendations. The current assessment has addressed as many of these recommendations as possible and substantial progress, as outlined below, has been made on most of them.

1. The Panel noted that the petrale sole stock trends were similar in both northern and southern areas, in spite of the different modeling choices made for each area, and that a single coast-wide assessment should be considered. This assessment treats petrale sole as a single coast-wide stock.
2. In the 2005 southern area assessment there was not enough discard data to estimate retention curves. There was also an indication that the discard data were interacting in a pathological way with the age- and length-composition data. The group discussed at length approaches to correct this problem and noted that it would be preferable in this case to assume the discard rates based on limited observations and inflate the landings to reflect this level to eliminate the spurious interactions between the retention curve estimates and fits to length and age compositions. A simple assumption of a constant percent discard was agreed to by the Panel and STAT team, primarily because of concerns about the reliability of historical discard estimates. This relatively crude approach assumes that discard and landed catch have the same length distribution, but it is likely that discard is primarily market (i.e., size) based. Therefore a retention curve was not estimated in the final southern area model. This is no longer an issue in the current assessment as the model is able to fit both discard fractions, mean weight of the discards, and the discard length compositions available for each fleet as well as estimate retention curves for each fleet.
3. The panel requested plots investigating changes in sex ratio over time. The current assessment has produced these plots. There is no indication of changes in sex ratio over time in the recent survey data. The fishery data show a somewhat higher proportion of females to males, as might be expected given dimorphic growth and winter fisheries that target spawning aggregations.
4. A large proportion of the discussion focused on aging bias and imprecision for the various ageing methods applied to petrale sole otoliths. The panel found no data for specifying whether the CV should be equal to 0.06 or 0.12 (the options that were considered) and recommended instead using as an approximation the vector of standard deviations used from the surface-ageing method (where data were available). The ageing-errors for the break-and-burn age data were also based on surface age data. There were also apparent shifts in ageing criteria that were causing poor model fits in the northern area assessment which caused the STAR panel to recommend removing all age composition data from the stock assessment. A bomb radiocarbon age validation study was designed and carried out for petrale sole and all available double read information for each ageing method applied to petrale sole otoliths was compiled. All of these data were used to estimate the ageing bias and precision for each of the ageing methods used in the current petrale sole stock assessment. There are no longer strong conflicts between the age data and other data sources.

5. The STAR panel discussed the possibility for differential natural mortality for males and females. Based on Beverton (1992) a flatfish species with similar longevity as petrale sole had values for female M ranging from 0.17 to 0.25 per year and values for male M ranging from 0.2 to 0.3. The Panel therefore suggested doing a sensitivity run with female M specified at 0.2 (the default value, which will provide some consistency in female spawning biomass in the base-case configuration) and setting the natural mortality for males at a value of 0.25. The rationale for this sensitivity analysis is to improve the interpretation of the highly domed-shaped selectivity curves currently estimated for males in virtually all model runs. The current assessment is able to estimate the values of M for both females and males.

6. A number of age-structures were collected during the NWFSC survey but were not aged. These structures have been aged for the current assessment.

7. The 2005 STAR panel expressed general concern regarding possible changes in growth over time and suggested that spatial and/or temporal factors impacting growth should be investigated. Time-invariant growth is well estimated in the current assessment. Investigations into including time varying growth in the assessment model suggest that the data available do not strongly support time-varying growth.

8. The STAR panel was concerned that discard practices may have changed in recent years and that data are limited on where and when this may have occurred. The panel suggested that information on the size composition of discards should be collected and analyzed from the groundfish observer program. The current assessment has two years of length composition data from the WCGOP for each of the fleets in the model. There is a general lack of reliable historical discard data.

9. There was concern that the CPUE data used in the southern area GLM analysis may have been affected by changes in regulations during the recent period. It was also suggested that future GLM analysis of CPUE be based on a finer spatial scale and that a greater level of vessel standardization should be done. The southern area model CPUE has been removed from this analysis. Only the CPUE data from Sampson and Lee (1999) were used in the current assessment.

10. In comparison to previous assessments of petrale sole, this assessment represents a significant change in our perception of petrale sole stock status. For example, in the 1999 assessment, spawning biomass stock biomass in 1998 was estimated to be at 39% of unfished stock biomass. The current assessment now estimates biomass in 1998 to have been at 12% of unfished stock biomass (northern area). An extended period of low stock abundance followed by a rapid increase was a consistent feature of model results regardless of geographic area, model configuration, or selection of input data. Nevertheless, this pattern of extreme stock dynamics is difficult to reconcile with the long-term stability of the petrale sole fishery, and the Panel recommends exploration of this issue in future assessments. The catch history for petrale shows peak catches in 1950 followed by a general decline in total catches through the

1980s, low catches through the 1990s, and a small increase in subsequent years. This is generally consistent with the trend in biomass estimated by the stock assessment model and suggests that historically the fishery is not as stable as it first appears, particularly considering the offshore movement of the fishery to focusing on winter spawning aggregations during the 1980s. The difference between the 1999 and more recent 2005 and 2009 stock assessments is also a classic case of shifting baselines since the catch history used in the 1999 assessment started in 1977 and the catch history used in the 2005 stock assessment started in 1876. Figure 36 shows comparisons of each of the stock assessment models estimates of spawning biomass and stock depletion.

11. Concerns regarding limited data for California in comparison to Washington and Oregon remain an issue. Although collection of length data for petrale sole in Californiahas increased, no recent age data are available.

2.5 Model Description

2.5.1 Link from the 2005 to current assessment model

Based on the results of the 2005 stock assessment (Lai et al. 2005) and recommendations from the STAR panel reviews, the current stock assessment for petrale sole is implemented as a single area model. This is because the rather complicated modeling of multiple fisheries with dome-shaped selectivity patterns using sex-specific age data from different agencies caused model convergence to be slow and erratic. Thse problems suggest that the 2005 models may have been over parameterized given the quality and quantity of the available data. The current assessment has been upgraded to the newest version of SS. The data inputs have been rebuilt for a coastwide assessment and reflect the best information currently available. A thorough description of the 2009 assessment model is presented separately below; this section linking the two models is intended only to more clearly identify where substantive changes were made.

The 2005 northern area model removed all of the age data due to problems with shifts in ageing criteria for an uncertain period of time. This problem has been addressed in the best manner possible, and all of the age data from the northern area are now included in the assessment. A new analysis has provided ageing-error estimates of bias and standard deviations for each ageing method applied to petrale otoliths. The NWFSC survey was not included in the 2005 assessment since time series was not long enough to be informative. There are now six years of data from the NWFSC survey that provides a biomass index, length compositions, and conditional age-at-length data that are introduced in this 2009 assessment. Because of the use of conditional age data in place of marginal age-frequency distributions the parameters describing the distribution of length at a given age were freely estimable. The discard data from the WCGOP, that were not included in the 2005 assessment are used directly in this 2009 stock assessment. The catch history for petrale sole has also been updated, resulting in generally higher landings during the early part of the fishery.

2.5.2 Summary of data for fleets and areas

Fishery removals were divided among 6 fleets: 1) winter Washington trawl, 2) summer Washington trawl, 3) winter Oregon trawl, 4) summer Oregon trawl, 5) winter California trawl, and 6) summer California trawl. The landings for the Washington fleet are defined as those fish caught in PSMFC areas 3A (a small portion of northern Oregon is included in area 3A), 3B and 3S. The landings for the Oregon fleet are defined as those fish caught in PSMFC area 2A, 2B, and 2C. The landings for the California fleet are defined as those fish caught in PSFMC area 1A, 1B, and 1C. Removals associated with research projects (the trawl surveys, and other much smaller sources of permitted mortality due to scientific research) are very small and are included in the trawl fishery removal. The data available for each fleet are described in Table 2.

2.5.3 Modeling software

This assessment used the Stock Synthesis 3 modeling framework written by Dr. Richard Methot at the NWFSC. The most recent version (SS-V3.02E) was used, since it included many improvements and corrections to older versions (Methot 2007).

2.5.4 Sample Weighting

Indices of relative abundance all had variance estimates generated as part of the analysis of raw catch data. These variances are converted to standard deviations in log space (as is required by SSv3) for use in the model, no iterative re-weighting is done for the abundance indices. Initial input sample size for compositional data was based on a method developed by I. Stewart and S. Miller, as part of the data and modeling workshop in 2006 (see background materials). Briefly, this method was based on analysis of the input and model-derived effective sample sizes from stock assessments completed in 2005 for west coast groundfish. It makes the input sample size a function of both the number of fish sampled and the number of trips or hauls sampled. A piece-wise linear regression was used to estimate the increase in effective sample size per sample based on fish-per-sample and the maximum effective sample size for large numbers of individual fish. These values are likely to represent a reasonable starting point that generally reflects the degree of observation error commensurate with sampling a given number of fish from a given number of samples.

This assessment follows the iterative re-weighting approach to developing consistency between the input composition sample sizes (or standard errors) and the effective sample sizes based on model fit. This approach attempts to reduce the potential for particular data sources to have a disproportionate effect on total model fit, while creating estimates of uncertainty that are commensurate with the uncertainty inherent in the input data. Iterative re-weighting was applied to the length and age data from the survey and all fleets. This consisted of comparing the mean input sample size for compositional data with the mean effective sample size based on model fit. Where the input sample size was greater, this implied the model was unable to fit the data in a manner that was consistent with the level of variability expected in the data and so a multiplicative scalar was used to reduce the input sample size for all length- or age-composition samples for that fleet accordingly.

A second weighting issue arises when both length and age data are included from the same individual fish and samples. In this case, it is theoretically appealing to treat the age data as conditional to the length observations (as described above) and avoid duplication of the information content. This is the approach taken for survey data. However, due to the technical constraints described above (very long run times), this approach was not feasible for all of the commercial sampling in this assessment at this time. Instead the approach taken is to use the lambda values (emphasis; a direct multiplier on the likelihood component) reducing the lambdas to 0.5 for length and age data from a given fleet where both types of data are available. This is consistent with many other west coast groundfish assessments.

The value of σ_R was determined using an iterative procedure to ensure that the value of σ_R assumed by the assessment model and the empirical variance in recruitment were self-consistent. This involved setting σ_R to an initial value, fitting the model and calculating the variance of the recruitment deviations for the years for which recruitments are estimated in the model (1959–2005), replacing the assumed value of σ_R by the calculated value, and repeating the process until convergence occurred. Very little iterative reweighting was necessary for σ_R.

2.5.5 Priors

Priors were not applied to most estimated parameters in the base case model. Only natural mortality has a normally distributed prior with a mean of 0.2 and a standard deviation of 0.025 for females with males estimated as an offset from females. The parameter bounds are sufficiently wide to avoid truncating the searching procedure during maximum likelihood estimation.

2.5.6 General model specifications

Stock synthesis has a broad suite of structural options available for each application. Where possible, the 'default' or most commonly used approaches are applied to this stock assessment. The assessment is sex-specific, including separate growth curves and estimated for natural mortality for males and females, and therefore tracking the spawning biomass of only females for use in calculating management quantities.

For the internal population dynamics, ages 0-40 are individually tracked, with the accumulator age of 40 determining when the 'plus-group' calculations are applied. As there is little growth occurring at this age, and the data are accumulated at age 17, this should be a robust choice (there needs to be enough space between the data 'plus-group' and that of the dynamics to avoid ageing error moving very old fish into observations of younger ages where this is unwarranted).

There are no explicit areas structuring the modeled dynamics of this assessment. Seasons and fleets based on landings in each state are used to structure catches. Since the time-series of catches starts in 1876 the stock is assumed to be in equilibrium at the beginning of the modeled period. The sex-ratio at birth is fixed at 1:1, although by allowing increased natural mortality on males, size-based selectivity, and dimorphic growth the sex ratio can vary appreciably due to differential mortality by age and sex.

2.5.7 Estimated and fixed parameters

A full list of all estimated parameters and values of key parameters that are fixed is provided in Table 14. Time-invariant sex-specific growth is fully estimated in this assessment with the length at age 1 assumed to be equal for males and females. The log of the unexploited recruitment level for the Beverton-Holt stock-recruit function is treated as an estimated parameter. Recruitment deviations are estimated for each year of the period informed by the data (1939-2005) based on evaluation of the variance of the early deviations. This approach may underestimate uncertainty in recruitment variability (and therefore derived quantities like spawning biomass) in the early years of the model. However, it provides for an efficient maximum likelihood minimization and reduces unwarranted patterns in early deviations. Asymptotic selectivity is used for both the triennial and NWFSC surveys and for all fishing fleets in the base case model. Selectivity for the fishing fleets is modeled as time-varying using either four or five time blocks (Table 15). The catchability parameters are not directly estimated, but are set as scaling factors such that the estimate is median unbiased, which is comparable to the way q was treated in the 2005 stock assessment.

2.6 Model Selection and Evaluation

2.6.1 Key assumptions and structural choices

All structural choices for stock assessment models are likely to be important under some circumstances. In this assessment these choices are generally made to 1) be as objective as possible, 2) follow generally accepted methods of approaching similar models and data and 3) address the previous STAR and Follow-up panel concerns. The relative effect on assessment results of each of these choices is often unknown; however an effort is made to explore alternate choices through sensitivity analysis.

Major choices in the structuring of this stock assessment model include a coastwide model with seasonal fleet structure for each state, splitting the triennial survey into an early and late time period, and estimates selectivity and retention curves for each fleet.

2.6.2 Alternate models explored

Many variations on the base case model were explored during this analysis; only the most relevant and recent are reported in this document. Many of these are reported as sensitivity and retrospective analyses. Many of these types of runs are described below.

Both prior to and during the STAR panel, detailed exploration was made to evaluate:

1. time varying selectivity
2. time varying growth
3. estimation of natural mortality

4. estimation of the stock-recruitment steepness
5. tuning of composition sample sizes
6. the period over which recruitment deviations are estimated
7. asymptotic versus dome shaped selectivity curves for all fishing fleets and surveys
8. the tuning of recruitment variability
9. values for the NWFSC survey q
10. data sources that have been added since the 2005 assessment including, Oregon and Washington ages, discard data, and the NWFSC survey.
11. splitting of the trienneial survey into two time periods
12. commercial age data
13. the 2005 catch history

2.6.3 Convergence status

Convergence testing through use of over dispersed starting values often requires very extreme values to actually explore new areas of the multivariate likelihood surface. For this reason, a good target for convergence testing is to 'jitter' or randomly adjust starting values between reasonable upper and lower bounds by a factor that produces low (~20-40%) rates of successful model estimation. When too much over-dispersion is included the approach is very inefficient, when too little, other minima are unlikely to be identified. Jitter is an SSv3 option which allows the generation of a uniform random number equal to the product of the input value and the range between upper and lower parameter bounds for each parameter. These random numbers are then added to initial parameter values in the input files and the model minimization started at these new conditions.

Poor behavior may be primarily due to multivariate parameter correlation and 'ridges' in the likelihood surface making the search difficult. Further, conflicting signal from various data sources can cause shifts that yield very similar results, but with different combinations of parameters or values for specific likelihood components. This exercise was repeated for the final base-case model and none of these trials found a different global minimum. These results, in conjunction with other convergence checks, indicate that it is likely that the base case model result represents the global minimum.

2.7 Response to STAR panel recommendations

During the STAR panel review auxiliary analyses were performed to explore data sources, better understand model performance, and to identify a single base case model on which both the STAT and STAR panel were in agreement. Areas identified for future research include:

1. The completion of comprehensive catch reconstructions currently underway by Washington and Oregon.
2. Gaining a better understanding of the mixing of U.S. and Canadian catches, particularly for the historical catches for the Washington fleet.

3. Investigating simpler, less structured, models including statistical catch/length models for comparing and contrasting purposes.
4. Expand stock assessment area to include Canadian waters to cover the actual biological range.
5. Expansion of the survey area insore of the since the abundance vs. survey depth plot suggests that there are still a high abundance of petrale inshore of the survey area.
6. A management strategy for petrale sole because the estimates of B_0 and $B_{current}$ are highly sensitive to the assumed stock-recruitment relationship, making these reference points more uncertain, while B_{MSY} estimates are consistent among all the model run results.

2.8 Base case model results

The biological parameters estimated from the base case model are reasonable and consistent with the raw data (Tables 16-17, Figure 37). Female and male petrale sole have similar growth trajectories until about age 5, beyond age 5 females grow to a maximum size of 58.0 cm while males grow to 42.0 cm (Figure 37). Both sexes show a similar distribution of lengths-at-age and relative CVs at age (Figure 37). Natural mortality for females is estimated to be lower, 0.15, compared to males, 0.17 (Table 17). This difference in sex-specific natural mortality suggests that the sex ratios will be dominated by females at older ages.

Estimated selectivity curves for the NWFSC and triennial surveys were generally similar, although in the later years, the triennial survey selected a slightly higher fraction of small petrale sole (Figure 38). The catchability values for the NWFSC and the early and late triennial surveys are different, 3.07 and 0.52 and 0.72 (the direct model estimate of 0.295 needs to be multiplied by 2 to be in the same scale as the NWFSC catchability), respectively (Table 17). The catchability estimate for the triennial survey is in-between the values estimated by the 2005 northern area assessment, 0.35, and 0.706 for 2005 southern area assessment.

Selectivity curves for the fishing fleets largely showed, as expected, a tendency towards larger fish being caught in the winter fisheries and smaller fish being captured in the summer fisheries (Figures 39-44). Time blocks were implemented to account for residual patterns in the composition data that are likely due to the impact of changing management regulations. Ten year time blocks beginning in 1973, 1983, 1993, and 2003 are used to estimate different selectivity parameters in each fleet (Table 15).

The base case model was able to fit both fishery independent and dependent indices well, with the exception of the 2004 data point from the triennial survey (Figures 45-46). Fits to the length and age distributions are fairly good, with no strong trends in the Pearson residuals (Figures 48-51, Appendix B). The Pearson residuals reflect the noise in the data both within and between years. The model is unable to fit the last two years of NWFSC survey composition data very well (Figure 47-49). These compositions suggest that there are proportionally more small/young fish in the population than expected (Figure 47-49). The fishery length- and age-frequency data required some tuning of input sample sizes to make the average effective sample sizes equal to or greater than average input sample sizes (Appendix B). The model also fits the discard data well (Figures 55-60).

The estimated recruitment deviations show relatively low variability, input value of 0.4. output value of 0.33, which is slightly lower than the output values from the 2005 stock assessment, 0.5 and 0.46 for the northern and southern assessment models, respectively. The choice of start year for estimating recruitment deviations, 1939, is based on the estimated variance of the recruitment deviations from the model being close to the input value for recruitment variability. Extending the series to earlier years degraded the model fit and estimates of recruitment deviations since there is little or no composition data to inform the estimation of the recruitment deviations during the earlier years of the model. The time-series of estimated recruitments shows a weak relationship with the decline in spawning biomass, punctuate by larger recruitments (Table 18, Figures 61-62). The four weakest recruitments since 1939 are estimated to be in 1972, 1985-1986, 1991 and 2003(Table 18, Figures 61-62). The four strongest recruitments since 1939 are estimated to be in 1939-1940, 1960, 1965, and 1997-1998 (Table 18, Figures 61-62). The most recent above average recruitment event, is estimated to be in 2005, and is about 20% smaller than of the 1997–1998 recruitment event (Table 18, Figures 61-62). The estimate of stock-recruitment steepness is 0.95 (Table17, Figure 63), which is higher than in both the 2005 northern and southern area assessments.

The biomass time series shows a strong decline from the late-1930s through the mid 1960s, followed by a small recovery through the mid-1970s, and another decline to its lowest point during the early 1990s (7-8% of unexploited) (Tables 18-19, Figure 64). This general pattern of stock decline is coincident with increasing catches (Figure 1). From the mid-1990s through 2005 the stock increased slightly to an estimated depletion of 16.4%, but since 2005 the biomass has declined to an estimated depletion of 11.6% in 2009 (Table 18-19, 65).

2.9 Uncertainty and Sensitivity Analysis

The base case assessment model includes parameter uncertainty from a variety of sources, but underestimates the considerable uncertainty in recent trend and current stock status. For this reason, in addition to asymptotic confidence intervals (based upon the model's analytical estimate of the variance near the converged solution), two alternate states of nature regarding the size of the spawning biomass in 2009 were analyzed. In the high and low states, the 2009 spawning biomass amounts are roughly 1.25 standard deviations higher and lower, respectively, than the base case. These amounts were achieved through manipulation of the size of NWFSC survey biomass in 2008. Much additional exploration of uncertainty was performed prior to and during the STAR panel. Some of that exploration of other sources of uncertainty is provided below.

2.9.1 Sensitivity analysis

Sensitivity analysis was performed to determine the model behavior under different assumptions than those of the base case model. In the numerous sensitivity model runs that were explored before and during the STAR panel, the model provided generally consistent behavior between model and data assumptions with the exception of the choice of stock-recruitment relationship. Three sensitivity runs were done for the final base case model to examine the influence of using the Ricker stock-recruitment function, reducing the effective survey sample sizes by half, and removing all of the 2008 NWFSC survey data. Table 20 shows the results of the sensitivity runs compared to the base case, and Figure 66 shows the biomass trajectory for the sensitivity model runs.

The sensitivities show the following patterns (Table 20, Figure 66). First, the choice of the stock-recruitment relationship specified has a significant effect on the estimates of unfished spawning biomass and depletion. The Ricker stock-recruitment relationship results in a 43% lower estimate of unfished spawning biomass and an 83% higher depletion level than the Beverton-Holt stock-recruitment relationship. Removing the 2008 survey data resulted in more optimistic model results, while halving the effective sample sized for the survey composition data had minimal impact on model results.

2.9.2 Retrospective analysis

A retrospective analysis was conducted by running the model using data only through 2003, 2004, 2005, 2006, and 2007 (Table 21, Figure 67). The following retrospective patterns emerge. All of the retrospective model runs suggest that the unfished spawning biomass is about 25,000 mt. The current biomass (the beginning of the year spawning biomass after the last year of data) is higher for the retrospective runs using data up to 2004, 2005, 2006 and 2007, and lower when the data end in 2003, which shows a smaller biomass and the lowest depletion in 2004. Because the NWFSC survey had only one biomass estimate in 2003, this data point was removed, thus there are no biomass estimates from the NWFSC survey in that retrospective run. Overall, the current depletion is generally higher with the data up to 2007, but the inclusion of data up to 2008 (base case) leads the model to predict a downward trend in the recent spawning biomass. The declining trend in spawning biomass with the inclusion of the 2008 data is driven by the four consecutive years of downward trend in the NWFSC survey biomass index and by the observation of a higher proportion of smaller fish in the 2008 survey length and age-composition data.

2.9.3 Likelihood profiles

Likelihood profiles for steepness, natural mortality, and the NWFSC survey biomass catchability (q) were completed to investigate the uncertainty in the estimates of these parameters, as well as the effect of these parameters on the estimated status of the stock for the pre-STAR model. The pre-STAR model profile for female and male natural mortality suggested that the range of 0.12 to 0.23 for females was within the 95% confidence interval, with male natural moratlity consistenly being about 0.02 higher. The pre-STAR model steepness profile was symmetric and the 95% confidence interval is approximately 0.76–0.99.

Likelihood profiles for the NWFSC catchability (q) and steepness (h) from the final base case model are presented here. Profile results are shown in Figures 68. The profile on the NWFSC survey catchability shows that it is very unlikely for the estimate to be much larger than the current value or the lower that about 2 (Figure 68). The profile on h shows that h may range between about 0.84 and 1.

3. Rebuilding Parameters

Both the STAT team and STAR panel are suggesting that the SSC consider using reference point based on the model estimates of Bmsy rather than the standard Bmsy proxy reference points based on 40% of unfished spawning biomass. Since the SSC has not had the opportunity to consider this issue, the status of the petrale sole stock is yet to be determined.

4. Reference points

The abundance dropped below the $SB_{40\%}$ management target in 1949 and the overfished threshold in 1952. Beginning in 1980 the stock was around 10-12% of unfished spawning biomass and in 1988 the stock dropped below 10% of unfished spawning biomass (Figures 64-65). The estimated relative depletion level in 2009 is 11.6% (Tables 18-19, Figures 64-65). The estimated relative depletion level in 2009 is 11.6% (~95% asymptotic interval: ±4.8%, ~ 75% interval based on the range of states of nature: 9.4-13.8%), corresponding to 2937.6 mt (~95% asymptotic interval: ±832.7 mt, states of nature interval: 2407.8-3468.1 mt) of female spawning biomass in the base model (Table 18).

Fishing mortality rates in excess of the current F-target for flatfish of $SPR_{40\%}$ are estimated to have begun in the late 1930s and persisted through 2008 (Figures 69-70). Current relative exploitation rates (catch/biomass of age-3 and older fish) are estimated to have been 0.29 in 2008. Figure 71 shows a phase plot comparing the time series of estimated fishing mortality and relative depletion. Figure 72 shows a phase plot using the Fmsy and Bmsy reference points.

The equilibrium unfished spawning stock biomass was estimated to be 25,334 mt. The target stock size ($SB_{40\%}$) is therefore 10,134 mt which gives a catch of 2060 mt (Table 18). The estimates of unfished spawning biomass, and therefore the $SB_{40\%}$ reference points were very sensitive to the assumption of stock-recruitment relationship (see section 2.9.1). Model estimates of spawning biomass at MSY and MSY yield were more robust to the assumption of stock-recruitment relationship (see section 2.9.1). Maximum sustained yield (MSY) applying recent fishery selectivity and allocations was estimated in the assessment model at 2,376 mt, occuring at a spawning stock biomass of 4,796 mt (SPR = 0.20). Figure 73 shows the equilibrium yield curve from the base case model; note that the proxy Bmsy reference point (40% of unfished biomass) is very conservative in comparison to the model estimate of Bmsy.

5. Harvest projections and decision tables

The total OYs in 2009 and 2010 are 2433 and 2393 mt and the projections are based on the assumption that they will be reached. The exploitation rate for 2011 and beyond for the base model projection potential is based upon an SPR of 40% (Table 22). Selectivity and fleet allocations are projected at the values for the most recent year. The states of nature in the decision table are low and high 2009 spawning biomass scenarios (Table 23). Seven possible time series of catches are provided and include: 1) a minimal constant catch time series of 3mt, 2) ½ the catches from the 40-10 catch control rul, 3) the catches from the 40-10 catch control rule, 4) a constant catch of 500 mt, 5) a constant catch of 1500 mt, 6) a constant catch based on 2/3 of the estimate Fmsy, 7) a ramping down of catches from 2/3 Fmsy when the stock is as Bmsy to zero catch when the stock is at 50% of Bmsy. Since the STAR panel and STAT team are suggesting that the model estimate of Bmsy be used as a reference point two time series of stock depletion are provided for each combination of catch time series and state of nature. The first measure of stock depletion is based on the model estimate of unfished spawning biomass, the second measure of stock depletion is based on the model estimate of Bmsy.

6. Regional management considerations

The resource is modeled as a single stock. Spatial aspects of the coast-wide population are addressed through geographic separation of data sources/fleets where possible and consideration of residual patterns that may be a result of inherent stock structure. There is currently no genetic evidence that there are distinct biological stocks of petrale sole off the U.S. coat and the limited tagging data that describes adult movement suggests that movement may be significant across depth and latitude.

7. Research needs

Progress on a number of research topics would substantially improve the ability of this assessment to reliably and precisely model petrale sole population dynamics in the future and provide better monitoring of progress toward rebuilding:

1. The estimate of the NWFSC survey catchability in the base case model is higher than expected. This may be due to the use of the total area within each strata during the expansion of the survey data rather than the trawlable areas only, where petrale are most likely to be found. At this time there are no area estimates for trawlable and untrawlable areas. However the petrale sole population is most likely well surveyed by the trawl survey and expanding using areas that include untrawlable areas is probably not appropriate.
2. Expand the assessment to include the waters of British Columbia since petrale sole are likely a single stock that moves across the U.S. Canadian boarder.
3. Many assessments are deriving historical catch by applying various ratios to the total flatfish catch prior to the period when most species were delineated. While progress has been made in moving towards a comprehensive historical catch reconstruction it would be best if a complete catch reconstruction is available from each state for all flatfish species. This will make it possible to compile a best estimated catch series that accounts for all the catch and makes sense for both petrale sole and flatfish as a group.
4. Age data from the California fishery are needed.
5. Historical age data could be improved by obtaining new break and burn ages where structures are available.
6. The estimation of ageing error for the WDFW samples could be improved by doing break-and-burn cross reads with the CAP ageing lab.
7. Studies on recent biological data and stock structure. For example, due to inconsistencies between studies and scarcity of appropriate data, new data are needed on both the maturity and fecundity relationships.

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10. Tables

Table 1. Total landed catches (mt) of petrale sole by fleet and season used in the assessment model. See text for a description of sources.

Fishing year	WA Winter	WA Summer	OR Winter	OR Summer	CA Winter	CA Summer	Total Winter	Total Summer
1876	0.00	0.00	0.00	0.00	0.00	1.00	0	1
1877	0.00	0.00	0.00	0.00	0.00	1.00	0	1
1878	0.00	0.00	0.00	0.00	0.00	1.00	0	1
1879	0.00	0.00	0.00	0.00	0.00	1.00	0	1
1880	0.00	0.00	0.00	0.00	0.00	11.55	0	11.55
1881	0.00	0.00	0.00	0.00	0.00	22.10	0	22.1
1882	0.00	0.00	0.00	0.00	0.00	32.65	0	32.65
1883	0.00	0.00	0.00	0.00	0.00	43.20	0	43.2
1884	0.00	0.00	0.00	0.00	0.00	53.75	0	53.75
1885	0.00	0.00	0.00	0.00	0.00	64.30	0	64.3
1886	0.00	0.00	0.00	0.00	0.00	74.85	0	74.85
1887	0.00	0.00	0.00	0.00	0.00	85.40	0	85.4
1888	0.00	0.00	0.00	0.00	0.00	95.95	0	95.95
1889	0.00	0.00	0.00	0.00	0.00	106.50	0	106.5
1890	0.00	0.00	0.00	0.00	0.00	117.05	0	117.05
1891	0.00	0.00	0.00	0.00	0.00	127.60	0	127.6
1892	0.00	0.00	0.00	0.00	0.00	138.15	0	138.15
1893	0.00	0.00	0.00	0.00	0.00	148.71	0	148.71
1894	0.00	0.00	0.00	0.00	0.00	159.26	0	159.26
1895	0.00	0.00	0.00	0.00	0.00	169.81	0	169.81
1896	0.00	0.00	0.00	0.00	0.00	180.36	0	180.36
1897	0.00	0.00	0.00	0.00	0.00	190.91	0	190.91
1898	0.00	0.00	0.00	0.00	0.00	201.46	0	201.46
1899	0.00	0.00	0.00	0.00	0.00	212.01	0	212.01
1900	0.00	0.00	0.00	0.00	0.00	222.56	0	222.56
1901	0.00	0.00	0.00	0.00	0.00	233.11	0	233.11
1902	0.00	0.00	0.00	0.00	0.00	243.66	0	243.66
1903	0.00	0.00	0.00	0.00	0.00	254.21	0	254.21
1904	0.00	0.00	0.00	0.00	0.00	264.76	0	264.76
1905	0.00	0.00	0.00	0.00	0.00	275.31	0	275.31
1906	0.00	0.00	0.00	0.00	0.00	285.86	0	285.86
1907	0.00	0.00	0.00	0.00	0.00	296.41	0	296.41
1908	0.00	0.00	0.00	0.00	0.00	306.96	0	306.96
1909	0.00	0.00	0.00	0.00	0.00	317.51	0	317.51
1910	0.00	0.00	0.00	1.00	0.00	328.06	0	329.06
1911	0.00	0.00	0.00	1.00	0.00	338.61	0	339.61
1912	0.00	0.00	0.00	1.00	0.00	349.16	0	350.16
1913	0.00	0.00	0.00	1.00	0.00	359.71	0	360.71
1914	0.00	0.00	0.00	1.00	0.00	370.26	0	371.26
1915	0.00	0.00	0.00	1.00	0.00	380.81	0	381.81
1916	0.00	0.00	0.00	1.00	0.00	386.42	0	387.42
1917	0.00	0.00	0.00	1.00	0.00	526.41	0	527.41
1918	0.00	0.00	0.00	1.00	0.00	423.85	0	424.85
1919	0.00	0.00	0.00	1.00	0.00	333.44	0	334.44
1920	0.00	0.00	0.00	1.00	0.00	230.49	0	231.49
1921	0.00	0.00	0.00	1.00	0.00	293.76	0	294.76
1922	0.00	0.00	0.00	1.00	0.00	424.78	0	425.78
1923	0.00	0.00	0.00	1.00	0.00	427.36	0	428.36

Fishing year	WA Winter	WA Summer	OR Winter	OR Summer	CA Winter	CA Summer	Total Winter	Total Summer
1924	0.00	0.00	0.00	1.00	0.00	532.86	0	533.86
1925	0.00	0.00	0.00	1.00	0.00	528.47	0	529.47
1926	0.00	0.00	0.00	1.00	0.00	521.67	0	522.67
1927	0.00	0.00	0.00	1.00	0.00	632.04	0	633.04
1928	0.00	0.00	0.00	0.00	0.00	620.09	0	620.09
1929	0.00	0.00	0.00	3.08	0.00	706.04	0	709.12
1930	0.00	0.00	0.00	1.00	0.00	658.83	0	659.83
1931	0.00	80.59	0.00	0.98	63.39	530.88	63.39	612.45
1932	1.99	241.77	0.00	6.80	36.40	519.91	38.39	768.48
1933	5.96	402.95	0.00	4.31	38.57	392.08	44.53	799.34
1934	9.93	564.13	0.00	2.90	139.41	896.36	149.34	1,463.39
1935	13.90	644.72	0.00	5.71	155.38	777.21	169.28	1,427.64
1936	15.88	752.33	0.00	18.60	95.49	431.51	111.37	1,202.44
1937	19.75	967.53	0.00	81.39	74.53	741.05	94.28	1,789.97
1938	27.49	1182.73	0.00	4.10	47.86	890.00	75.35	2,076.83
1939	35.22	1290.33	0.00	2.50	30.84	1028.96	66.06	2,321.79
1940	39.09	1280.50	0.00	352.70	162.53	596.69	201.62	2,229.89
1941	41.40	1260.83	0.00	464.20	110.81	331.32	152.21	2,056.35
1942	46.00	1241.16	0.00	1868.70	24.37	215.56	70.37	3,325.42
1943	50.61	1221.48	0.00	1898.56	71.66	344.72	122.27	3,464.76
1944	55.21	1201.81	0.00	1007.50	85.53	446.58	140.74	2,655.89
1945	59.82	1182.14	0.00	785.42	101.75	439.34	161.57	2,406.9
1946	64.43	1162.46	0.00	1488.90	71.91	1115.57	136.34	3,766.93
1947	69.03	1142.79	0.00	720.46	153.68	1092.65	222.71	2,955.9
1948	73.64	1123.12	0.00	1326.50	272.66	1544.35	346.3	3,993.97
1949	75.94	1113.27	0.00	755.79	615.70	1476.28	691.64	3,345.34
1950	156.21	957.31	0.00	1643.80	410.94	1346.41	567.15	3,947.52
1951	117.97	774.51	0.00	949.08	207.05	938.14	325.02	2,661.73
1952	131.01	743.76	0.00	729.70	318.12	857.63	449.13	2,331.09
1953	46.07	354.35	0.00	502.68	525.77	778.53	571.84	1,635.56
1954	26.56	418.07	0.00	692.80	797.19	891.57	823.75	2,002.44
1955	57.14	398.57	0.00	882.91	520.17	925.76	577.31	2,207.24
1956	120.46	356.24	19.09	500.90	504.50	683.23	644.05	1,540.37
1957	106.45	361.57	83.20	739.29	517.79	954.42	707.44	2,055.28
1958	29.12	443.81	37.86	529.90	557.95	729.26	624.93	1,702.97
1959	73.98	678.12	389.39	364.92	370.52	625.42	833.89	1,668.46
1960	123.30	587.40	84.95	634.64	514.39	592.71	722.64	1,814.75
1961	133.94	802.19	56.76	595.02	540.53	927.43	731.23	2,324.64
1962	156.57	497.80	93.82	549.73	510.21	783.04	760.6	1,830.57
1963	118.57	535.59	151.70	473.51	530.82	810.08	801.09	1,819.18
1964	103.21	455.02	75.67	297.23	372.19	912.61	551.07	1,664.86
1965	127.72	434.58	82.28	468.00	373.44	845.83	583.44	1,748.41
1966	91.56	414.37	59.43	304.21	324.71	916.97	475.7	1,635.55
1967	60.01	312.00	73.88	307.81	521.08	858.30	654.97	1,478.11
1968	137.39	222.56	41.26	318.96	360.61	845.90	539.26	1,387.42
1969	52.02	161.12	34.88	369.51	420.97	848.19	507.87	1,378.82
1970	143.76	356.86	114.24	457.86	472.37	1070.97	730.37	1,885.69
1971	152.49	418.93	133.52	296.50	539.72	1015.59	825.73	1,731.02
1972	186.61	553.63	157.97	297.19	703.21	1000.27	1047.79	1,851.09
1973	200.86	545.65	106.25	407.14	417.44	741.68	724.55	1,694.47
1974	167.91	712.88	161.63	428.64	664.63	893.27	994.17	2,034.79
1975	189.29	703.09	178.26	611.08	560.51	900.92	928.06	2,215.09
1976	161.12	494.31	176.45	283.54	712.75	736.71	1050.32	1,514.56

Year	WA Winter	WA Summer	OR Winter	OR Summer	CA Winter	CA Summer	Total Winter	Total Summer
1977	161.77	437.19	152.86	294.20	484.15	494.81	798.78	1,226.2
1978	246.92	578.04	141.07	352.58	419.09	800.66	807.08	1,731.28
1979	248.02	514.70	200.94	505.39	352.88	944.80	801.84	1,964.89
1980	56.44	444.24	67.13	347.00	518.33	680.05	641.9	1,471.29
1981	262.96	417.96	166.68	420.06	352.88	533.63	782.52	1,371.65
1982	121.26	580.12	133.20	714.50	261.53	502.05	515.99	1,796.67
1983	229.54	750.63	491.38	340.79	272.72	364.76	993.64	1,456.18
1984	241.92	595.04	228.42	152.39	260.56	329.98	730.9	1,077.41
1985	286.38	282.35	173.60	124.38	273.29	471.93	733.27	878.66
1986	206.97	327.23	264.52	123.83	402.99	355.49	874.48	806.55
1987	422.20	439.51	431.99	126.17	310.94	556.37	1165.13	1,122.05
1988	333.64	449.18	409.10	160.73	349.17	411.28	1091.91	1,021.19
1989	298.05	397.97	396.63	184.84	393.89	414.79	1088.57	997.6
1990	383.28	300.53	257.06	158.15	319.63	373.52	959.97	832.2
1991	352.01	246.91	440.45	149.91	447.94	310.28	1240.4	707.1
1992	298.02	204.76	339.67	159.65	273.54	307.39	911.23	671.8
1993	271.41	213.33	413.08	173.93	237.99	235.66	922.48	622.92
1994	237.33	173.72	280.06	175.63	246.13	303.99	763.52	653.34
1995	235.31	236.41	354.51	201.96	236.03	290.53	825.85	728.9
1996	264.64	247.53	310.87	182.23	406.09	401.93	981.6	831.69
1997	247.73	233.34	366.99	176.33	451.30	461.33	1066.02	871
1998	217.87	330.41	303.30	242.54	221.71	302.80	742.88	875.75
1999	134.65	308.16	323.37	193.18	292.03	268.39	750.05	769.73
2000	241.94	425.75	323.49	136.28	408.47	241.95	973.9	803.98
2001	308.96	366.51	358.42	225.93	317.31	261.34	984.69	853.78
2002	346.36	514.31	295.64	185.37	340.01	195.69	982.01	895.37
2003	295.56	541.41	241.76	166.43	260.70	180.25	798.02	888.09
2004	683.93	550.18	322.90	188.51	177.27	267.84	1184.1	1,006.53
2005	555.51	763.67	374.93	286.19	339.46	534.42	1269.9	1,584.28
2006	252.38	618.63	277.56	363.47	125.64	464.78	655.58	1,446.88
2007	303.55	331.03	557.89	173.78	469.05	493.46	1330.49	998.27
2008	286.74	179.39	448.62	136.28	617.62	410.51	1352.98	726.18

Table 2. Recent trend in estimated total petrale sole catch and commercial landings (mt) relative to management guidelines.

Fishing year	ABC (mt)	OY (mt)	Commercial Landings (mt)	Estimated[1] Total Catch (mt) for the Annual Year	Estimated Total Catch (mt) for the Fishing Year
1999	2,700	2,700	1,520	1,617	1,591
2000	2,950	2,950	1,778	1,888	1,856
2001	2,762	2,762	1,838	1,975	1,934
2002	2,762	2,762	1,877	2,066	2,024
2003	2,762	2,762	1,686	1,786	1,809
2004	2,762	2,762	2,191	2,273	2,284
2005	2,762	2,762	2,854	2,948	2,960
2006	2,762	2,762	2,102	2,173	2,183
2007	3,025	2,499	2,329	2,372	2,376
2008	2,919	2,499	2,079	2,114	2,117

[1] Total annual catches reflect the commercial landings plus the model estimated annual discard biomass (commercial landings * retained catch/total catch). The total amounts of discard may differ from those reported in the NWFSC reports on total catch for some of these years.

Table 3a. Summary of fishery independent data sources available in 2009. Highlighted areas denote data used.

	YEAR																												
	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
ABUNDANCE INDEX																													
AFSC Shelf Triennial																													
NWFSC Shelf-Slope																													
BIOLOGICAL DATA																													
Length																													
AFSC Shelf Triennial																													
NWFSC Shelf-Slope																													
Age **																													
NWFSC Shelf-Slope																								BB	SR	BB	BB	BB	BB

Table 3b. Continued.

	Hist. Data	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
LANDINGS																											
WA	35-54																										
OR	28-54																										
CA	16-54																										
CPUE																											
OR																											
DISCARDS																											
Fraction Discard																											
Mean Weights																											
Length Frequency																											
BIOLOGICAL DATA																											
Length																											
WA (PacFIN)																											
OR (PacFIN)																											
CA (CALCOM/PacFIN) 1948-1949																											
Age																											
WA (PacFIN)																											
OR (PacFIN)																											
CA (CALCOM)																											

Table 3b. Continuted.

	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08
LANDINGS																												
WA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
OR	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CPUE																												
OR										■	■	■	■	■	■	■	■	■	■	■	■	■	■					
DISCARDS																												
Fraction Discard						OR Only	■															■	■	■	■	■	■	■
Mean Weights																						■	■	■	■	■	■	■
Length Frequency																										■	■	■
BIOLOGICAL DATA																												
Length																												
WA (PacFIN)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
OR (PacFIN)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
CA (CALCOM/PacFIN) 1948-1949	■	■	■	■	■	■	■	■	■	■	■	■							■		■	■	■	■	■	■	■	■
Age																												
WA (PacFIN)	■	■			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
OR (PacFIN)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■				■	■	■			■	■
CA (CALCOM)	■	■	■	■	■					■	■								■								■	

Table 4. Summary of the tow data from the NWFSC survey.

Year	Number of tows	Number of Tows with Petrale	Percent of Tows with Petrale
2003	558	203	36.4
2004	497	225	45.3
2005	674	293	43.5
2006	652	250	38.3
2007	696	261	37.5
2008	685	260	38.0

Year	Number of tows with lengths taken	Percent Petrale tows with lengths taken	Number of male lengths	Number of female lengths	Number of unsexed lengths
2003	202	99.5	1,422	1,442	4
2004	222	98.7	1,875	1,633	1
2005	290	99.0	2,470	2,246	16
2006	250	100.0	1,989	1,752	4
2007	261	100.0	1,976	1,479	6
2008	260	100.0	1,620	1,444	5

Year	Number of tows with ages taken	Percent Petrale tows with ages taken	Number of male ages	Number of female ages	Number of unsexed ages
2003	177	87.2	392	389	0
2004	185	82.2	548	370	1
2005	248	84.6	396	397	1
2006	239	95.6	425	358	2
2007	200	76.6	384	320	0
2008	228	87.7	401	353	1

Table 5. Estimates of biomass (mt) and standard errors (of the natural log of biomass).

	Triennial			NWFSC		
Year	Estimate (B)	log(B)	SE(logB)	Estimate (B)	log(B)	SE(logB)
1980	2,175	7.68	0.2104			
1981						
1982						
1983	2,084	7.64	0.1750			
1984						
1985						
1986	2,241	7.71	0.1744			
1987						
1988						
1989	3,613	8.19	0.1711			
1990						
1991						
1992	1,996	7.60	0.1682			
1993						
1994						
1995	2,330	7.75	0.1710			
1996						
1997						
1998	3,414	8.14	0.1644			
1999						
2000						
2001	3,488	8.16	0.1721			
2002						
2003				19,131	9.86	0.1332
2004	9,294	9.14	0.1719	22,168	10.01	0.1478
2005				23,494	10.06	0.1252
2006				19,573	9.88	0.1358
2007				15,892	9.67	0.1293
2008				13,532	9.51	0.1275

Table 6. Summary of the tow data from the Triennial survey.

Year	Number of tows	Number of Tows with Petrale	Percent of Tows with Petrale
1980	301	139	46.2
1983	479	250	52.2
1986	483	268	55.5
1989	440	275	62.5
1992	421	251	59.6
1995	441	209	47.4
1998	468	291	62.2
2001	466	256	54.9
2004	383	244	63.7

Year	Number of tows with lengths taken	Percent Petrale tows with lengths taken	Numberof male lengths	Number of female lengths	Number of unsexed lengths
1980	1	0.7	2	14	0
1983	2	0.8	20	10	0
1986	36	13.4	248	292	0
1989	141	51.3	642	773	4
1992	116	46.2	480	535	0
1995	145	69.4	565	804	0
1998	236	81.1	1,147	1,447	30
2001	254	99.2	1,453	1,559	4
2004	239	98	2,306	2,369	1

Table 7. The number of double read samples available for estimating ageing error for petrale sole. Shaded samples with the same number of reads between ageing method indicates a data set with triple or quadruple reads.

	Agency/Lab/Study					
Ageing Method	WDFW	Pre CAP (OR samples from before 1980)	Early CAP (OR samples from 1981-1999)	Recent CAP (OR and NWFSC samples 2000-present)	CDFW	Bomb Radiocarbon Study
BB v BB	590		7	199	0	333
BB v. Combo	590				0	
BB v. S		216	3	314	0	333
Combo v. Combo	156				0	
Combo v. S			142		0	
S v. S			338	362	0	333

Table 8a. The structure of the ageing bias and imprecision analysis for WDFW samples with the comparison(s) of interest for the assessment highlighted. The Radiocarbon ages are break and burn reads from a single reader from the bomb radiocarbon study that are known to be unbias. Therefore, these ages are used as the benchmark against which the other ageing methods are compared in the analysis.

	Radiocarbon v. BB	BB v. BB	BB v. Combo
Radiocarbon v. BB	**x**		
BB v. BB		**x**	
BB v. Combo			**x**

Table 8b. The same as table 8a except these are comparisons from the CAP laboratory.

	Radiocarbon v. BB	BB v BB	BB v. S	S v. S
Radiocarbon v. BB	**x**			
BB v BB		**x**		
BB v. S			**X**	
S v. S				**x**

Table 8c. The same as a except these are comparisons for a second tier analysis meant to estimate only the bias and imprecision of the combo ageing method (since the ageing error software can only handle three methods and the CAP data have four). In this case the BB method is set as the unbias benchmark and the bias estimated for the combo method is adjusted using the estimated bias for the BB samples from the tier 1 analysis

	BB v BB	BB v. S	S v. S	S v. Combo
BB v BB	**x**			
BB v. S		**x**		
S v. S			**X**	
S v. Combo				**X**

Table 9a. A subset of the different models fit to each CAP analysis #1 data set as well as the likelihoods, the model selected is highlighted. The bias options are 0 = unbias, 1 = linear, 2 = type 2. The standard deviation options are 1=constant CV and 2=increase in CV with age. There is one value specified for each age reading method in the analysis.

Model Run	Bias Options	Standard Deviation Options	Plus Group	Negative Log Likelihood
1	0,1,1	1,1,1	25	5956.49
2	0,1,1	1,1,1	30	Not Converged
3	0,1,1	1,2,2	25	Not Converged
4	0,1,1	2,2,2	25	Not Converged
5	0,1,2	1,1,1	25	Not Converged
6	0,1,2	1,1,2	25	Not Converged
7	0,2,2	1,1,1	25	Not Converged
8	0,2,2	2,2,2	25	Not Converged

Table 9b. The same as 9a but for the CAP analysis #2 data set.

Model Run	Bias Options	Standard Deviation Options	Plus Group	Negative Log Likelihood	Maximum Standard Deviation	Notes
1	0,1,1	1,1,1	25	5465.41	30	selected to limit the bias and standard deviation
2	0,1,1	1,1,1	25	Not Converged	10	Unreasonable huge bias at older ages
3	0,1,1	1,1,2	25	Not Converged	10	hit bound on maximum standard deviation
4	0,1,1	1,1,2	25	Not Converged	30	hit bound on maximum standard deviation
5	0,1,1	1,1,2	25	Not Converged	60	hit bound on maximum standard deviation
6	0,1,2	1,1,2	25	Not Converged	100	huge standard deviation

Table 9c. The same as 9a but for the WDFW data set.

Model Run	Bias Options	Standard Deviation Options	Plus Group	Negative Log Likelihood
1	0,1,1	1,1,1	25	Not Converged
2	0,1,2	1,1,1	25	3485.25
3	0,1,2	1,1,2	25	Not Converged

Table 10. The estimates of bias (mean observed age at true age) and imprecision (SD of observed age at true age) from the best fit models that are used for the various age reading methods in the assessment.

	Break and Burn		Surface		CAP Combo		WDFW Combo	
True Age	Bias	Standard Deviation	Bias	Standard Deviation	Bias	Standard Deviation	Bias	Standard Deviation
0.5	0	0.13	0	0.09	0	0.2	1.65	0.21
1.5	0.98	0.13	0.94	0.09	0.97	0.2	2.3	0.21
2.5	1.96	0.26	1.87	0.18	1.94	0.39	2.96	0.41
3.5	2.95	0.38	2.81	0.28	2.91	0.59	3.64	0.62
4.5	3.93	0.51	3.75	0.37	3.87	0.78	4.34	0.83
5.5	4.91	0.64	4.68	0.46	4.84	0.98	5.06	1.04
6.5	5.89	0.77	5.62	0.55	5.81	1.17	5.79	1.24
7.5	6.87	0.9	6.56	0.64	6.78	1.37	6.55	1.45
8.5	7.85	1.02	7.49	0.73	7.75	1.56	7.32	1.66
9.5	8.84	1.15	8.43	0.83	8.72	1.76	8.11	1.86
10.5	9.82	1.28	9.37	0.92	9.69	1.95	8.91	2.07
11.5	10.8	1.41	10.3	1.01	10.66	2.15	9.74	2.28
12.5	11.78	1.53	11.24	1.1	11.62	2.34	10.59	2.49
13.5	12.76	1.66	12.17	1.19	12.59	2.54	11.46	2.69
14.5	13.74	1.79	13.11	1.28	13.56	2.73	12.36	2.9
15.5	14.73	1.92	14.05	1.38	14.53	2.93	13.27	3.11
16.5	15.71	2.05	14.98	1.47	15.5	3.12	14.21	3.31
17.5	16.69	2.17	15.92	1.56	16.47	3.32	15.17	3.52
18.5	17.67	2.3	16.86	1.65	17.44	3.51	16.15	3.73
19.5	18.65	2.43	17.79	1.74	18.4	3.71	17.16	3.94
20.5	19.63	2.56	18.73	1.83	19.37	3.91	18.19	4.14
21.5	20.62	2.69	19.67	1.93	20.34	4.1	19.25	4.35
22.5	21.6	2.81	20.6	2.02	21.31	4.3	20.33	4.56
23.5	22.58	2.94	21.54	2.11	22.28	4.49	21.44	4.76
24.5	23.56	3.07	22.48	2.2	23.25	4.69	22.58	4.97
25.5	24.54	3.2	23.41	2.29	24.22	4.88	23.75	5.18
26.5	25.52	3.33	24.35	2.39	25.18	5.08	24.94	5.39
27.5	26.51	3.45	25.29	2.48	26.15	5.27	26.17	5.59
28.5	27.49	3.58	26.22	2.57	27.12	5.47	27.42	5.8
29.5	28.47	3.71	27.16	2.66	28.09	5.66	28.71	6.01
30.5	29.45	3.84	28.1	2.75	28.09	5.65	30.03	6.21
31.5	30.43	3.97	29.03	2.84	29.06	5.84	31.38	6.42
32.5	30.43	3.96	29.03	2.84	30.03	6.04	31.2	6.41
33.5	31.41	4.09	29.97	2.93	31	6.23	32.52	6.61
34.5	32.4	4.21	30.9	3.02	31.97	6.43	33.86	6.82
35.5	33.38	4.34	31.84	3.11	32.94	6.62	35.22	7.03
36.5	34.36	4.47	32.78	3.2	33.9	6.81	36.61	7.23
37.5	35.34	4.59	33.71	3.29	34.87	7.01	38.02	7.44
38.5	36.32	4.72	34.65	3.39	35.84	7.2	39.45	7.64
39.5	37.3	4.85	35.59	3.48	36.81	7.4	40.91	7.85
40.5	38.29	4.98	36.52	3.57	37.78	7.59	42.38	8.05

Table 11. Petrale sole discard biomass (mt) and bootstrap estimated CVs (WCGOP only) for the commercial fisheries used in the model.

Fishing year	Washington Winter	Washington Summer	Oregon Winter	Oregon Summer	California Winter	California Summer
1986				11.88 (0.50)		
1987				12.17 (0.50)		
2002	2.96 (0.21)	157.42 (0.13)	6.68 (0.43)	32.12 (0.18)	9.12 (0.36)	12.75 (0.22)
2003	3.12 (1.09)	106.13 (0.30)	0.64 (0.40)	12.65 (0.32)	14.74 (0.65)	7.74 (0.21)
2004	1.86 (0.51)	67.54 (0.22)	0.17 (0.61)	7.64 (0.57)	1.66 (1.70)	7.53 (0.28)
2005	1.60 (0.45)	55.66 (0.15)	3.33 (0.71)	10.34 (0.38)	2.06 (0.40)	5.43 (0.22)
2006	1.75 (0.26)	42.43 (0.24)	2.15 (0.43)	34.43 (0.18)	7.08 (0.34)	19.40 (0.28)
2007	1.77 (0.54)	32.55 (0.30)	1.47 (0.63)	28.06 (0.32)	5.65 (0.18)	36.73 (0.28)
2008	8.14 (0.82)		18.02 (0.57)		0.79 (0.32)	

Table 12. Summary of sampling effort generating length-frequency distributions used in the assessment model for the trawl fleets for females and then males.

	Washington Winter		Washington Summer		Oregon Winter		Oregon Summer		California Winter		California Summer	
Fishing year	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish
1948											4	(196,209)
1949									10	(604,300)	4	(104,262)
1955	1	(168,339)										
1956	1	(64,36)	2	(344,345)								
1957			4	(678,375)								
1958			3	(920,1220)								
1959												
1960			1	(32,221)								
1961			1	(53,47)								
1962											3	(244,56)
1963												
1964			1	(86,114)					1	(54,44)	22	(1072,722)
1965			1	(52,48)					2	(10,63)	14	(800,366)
1966			28	(1258,1065)			9	(297,147)	8	(354,146)	33	(1358,1384)
1967	4	(132,68)	31	(851,1019)			11	(283,275)	20	(1046,662)	44	(2030,921)
1968	11	(378,184)	38	(2165,2455)			19	(554,389)	11	(724,276)	87	(3404,3404)
1969	9	(367,361)	37	(1193,1739)	1	(36,15)	18	(697,201)	14	(658,250)	49	(2043,1746)
1970	9	(521,222)	40	(2122,2625)			21	(713,306)	13	(506,342)	29	(962,828)
1971	11	(429,957)	10	(928,1291)			5	(291,210)	7	(336,164)	37	(1438,922)
1972	4	(460,440)	24	(1730,2567)			7	(318,383)	23	(1354,459)	39	(1432,1438)
1973	3	(398,252)	14	(950,940)			5	(227,273)	12	(506,317)	41	(1357,1556)
1974	3	(161,625)	35	(4250,4812)			7	(360,416)	31	(1364,988)	35	(1290,976)
1975	10	(1111,1081)	20	(1910,2347)			5	(210,290)	11	(402,248)	19	(1034,712)
1976	1	(105,274)	6	(1066,527)					12	(532,493)	26	(1200,1310)
1977	2	(206,115)	10	(629,691)			11	(549,541)	8	(524,276)	38	(2112,1488)
1978	3	(506,172)	9	(530,711)	1	(92,8)	12	(563,653)	17	(734,790)	33	(2024,1274)
1979	2	(53,166)	17	(1111,722)			6	(345,260)	7	(376,324)	12	(640,560)
1980	5	(468,205)	28	(1657,1225)	4	(188,207)	16	(934,630)	6	(404,190)	81	(4676,3408)
1981	8	(592,208)	8	(434,364)	2	(102,100)	29	(1844,1053)	36	(2504,1042)	65	(3642,2626)
1982	4	(244,156)	1	(72,29)	1	(41,59)	16	(990,608)	26	(1202,1236)	34	(1608,1256)
1983	1	(59,52)			3	(173,127)	1	(13,87)	26	(1478,1170)	33	(2024,1176)

Fishing year	Washington Winter N trips	Washington Winter N fish	Washington Summer N trips	Washington Summer N fish	Oregon Winter N trips	Oregon Winter N fish	Oregon Summer N trips	Oregon Summer N fish	California Winter N trips	California Winter N fish	California Summer N trips	California Summer N fish
1984	1	(111,90)			2	(133,78)			13	(636,520)	19	(1066,820)
1985		(,)	3	(156,146)			2	(173,27)	13	(612,688)	17	(1052,598)
1986	2	(112,87)	5	(277,224)	1	(53,48)	4	(265,129)	6	(270,330)	16	(894,708)
1987	6	(251,201)	9	(232,223)	1	(43,7)	7	(239,111)	10	(436,564)	14	(712,688)
1988	4	(118,81)	5	(149,102)			2	(75,25)	6	(296,304)	6	(322,210)
1989	5	(158,92)	7	(202,150)	6	(184,116)	6	(204,96)	9	(532,350)	9	(638,262)
1990	2	(39,62)	6	(164,138)	2	(44,56)	5	(151,99)	2	(162,38)	1	(48,28)
1991	2	(33,18)	5	(90,102)	9	(233,142)	2	(65,20)	12	(458,406)	1	(44,38)
1992	1	(5,24)	5	(123,64)	3	(61,83)	6	(155,86)	6	(222,146)		
1993	4	(56,47)	6	(173,62)	3	(44,71)	2	(44,17)				
1994	4	(66,50)	7	(152,152)	5	(132,92)	2	(44,23)				
1995	3	(36,81)	2	(44,22)	5	(108,76)						
1996	2	(26,41)	3	(95,33)	1	(23,12)	1	(24,16)				
1997	1	(30,9)	3	(78,47)	2	(63,36)	9	(242,97)				
1998	2	(39,47)	16	(453,276)	2	(26,39)	5	(111,104)				
1999	3	(63,67)	14	(429,229)	2	(49,15)			1	(17,10)		
2000	10	(191,220)	20	(548,304)	4	(87,46)	2	(47,4)				
2001	12	(197,264)	13	(433,195)	5	(107,53)	1	(27,14)			8	(180,79)
2002	7	(111,193)	20	(562,290)	2	(32,56)	3	(59,65)	12	(66,250)	9	(90,104)
2003	12	(272,206)	25	(597,402)	4	(89,38)	8	(177,114)	7	(78,124)	30	(245,205)
2004	13	(169,354)	22	(607,373)	5	(79,79)	6	(128,157)	12	(117,129)	13	(160,200)
2005	16	(304,196)	26	(775,396)	5	(81,96)	1	(12,37)	8	(125,74)	34	(435,494)
2006	8	(282,159)	27	(1141,631)	6	(96,143)	12	(257,197)	25	(307,380)	43	(392,614)
2007	8	(369,213)	18	(1048,562)	18	(308,261)	12	(191,157)	43	(381,807)	102	(1057,1858)
2008	8	(228,218)	23	(1014,743)	27	(470,340)	6	(99,81)	43	(472,823)	1	(26,4)

Table 13. Summary of sampling effort generating age-frequency distributions used in the assessment model for the trawl fleets.

	Washington Winter		Washington Summer		Oregon Winter		Oregon Summer		California Winter		California Summer	
Fishing year	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish
1960			1	(24,144)								
1961			1	(53,47)								
1964			1	(86,114)								
1965			1	(52,48)								
1966			27	(904,812)			8	(276,119)	8	(212,68)	27	(602,661)
1967	4	(132,68)	31	(843,1015)			11	(282,275)	13	(326,301)	11	(244,277)
1968	11	(376,184)	34	(1819,1589)		18	(519,369)		56	(1354,1326)	1968	11
1969	9	(341,157)	35	(1019,1000)	1	(36,15)	18	(695,198)	8	(236,52)	31	(803,702)
1970	8	(389,183)	39	(1810,1587)			21	(706,303)	10	(251,200)	29	(761,636)
1971	5	(124,214)	9	(698,806)			5	(290,209)	6	(228,72)	37	(1074,786)
1972	4	(407,295)	23	(1430,1548)			7	(316,377)	23	(796,251)	38	(966,964)
1973	3	(364,178)	14	(925,784)			5	(225,272)	12	(360,212)	38	(903,990)
1974	3	(123,246)	28	(1280,1529)			7	(304,365)	29	(843,571)	34	(926,750)
1975	9	(472,392)	17	(778,829)			5	(206,288)	9	(244,158)	18	(590,356)
1976	1	(35,64)	5	(333,166)					12	(282,293)	23	(568,582)
1977	2	(103,96)	8	(447,342)			11	(529,535)	8	(284,116)	33	(946,698)
1978	3	(222,86)	8	(351,500)	1	(90,8)	8	(344,461)	9	(190,242)	32	(992,608)
1979			15	(975,640)			6	(342,259)	5	(128,122)	11	(294,248)
1980	3	(220,58)	22	(1211,952)	4	(185,206)	16	(924,629)	6	(196,106)	50	(1468,1022)
1981	6	(412,181)	8	(432,363)	2	(101,99)	29	(1826,1051)	18	(740,160)	27	(830,524)
1982	4	(232,114)	1	(71,28)	1	(40,58)	15	(429,216)	1	(38,12)	18	(434,266)
1983					3	(168,123)	1	(11,84)	12	(412,292)	8	(296,90)
1984					2	(131,78)			6	(167,104)	3	(72,76)
1985			3	(100,143)			2	(169,26)	2	(26,74)	4	(164,36)
1986	2	(111,86)	5	(216,106)	1	(26,23)	4	(226,115)				
1987	6	(187,158)	9	(169,155)	1	(21,4)	7	(171,79)				
1988	4	(59,39)	5	(105,79)	6	(159,113)	2	(33,14)				
1989	5	(97,85)	7	(175,118)	2	(29,42)	5	(174,73)				
1990	2	(27,32)	6	(81,65)	8	(103,57)	5	(76,49)	1	(48,2)		
1991	2	(33,18)	5	(41,68)	3	(50,79)	2	(32,10)	4	(74,90)		
1992	1	(5,24)	5	(121,64)	3	(44,71)	6	(153,86)				
1993	4	(56,47)	6	(173,62)	5	(132,92)	2	(44,17)				

Fishing year	Washington Winter N trips	Washington Winter N fish	Washington Summer N trips	Washington Summer N fish	Oregon Winter N trips	Oregon Winter N fish	Oregon Summer N trips	Oregon Summer N fish	California Winter N trips	California Winter N fish	California Summer N trips	California Summer N fish
1994	4	(66,50)	7	(152,152)	5	(107,75)	2	(44,23)				
1995	3	(36,81)	2	(44,22)	1	(23,12)						
1996	2	(26,41)	3	(94,32)	2	(63,36)	1	(23,16)				
1997	1	(30,9)	3	(77,47)	2	(26,39)	9	(239,96)				
1998	2	(39,47)	16	(451,275)			5	(111,104)				
1999	3	(63,67)	13	(398,134)					1	(17,10)		
2000	6	(135,136)	12	(359,201)								
2001	6	(121,138)	10	(354,131)								
2002	7	(111,191)	16	(464,240)	2	(32,56)	1	(33,2)				
2003	8	(160,137)	22	(528,349)	2	(41,24)	3	(79,59)				
2004	8	(112,265)	21	(589,367)	2	(36,27)	1	(23,18)				
2005	3	(77,73)	15	(514,211)								
2006	4	(132,66)	4	(142,56)								
2007	4	(135,65)	17	(548,281)	1	(16,14)	3	(46,44)	1	(25,6)		
2008	3	(89,61)	18	(483,325)	2	(47,13)	1	(10,18)				

Table 14. Description of model parameters in the base case assessment model.

Parameter	Number estimated	Bounds (low, high)	Prior (Mean, SD)
Natural mortality (*M*, female)	1	(0.05,0.4)	(0.2,0.025)
Natural mortality (*M*, male) (value estimated as offset from female)	1	(-0.5,0.7)	
<u>Stock and recruitment</u>			
Ln(R_0)	1	(5,99)	-
Steepness (*h*)	1	(0.2,1)	-
σ_r	-	-	-
Ln(Early Recruitment Deviations): 1939-1958	20	(-3,3)	-
Ln(Main Recruitment Deviations): 1959-2005	47	(-3,3)	-
Ln(Forecast Recruitment Deviations): 2005-2020	15	(-3,3)	-
<u>Catchability</u>			
Ln(*q*) – NWFSC survey	-	Analytic solution	
Ln(*q*) – Triennial survey	-	Analytic solution	
<u>Selectivity (assympotitc, sex specific, with retention curves)</u>			
Fisheries:			
	6		-
Length at peak selectivity		(15,75)	
Width of top (as logistic)	-		-
Ascending width (as exp(width))	6	(-4,12)	-
Descending width (as exp(width))	-		-
Initial selectivity (as logistic)	6	(-15,5)	-
Final selectivity (as logistic)	-		-
Male 1	6	(-15,15)	-
Male 2	6	(-15,15)	-
Male 3	-		-
Male 4	-		-
Retention 1	6	(10,40)	-
Retention 2	6	(0.1,10)	-
Retention 3	6	(0.001,1)	-
Retention 4	-		-
Time block parameters	28	(-20,20)	
Surveys:			-
Length at peak selectivity	2	(15,61)	-
Width of top (as logistic)	-		-
Ascending width (as exp(width))	2	(-4,12)	-
Descending width (as exp(width))	-		-
Initial selectivity (as logistic)	2	(-15,5)	-
Final selectivity (as logistic)	-		-
Male 1	2	(-15,15)	-
Male 2	2	(-15,15)	-
Male 3	-		-
Male 4	-		-
<u>Individual growth</u>			
Females:			
Length at age min	1	(10,45)	-
Length at age max	1	(45,80)	-
von Bertalanffy *K*	1	(0.04,0.5)	-
SD of length at age min	1	(0.02,8)	-
SD of length at age max offset to age min	1	(-1,1)	-
Males:			
Length at age min offset to females	1	(-1,2)	-
Length at age max offset to females	1	(-1,2)	-
von Bertalanffy K offset to females	1	(0.04,0.8)	-
SD of length at age min offset to females	1	(-1,1)	-
SD of length at age max offset to females	1	(-1,1)	-
Total: 100 + 82 recruitment deviations =182 estimated parameters			

Table 15. Time blocks

Block Pattern				
#1 (all fleets other than Winter-OR)	1973-1982	1983-1992	1993-2002	2003-2008
#2 (only fleet Winter-OR)		1983-1992	1993-2002	2003-2008

Table 16. Estimates of the growth parameters from the base case model. Age min is 2.83 and Age max is 15.83. Variability of the male estimates are not given because those parameters were estimated as offsets to female values.

Parameter	Value	SD
Females:		
Length at age min	17.3	0.43
Length at Linf	58.0	0.48
von Bertalanffy *K*	0.16	0.01
SD of length at age min	2.83	0.19
SD of length at age max	3.33	0.17
Males:		
Length at age min	16.7	–
Length at Linf	42.0	–
von Bertalanffy *K*	0.29	–
SD of length at age min	2.07	–
SD of length at age max	3.71	–

Table 17. Petrale sole catchability and productivity parameters.

Parameter	Value
Catchability:	
NWFSC survey catchability (*q*)	3.07
Triennial survey catchability (*q*) early, late	0.52; 0.72
Productivity:	
R_0	9.52
Steepness (*h*)	0.95
Female natural mortality (*M*)	0.15
Male natural mortality (*M*)	0.17

Table 18. Time-series of population estimates from the base case model.

Fishing year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	SPR	Relative exploitation rate
1876	39,388	25,334	100%	13,604	1	1.00	0.000
1877	39,387	25,333	100%	13,604	1	1.00	0.000
1878	39,386	25,333	100%	13,604	1	1.00	0.000
1879	39,385	25,332	100%	13,604	1	1.00	0.000
1880	39,384	25,331	100%	13,604	12	1.00	0.000
1881	39,373	25,324	100%	13,604	22	0.99	0.001
1882	39,353	25,309	100%	13,604	33	0.99	0.001
1883	39,324	25,288	100%	13,604	43	0.99	0.001
1884	39,287	25,261	100%	13,604	54	0.99	0.001
1885	39,242	25,229	100%	13,604	64	0.98	0.002
1886	39,191	25,191	99%	13,603	75	0.98	0.002
1887	39,135	25,149	99%	13,603	86	0.98	0.002
1888	39,073	25,104	99%	13,603	96	0.97	0.002
1889	39,007	25,054	99%	13,602	107	0.97	0.003
1890	38,936	25,002	99%	13,602	117	0.97	0.003
1891	38,862	24,946	98%	13,602	128	0.97	0.003
1892	38,785	24,888	98%	13,601	139	0.96	0.004
1893	38,706	24,828	98%	13,601	149	0.96	0.004
1894	38,623	24,766	98%	13,600	160	0.96	0.004
1895	38,539	24,703	98%	13,600	170	0.95	0.004
1896	38,453	24,638	97%	13,599	181	0.95	0.005
1897	38,365	24,571	97%	13,599	191	0.95	0.005
1898	38,276	24,504	97%	13,598	202	0.95	0.005
1899	38,186	24,435	96%	13,598	213	0.94	0.006
1900	38,095	24,366	96%	13,597	223	0.94	0.006
1901	38,002	24,296	96%	13,597	234	0.94	0.006
1902	37,909	24,225	96%	13,596	244	0.93	0.006
1903	37,815	24,154	95%	13,595	255	0.93	0.007
1904	37,721	24,082	95%	13,595	265	0.93	0.007
1905	37,625	24,009	95%	13,594	276	0.92	0.007
1906	37,530	23,937	94%	13,594	287	0.92	0.008
1907	37,434	23,863	94%	13,593	297	0.92	0.008
1908	37,337	23,790	94%	13,593	308	0.92	0.008
1909	37,240	23,716	94%	13,592	318	0.91	0.009
1910	37,143	23,642	93%	13,591	330	0.91	0.009
1911	37,044	23,567	93%	13,591	341	0.91	0.009
1912	36,946	23,492	93%	13,590	351	0.90	0.010
1913	36,847	23,417	92%	13,589	362	0.90	0.010
1914	36,748	23,341	92%	13,589	372	0.90	0.010
1915	36,648	23,266	92%	13,588	383	0.90	0.010
1916	36,549	23,190	92%	13,588	388	0.89	0.011
1917	36,454	23,118	91%	13,587	529	0.86	0.015
1918	36,234	22,957	91%	13,586	426	0.88	0.012
1919	36,130	22,877	90%	13,585	335	0.91	0.009
1920	36,126	22,867	90%	13,585	232	0.93	0.006
1921	36,226	22,932	91%	13,585	296	0.92	0.008
1922	36,263	22,956	91%	13,586	427	0.88	0.012
1923	36,172	22,890	90%	13,585	430	0.88	0.012
1924	36,085	22,826	90%	13,584	535	0.86	0.015

Fishing year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	SPR	Relative exploitation rate
1925	35,901	22,695	90%	13,583	531	0.86	0.015
1926	35,736	22,573	89%	13,582	524	0.86	0.015
1927	35,590	22,465	89%	13,581	635	0.83	0.018
1928	35,351	22,291	88%	13,580	622	0.83	0.018
1929	35,144	22,137	87%	13,578	711	0.81	0.020
1930	34,869	21,935	87%	13,576	662	0.82	0.019
1931	34,666	21,782	86%	13,575	678	0.82	0.020
1932	34,473	21,633	85%	13,573	811	0.79	0.024
1933	34,180	21,408	85%	13,571	849	0.79	0.025
1934	33,888	21,178	84%	13,569	1,621	0.65	0.048
1935	32,895	20,455	81%	13,561	1,606	0.64	0.049
1936	32,000	19,792	78%	13,554	1,323	0.69	0.042
1937	31,462	19,370	76%	13,549	1,897	0.59	0.061
1938	30,445	18,610	73%	13,539	2,168	0.55	0.072
1939	29,268	17,734	70%	21,489	2,405	0.51	0.083
1941	27,994	16,774	66%	18,107	2,450	0.49	0.088
1942	26,856	15,859	63%	14,729	2,226	0.51	0.084
1943	26,134	15,175	60%	12,738	3,420	0.38	0.132
1944	24,589	13,747	54%	12,685	3,614	0.34	0.148
1945	23,170	12,365	49%	14,401	2,822	0.38	0.123
1946	22,663	11,867	47%	15,114	2,593	0.39	0.115
1947	22,376	11,835	47%	14,478	3,934	0.28	0.177
1948	20,756	10,982	43%	13,509	3,204	0.31	0.156
1949	19,801	10,457	41%	12,616	4,371	0.23	0.223
1950	17,755	9,067	36%	11,945	4,068	0.22	0.231
1951	16,047	7,890	31%	11,676	4,552	0.17	0.287
1952	13,952	6,490	26%	11,852	3,016	0.21	0.219
1953	13,327	6,129	24%	11,893	2,807	0.22	0.213
1954	12,868	5,940	23%	12,067	2,224	0.26	0.175
1955	12,878	6,064	24%	12,634	2,846	0.21	0.224
1956	12,245	5,751	23%	12,167	2,806	0.20	0.232
1957	11,631	5,367	21%	10,303	2,201	0.24	0.192
1958	11,587	5,326	21%	9,589	2,784	0.19	0.243
1959	11,007	4,939	19%	10,786	2,348	0.21	0.216
1960	10,828	4,822	19%	13,582	2,526	0.20	0.236
1961	10,467	4,646	18%	17,507	2,562	0.19	0.248
1962	10,045	4,468	18%	9,034	3,088	0.15	0.313
1963	9,130	3,935	16%	8,910	2,616	0.15	0.293
1964	8,714	3,556	14%	11,459	2,649	0.14	0.308
1965	8,409	3,148	12%	9,246	2,247	0.14	0.271
1966	8,484	3,117	12%	30,055	2,365	0.14	0.284
1967	8,419	3,246	13%	13,621	2,137	0.16	0.259
1968	8,549	3,475	14%	17,088	2,153	0.16	0.262
1969	8,723	3,460	14%	12,526	1,945	0.18	0.228
1970	9,490	3,462	14%	12,631	1,907	0.18	0.205
1971	10,541	3,581	14%	14,363	2,655	0.14	0.256
1972	11,024	3,829	15%	9,504	2,591	0.16	0.239
1973	11,457	4,465	18%	7,718	2,932	0.16	0.260

Fishing year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	SPR	Relative exploitation rate
1974	11,473	5,105	20%	8,260	3,073	0.16	0.270
1975	10,749	4,887	19%	13,860	3,190	0.15	0.300
1976	9,664	4,464	18%	16,578	2,595	0.17	0.272
1977	8,988	4,217	17%	8,663	2,049	0.20	0.233
1978	8,797	4,068	16%	8,811	2,573	0.15	0.299
1979	8,212	3,537	14%	16,169	2,813	0.11	0.347
1980	7,569	2,867	11%	10,162	2,161	0.13	0.291
1981	7,568	2,726	11%	10,421	2,202	0.13	0.299
1982	7,533	2,823	11%	8,418	2,364	0.12	0.319
1983	7,382	2,820	11%	15,598	2,729	0.09	0.376
1984	6,745	2,521	10%	12,849	2,021	0.12	0.306
1985	6,680	2,567	10%	7,137	1,717	0.15	0.265
1986	6,858	2,777	11%	6,325	1,787	0.15	0.266
1987	7,021	2,856	11%	9,235	2,458	0.10	0.355
1988	6,579	2,509	10%	12,535	2,318	0.10	0.357
1989	6,138	2,342	9%	13,228	2,245	0.10	0.374
1990	5,593	2,291	9%	15,608	1,893	0.11	0.349
1991	5,333	2,221	9%	6,573	2,054	0.09	0.398
1992	5,014	1,824	7%	8,896	1,719	0.09	0.355
1993	5,173	1,620	6%	17,350	1,687	0.09	0.332
1994	5,525	1,652	7%	9,318	1,542	0.12	0.286
1995	5,998	1,983	8%	10,273	1,667	0.13	0.288
1996	6,288	2,373	9%	9,792	1,905	0.12	0.309
1997	6,392	2,481	10%	19,327	2,056	0.11	0.328
1998	6,366	2,321	9%	19,869	1,764	0.13	0.284
1999	6,635	2,475	10%	11,967	1,623	0.15	0.254
2000	7,082	2,765	11%	10,903	1,895	0.14	0.277
2001	7,490	2,810	11%	8,563	1,987	0.13	0.271
2002	8,048	2,798	11%	8,161	2,088	0.14	0.264
2003	8,532	3,030	12%	7,164	1,793	0.18	0.213
2004	9,183	3,706	15%	11,897	2,276	0.17	0.251
2005	9,188	4,161	16%	15,771	2,951	0.13	0.325
2006	8,298	3,950	16%	12,740	2,176	0.17	0.268
2007	7,932	3,818	15%	12,049	2,373	0.15	0.307
2008	7,403	3,350	13%	12,509	2,115	0.15	0.292
2009	7,308	2,938	12%	12,348	2,604	0.10	0.364

Table 19. Asymptotic standard deviation estimates for spawning biomass and recruitment.

Fishing year	SD Spawning biomass (mt)	SD Age-0 recruits (1000s)	Year	SD Spawning biomass (mt)	SD Age-0 recruits (1000s)	Year	SD Spawning biomass (mt)	SD Age-0 recruits (1000s)
1876	2,658	3,872	1921	2,356	3,846	1966	250	4,180
1877	2,658	3,872	1922	2,348	3,847	1967	267	4,635
1878	2,658	3,872	1923	2,340	3,846	1968	271	3,617
1879	2,658	3,872	1924	2,332	3,845	1969	271	3,578
1880	2,657	3,872	1925	2,323	3,844	1970	275	3,797
1881	2,657	3,872	1926	2,314	3,842	1971	302	2,711
1882	2,657	3,872	1927	2,304	3,841	1972	342	2,241
1883	2,656	3,872	1928	2,292	3,838	1973	362	2,631
1884	2,655	3,872	1929	2,278	3,836	1974	361	2,326
1885	2,653	3,871	1930	2,262	3,834	1975	339	3,361
1886	2,651	3,871	1931	2,246	3,832	1976	309	4,009
1887	2,649	3,870	1932	2,228	3,830	1977	281	2,693
1888	2,645	3,870	1933	2,207	3,827	1978	248	2,816
1889	2,642	3,869	1934	2,184	3,823	1979	215	4,350
1890	2,637	3,869	1935	2,145	3,813	1980	196	3,257
1891	2,633	3,868	1936	2,101	3,802	1981	199	2,897
1892	2,627	3,868	1937	2,056	3,795	1982	212	2,464
1893	2,621	3,867	1938	1,999	3,781	1983	219	3,623
1894	2,615	3,866	1939	1,930	11,956	1984	216	2,986
1895	2,608	3,866	1940	1,852	9,290	1985	206	1,871
1896	2,601	3,865	1941	1,767	6,918	1986	195	1,789
1897	2,593	3,864	1942	1,681	5,640	1987	179	2,303
1898	2,586	3,864	1943	1,574	5,523	1988	162	3,031
1899	2,577	3,863	1944	1,433	6,559	1989	149	3,342
1900	2,569	3,862	1945	1,230	7,152	1990	144	3,591
1901	2,560	3,861	1946	1,095	6,738	1991	135	1,872
1902	2,551	3,861	1947	1,100	6,077	1992	126	2,313
1903	2,542	3,860	1948	1,177	5,489	1993	125	3,797
1904	2,532	3,859	1949	1,238	5,041	1994	134	2,284
1905	2,523	3,858	1950	1,242	4,816	1995	147	2,458
1906	2,513	3,858	1951	1,174	4,808	1996	156	2,353
1907	2,503	3,857	1952	1,086	4,825	1997	158	4,131
1908	2,493	3,856	1953	999	4,855	1998	156	4,268
1909	2,483	3,855	1954	934	4,963	1999	162	2,652
1910	2,473	3,854	1955	880	4,588	2000	168	2,409
1911	2,462	3,854	1956	842	3,723	2001	168	1,947
1912	2,452	3,853	1957	808	3,293	2002	170	1,942
1913	2,441	3,852	1958	752	3,452	2003	194	1,840
1914	2,431	3,851	1959	680	3,988	2004	236	3,234
1915	2,420	3,850	1960	582	4,436	2005	270	4,858
1916	2,410	3,849	1961	466	2,673	2006	294	5,057
1917	2,399	3,848	1962	353	2,505	2007	318	5,437
1918	2,386	3,846	1963	278	3,003	2008	359	5,662
1919	2,374	3,846	1964	236	2,775	2009	425	5,536
1920	2,364	3,845	1965	230	7,019			

Table 20. Results from the sensitivity model runs.

Description	Base case	Ricker	½ Effective N NWFSC Survey Comps	No 2008 NWFSC Survey Data
Negative log-likelihoods				
Total	3076	3089	2407	2891
Indices	-25.2	-25.1	-26.1	-23.1
Length-frequency data	1178	1190	1061	1154
Age-frequency data	1926	1921	1377	1764
Discard biomass	97.0	96.7	96.4	96.4
Discard mean weight	-71.0	-71.4	-71.3	-71.9
Recruitment	-30.9	-22.6	-32.3	-32.3
Priors	2.0	0.44	2.43	3.51
Forecast recruitment	0.01	0.005	0.0001	0.001
Select parameters				
Stock-recruit, productivity				
R_0	9.52	9.35	9.43	9.32
Steepness (*h*)	0.95	2.32	0.97	0.99
Female M	0.15	0.18	0.14	0.13
Male M	0.17	0.19	0.16	0.15
Survey catchability & selectivity				
NWFSC survey catchability (*q*)	3.07	2.85	3.28	2.98
Triennial survey catchability (*q*) early	0.52	0.49	0.55	0.54
Triennial survey catchability (*q*) late	0.72	0.68	0.79	0.75
Individual growth				
Female length at age min	17.3	17.1	17.5	16.8
Female length at Linf	58.0	57.8	58.6	56.3
Female von Bertalanffy *K*	0.16	0.16	0.15	0.17
Female SD of length-at-age min	2.83	2.89	2.74	2.69
Female SD of length-at-age max	3.33	3.26	3.52	3.76
Male length at age min	16.7	16.6	16.7	16.3
Male length at Linf	42.0	42.0	42.6	42.0
Male von Bertalanffy *K*	0.29	0.29	0.29	0.30
Male SD of length-at-age at age min	2.07	2.07	2.00	1.96
Male SD of length-at-age at age max	3.71	3.71	3.74	3.82
Management quantities				
SB_0	25,334	14,415	25,501	26,206
2009 Spawning biomass	2,938	3,179	2,702	4,280
2009 Depletion	0.12	0.22	0.11	0.16
2009 1-*SPR*	0.90	0.86	0.91	0.85
2008 instantaneous fishing mortality	0.29	0.26	0.31	0.24
SSB MSY	4,796	5,447	4,566	4,395
1-SPR MSY	0.80	0.76	0.81	0.83
F MSY	0.23	0.22	0.24	0.25
2009 %Bmsy	0.61	0.58	0.59	0.97

Table 21. Results from the retrospective model runs.

Year assessed	SB0	Year-assessed SB	Assessed depletion	SB2005	2005 depletion	2009 depletion
2009	25.334	2,938	11.6	4,161	16.4	11.6
2008	25,872	4,545	17.6	4,483	17.3	17.5
2007	25,275	5,329	21.1	4,742	18.8	23.0
2006	25,058	4,394	17.5	4,192	16.7	22.8
2005	24,812	4,822	19.4	4,822	19.4	25.6
2004	24,980	2,752	11.0	3,311	13.3	12.9

Table 22. Projection of potential petrale sole ABC, OY, spawning biomass and depletion for the base case model based on the SPR= 0.4 fishing mortality target and $F_{40\%}$ overfishing limit/target (ABC). Assuming the OYs of 2433 and 2393 mt are attained in 2009 and 2010.

Year	ABC (mt)	OY (mt)	Age 3+ biomass (mt)	Spawning biomass (mt)	Depletion
2009	2,499	2,433	7,151	2,938	11.6%
2010	2,499	2,393	6,776	2,400	9.5%
2011	535	0	6,468	2,171	8.6%
2012	802	311	8,646	3,427	13.5%
2013	1,068	680	10,680	4,712	18.6%
2014	1,301	997	12,358	5,843	23.1%
2015	1,489	1,311	13,675	6,778	26.8%
2016	1,631	1,489	14,678	7,503	29.6%
2017	1,735	1,621	15,437	8,037	31.7%
2018	1,812	1,718	16,022	8,431	33.3%
2019	1,870	1,794	16,482	8,740	34.5%
2020	1,917	1,838	16,850	8,991	35.5%

Table 23. Decision table of 12-year projections for alternate states of nature (columns) and management options (rows) beginning in 2011. There are two values for depletion, the first calculates depetion using the SB40% Bmsy proxy and the second calculates depletion relative to the model estimate of Bmsy. Relative probabilities of each state of nature are based on low and high values for the model estimate of 2009 spawning biomass with the 2008 NWFSC survey biomass estimate as the axis of uncertainty. Landings in 2009–2010 are 2433 and 2393 mt, respectively, for all cases. Selectivity and fleet allocations are projected at the 2008 values

			State of nature								
			Low 2009 Spawning Biomass (-1.25 SD)			Base case			High 2009 Spawning Biomass (+1.25 SD)		
Relative probability			0.25			0.5			0.25		
			Depletion		Spawning biomass	Depletion		Spawning biomass	Depletion		Spawning biomass
Management decision	Year	Catch (mt)	SB0	Bmsy	(mt)	SB0	Bmsy	(mt)	SB0	Bmsy	(mt)
Catches Near Zero (3 mt)	2011	3	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	3	9%	50%	2,380	14%	74%	3,572	19%	100%	4,786
	2013	3	14%	75%	3,600	20%	105%	5,012	26%	134%	6,426
	2014	3	19%	104%	4,976	26%	136%	6,514	32%	168%	8,033
	2015	3	25%	134%	6,423	32%	167%	8,025	38%	200%	9,589
	2016	3	31%	164%	7,856	37%	198%	9,493	44%	231%	11,068
	2017	3	36%	192%	9,217	43%	227%	10,884	50%	260%	12,452
	2018	3	41%	219%	10,511	48%	254%	12,197	55%	286%	13,739
	2019	3	46%	245%	11,766	53%	280%	13,440	59%	311%	14,933
	2020	3	50%	271%	12,984	58%	305%	14,613	64%	334%	16,034
Half 40-10 catches from base case	2011	0	5%	50%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	156	9%	37%	2,382	14%	75%	3,574	18%	95%	4,554
	2013	340	14%	29%	3,524	19%	103%	4,932	24%	127%	6,090
	2014	499	18%	50%	4,710	25%	130%	6,239	30%	156%	7,493
	2015	656	23%	73%	5,861	29%	155%	7,451	35%	182%	8,750
	2016	745	27%	98%	6,893	34%	178%	8,520	39%	205%	9,837
	2017	810	30%	122%	7,796	37%	197%	9,460	43%	225%	10,785
	2018	859	33%	144%	8,604	41%	215%	10,297	46%	242%	11,615
	2019	897	36%	163%	9,365	44%	231%	11,060	49%	257%	12,349
	2020	919	39%	179%	10,097	46%	245%	11,763	52%	271%	13,004
40-10 catches from base case	2011	0	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	311	9%	50%	2,382	14%	75%	3,574	19%	100%	4,788
	2013	680	13%	72%	3,444	19%	101%	4,849	25%	130%	6,258
	2014	997	17%	93%	4,439	24%	124%	5,959	30%	156%	7,469
	2015	1,311	21%	110%	5,291	27%	143%	6,871	34%	176%	8,418
	2016	1,489	23%	123%	5,918	30%	158%	7,576	36%	190%	9,095
	2017	1,621	25%	133%	6,358	32%	169%	8,096	38%	200%	9,579
	2018	1,718	26%	139%	6,669	33%	177%	8,480	39%	207%	9,920
	2019	1,794	27%	144%	6,923	35%	183%	8,782	40%	212%	10,161
	2020	1,838	28%	149%	7,152	36%	188%	9,026	41%	215%	10,331

Table 23 continued.

			State of nature								
			Low 2009 Spawning Biomass (-1.25 SD)			Base case			High 2009 Spawning Biomass (+1.25 SD)		
Relative probability			0.25			0.5			0.25		
			Depletion		Spawning biomass	Depletion		Spawning biomass	Depletion		Spawning biomass
Management decision	Year	Catch (mt)	SB0	Bmsy	(mt)	SB0	Bmsy	(mt)	SB0	Bmsy	(mt)
Constant 500 mt	2011	500	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	500	8%	44%	2,134	13%	69%	3,314	18%	94%	4,522
	2013	500	12%	64%	3,056	18%	93%	4,455	23%	122%	5,861
	2014	500	16%	86%	4,109	22%	118%	5,639	28%	149%	7,153
	2015	500	20%	109%	5,228	27%	142%	6,833	33%	175%	8,397
	2016	500	25%	132%	6,342	32%	167%	7,997	38%	200%	9,578
	2017	500	29%	154%	7,403	36%	190%	9,104	43%	223%	10,687
	2018	500	33%	176%	8,418	40%	212%	10,157	47%	244%	11,723
	2019	500	37%	196%	9,415	44%	233%	11,165	51%	265%	12,694
	2020	500	40%	217%	10,401	48%	253%	12,129	54%	284%	13,599
Constant 1500 mt	2011	1,500	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	1,500	6%	34%	1,649	11%	58%	2,802	16%	83%	3,995
	2013	1,500	8%	41%	1,979	13%	70%	3,341	19%	99%	4,728
	2014	1,500	9%	49%	2,367	15%	81%	3,874	21%	112%	5,375
	2015	1,500	11%	58%	2,791	17%	92%	4,407	24%	125%	5,973
	2016	1,500	12%	67%	3,210	19%	103%	4,926	26%	136%	6,534
	2017	1,500	14%	75%	3,599	21%	113%	5,424	28%	147%	7,062
	2018	1,500	15%	83%	3,968	23%	123%	5,907	30%	158%	7,564
	2019	1,500	17%	91%	4,348	25%	133%	6,388	32%	168%	8,050
	2020	1,500	18%	99%	4,752	27%	143%	6,869	34%	178%	8,519
Constant 2/3 Fmsy	2011	36	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	86	9%	50%	2,375	14%	74%	3,555	19%	100%	4,781
	2013	166	14%	75%	3,576	20%	103%	4,948	25%	133%	6,400
	2014	274	19%	102%	4,905	25%	132%	6,354	32%	166%	7,960
	2015	447	24%	131%	6,261	30%	161%	7,703	38%	196%	9,421
	2016	582	29%	157%	7,517	35%	186%	8,930	43%	224%	10,721
	2017	714	34%	180%	8,629	39%	209%	10,000	47%	247%	11,856
	2018	837	37%	200%	9,602	43%	228%	10,918	51%	267%	12,825
	2019	949	41%	218%	10,473	46%	244%	11,706	54%	284%	13,641
	2020	1,020	44%	235%	11,252	49%	258%	12,376	57%	298%	14,314
Ramp down catches between 2/3 Fmsy at Bmsy and 0 catch at 50%Bmsy	2011	0	5%	29%	1,397	9%	48%	2,295	13%	67%	3,229
	2012	354	9%	50%	2,382	14%	75%	3,574	18%	93%	4,478
	2013	764	14%	75%	3,603	19%	101%	4,826	24%	123%	5,921
	2014	977	19%	100%	4,795	23%	123%	5,888	29%	152%	7,307
	2015	1,161	23%	121%	5,819	27%	142%	6,807	34%	176%	8,421
	2016	1,280	26%	139%	6,650	30%	158%	7,585	37%	194%	9,306
	2017	1,379	28%	153%	7,320	32%	171%	8,224	40%	209%	10,030
	2018	1,461	31%	164%	7,868	35%	183%	8,754	42%	221%	10,618
	2019	1,530	32%	174%	8,354	36%	192%	9,211	44%	231%	11,100
	2020	1,574	34%	184%	8,801	38%	200%	9,610	46%	240%	11,494

11. Figures

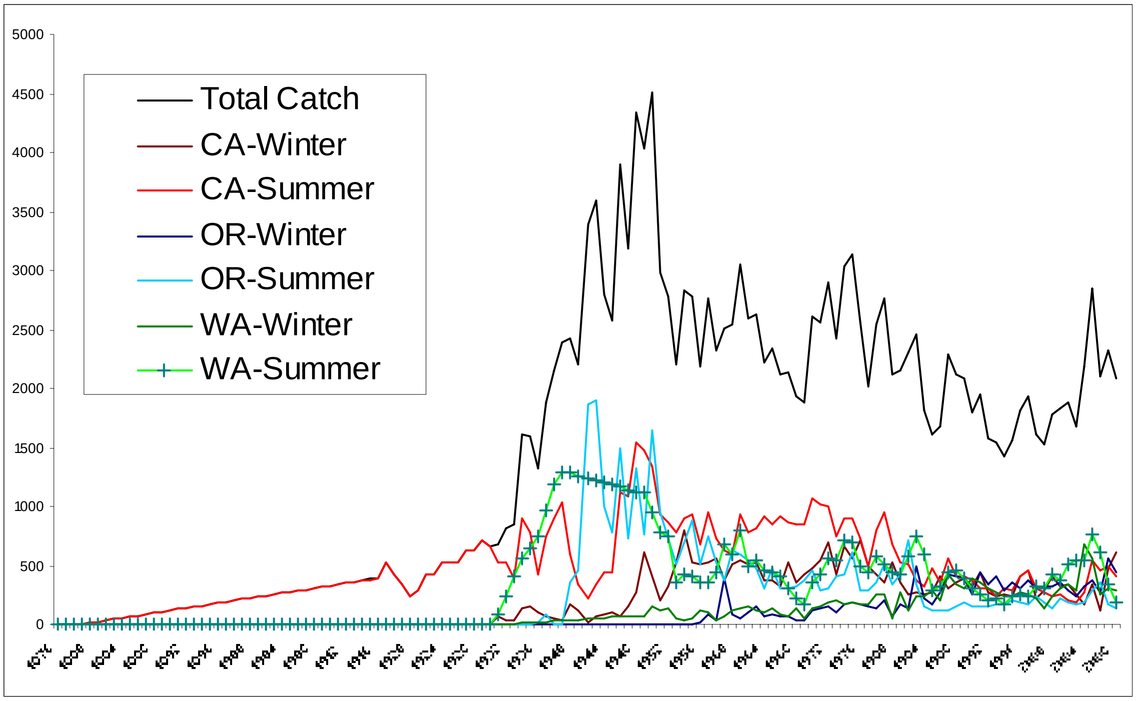


Figure 1. Distribution of total catch among each state for each of the summer and winter seasons 1876-2008 in comparison to the total catch in each year.

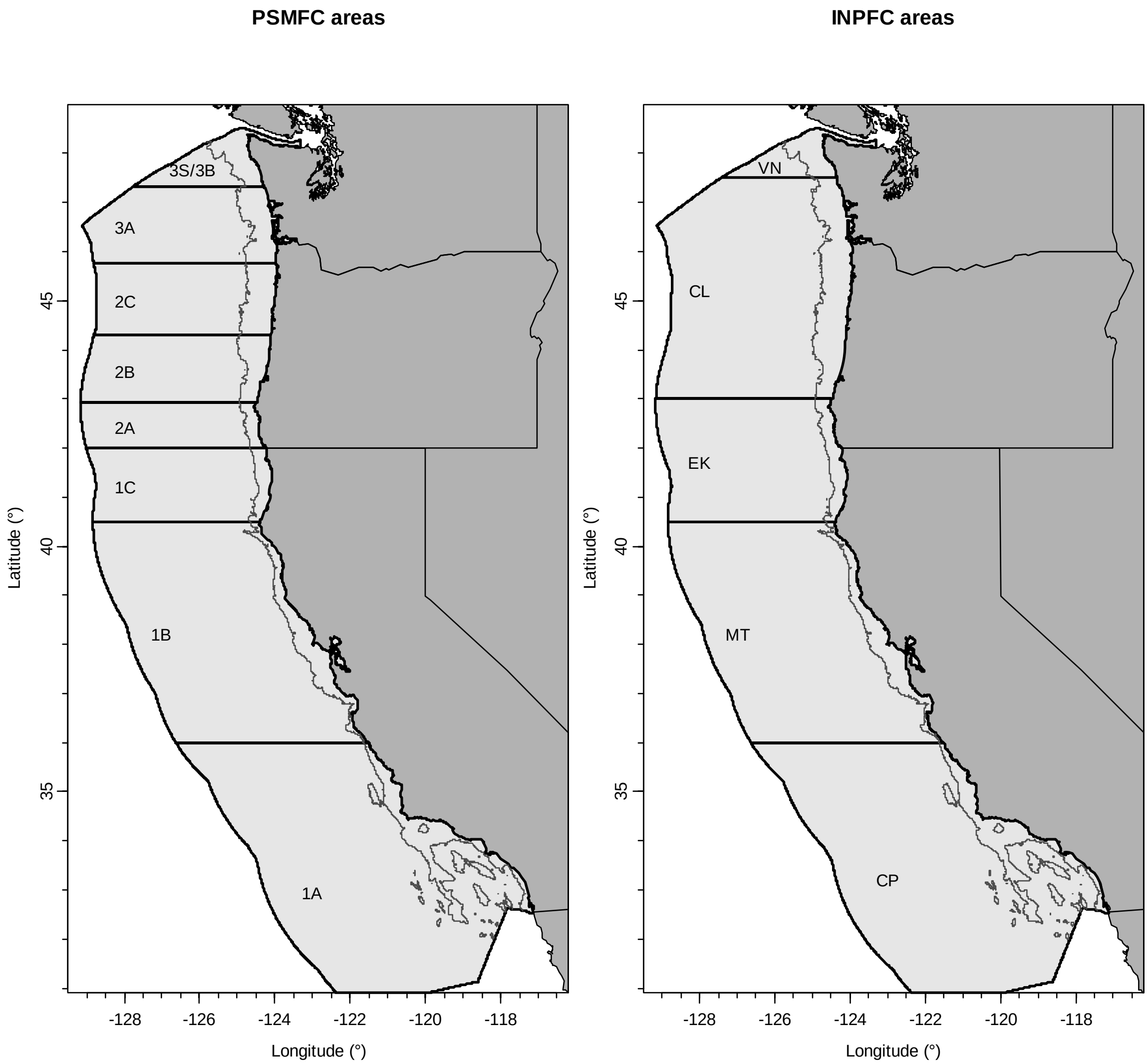


Figure 2. Map showing PSMFC and INPFC boundaries used in the 2009 assessment. The solid gray line off the coast is the 300 fathom depth contour.

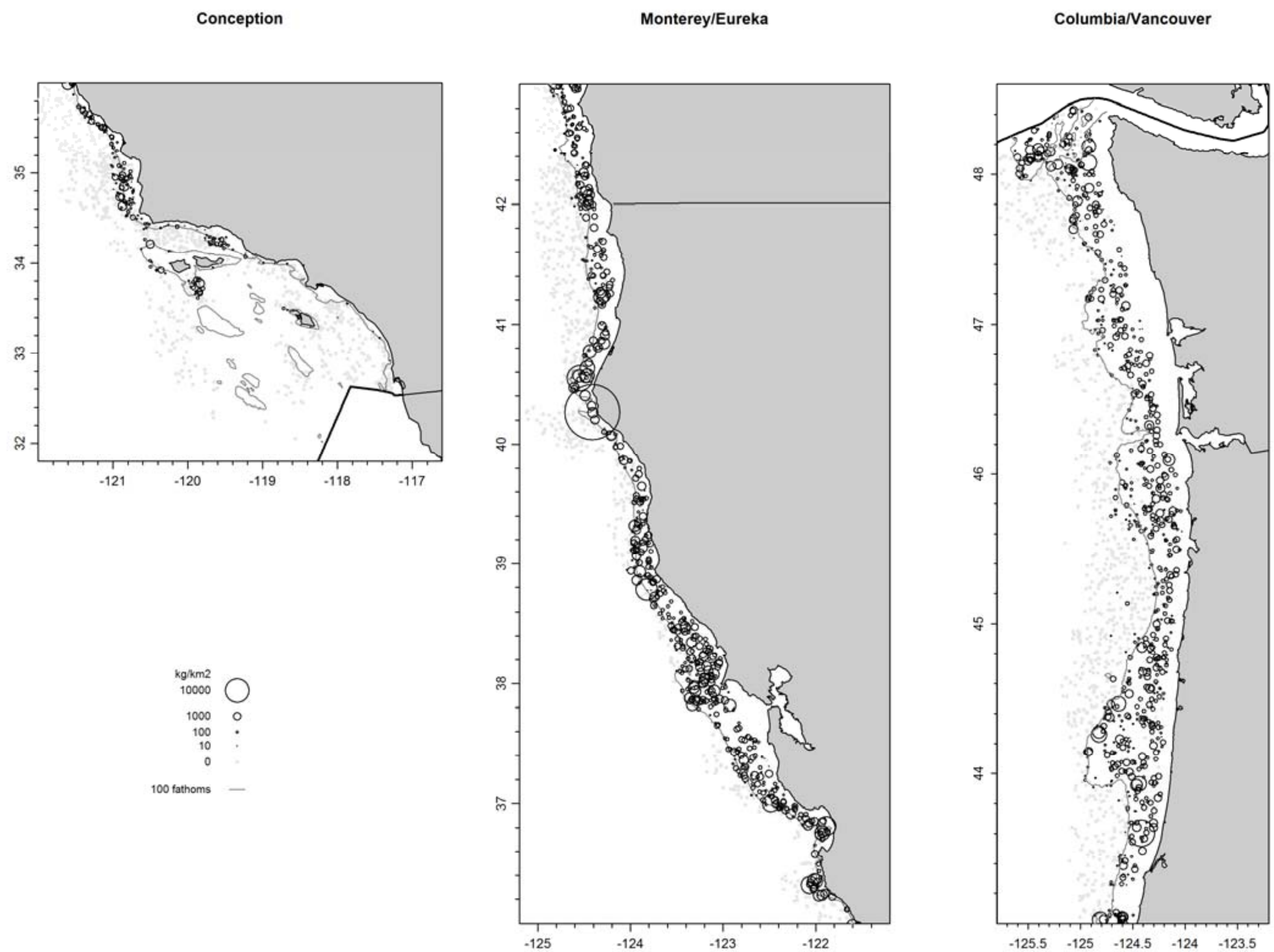


Figure 3. Catch rates over all years for the NWFSC survey.

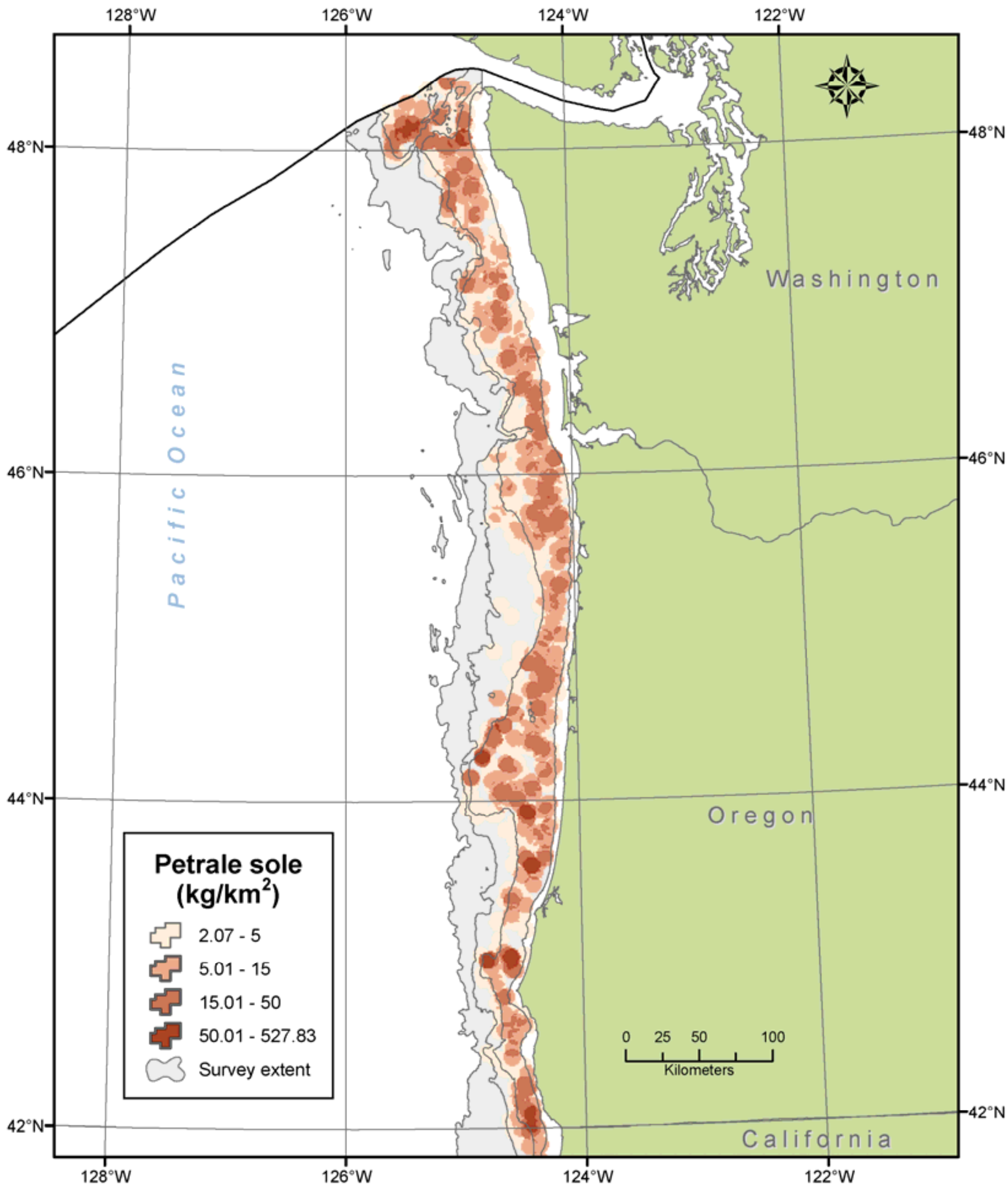


Figure 4a. Density of petrale sole (*Eopsetta jordani*) catch during NWFSC Groundfish Survey (2003-2008) of of Washington and Oregon. Three main survey strata are defined by the 30-, 100-, 300- and 700-fathom isobaths.

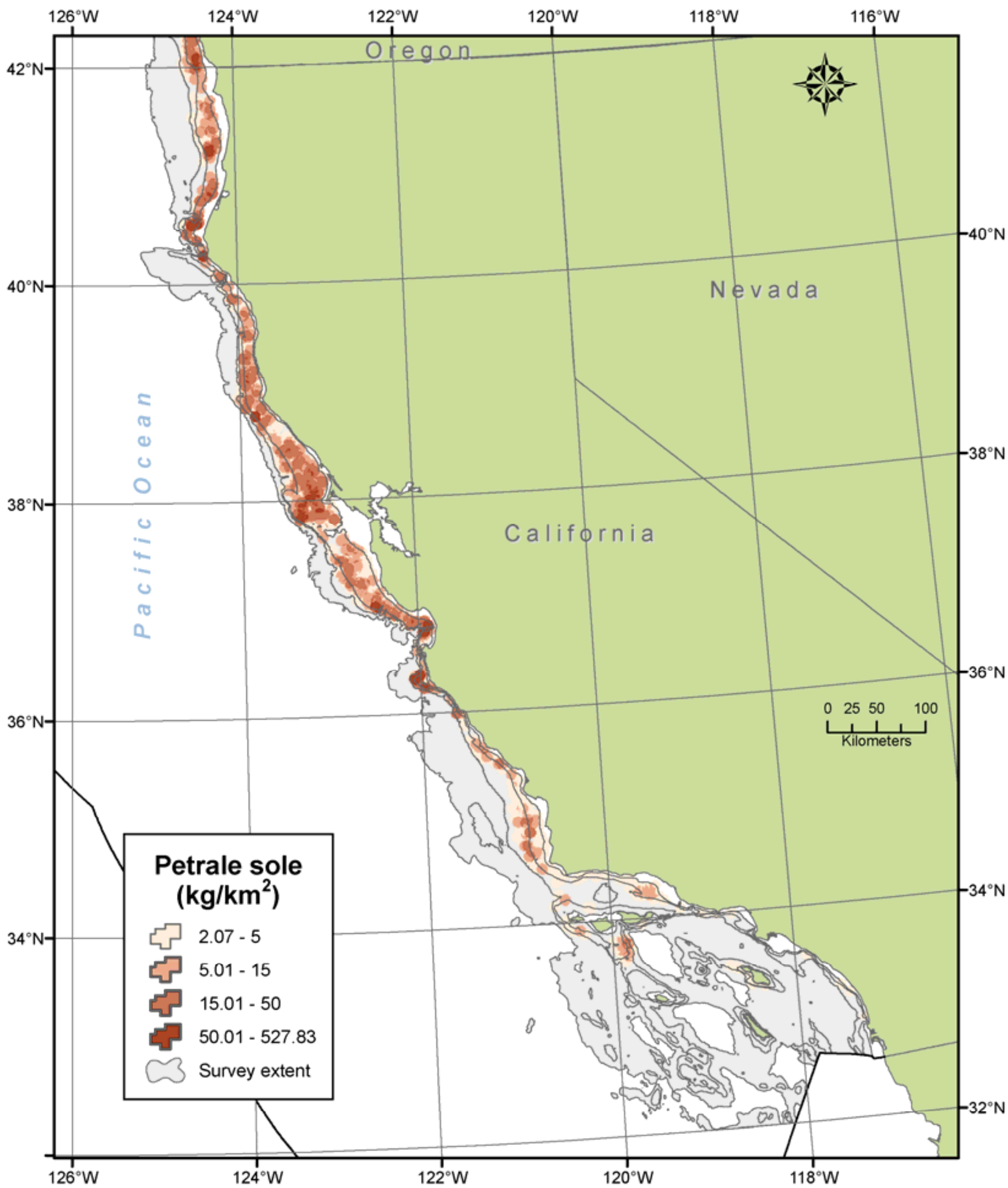


Figure 4b. Density of petrale sole (*Eopsetta jordani*) catch during NWFSC Groundfish Survey (2003-2008) off of California. Three main survey strata are defined by the 30-, 100-, 300- and 700-fathom isobaths.

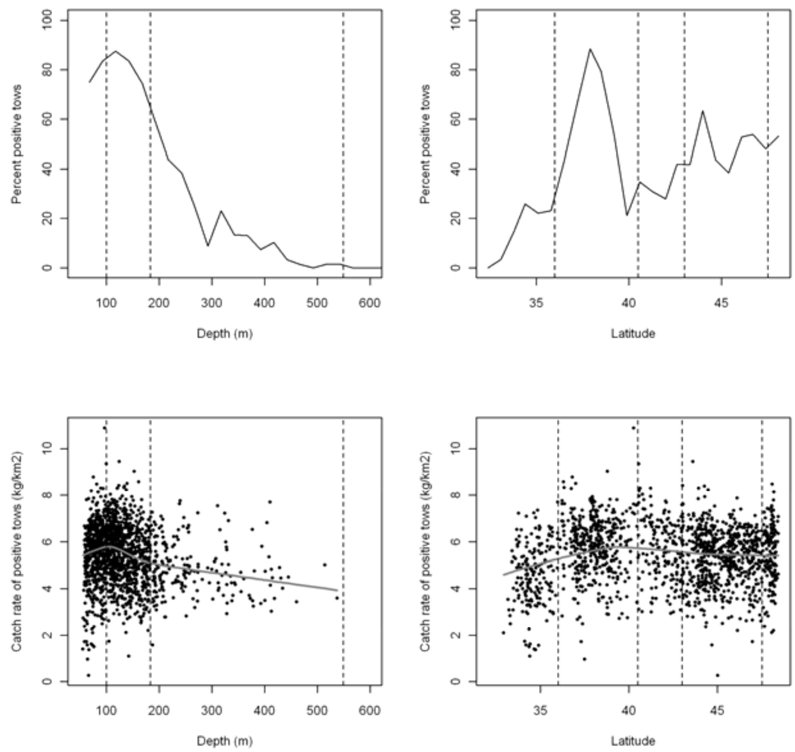


Figure 5. Plots of the percentage of positive tows and the catch rates for positive tows over depth and latitude.

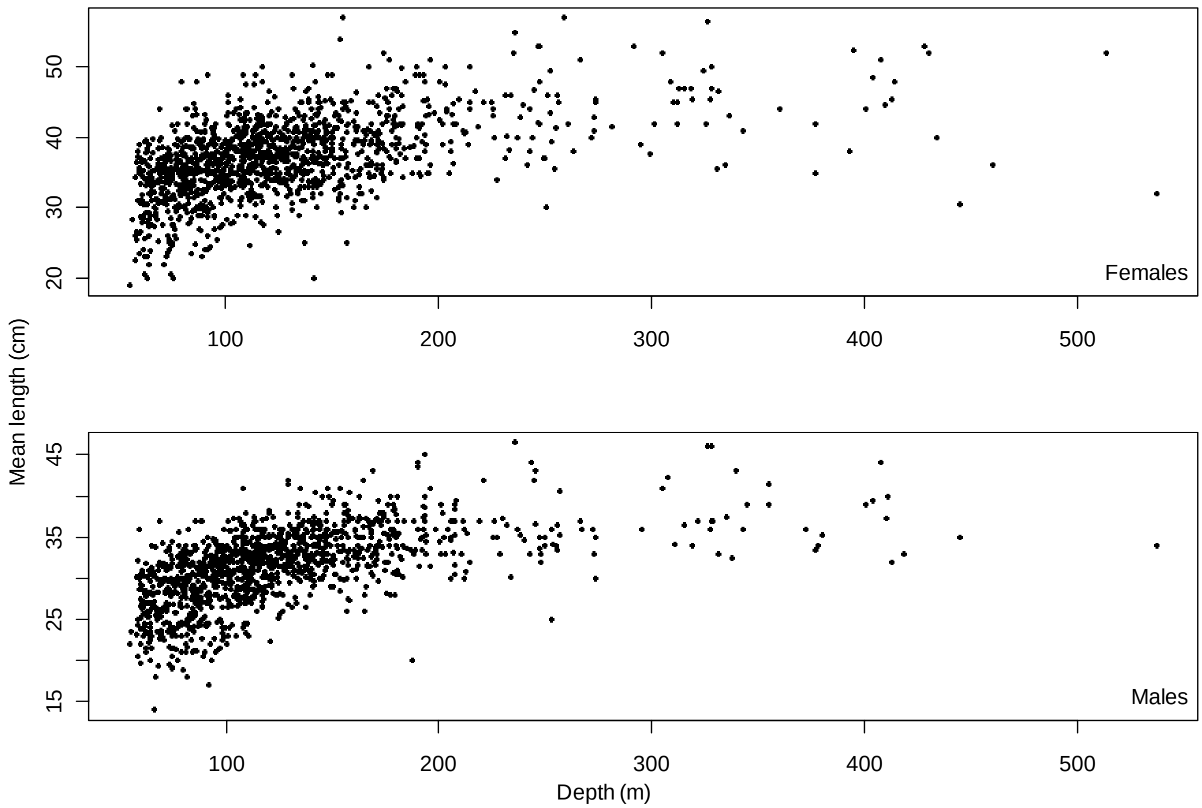


Figure 6. NWFSC survey mean length per tow by depth for females and males.

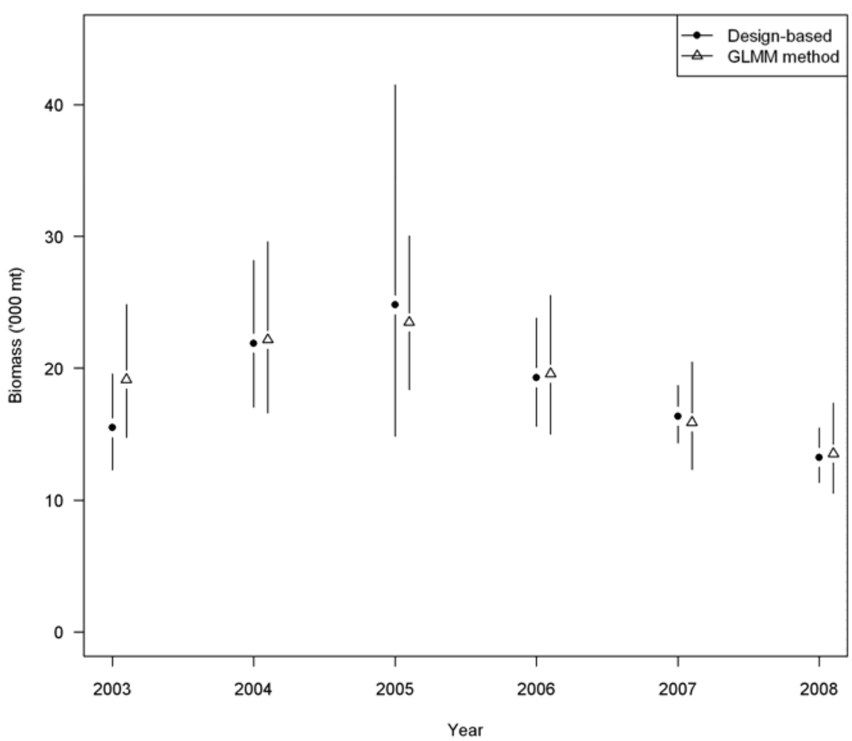


Figure 7. Design-based and GLMM biomass estimates from the NWFSC survey.

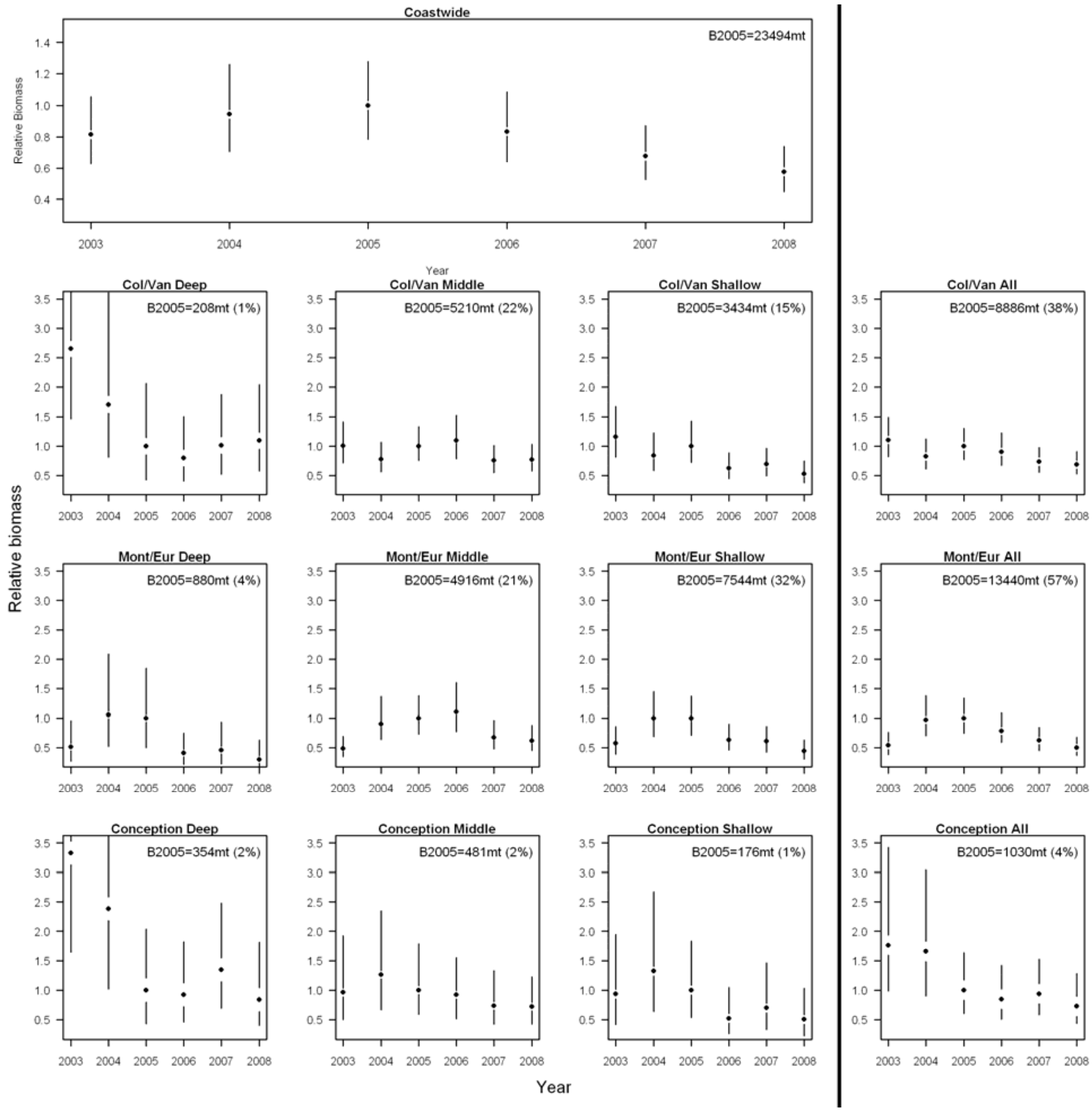


Figure 8. Plots of the estimated biomass relative to the year 2005 for each strata chosen for the GLMM using the NWFSC survey. The top wide plot is the entire coast and the plots to the right of the solid line are summed over depth.

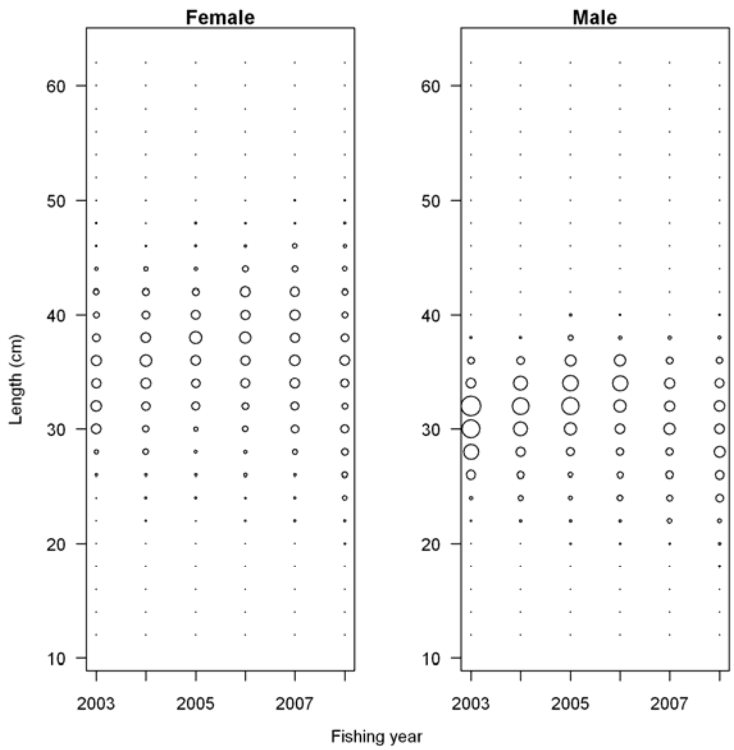


Figure 9. Length frequencies for the NWFSC survey.

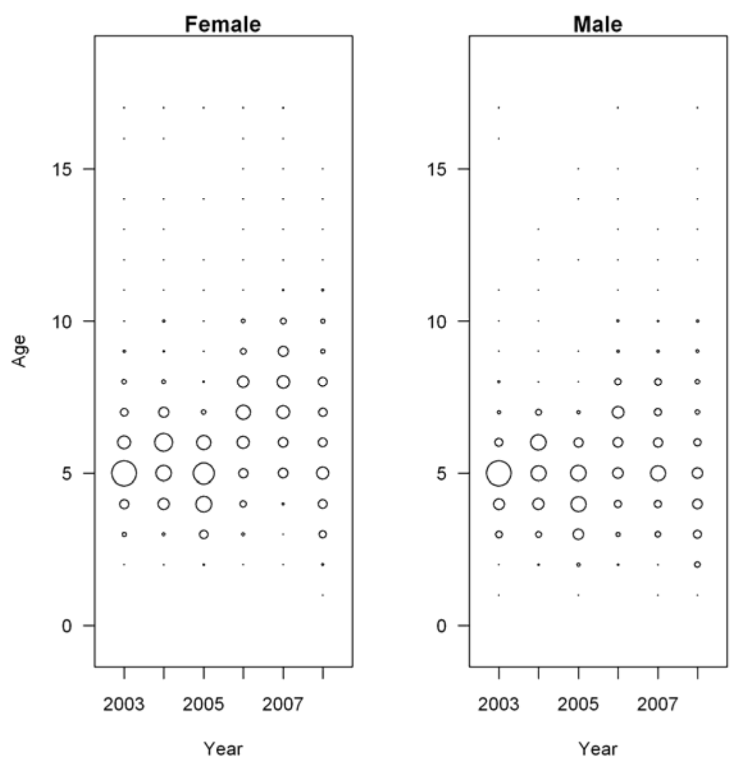


Figure 10. Age frequencies from the NWFSC survey.

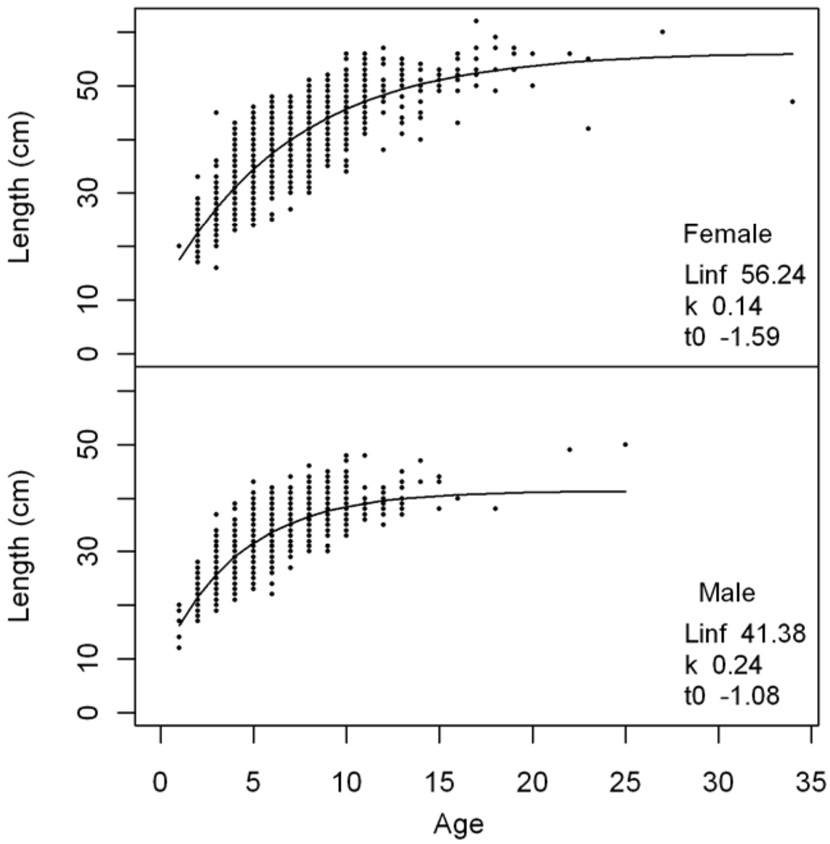


Figure 11. Length at age for males and females from the NWFSC survey with fits to the von Bertalanffy growth curve.

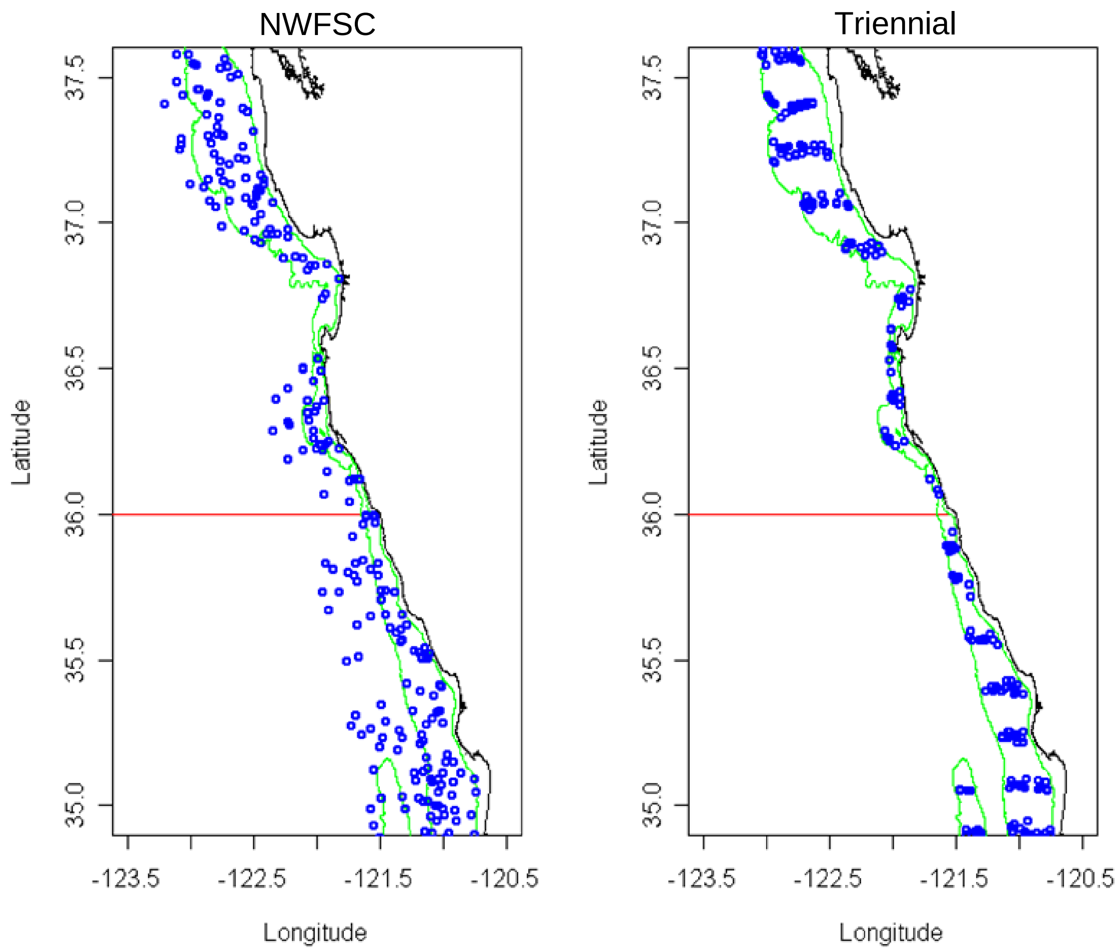


Figure 12. Survey tow locations in 2004, showing the difference in station design for the NWFSC survey relative to the Triennial trawl survey.

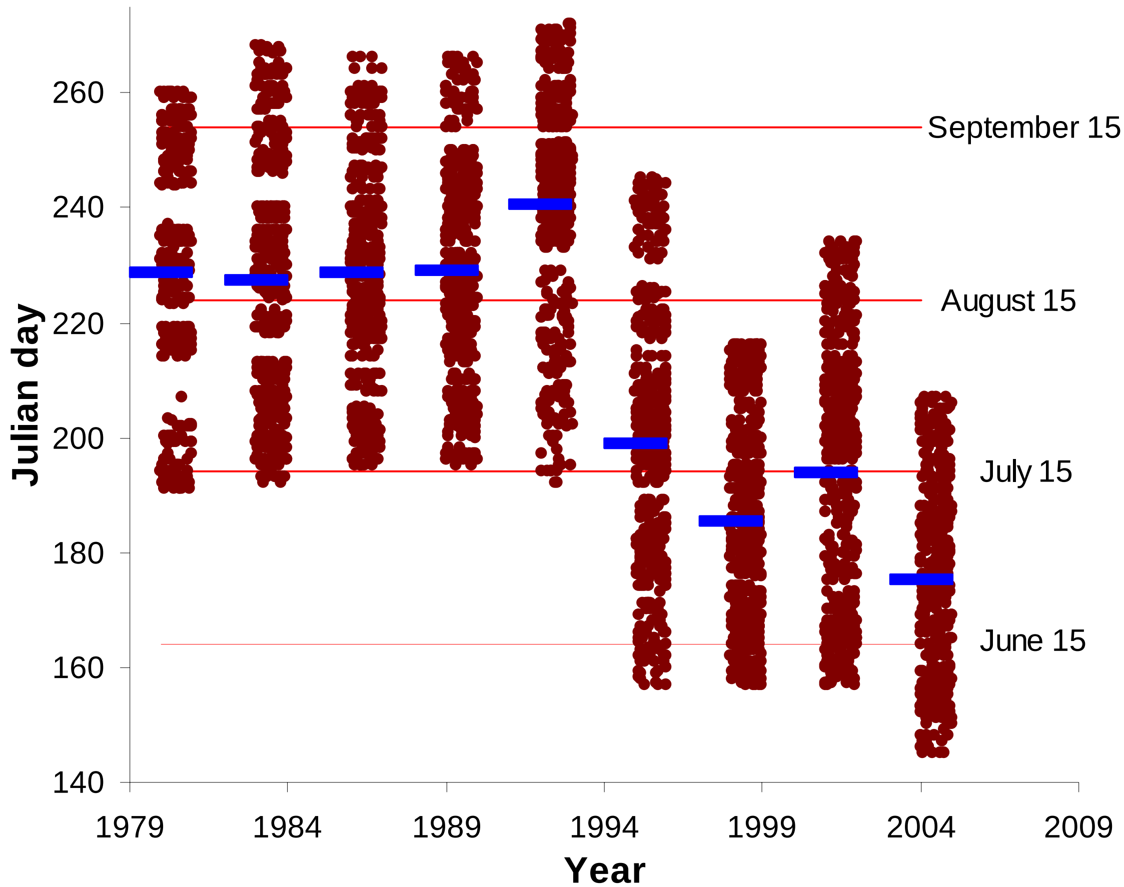


Figure 13. Distribution of dates of operation for the triennial survey (1980-2004). Solid bars show the mean date for each survey year, points represent individual hauls dates, but are jittered to allow better delineation of the distribution of individual points.

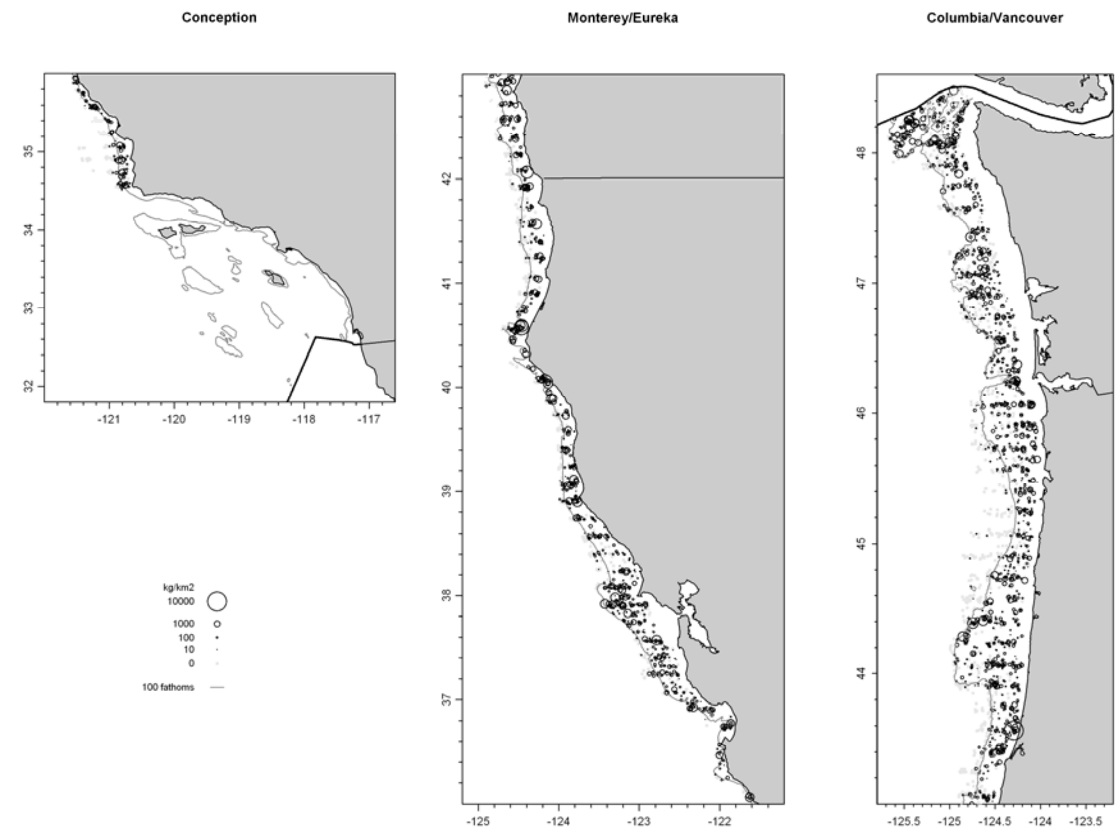


Figure 14. Catch rates over all years for the Triennial survey.

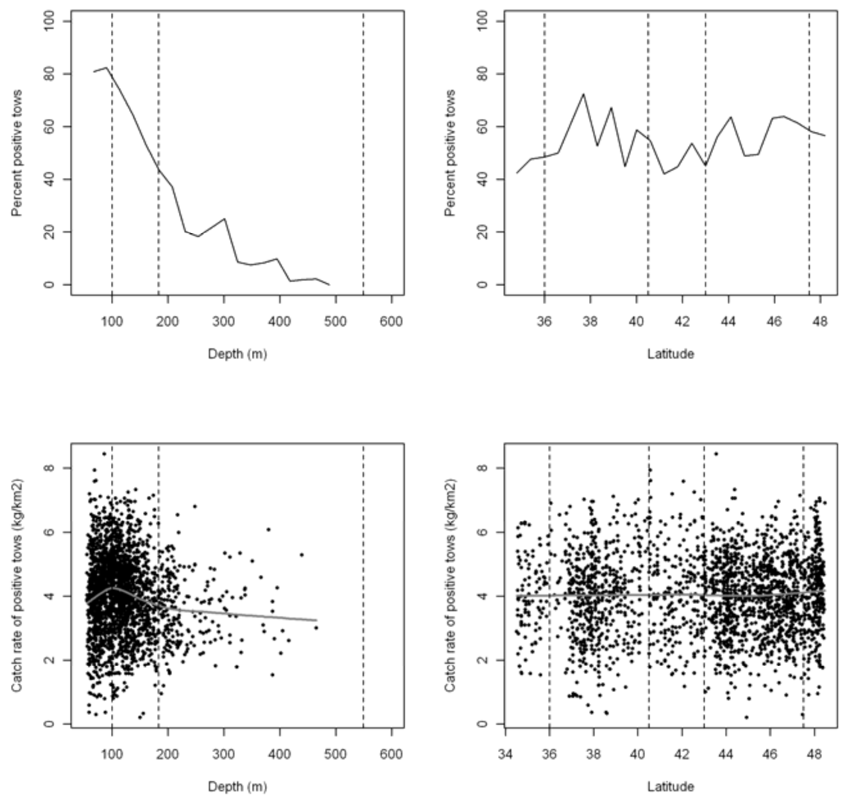


Figure 15. Plots of the percentage of positive tows and the catch rates for positive tows over depth and latitude.

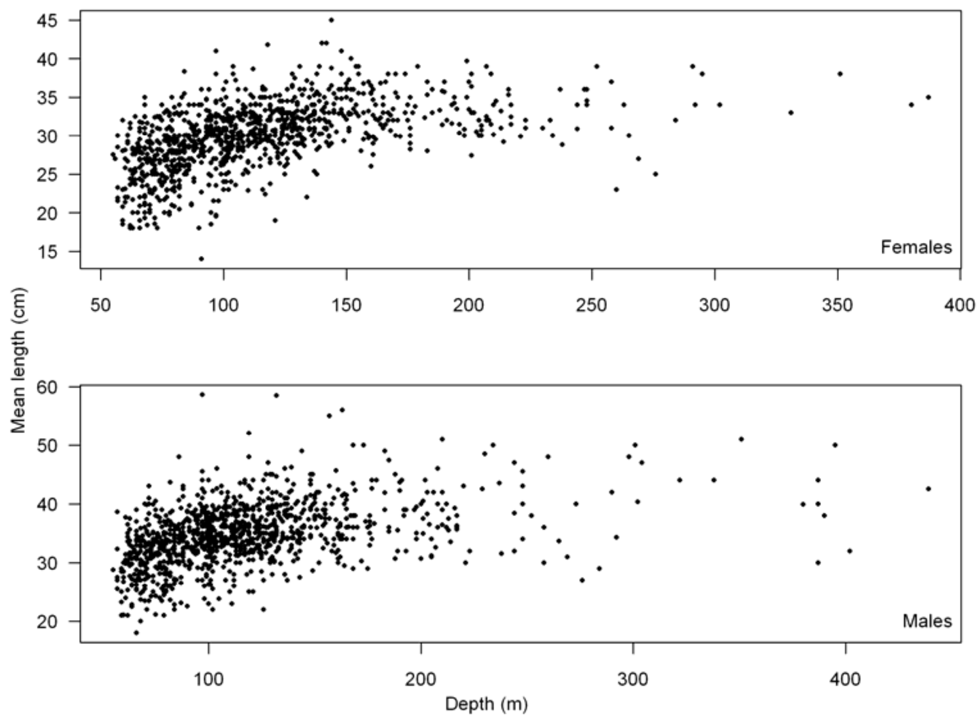


Figure 16. The mean length per tow from the Triennial survey data plotted over depth for females and males.

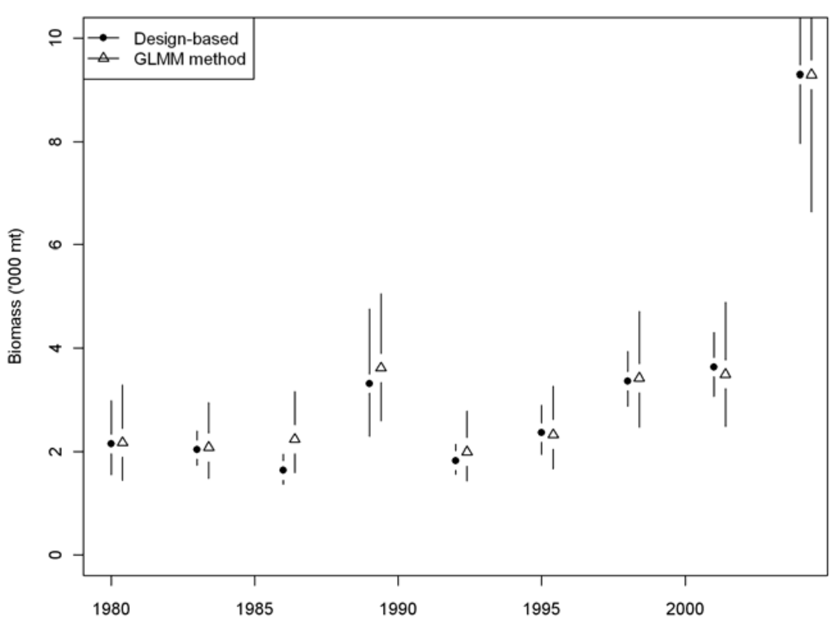


Table 17. Design-based and GLMM biomass estimates from the Triennial survey. The GLMM estimates were expanded by half of the area size, thus have been doubled to compare to the properly expanded design-based estimates.

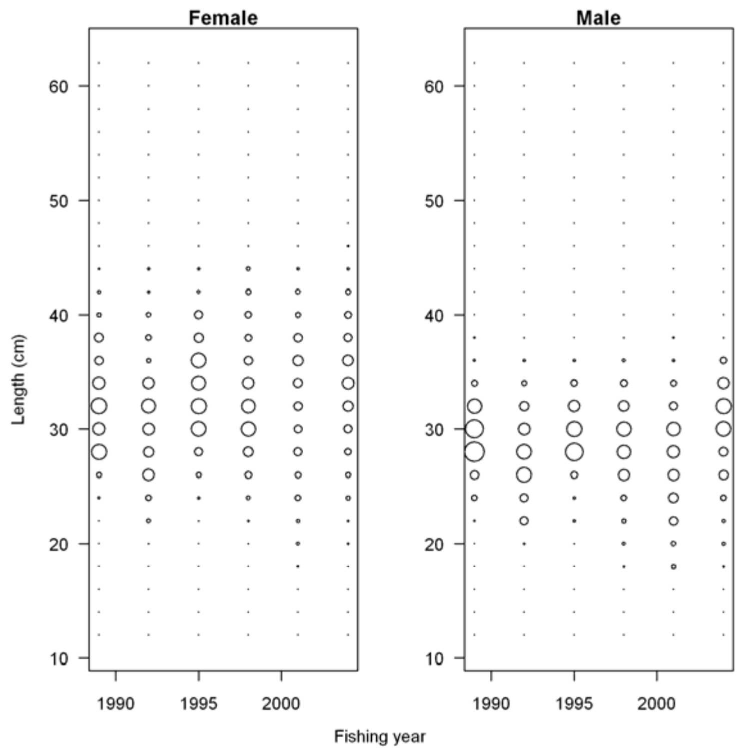


Figure 18. Plots of length frequencies from the triennial survey.

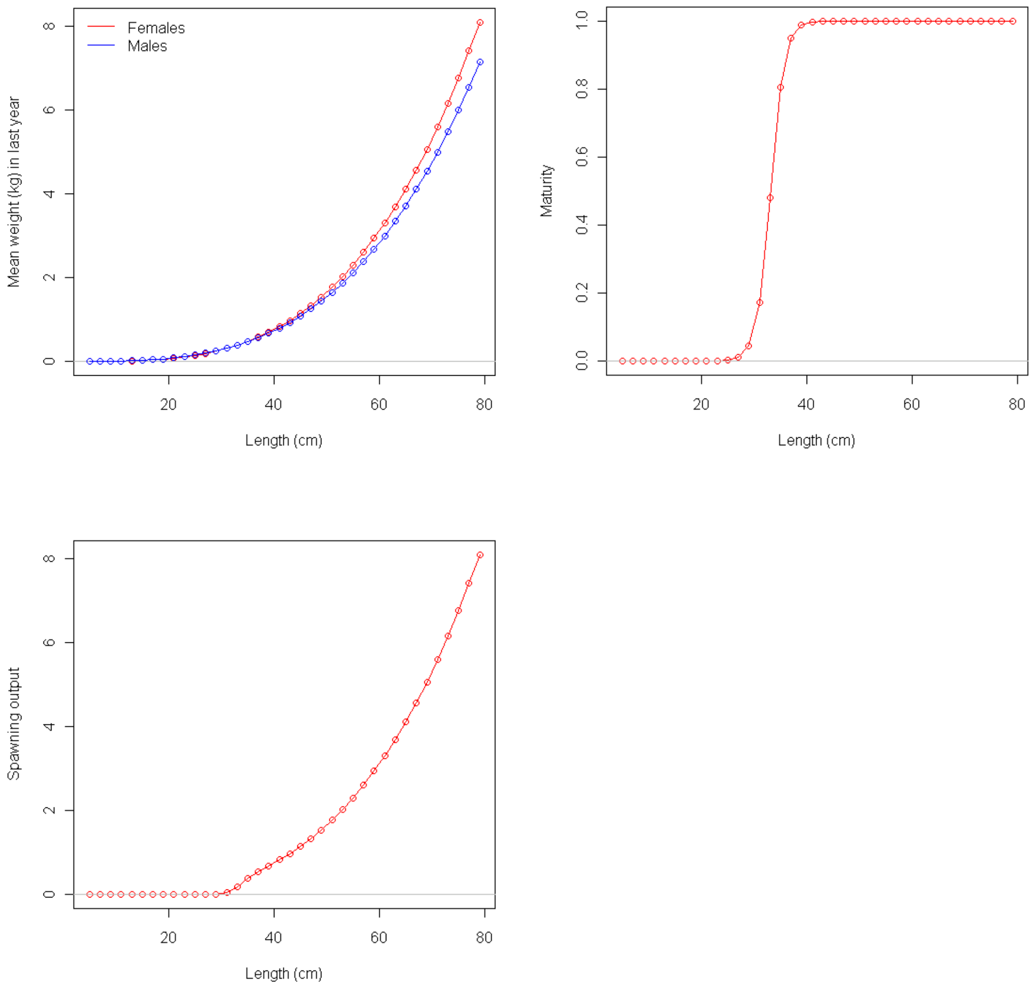


Figure 19. Biological relationships used for petrale sole weight-length relationship, maturity ogive (females only) and spawning output as a function of length.

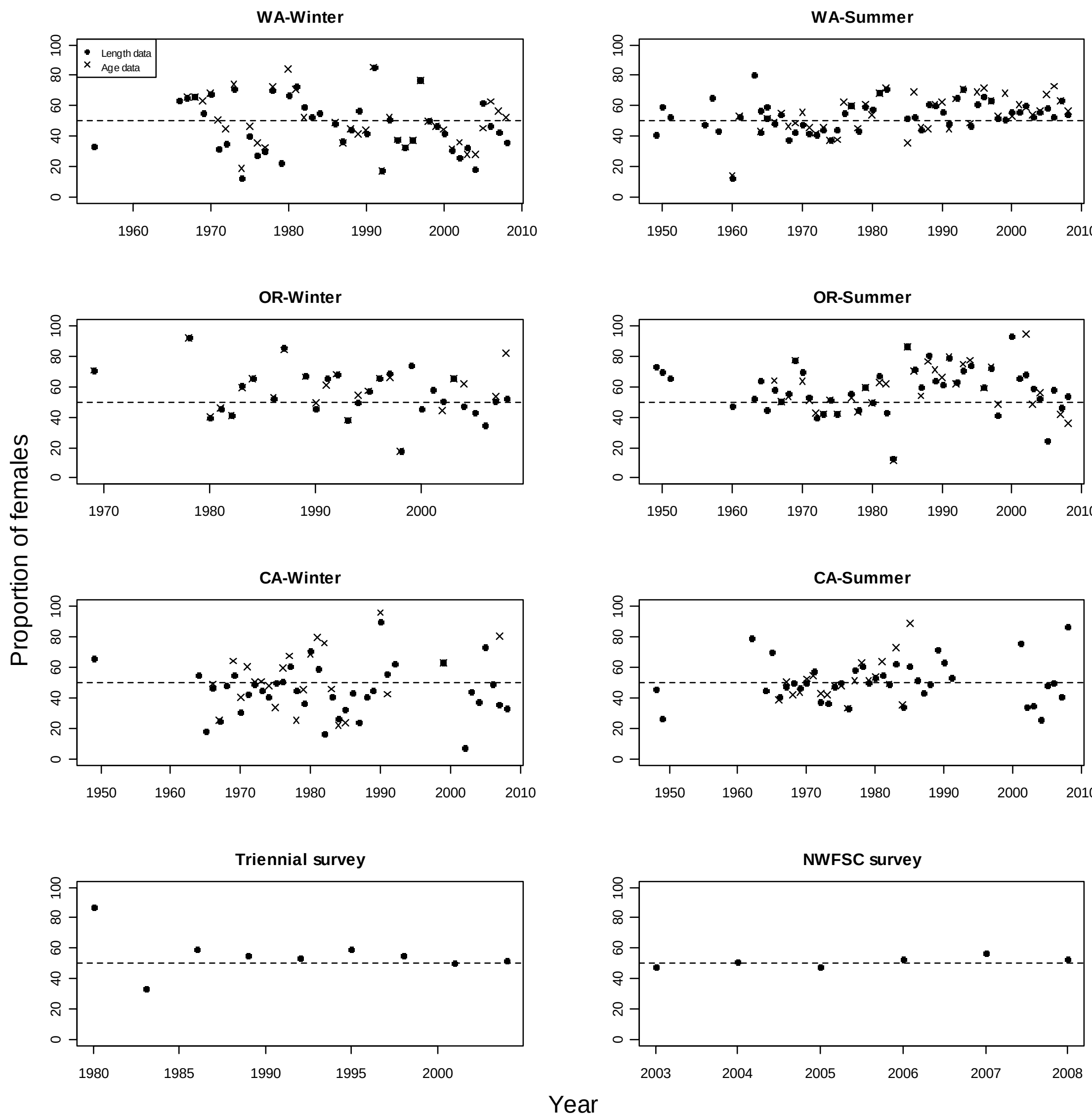
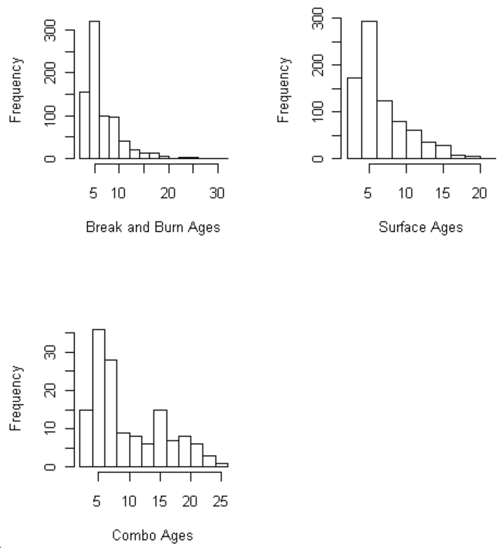
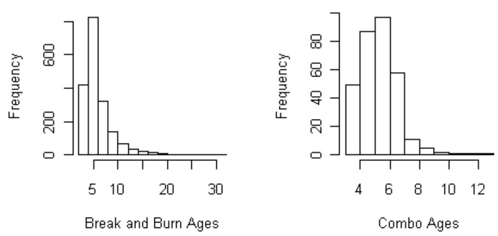


Figure 20. Proportion of females in length and age samples collected from the fisheries and surveys.



a



b

Figure 21. Distribution of double- and triple-reads used to calculate the ageing error keys for the CAP (a) and WDFW (b).

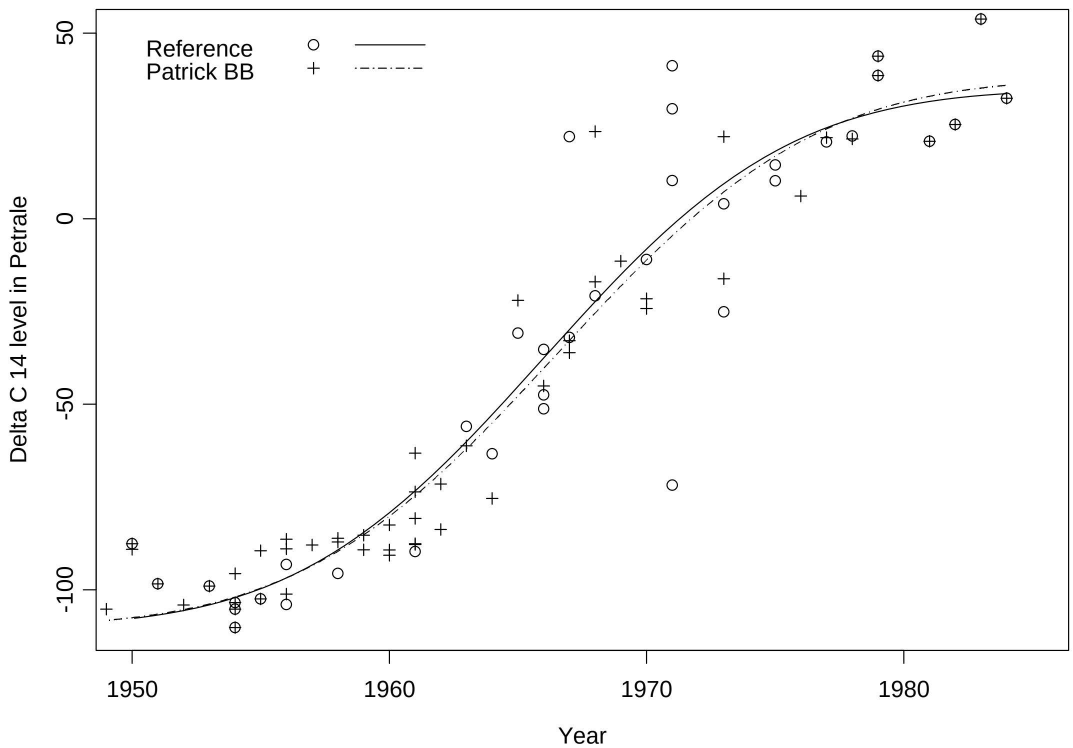


Figure 22. Fit of coupled-functions model (Hamel et al. 2008) to reference data and to age reader #1 break and burn ages of test samples (aged between 6 and 31) with early and late reference data (=1955, >=1979) added to ensure match at beginning and end of time series. No (or miniscule underageing) bias is seen (Haltuch et al. in prep).

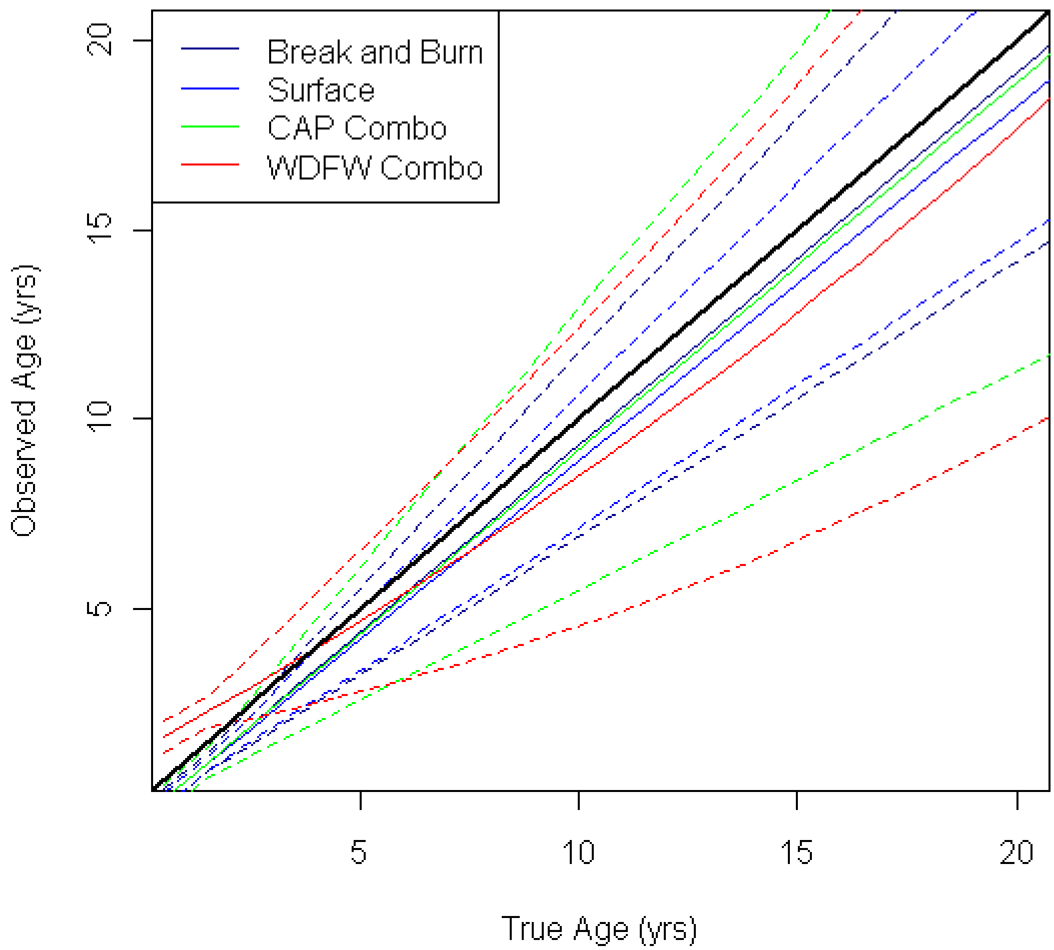


Figure 23. Plots of bias and imprecision for each data set.

Figure 24a. Spatial distribution of petrale sole catch (lbs/km^2) observed by the West Coast Groundfish Observer Program from 2002 – April 2008 and the summary area of all observed fishing events off of Washington and Oregon.

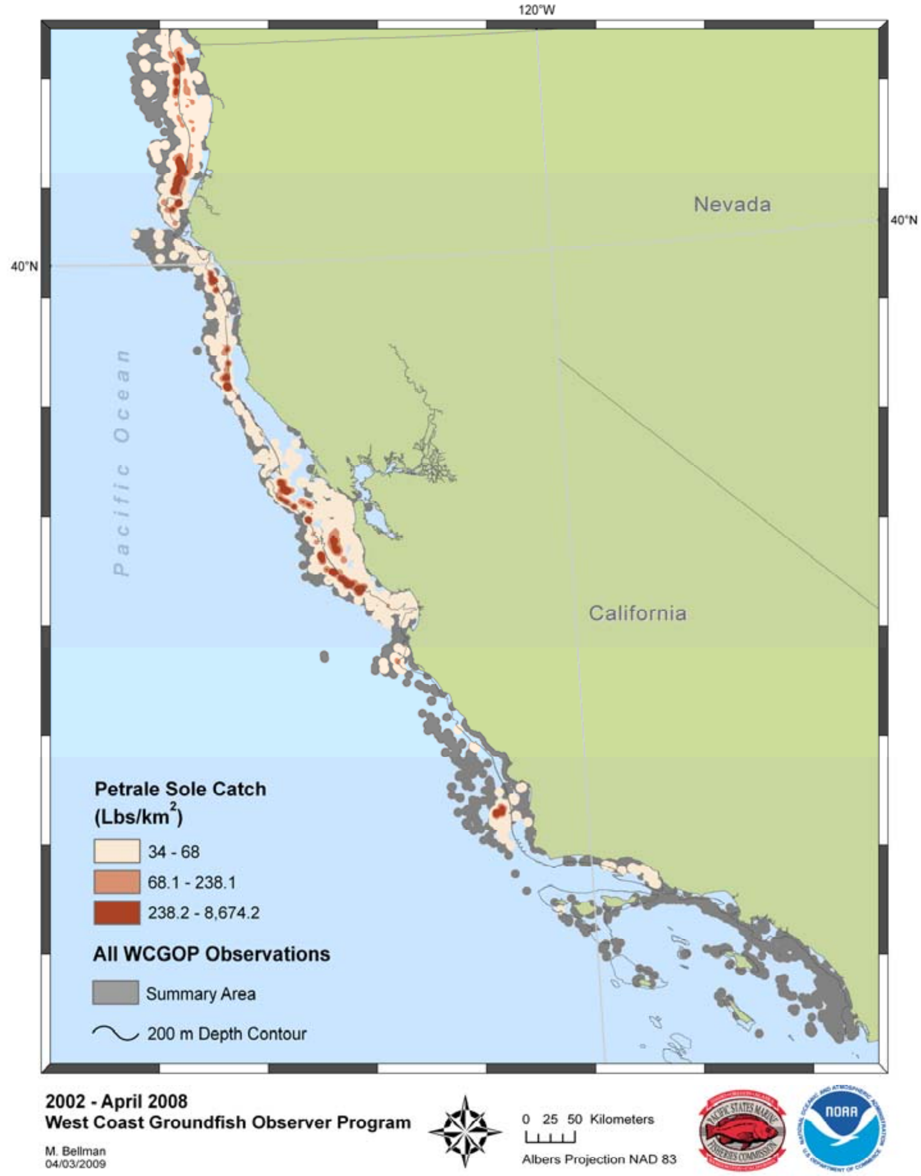


Figure 24b. Spatial distribution of petrale sole catch (lbs/km^2) observed by the West Coast Groundfish Observer Program from 2002 – April 2008 and the summary area of all observed fishing events off of California.

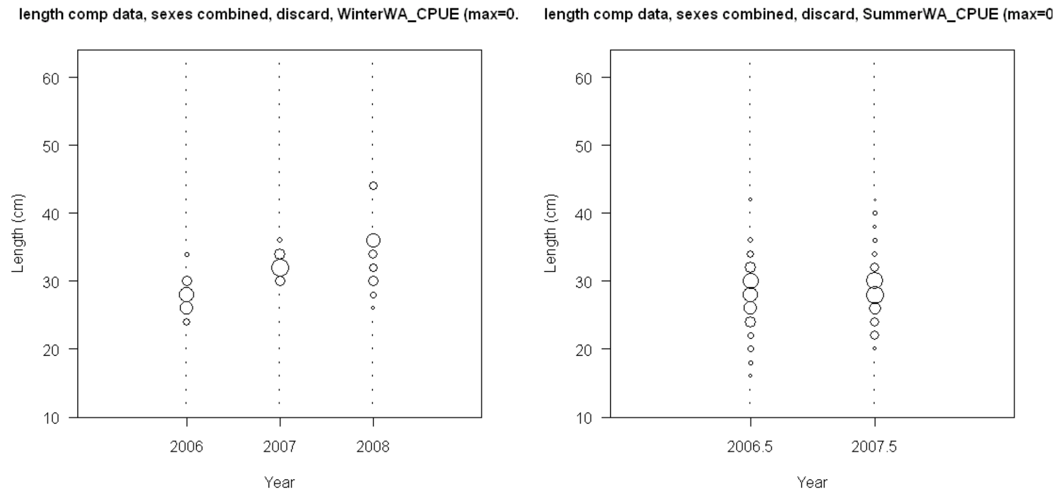


Figure 25. Discard length compositions by season for Washington.

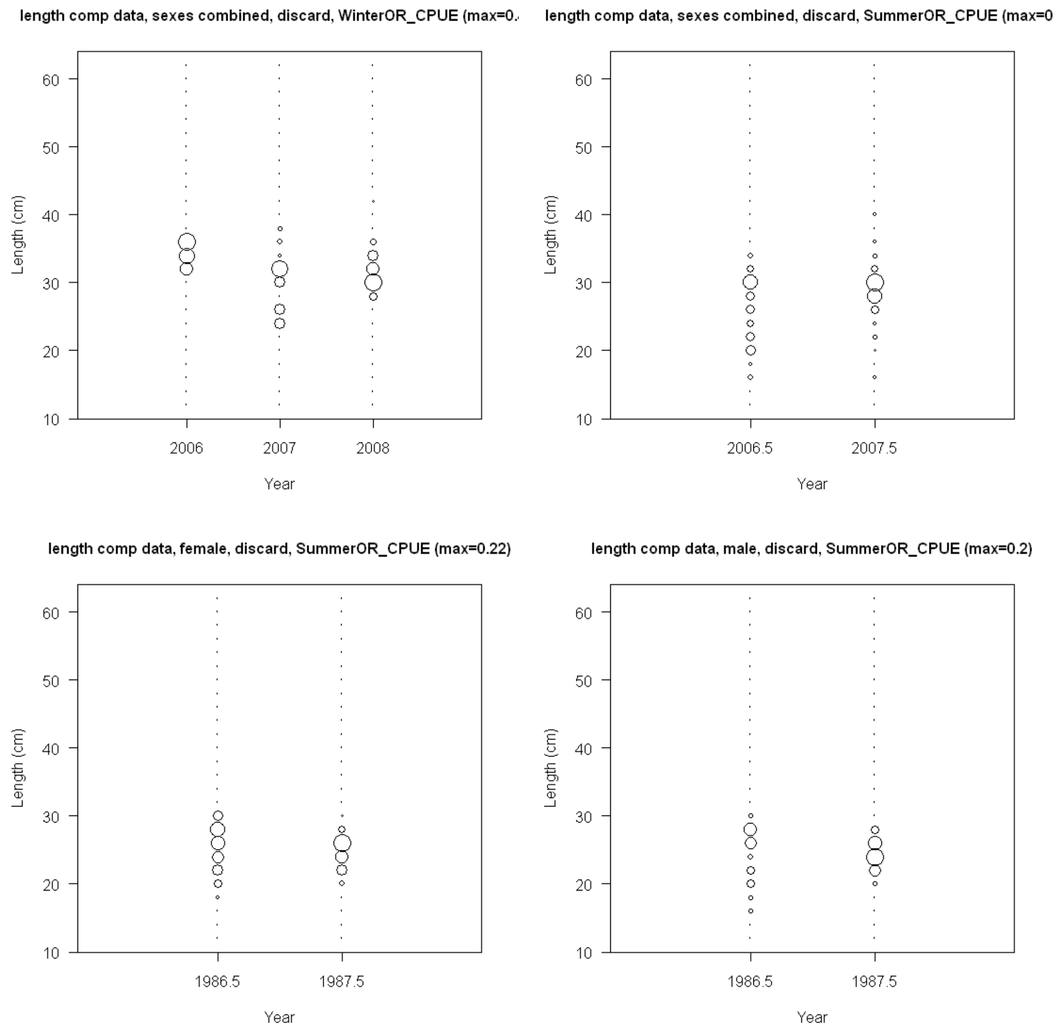


Figure 26. Discard length compositions by data source, season, and gender (where available) for Oregon.

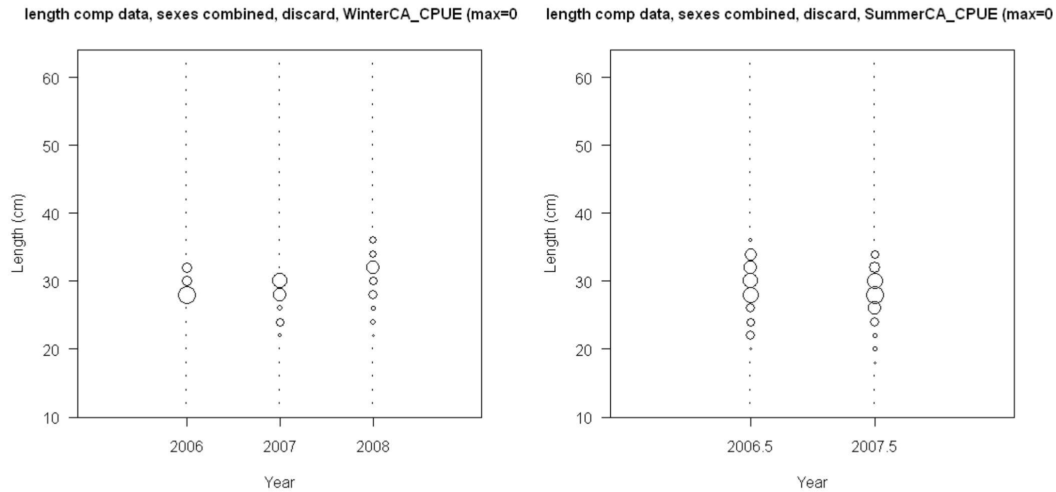


Figure 27. Discard length compositions by season for California.

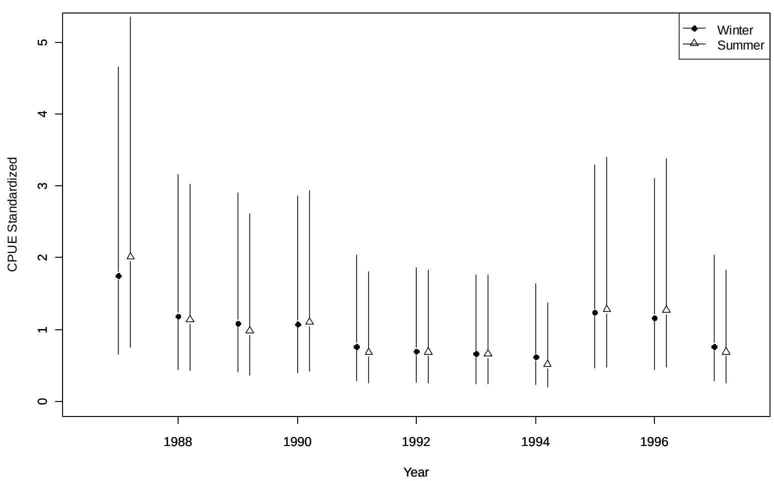


Figure 28. Plot of the OR CPUE Index.

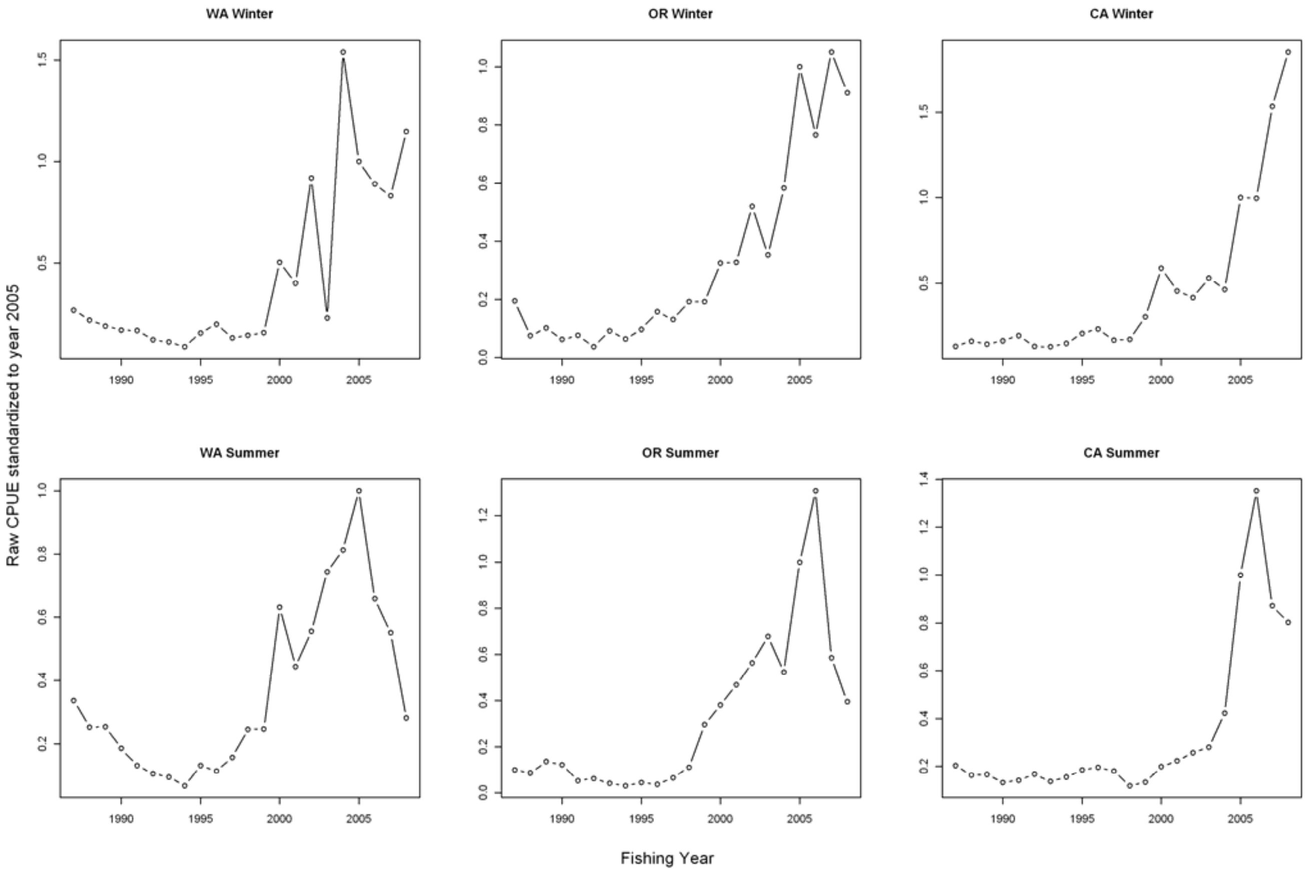


Figure 29. Plot of RAW unstandardized CPUE.

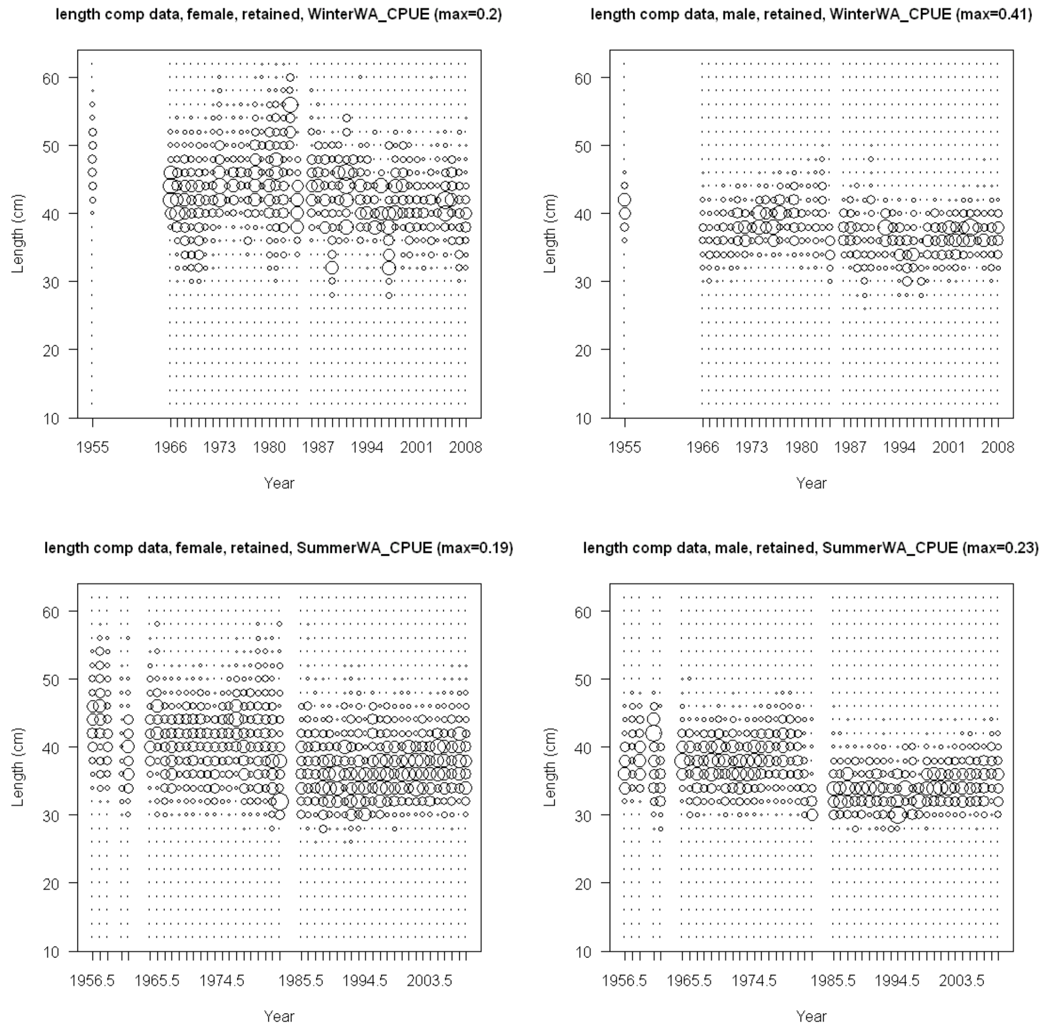


Figure 30. Length-frequency data by gender and season for the Washington fleets.

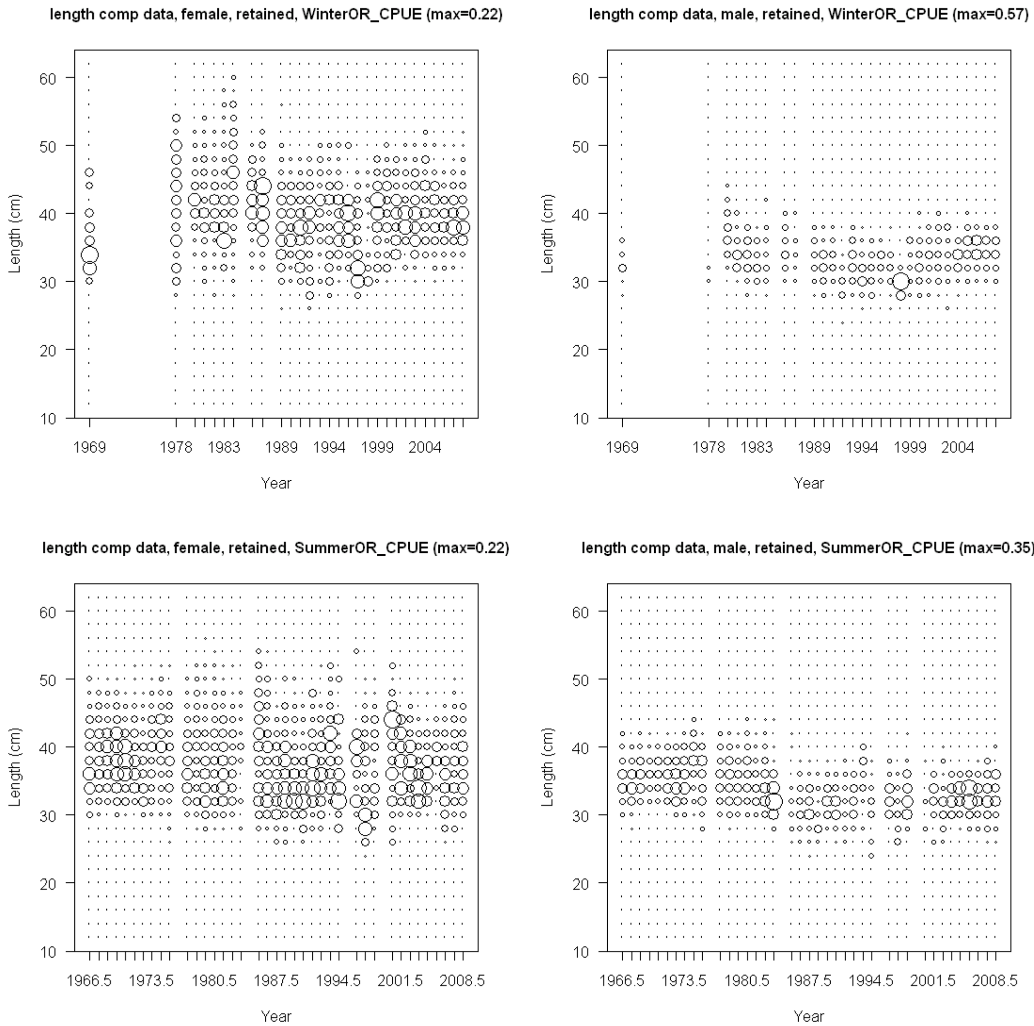


Figure 31. Length-frequency data by gender and season for the Oregon fleets.

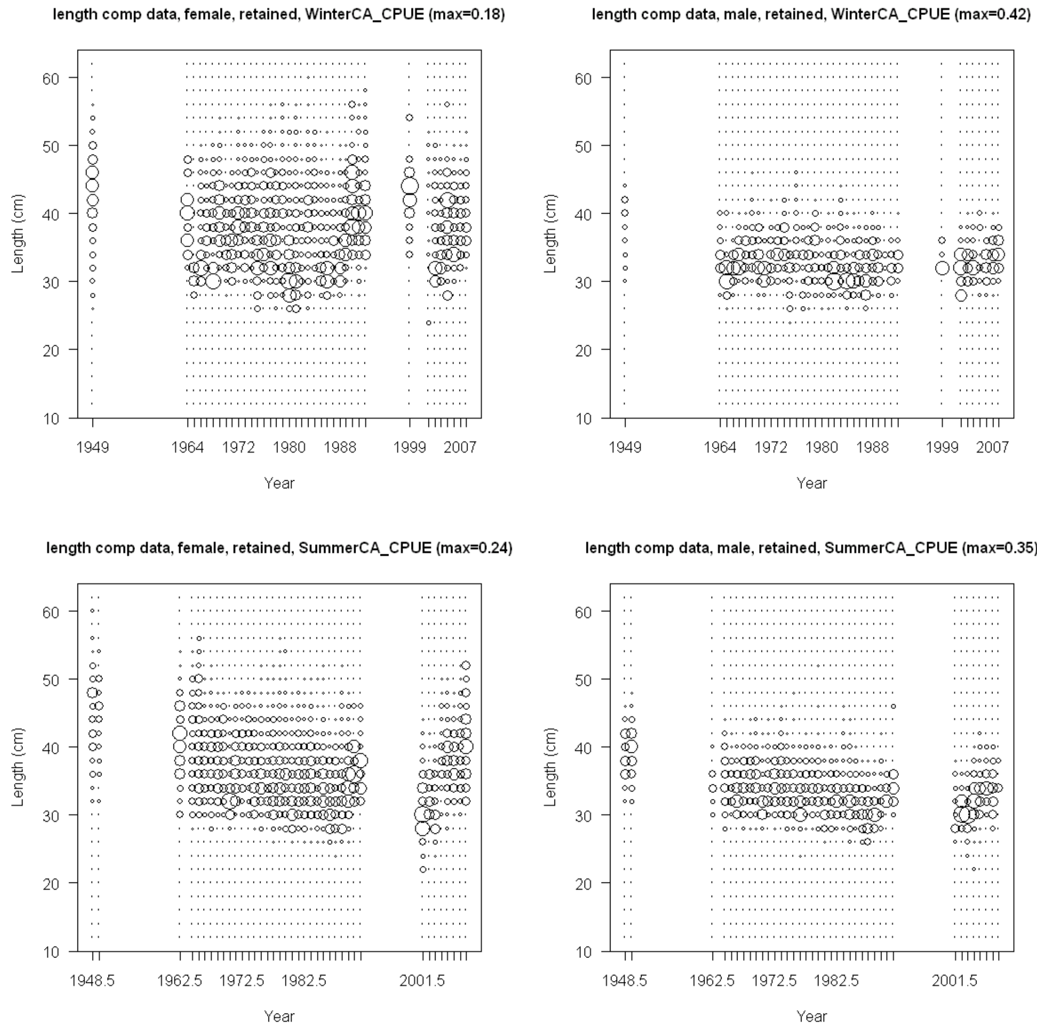


Figure 32. Length-frequency data by gender and season for the California fleets.

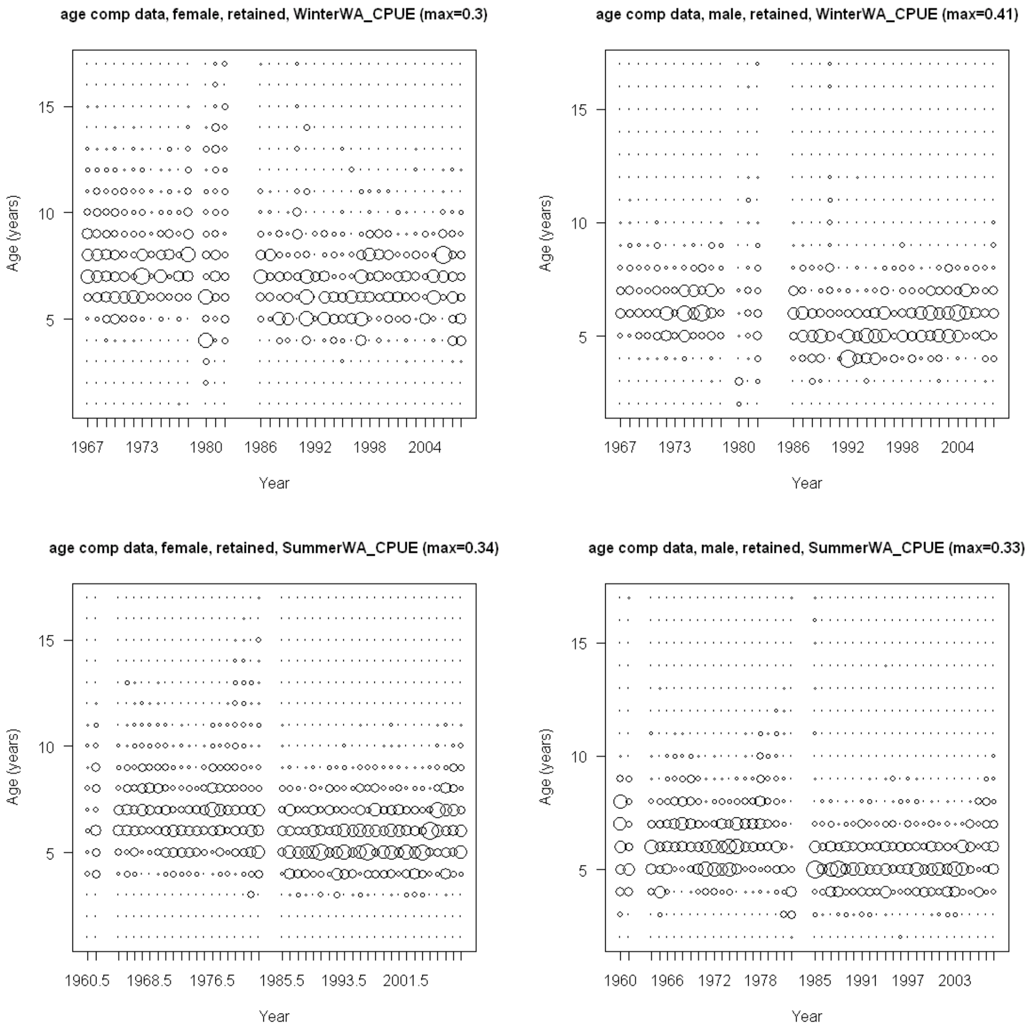


Figure 33. Age-frequency data by gender and season for the Washington fleets.

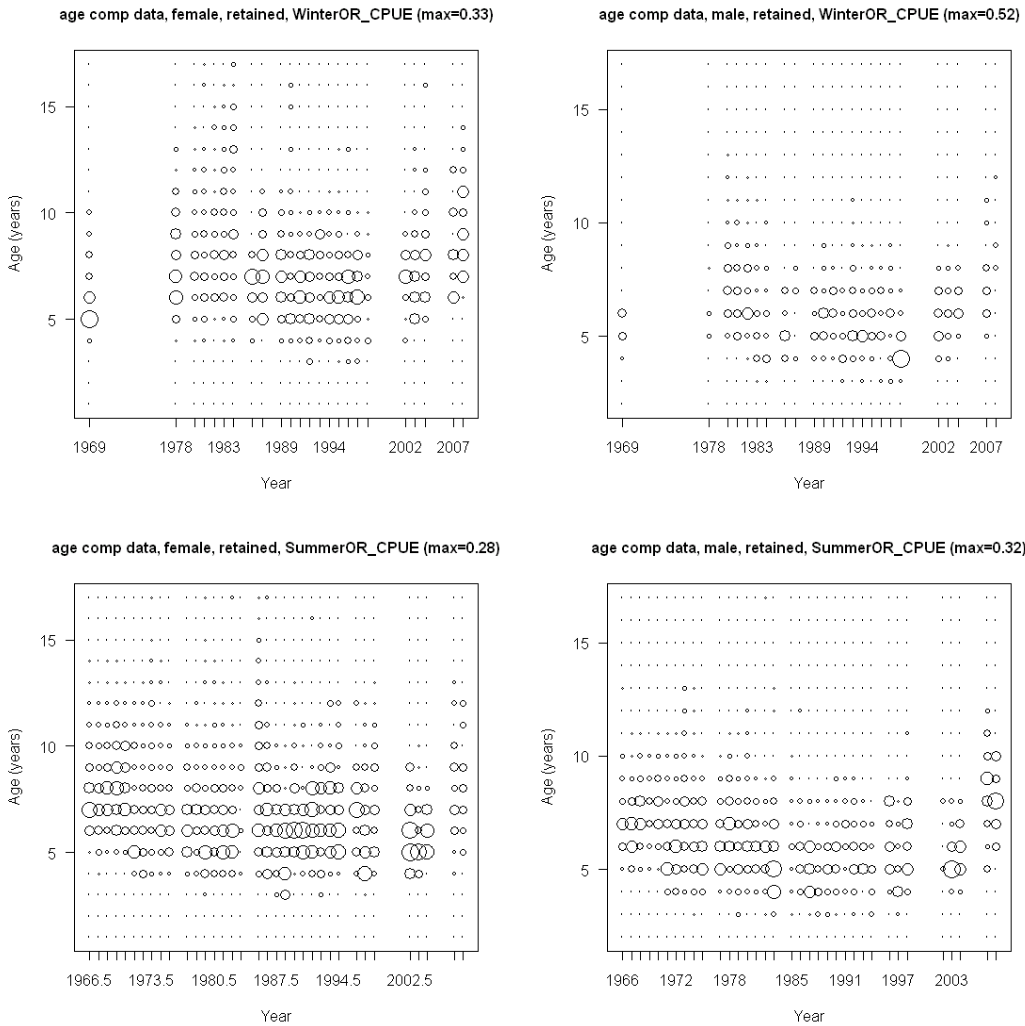


Figure 34. Age-frequency data by gender and season for the Oregon fleets.

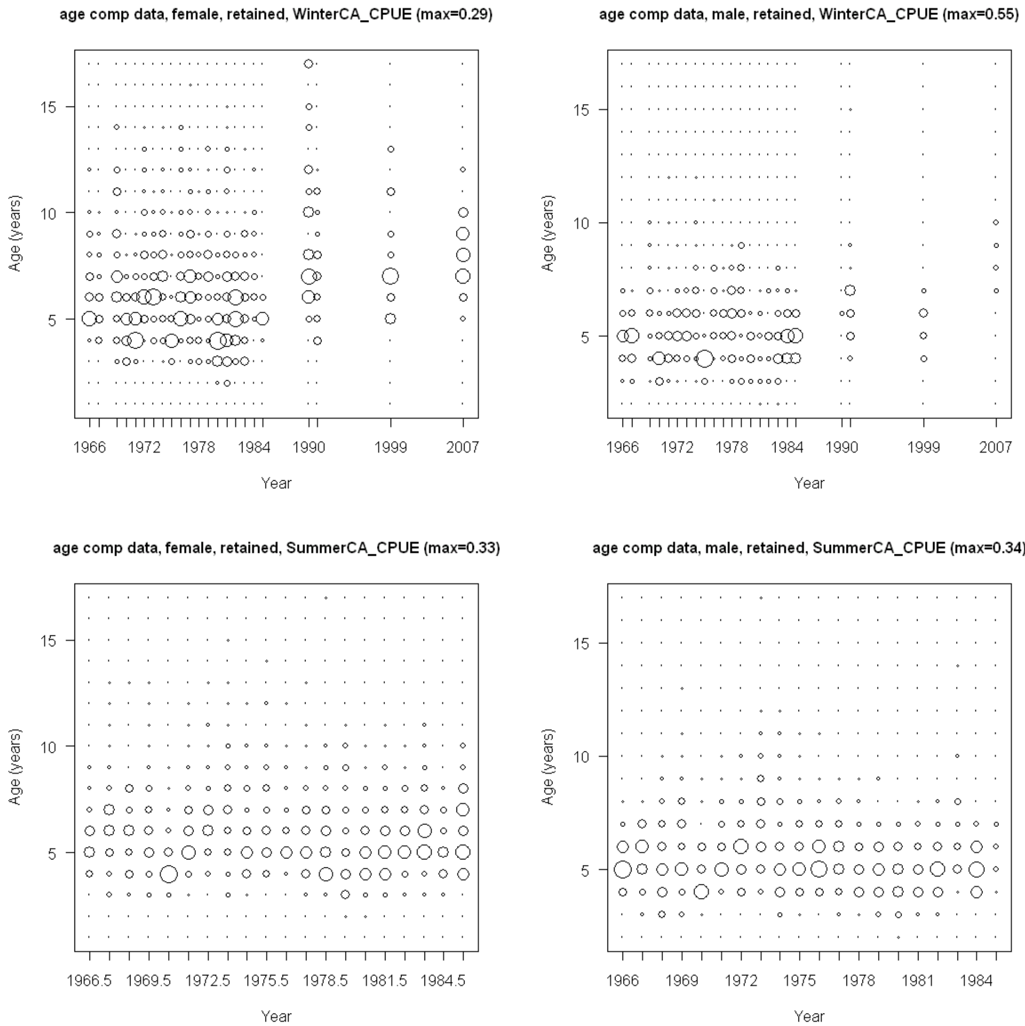
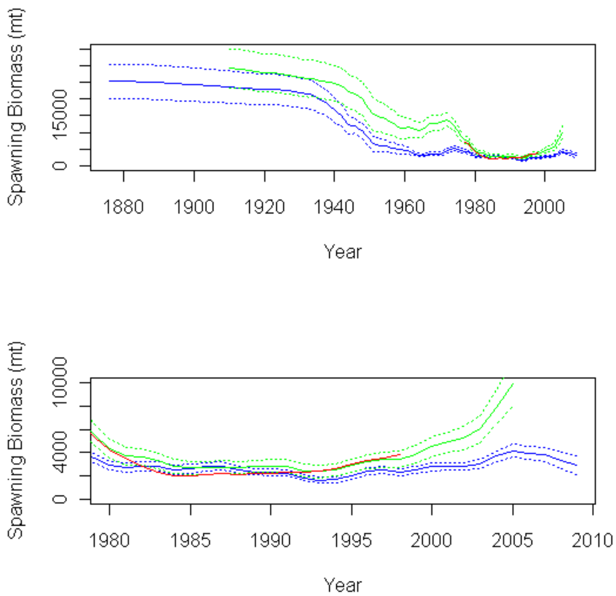
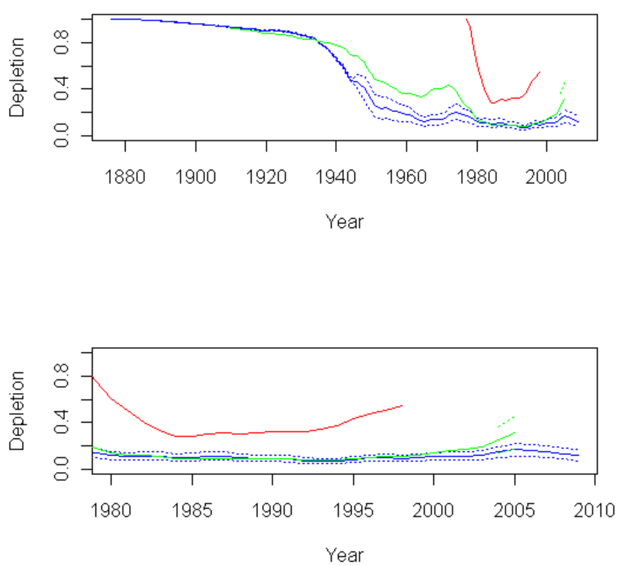


Figure 35. Age-frequency data by gender and season California fleets.



a



b

Figure 36. Comparisons of the model estimated spawning biomass (panel a) and stock depletion (panel b) for the 1999 (red), 2005 (green), and 2009 (blue) assessment models. Where available the ~95% confidence intervals are shown as broken lines.

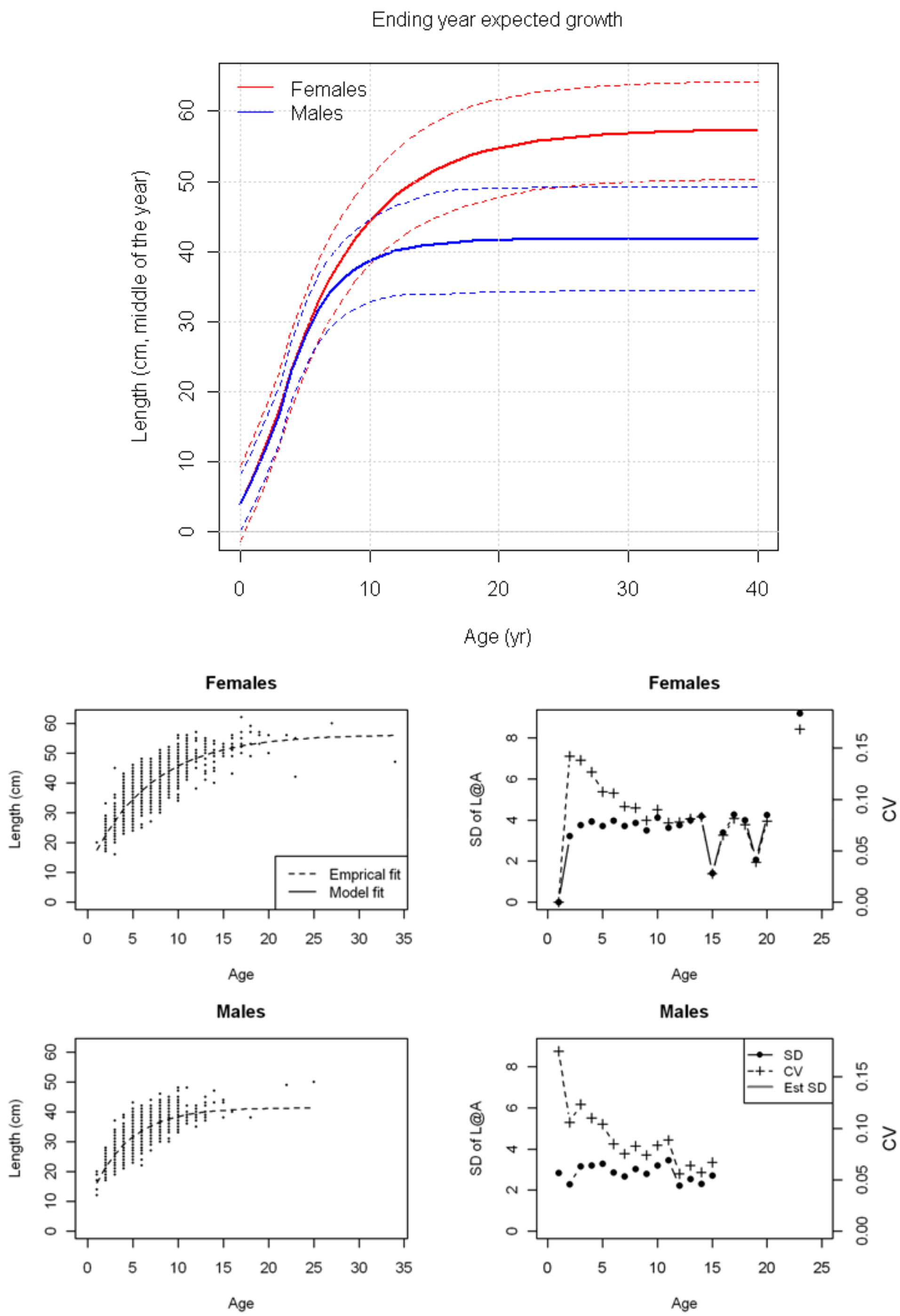


Figure 37. The top panel shows the growth curve for females (upper solid line) and males (lower solid line) with ~95% interval (dashed lines) indicating the estimated variability of length-at-age for the base case model. The bottom panel of four plots shows fits of the estimated growth curves to the NWFSC survey length-at-age data and the fits of the estimated standard deviations to the empirical standard deviation of length-at-age calculated from the NWFSC survey.

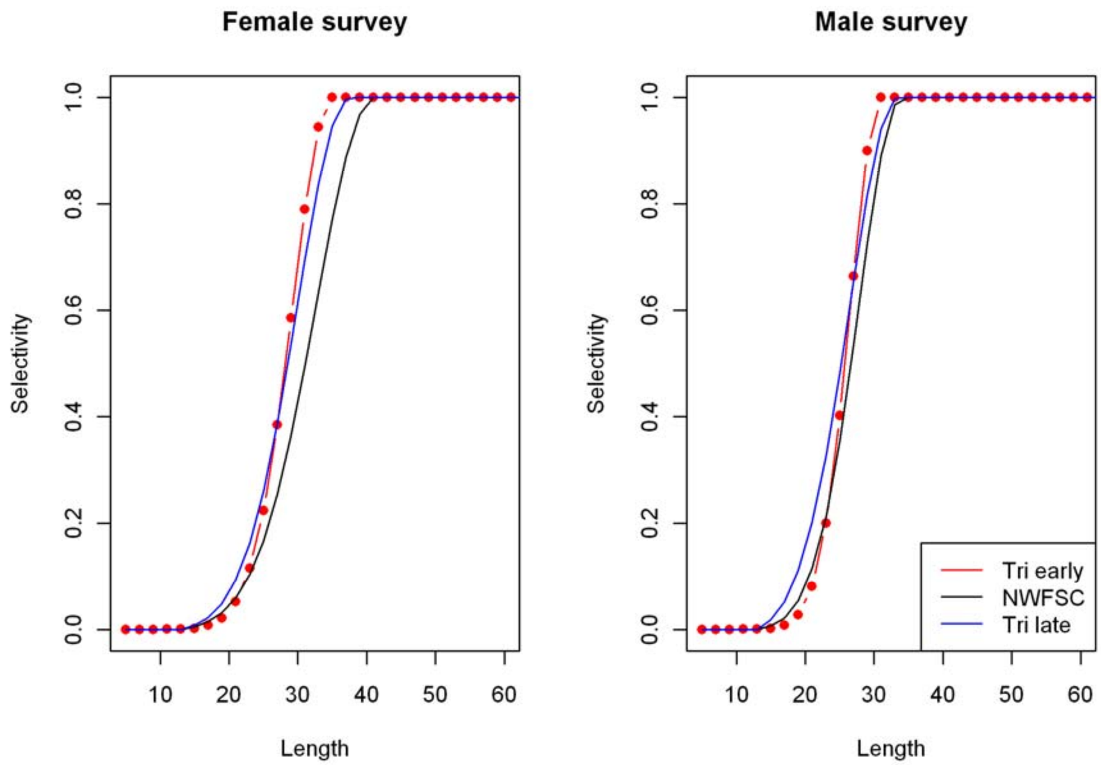


Figure 38. Estimated length-based selectivity curves for the NWFSC and triennial surveys.

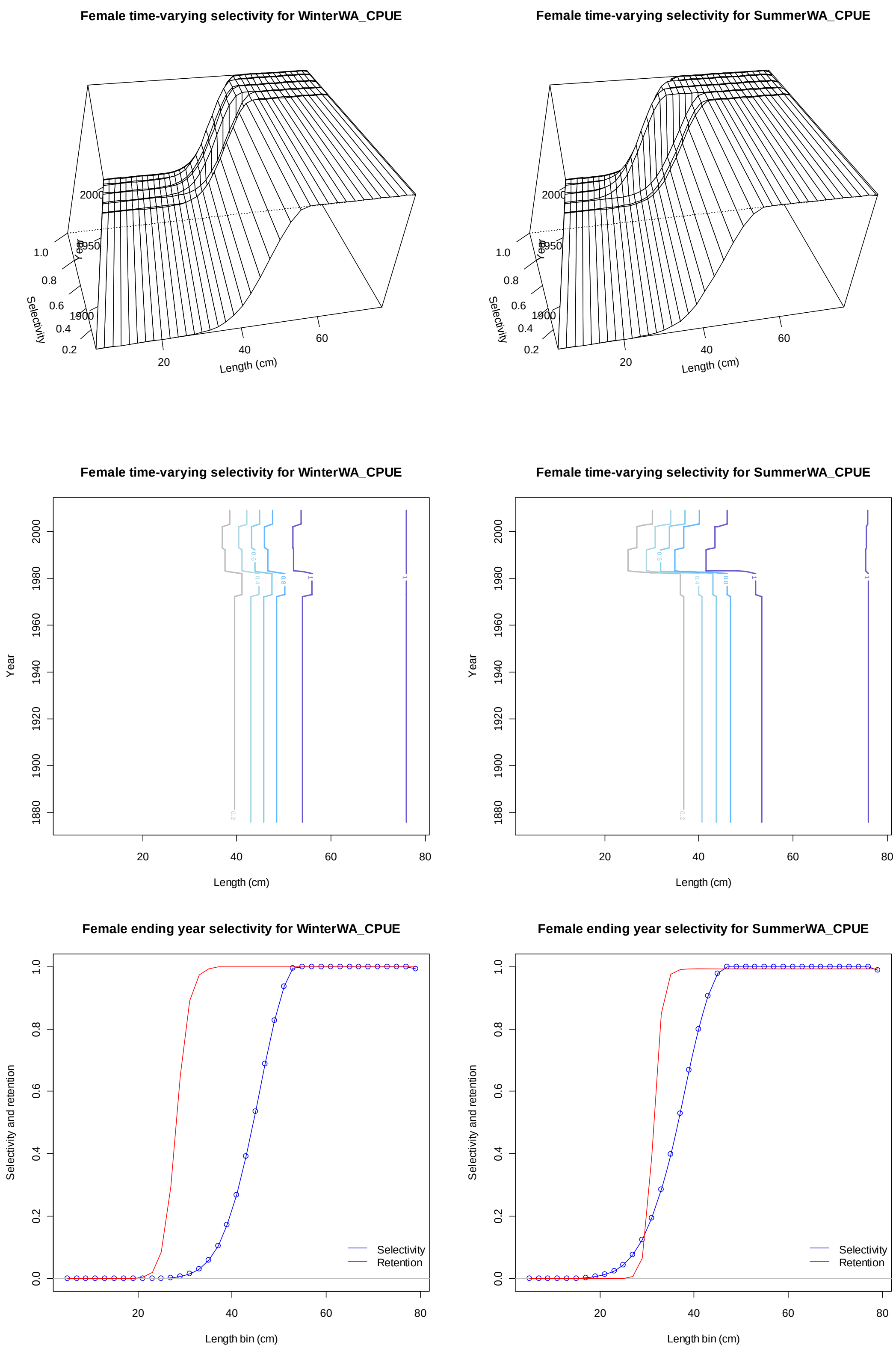


Figure 39. Estimated length-based female selectivity curves for the Washington fleets.

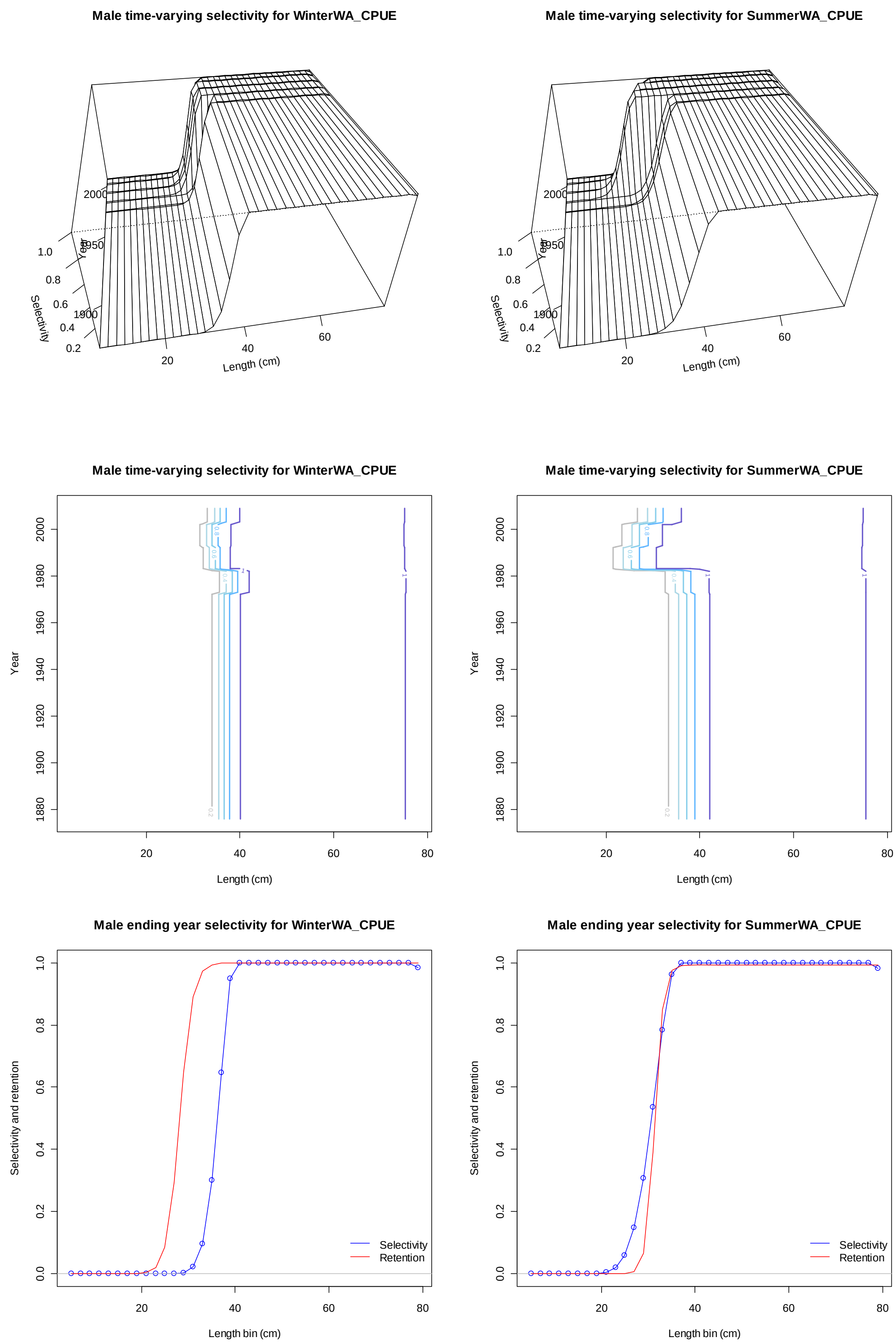


Figure 40. Estimated length-based male selectivity curves for the Washington fleets.

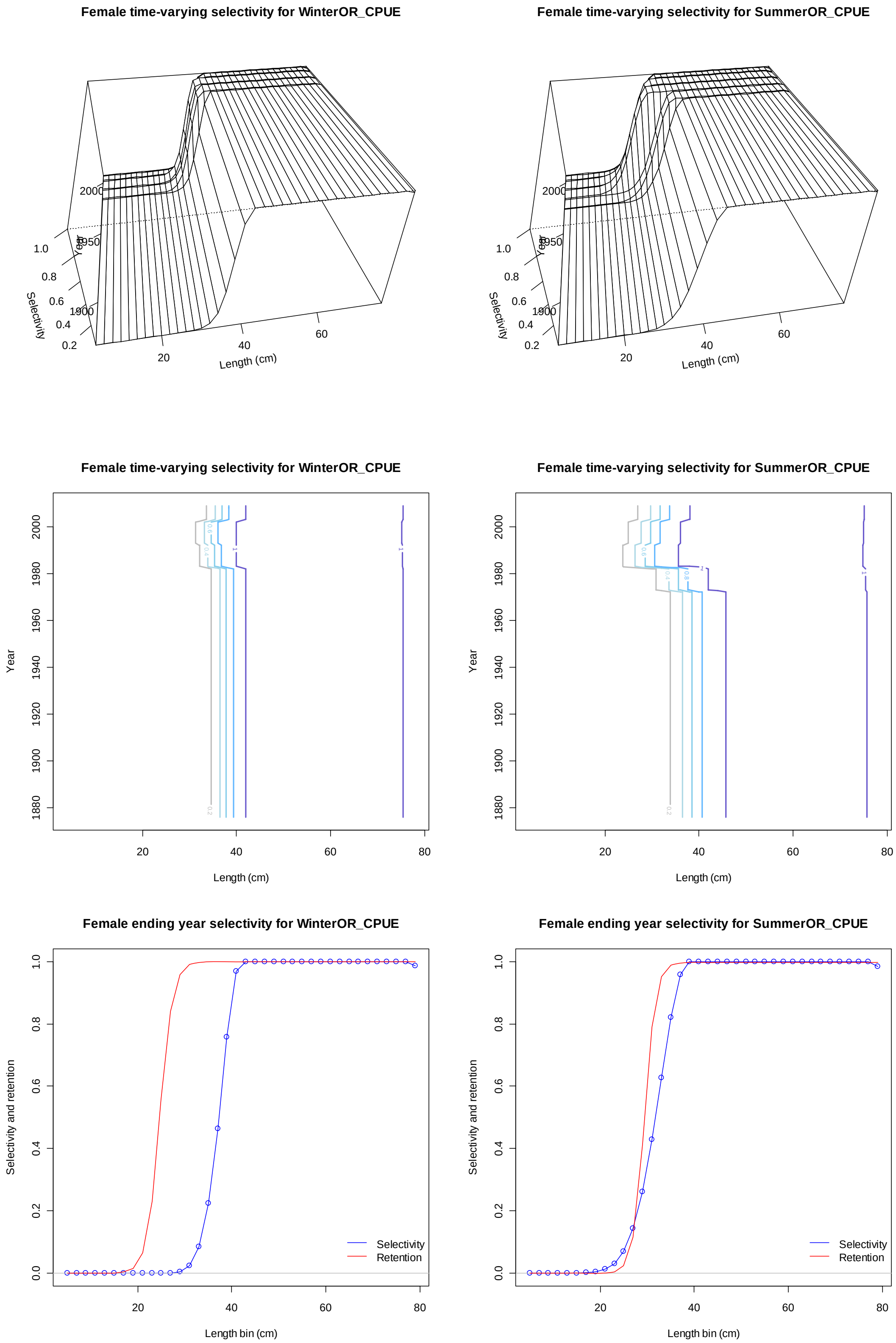


Figure 41. Estimated length-based female selectivity curves for the Oregon fleets.

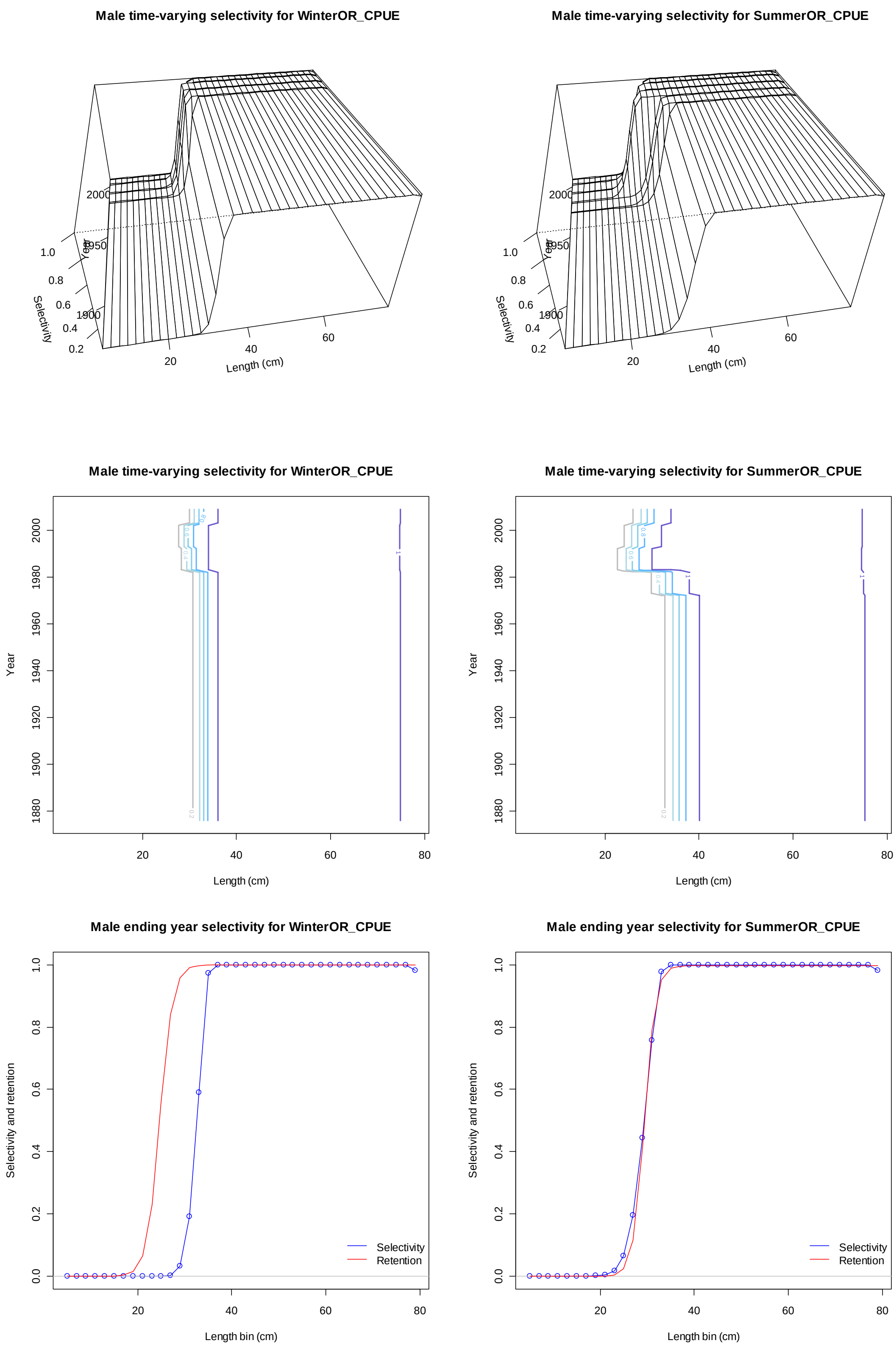


Figure 42. Estimated length-based male selectivity curves for the Oregon fleets.

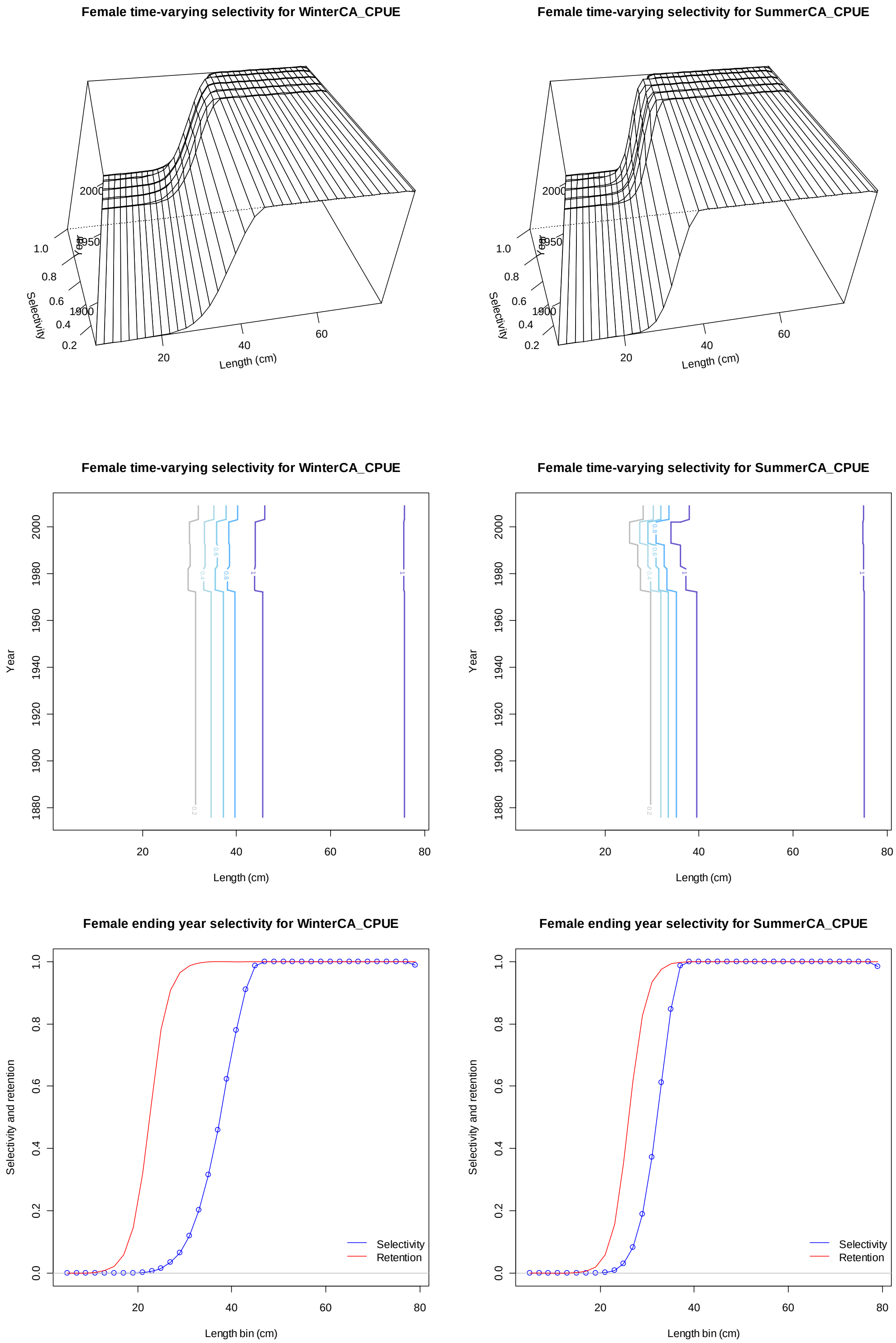


Figure 43. Estimated length-based female selectivity curves for the California fleets.

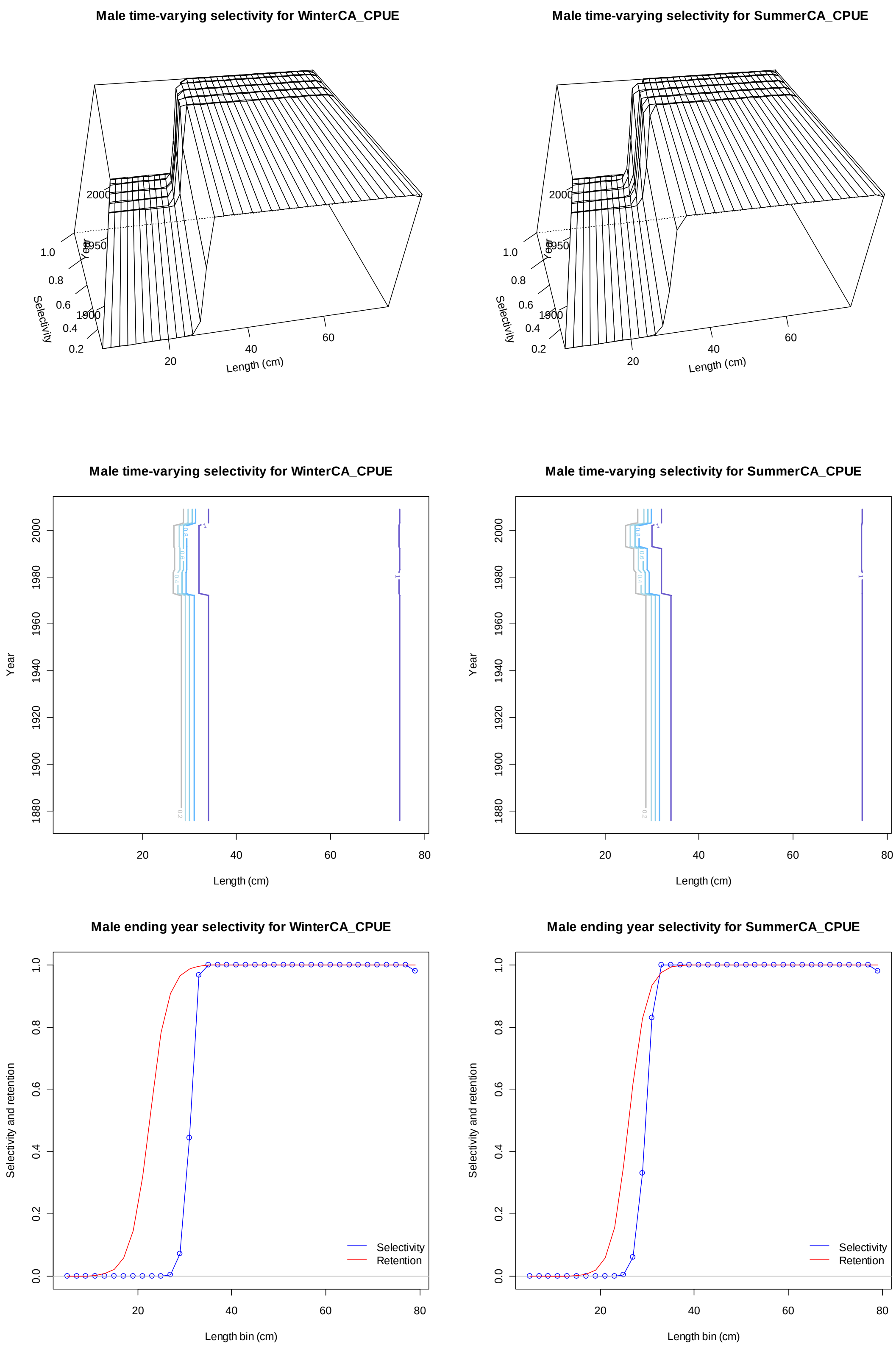


Figure 44. Estimated length-based male selectivity curves for the California fleets.

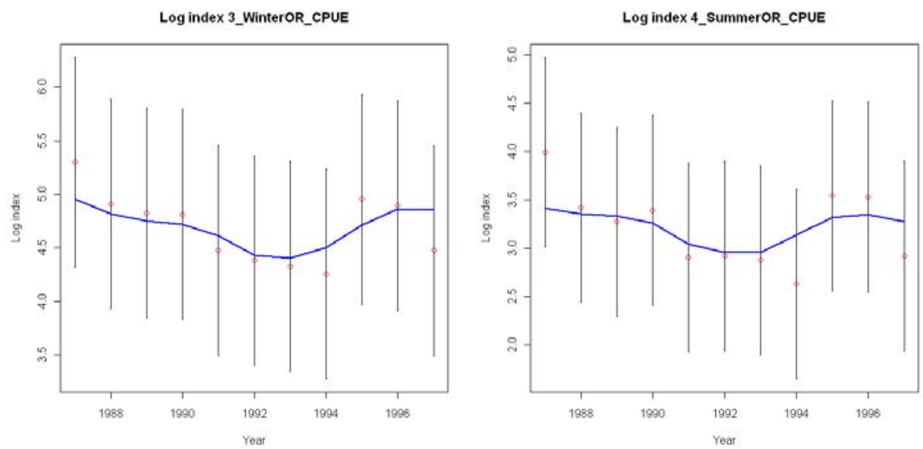


Figure 45. Fit to Oregon CPUE.

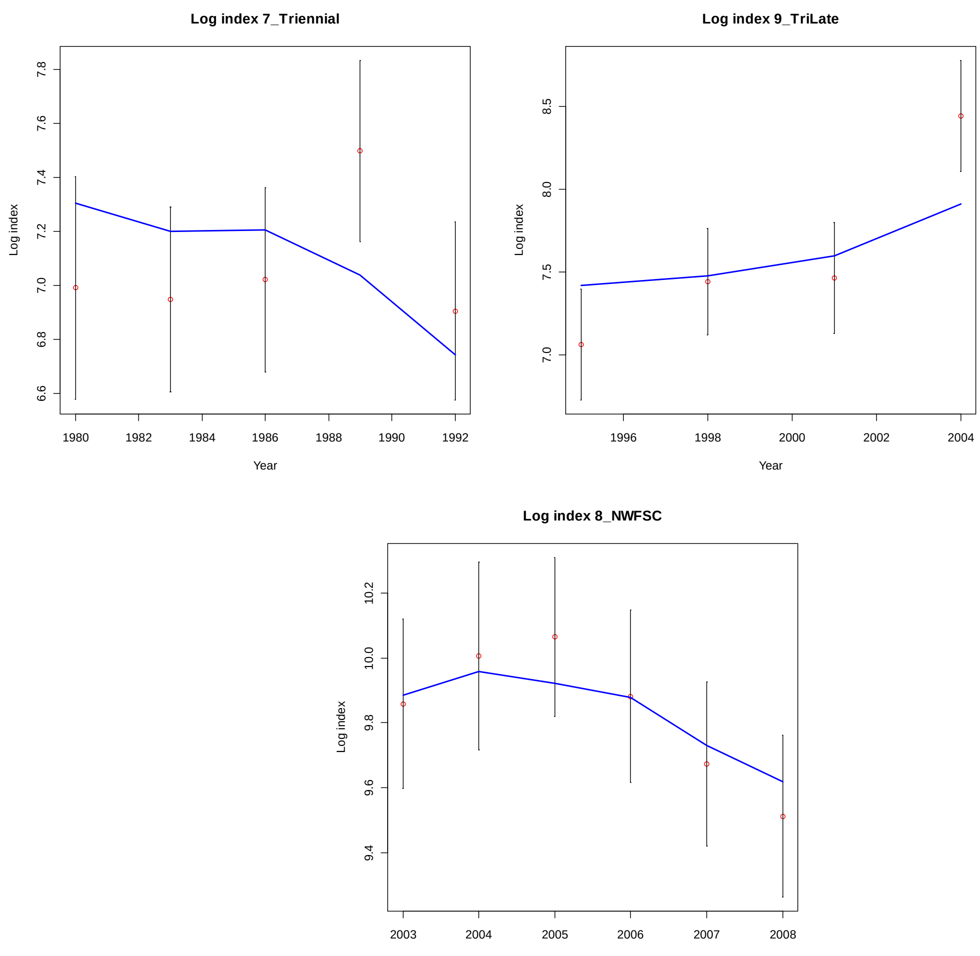


Figure 46. Fit to the early and late triennial (top) and NWFSC survey (bottom) GLMM-based time series of relative biomass in the base case model.

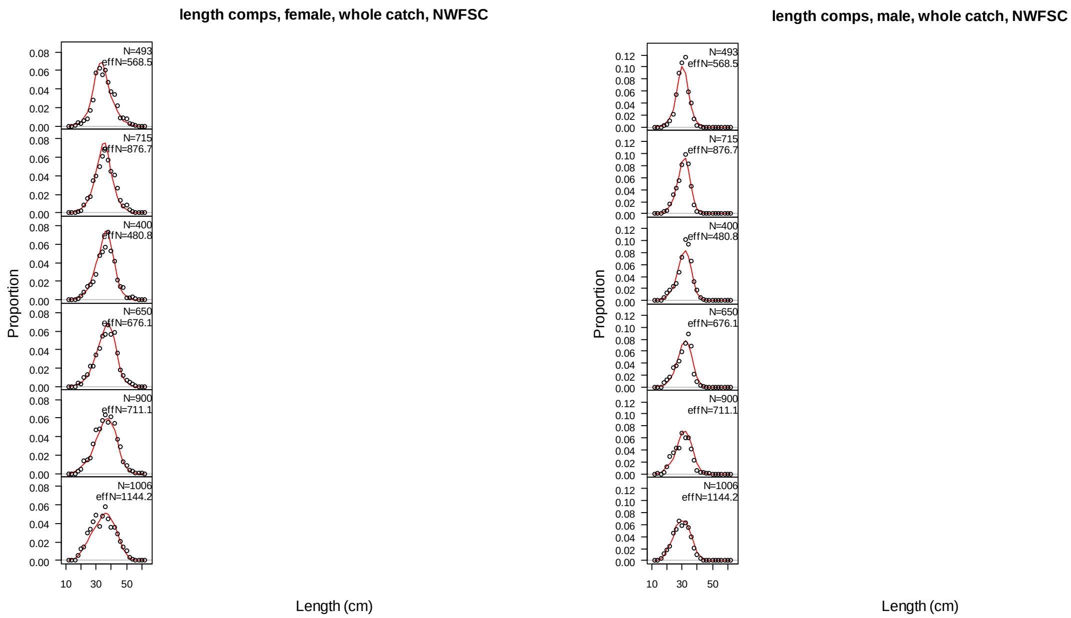


Figure 47. Fit to the NWFSC survey length-frequencies.

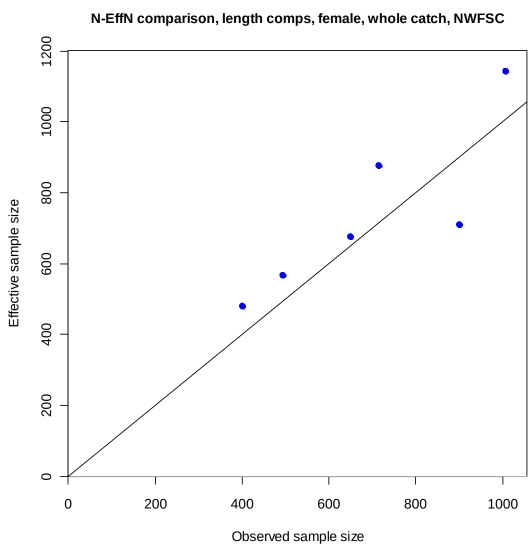


Figure 48. Observed and effective sample sizes for the NWFSC length-frequency observations.

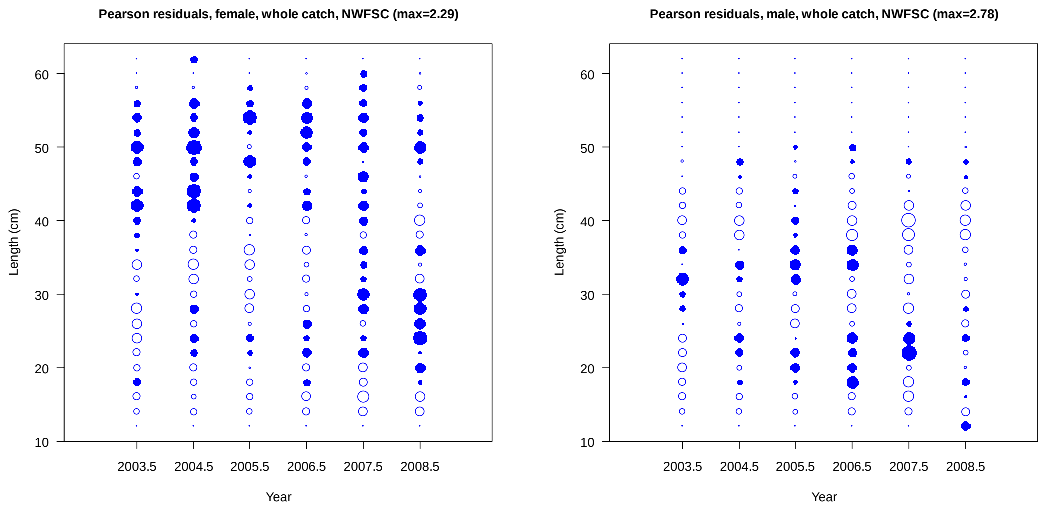


Figure 49. Pearson residuals for the fit to NWFSC survey length-frequencies.

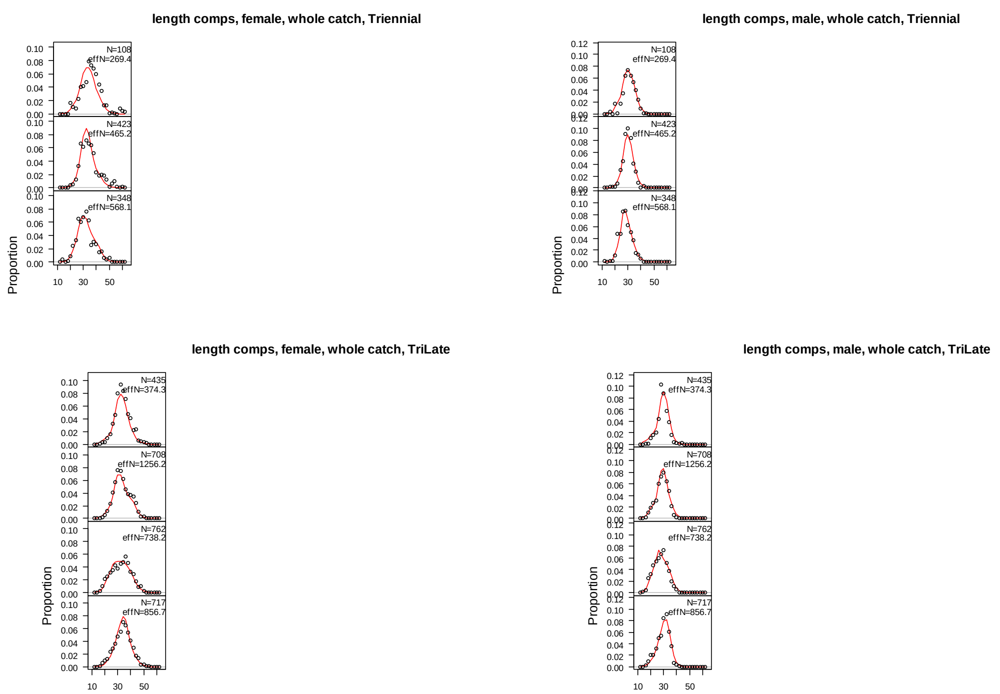


Figure 50. Fit to the early (top row) and late (bottom row) triennial survey length-frequencies.

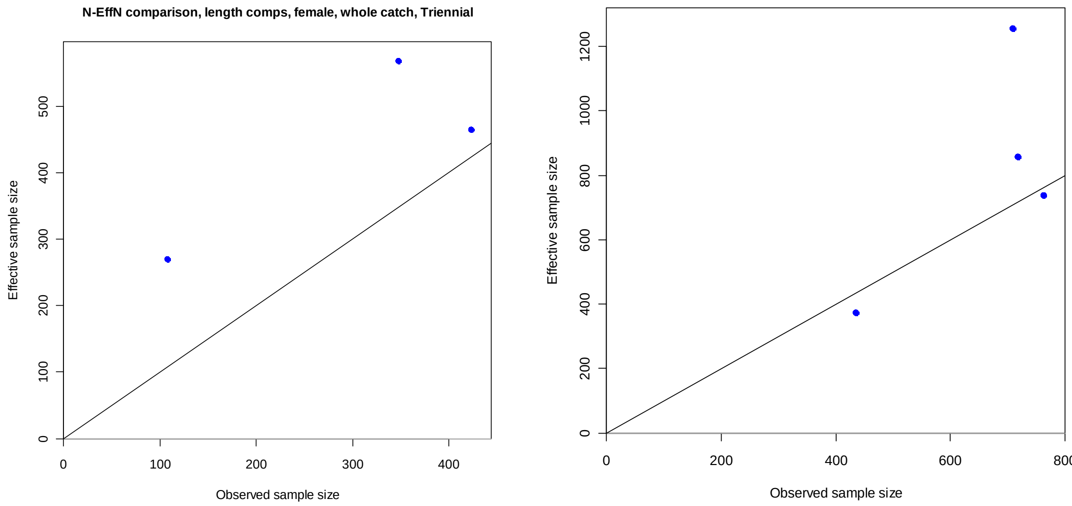


Figure 51. Observed and effective sample sizes for the early (left panel) and late (right panel) triennial length-frequency observations.

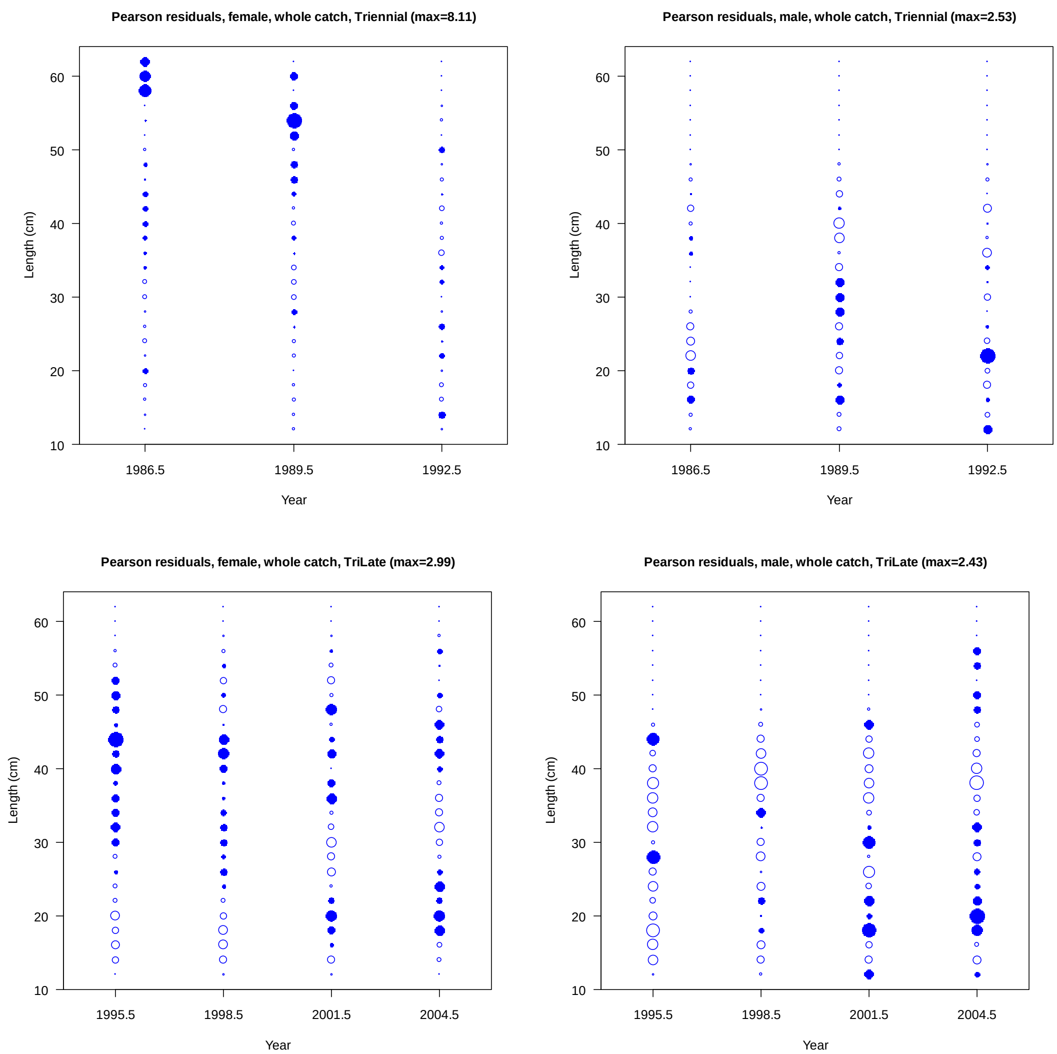


Figure 52. Pearson residuals for the fit to the early (top row) and late (bottom row) triennial survey length-frequencies.

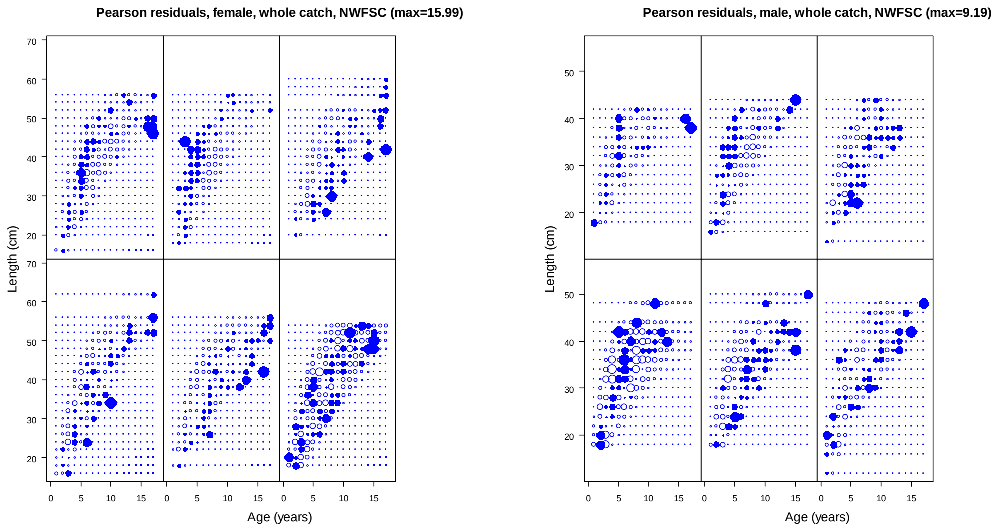


Figure 53. Pearson residuals for the fit to the NWFSC survey conditional age-at-length frequencies. Each panel is scaled independently.

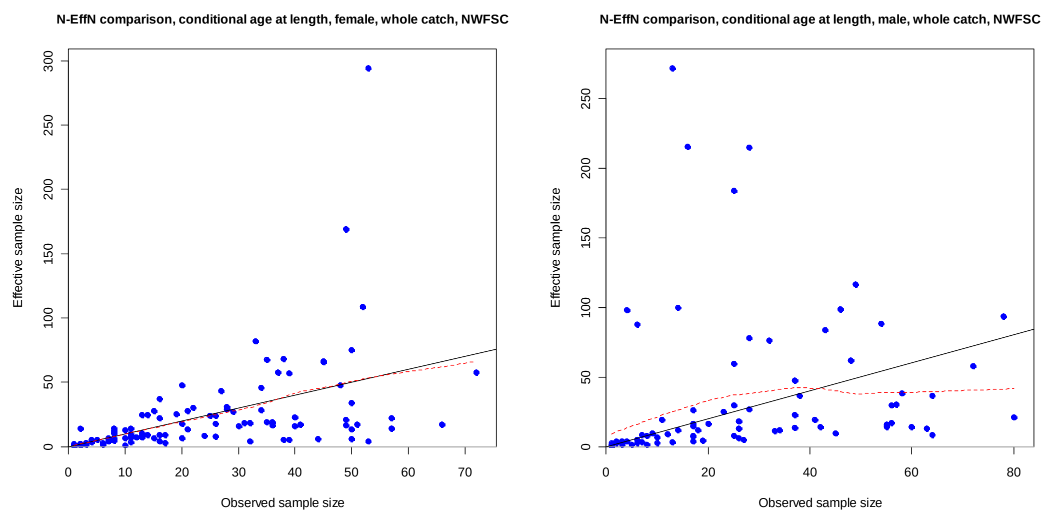


Figure 54. Observed and effective sample sizes for the NWFSC survey conditional age-at-length frequency observations.

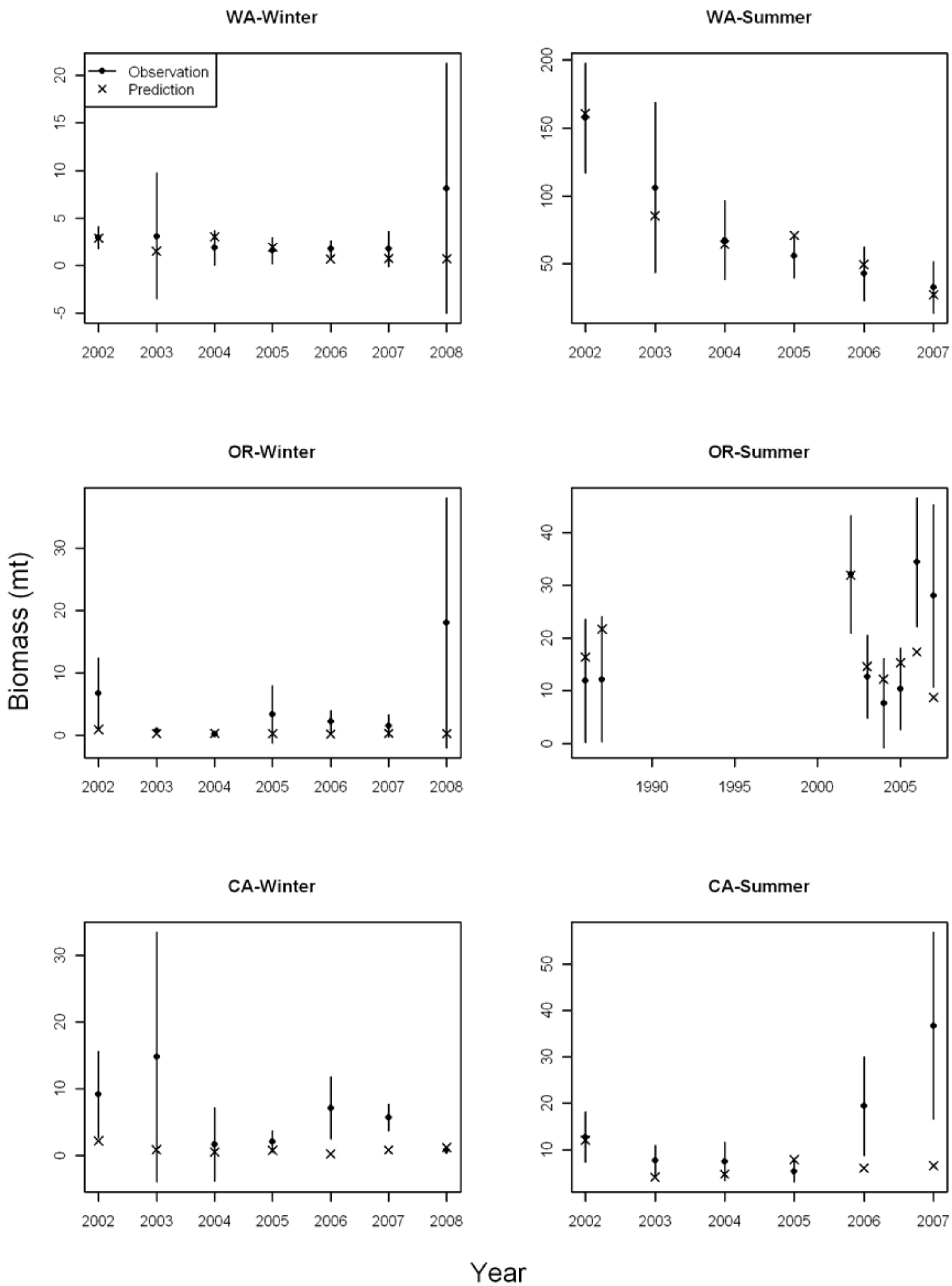


Figure 55: Fits to the total discarded biomass (mt) for each fleet and year for the base case model run.

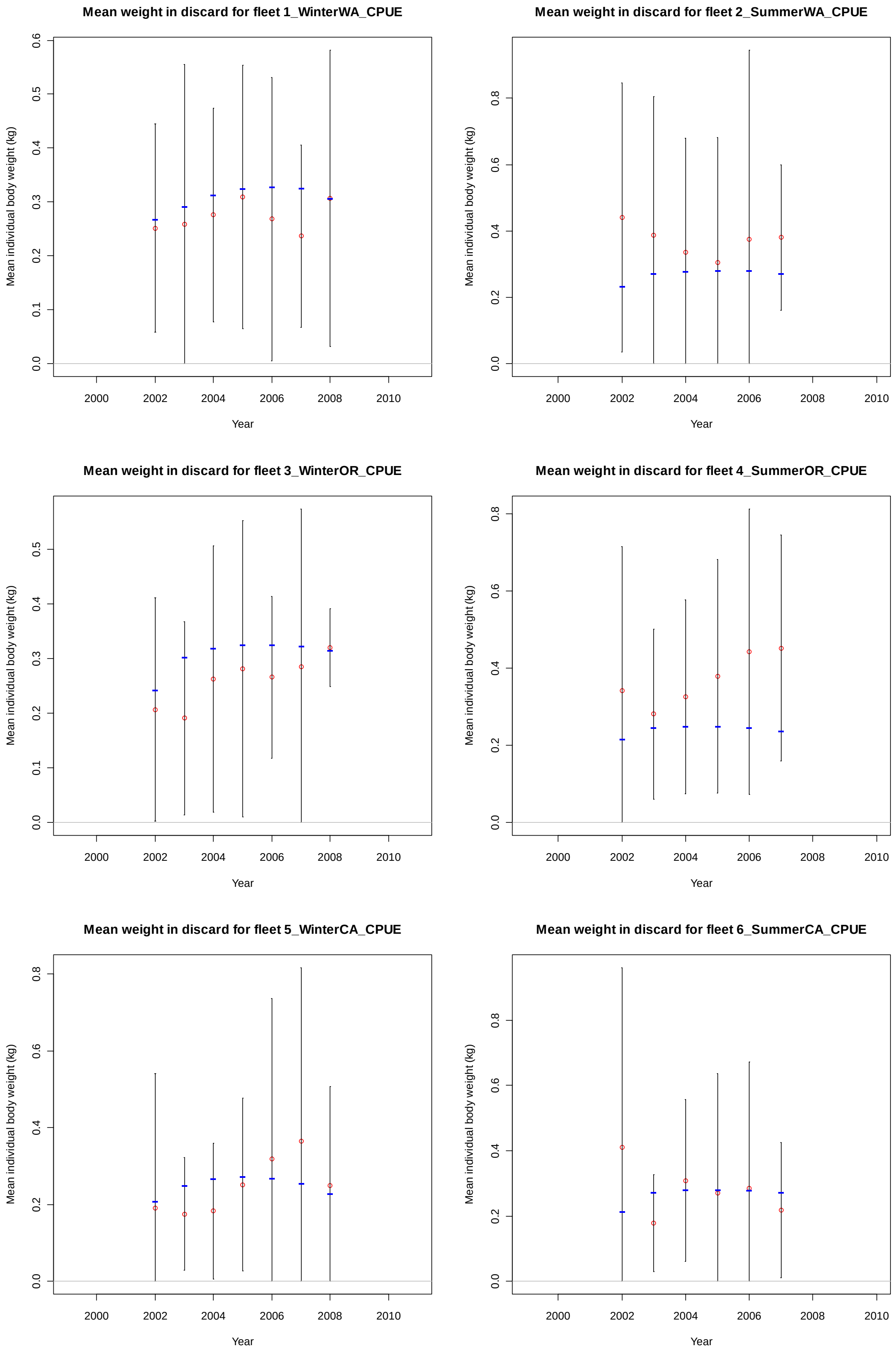


Figure 56. Fit to the mean weight of the discards recorded by the WCGOP.

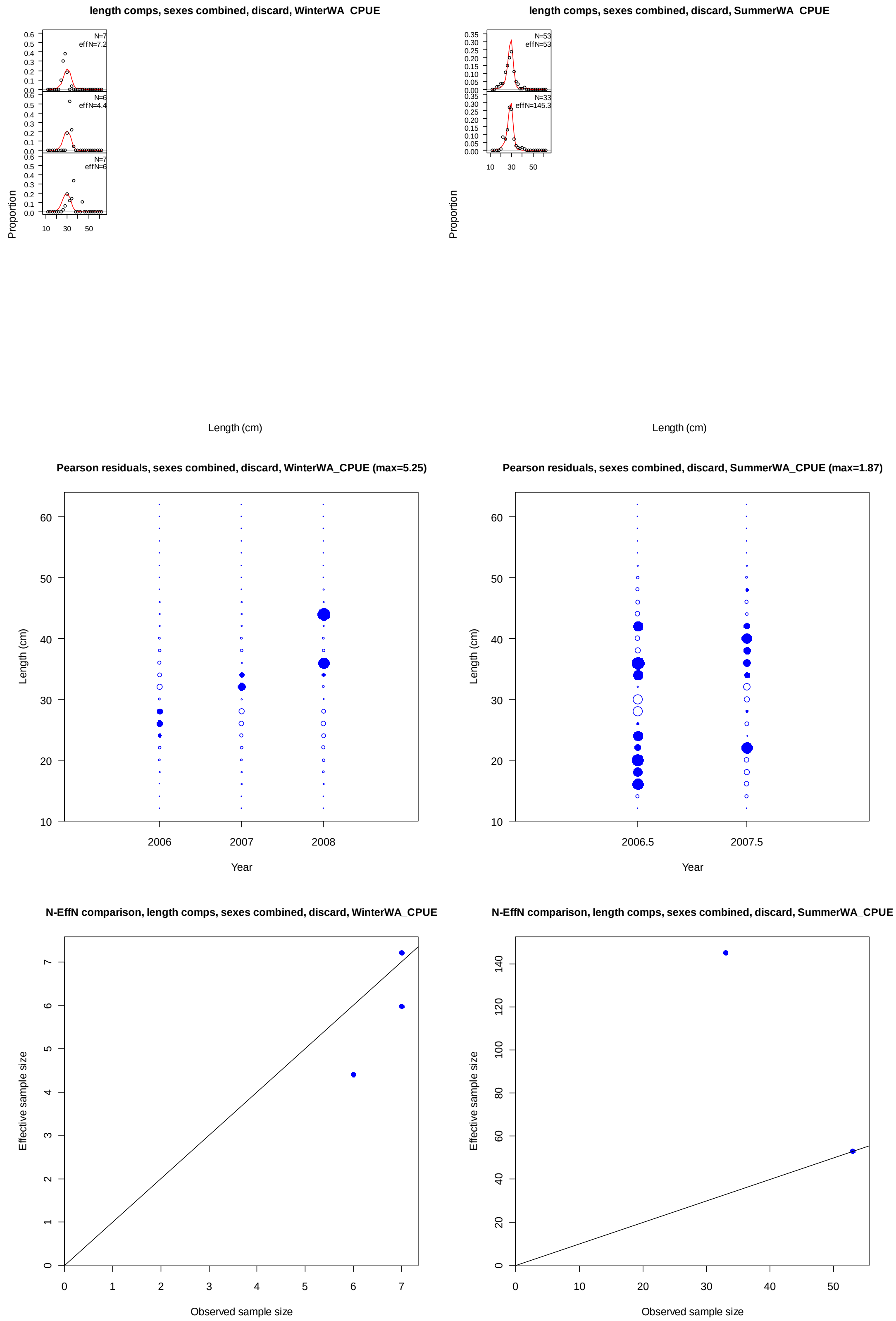


Figure 57. Fit to the Washington fleet discard length compositions.

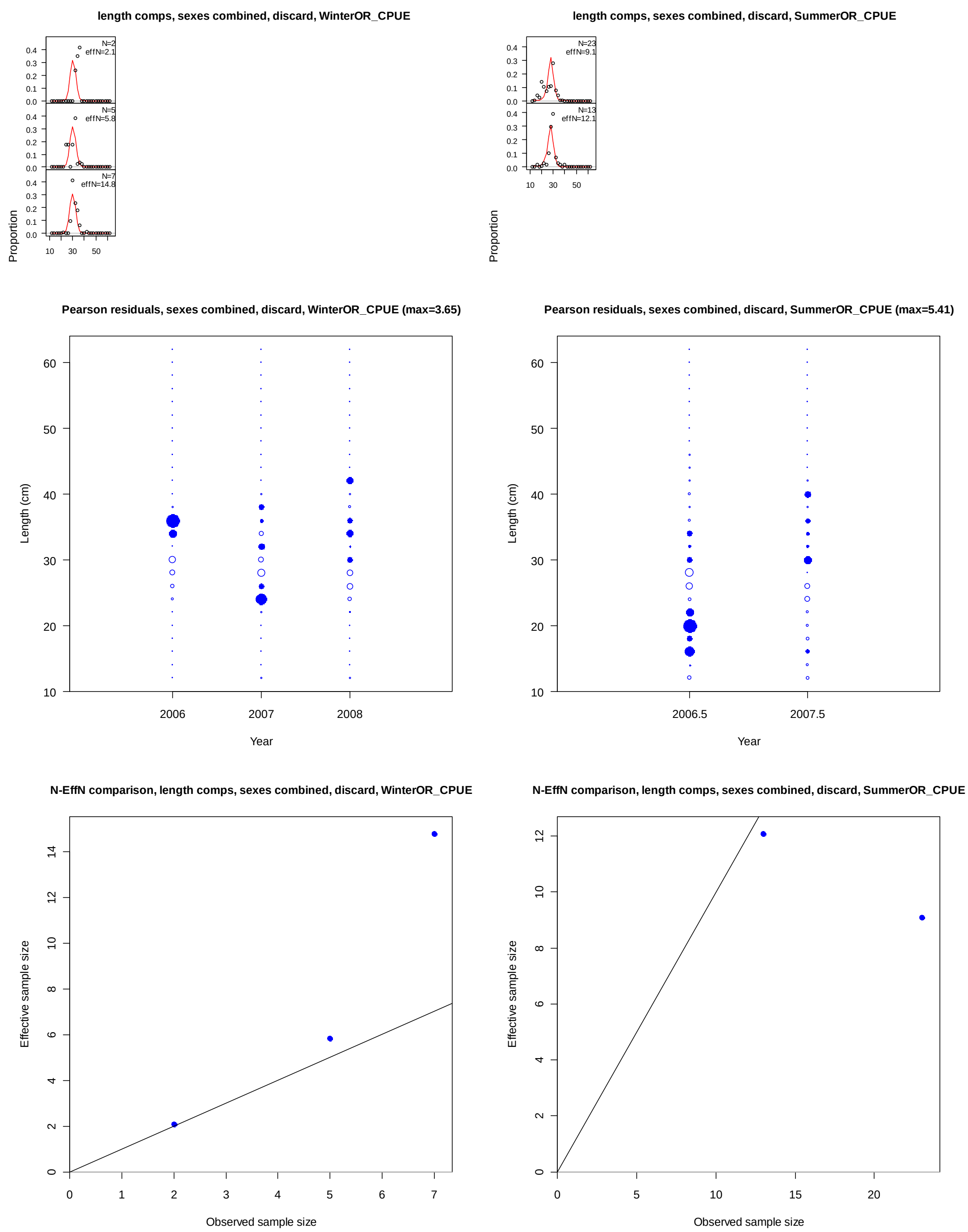


Figure 58. Fit to the Oregon fleet recent discard length compositions from the WCGOP.

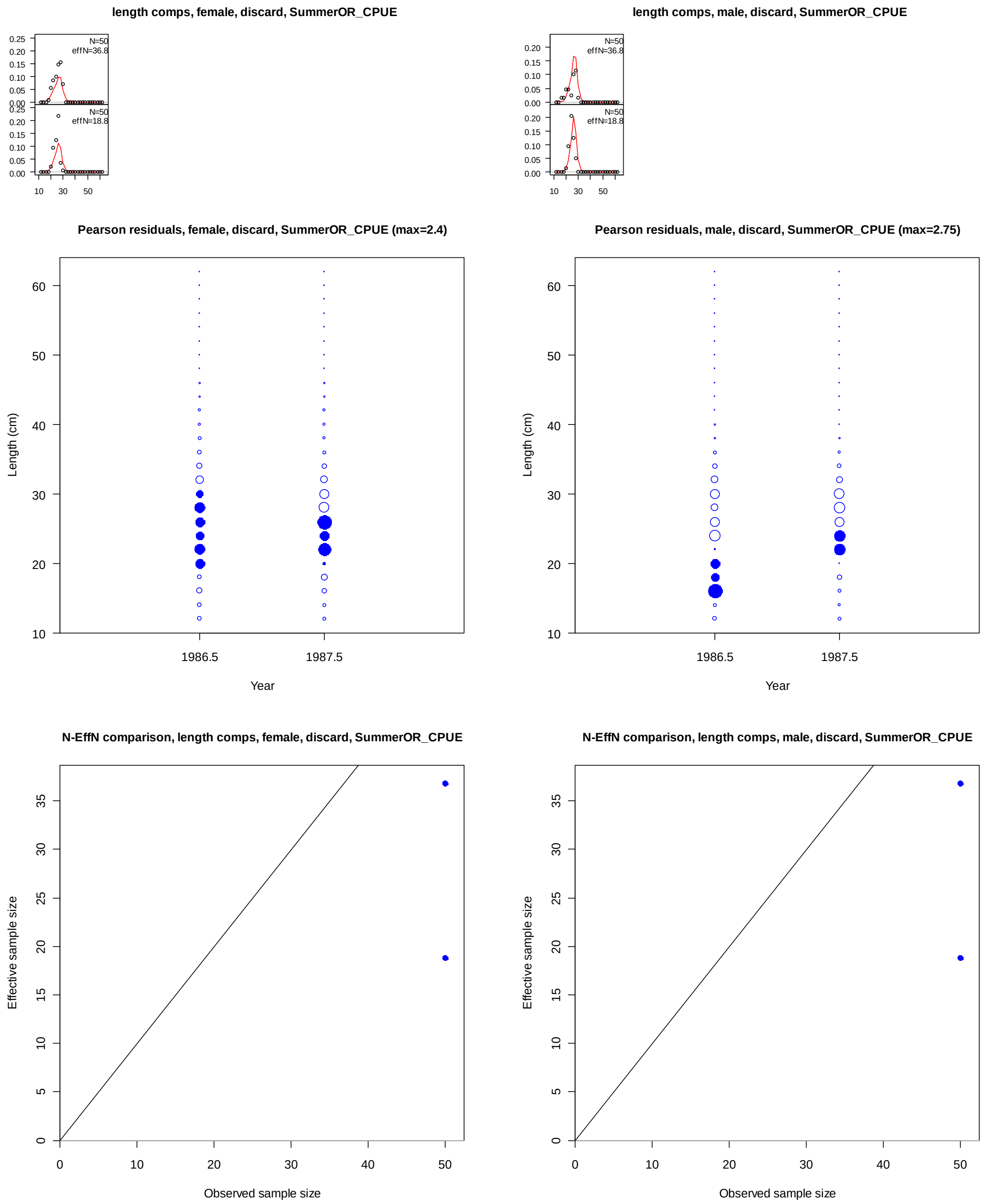


Figure 59. Fit to the Oregon fleet discard length compositions from Pikitch et al (1988).

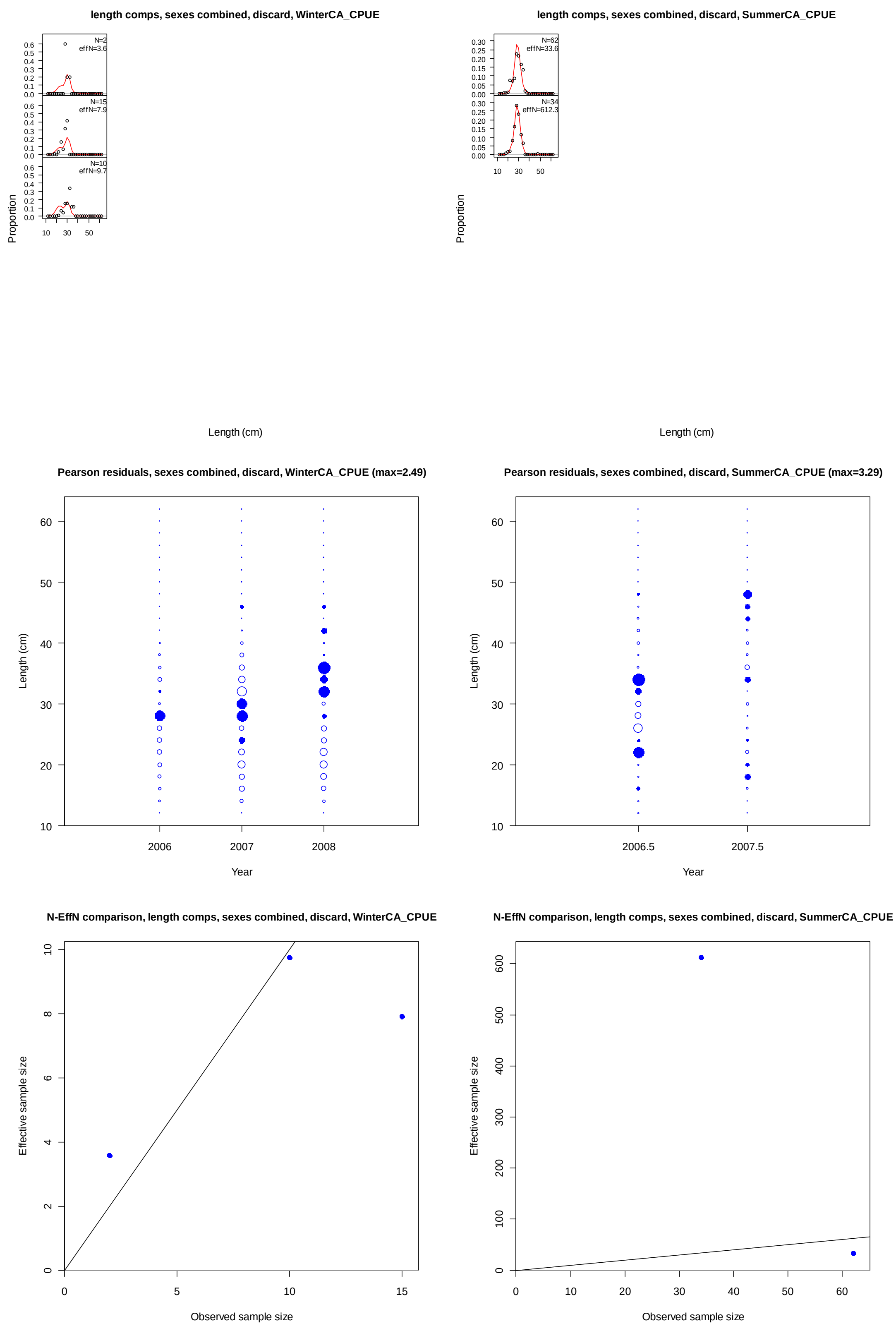


Figure 60. Fit to the California fleet discard length compositions.

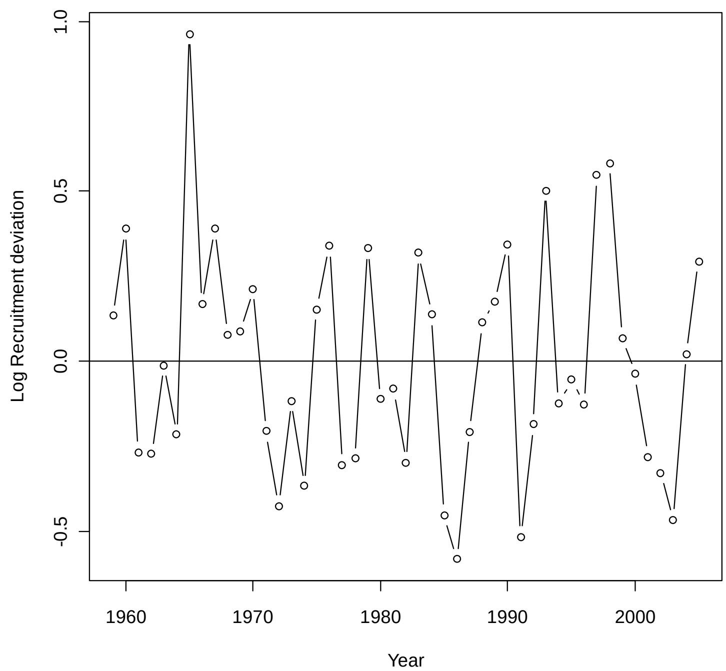


Figure 61. Log recruitment deviations from the base case model run.

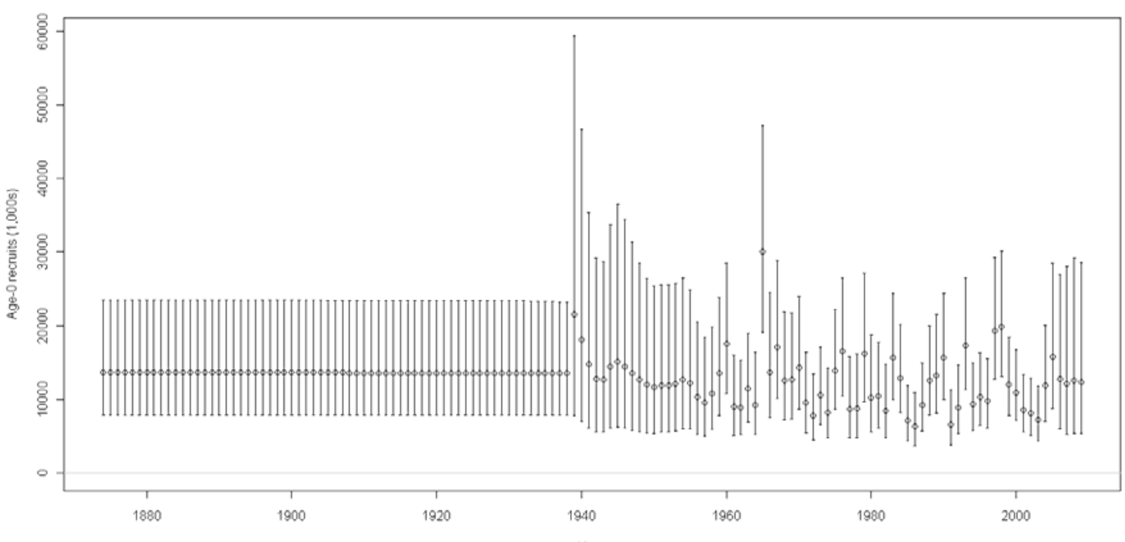


Figure 62. Time series of estimated petrale sole recruitments for the base case model (round points) with approximate asymptotic 95% confidence interval (horizontal lines).

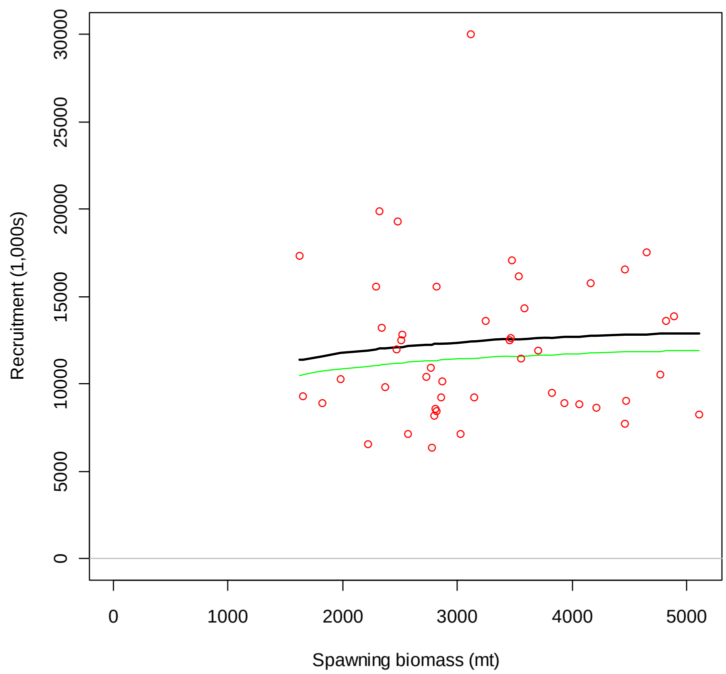


Figure 63. Stock-recruit function with predicted recruitments (points) and bias-corrected expectation (light line).

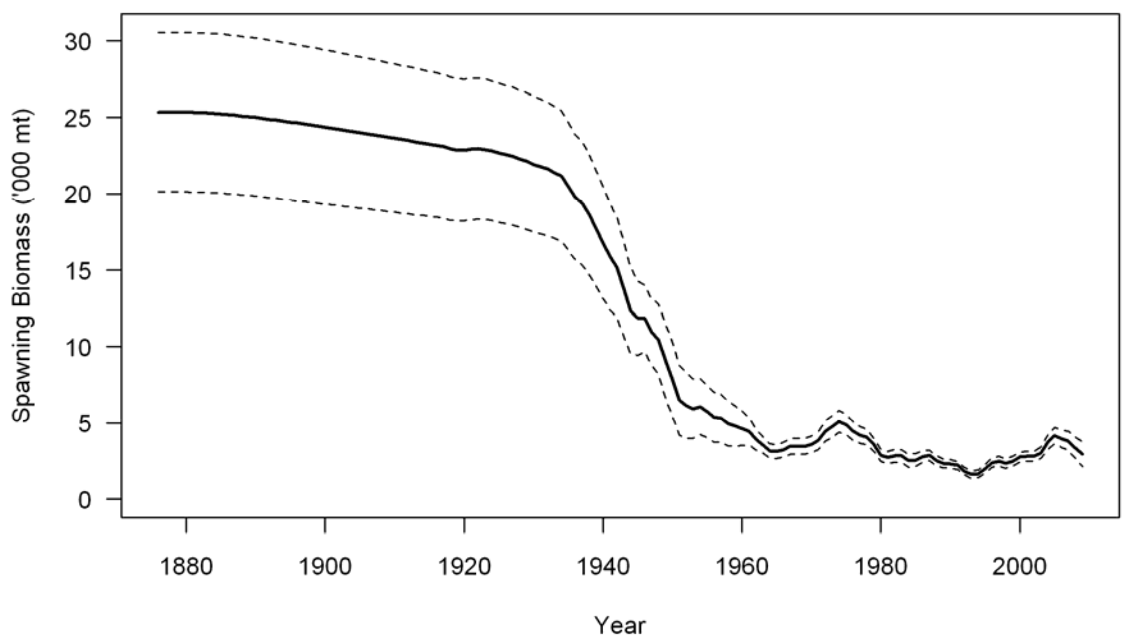


Figure 64. Estimated spawning biomass time-series (1916-2007) for the base case model (solid line) with approximate asymptotic 95% confidence interval (dashed lines).

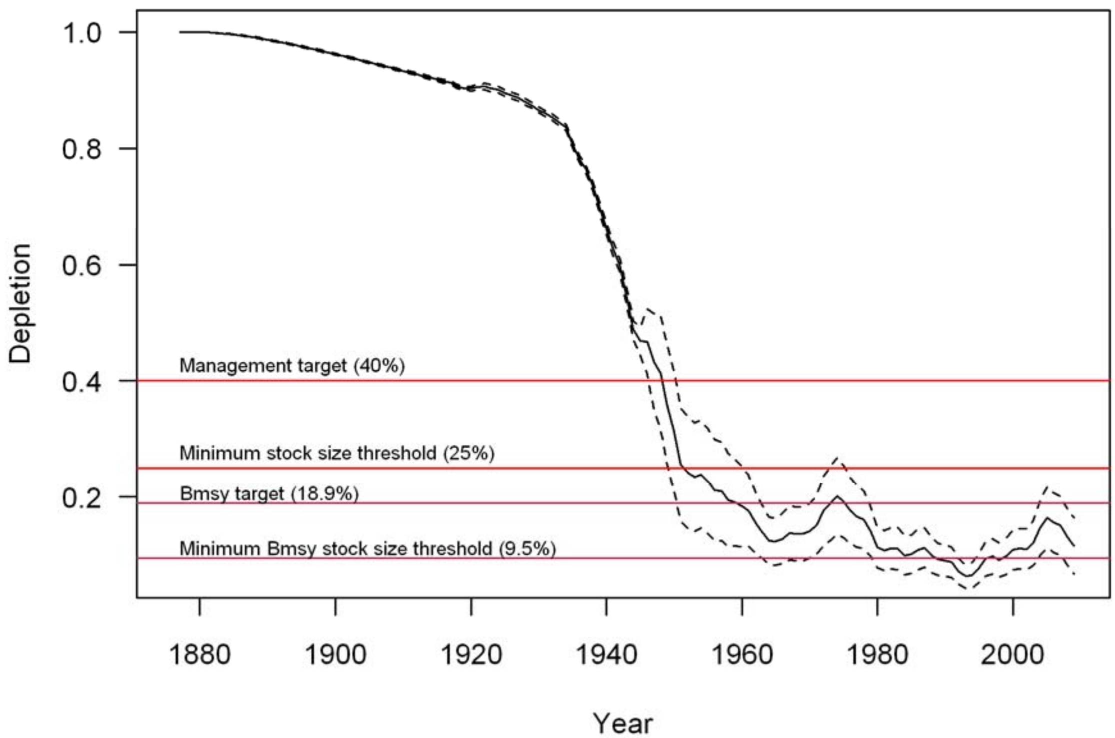


Figure 65. Time series of depletion level as estimated in the base case model (round points) with approximate asymptotic 95% confidence interval (dashed lines) and alternate states of nature (light lines).

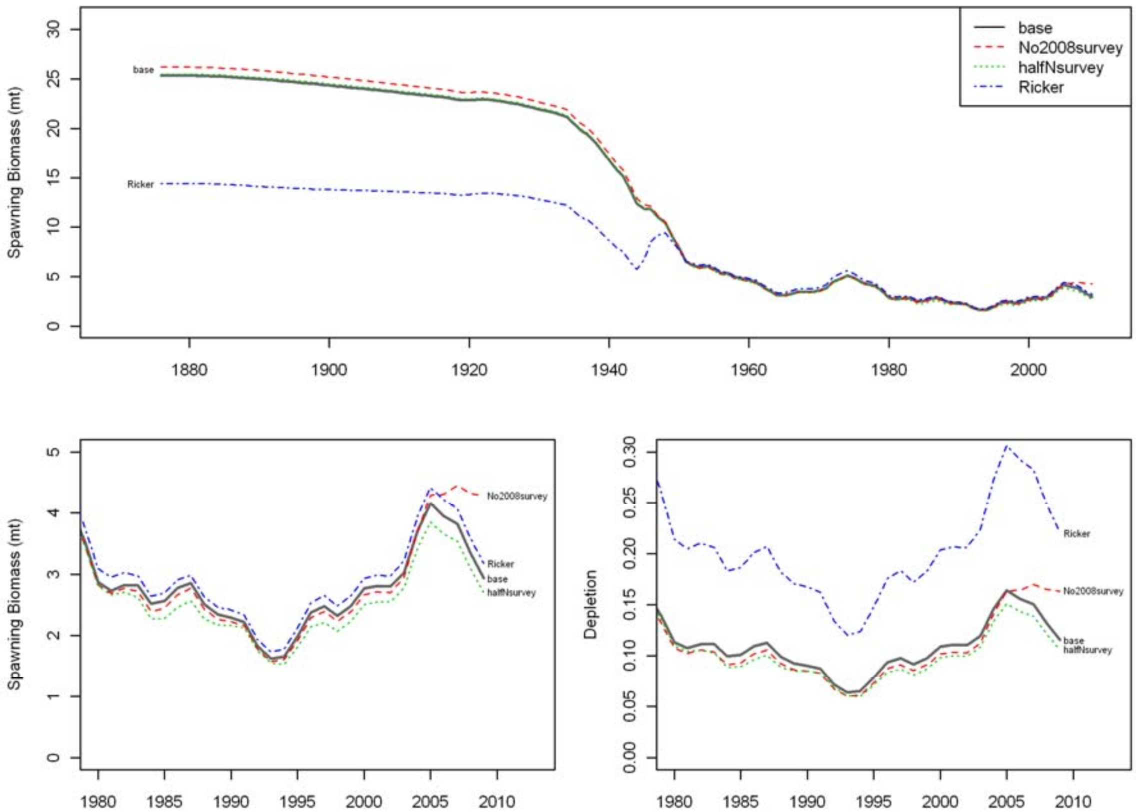


Figure 66. Plot showing sensitivity model runs.

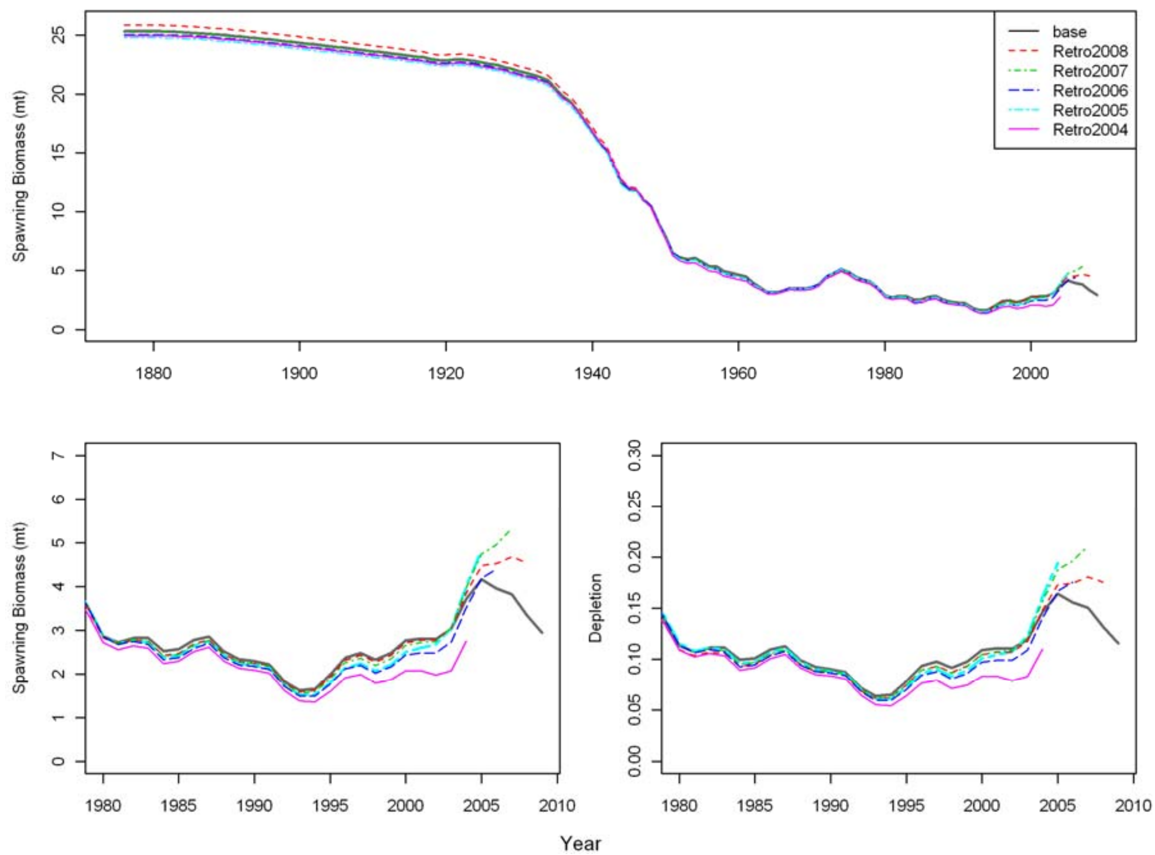


Figure 67. Results from a 5-year retrospective analysis. Each year of retrospective is performed as if the assessment were conducted in that year (i.e., retrospective in 2007 includes data through 2006).

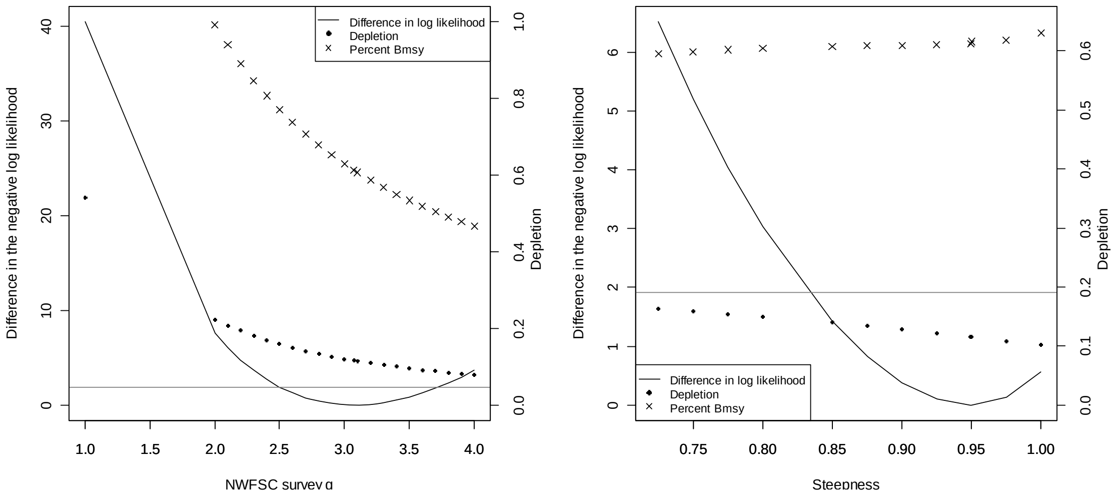


Figure 68. Individual likelihood profiles for the NWFSC survey catchability (q) and stock-recruitment steepness (h) parameters. The negative log likelihood is shown as a solid black line with a grey horizontal line indicating the approximate 95% confidence interval. Depletion (relative to unfished equilibrium biomass) is shown as dots and biomass in 2009 as a percentage of Bmsy is shown as an X's.

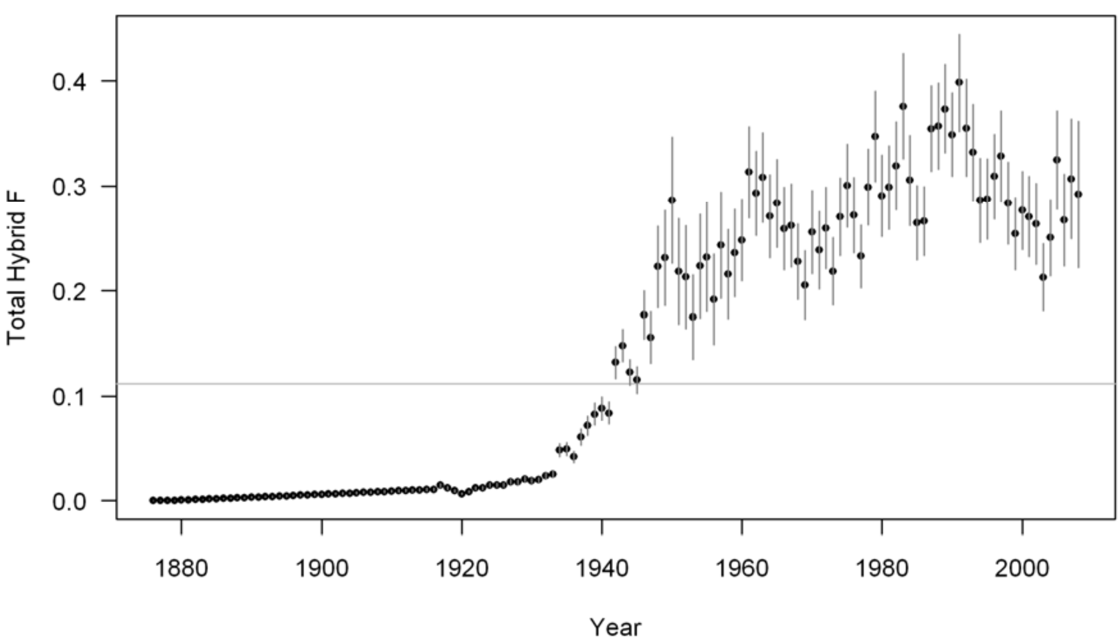


Figure 69. F time-series for all fleets combined.

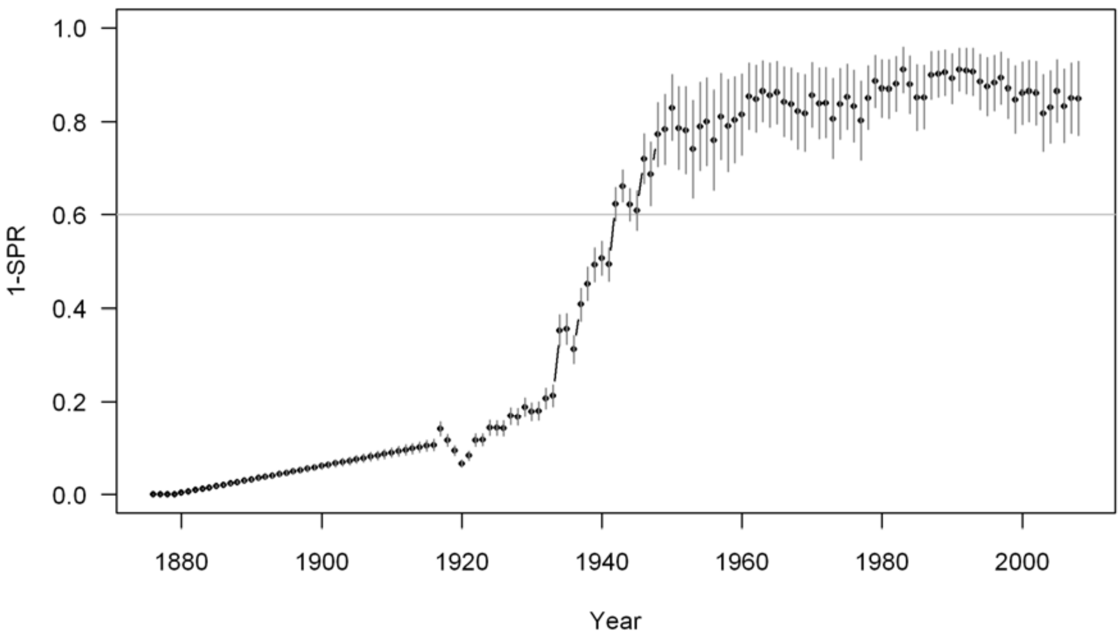


Figure 70. Time series of estimated spawning potential ratio (displayed as 1-SPR) for the base case model (round points). Values of SPR above 0.6 reflect harvests in excess of the current overfishing proxy.

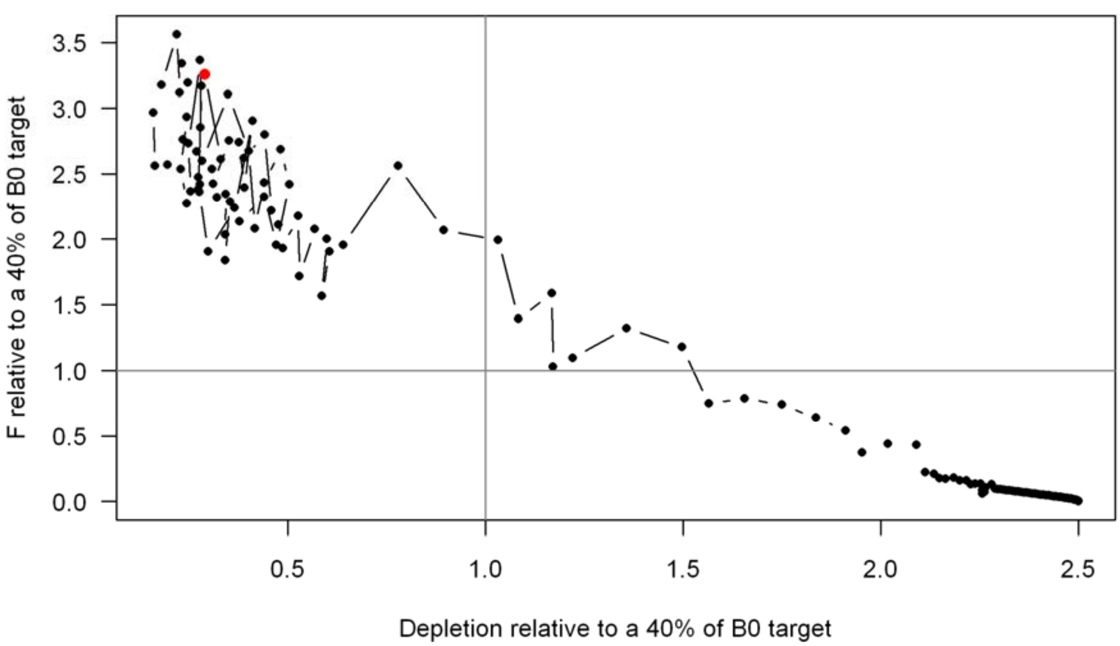


Figure 71. Phase plot of estimated fishing intensity vs. relative spawning biomass for the base case model. Fishing intensity is the relative exploitation rate divided by the level corresponding to the overfishing proxy (0.12). Relative spawning biomass is annual spawning biomass relative to virgin spawning biomass divided by the 40% rebuilding target.

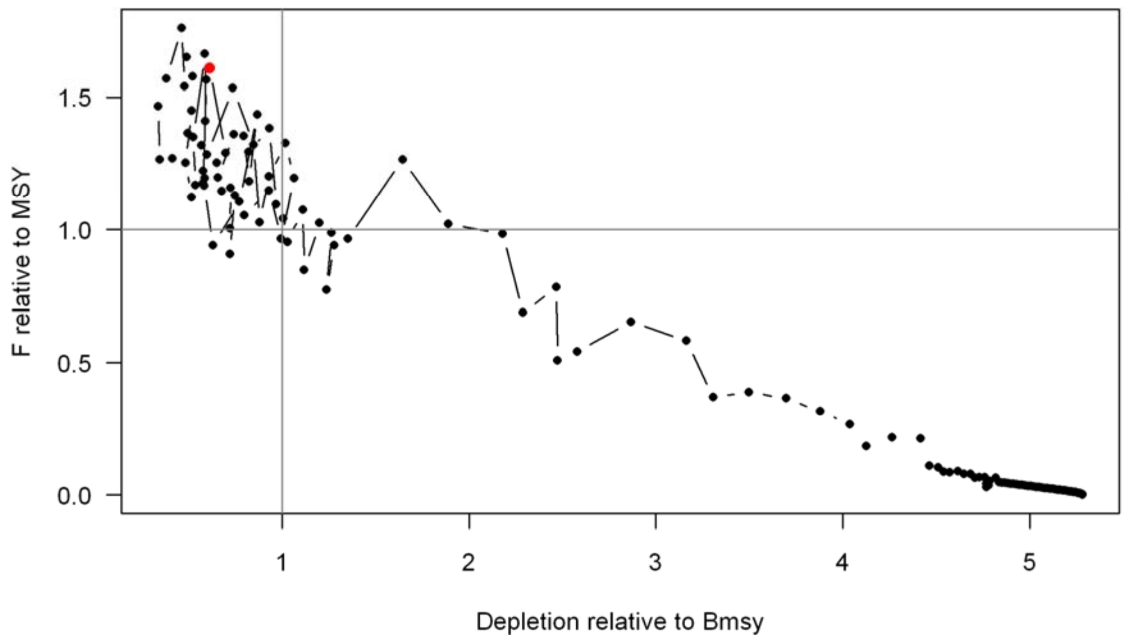


Figure 72. Phase plot of estimated fishing intensity vs. relative spawning biomass for the base case model. Fishing intensity is the relative exploitation rate divided by the level corresponding to Fmsy. Relative spawning biomass is annual spawning biomass relative to the model estimate of Bmsy. The red point is 2009.

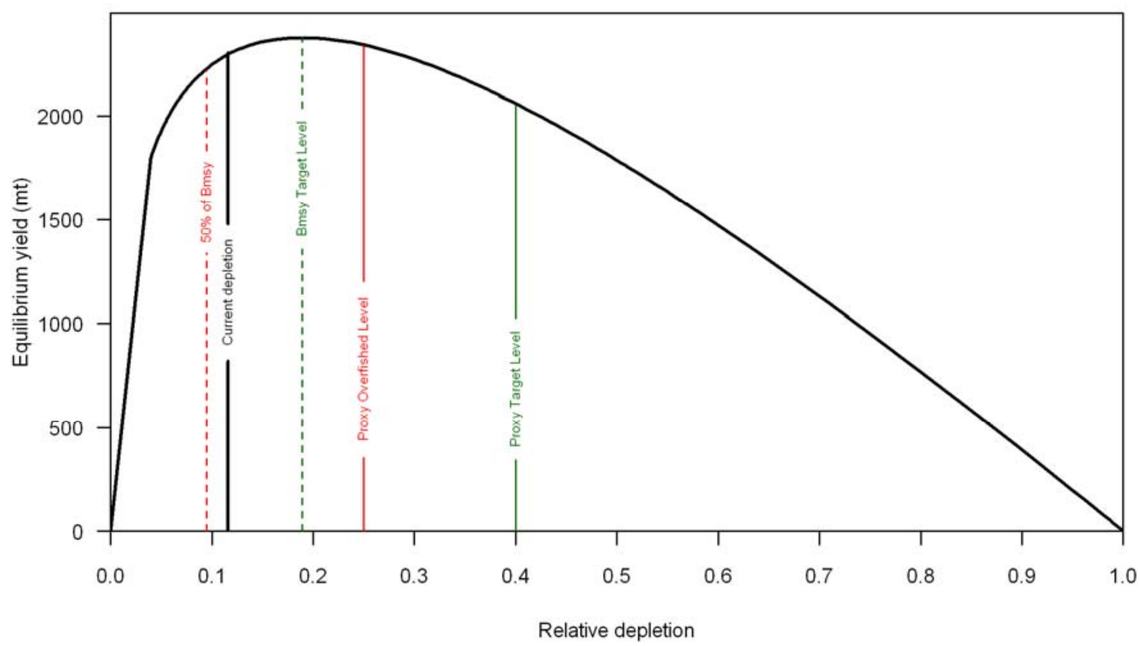


Figure 73. Equilibrium yield curve for the base case model. Values are based on 2008 fishery selectivity.

12. Appendix A: Post stratification of the Triennial and NWFSC surveys

The default stratification from the Triennial and NWFSC surveys is not necessarily the best stratification when analyzing the survey data for Petrale sole. The last Petrale assessment (Lai et al) post-stratified the Triennial survey data based on a Bayesian changepoint analysis of the length as a function of depth. The reasoning behind the changepoint analysis was that Petrale show an ontogenetic migration to deeper water. Therefore the mean length would increase with depth until some point when the slope of the relationship would decrease due to mixing of adult fish. Their results showed median changepoints of 114 m and 144 m for females and males, respectively, and they chose to post-stratify the survey data into three strata (50–100 m, 100–155 m, and 155–700 m).

We chose to revisit the post-stratification because the NWFSC survey was not analyzed in the 2005 assessment. Lai et al (2005) used Bayesian statistics with uninformative priors and MCMC sampling to calculate the posterior distribution. However, we used a frequentist approach since there is no prior information for any of the parameters, and the problem in the frequentist paradigm allows for quick point estimates which are used as guidance for the strata definitions.

Piecewise linear regression is similar to linear regression except that the data are split into two parts by a breakpoint, and separate linear relationships describe each part. In mathematical terms,

$$L = \alpha_1 + \beta_1 d \quad d \le \delta$$
$$L = \alpha_2 + \beta_2 d \quad d \ge \delta$$

Furthermore, because we are assuming that the fish are migrating to deeper water, the relationship at the breakpoint (δ) should be continuous. In other words, the relationships to the two pieces are equal at the breakpoint.

$$\alpha_1 + \beta_1 \delta = \alpha_2 + \beta_2 \delta$$
$$\alpha_2 = \beta_1 + \delta(\beta_1 - \beta_2)$$

Substituting in and rearranging the equations we arrive at the same model used by Lai et al. (2005).

$$L = \omega + \beta_1 (d - \delta) \quad d \le \delta$$
$$L = \omega + \beta_2 (d - \delta) \quad d \ge \delta$$

where $\omega = \alpha_1 + \beta_1 \delta = \alpha_2 + \beta_2 \delta$, or the length at the breakpoint. There are four parameters to estimate.

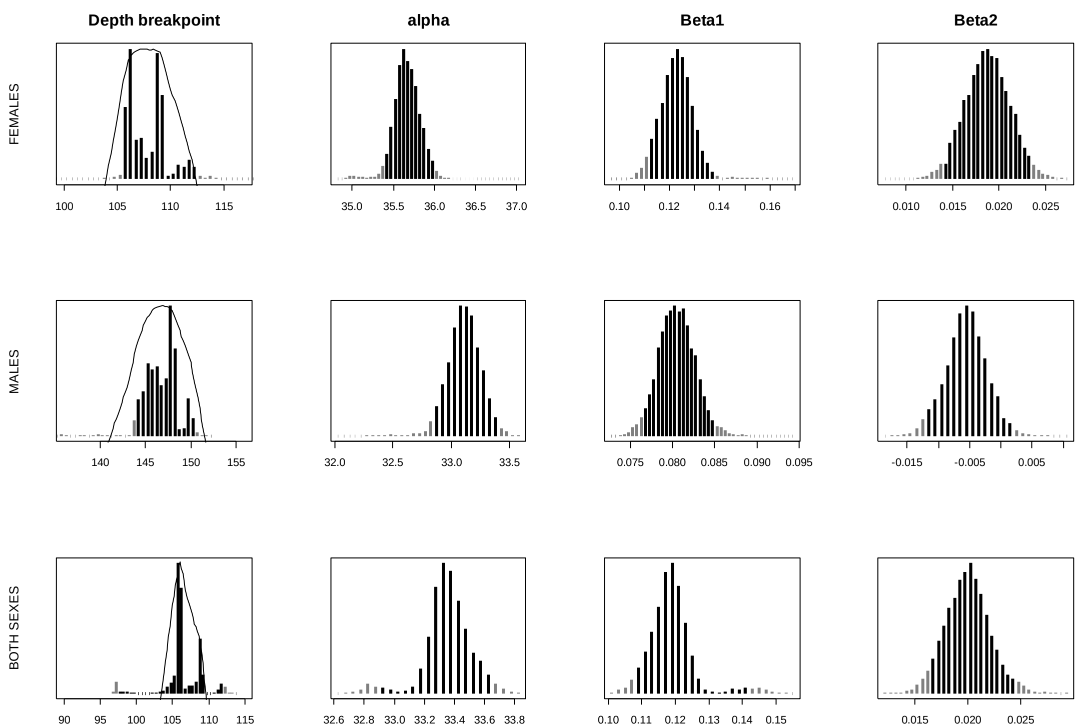
The parameters were estimated by minimizing the sum of the squared residuals and non-parametric bootstrapping was used to estimate the 95% confidence intervals.

Furthermore, likelihood profiles were compared with these confidence intervals after assuming that the residuals were normally distributed with equal variance.

The results here agreed with the analysis performed by Lai et al (2005), and we also chose a breakpoint at 100 m. A breakpoint around 110 m may be more reasonable, but strata specific values, such as stratum area, is more easily available with a breakpoint at 100 m.

Table A3: 95% confidence intervals of the breakpoint from the likelihood profiles and bootstraps for each survey.

	Triennial		NWFSC	
	Profile	Bootstrap	Profile	Bootstrap
Female	**104.2–112.2**	**105.2–112.1**	**105.2–121.2**	**104.3–120.4**
Male	**141.2–151.4**	**143.7–150.0**	**146.0–159.8**	**144.2–160.8**
Both	**103.6–109.4**	**97.0–112.0**	**112.6–120.8**	**112.8–120.4**



FigureA1: Plot of the Triennial survey bootstrap results from piecewise regression for each sex and all years combined. The line in the depth breakpoint plot is a likelihood profile (the 95% CI is where the profile crosses zero).

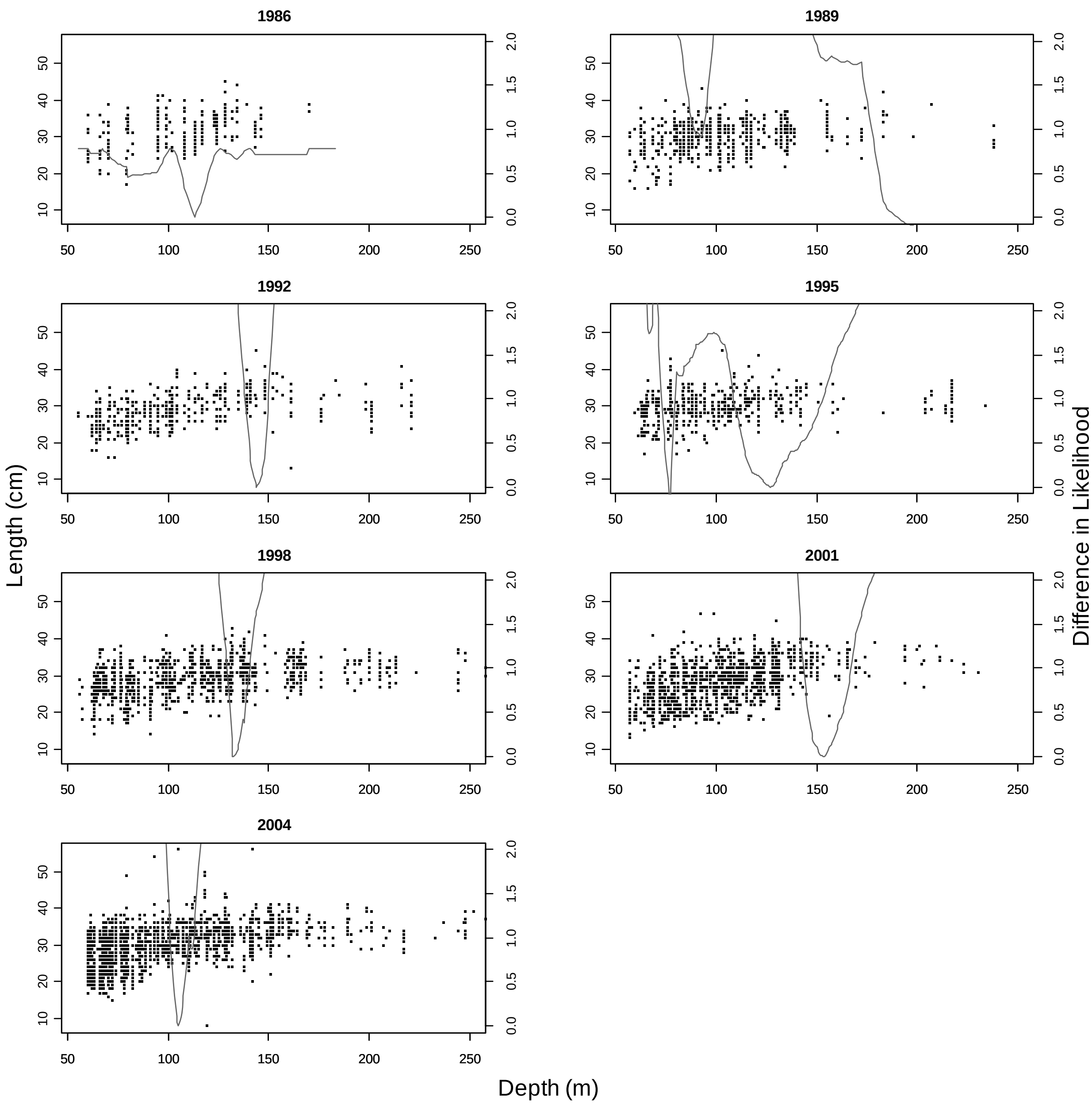


Figure A2: Plots of length vs depth from the Triennial survey for each year and males only with the likelihood profile of the breakpoint overlayed.

NWFSC Survey

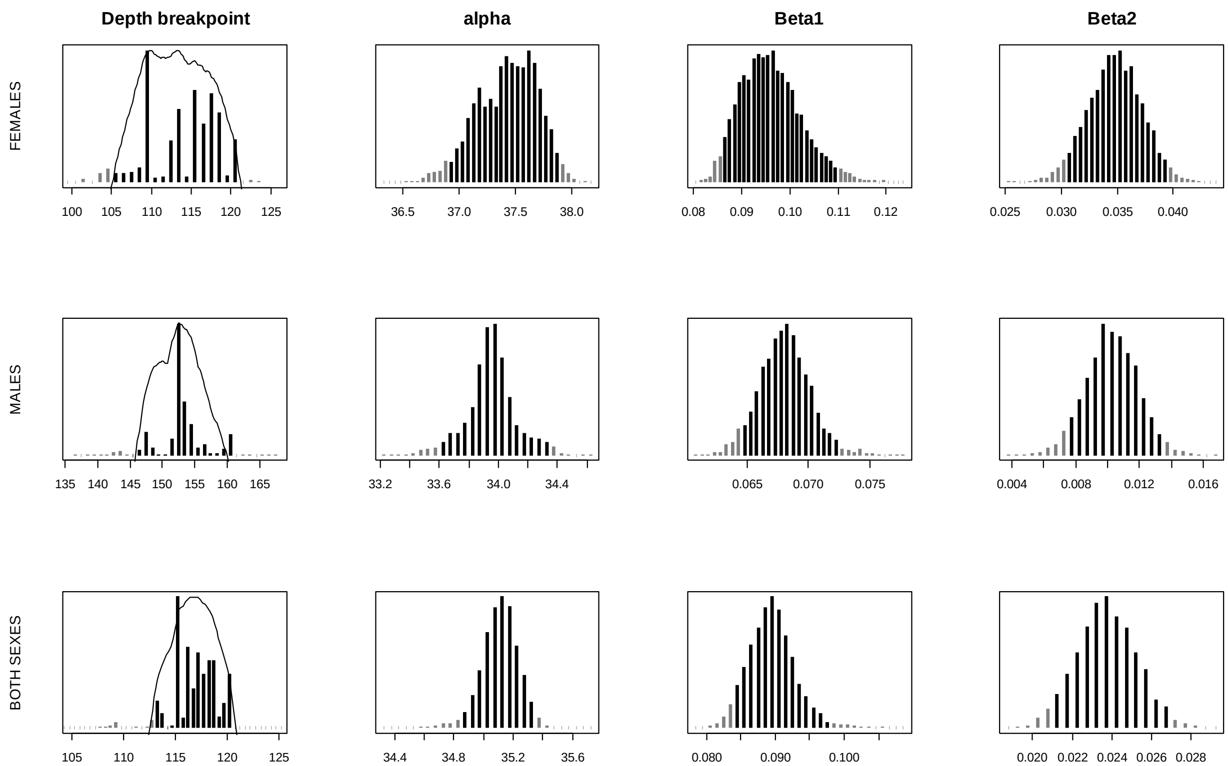
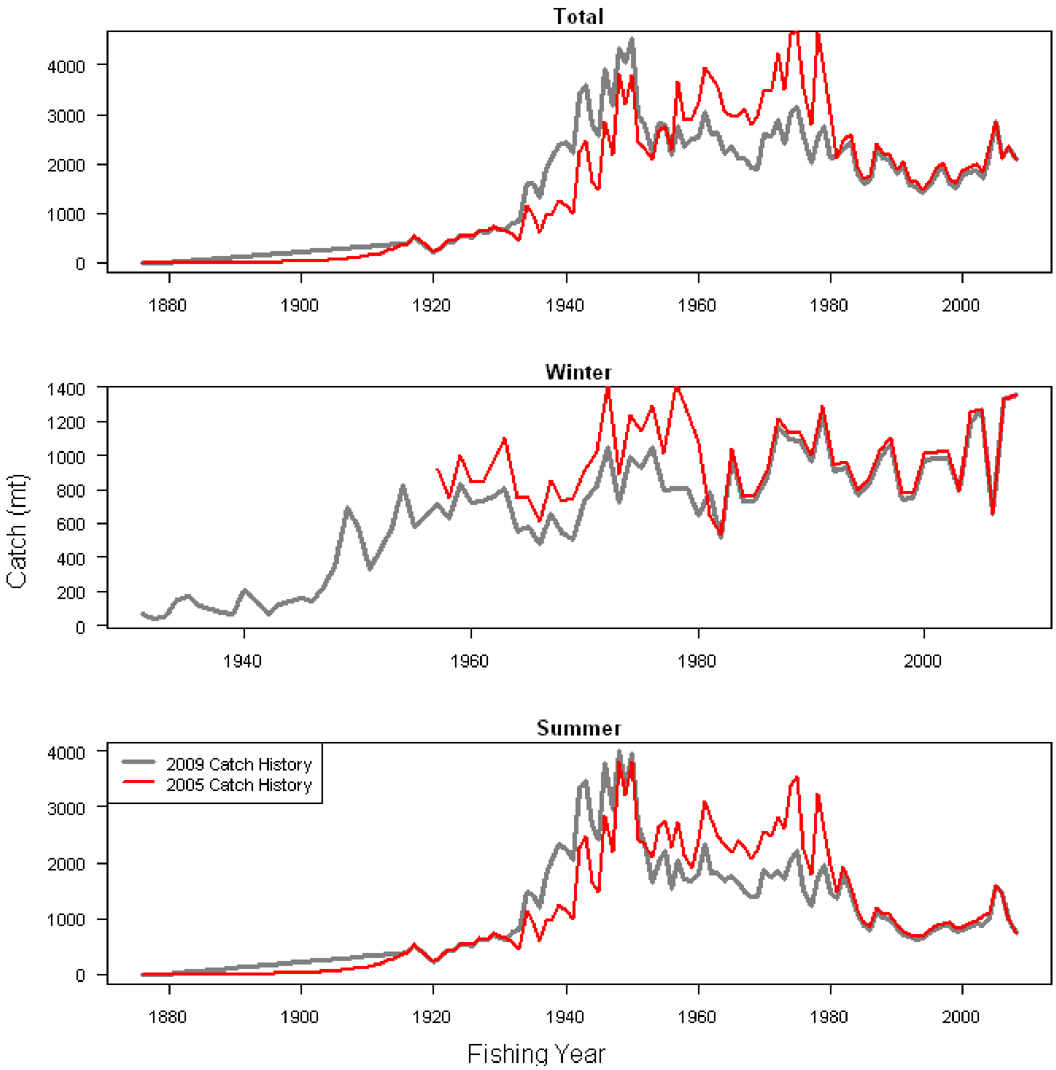


Figure A3: Plot of NWFSC survey bootstrap results from piecewise regression for each sex. The line in the depth breakpoint plot is a likelihood profile (the 95% CI is where the profile crosses zero).

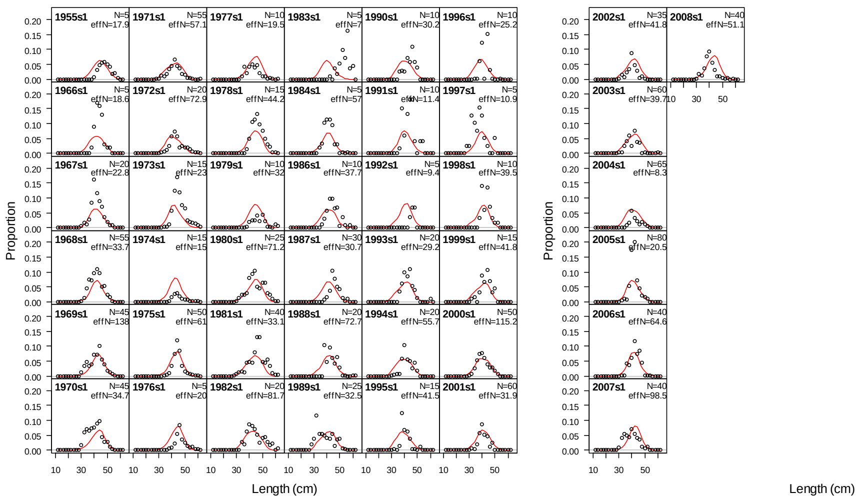
13. Appendix B: Comparison between the 2005 and 2009 catch histories.



14. Appendix C: Model fits and diagnostics for fishery age and length composition data.

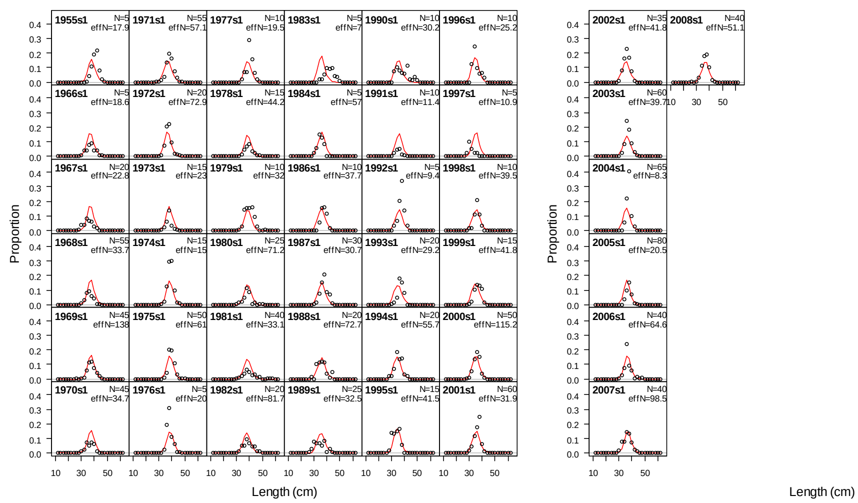
length comps, female, retained, WinterWA_CPUE

length comps, female, retained, WinterWA_CPUE



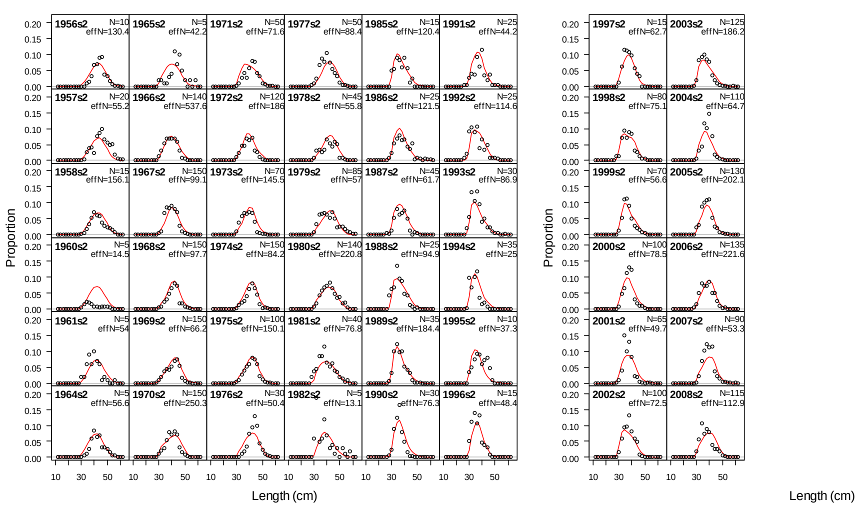
length comps, male, retained, WinterWA_CPUE

length comps, male, retained, WinterWA_CPUE



length comps, female, retained, SummerWA_CPUE

length comps, female, retained, SummerWA_CPUE



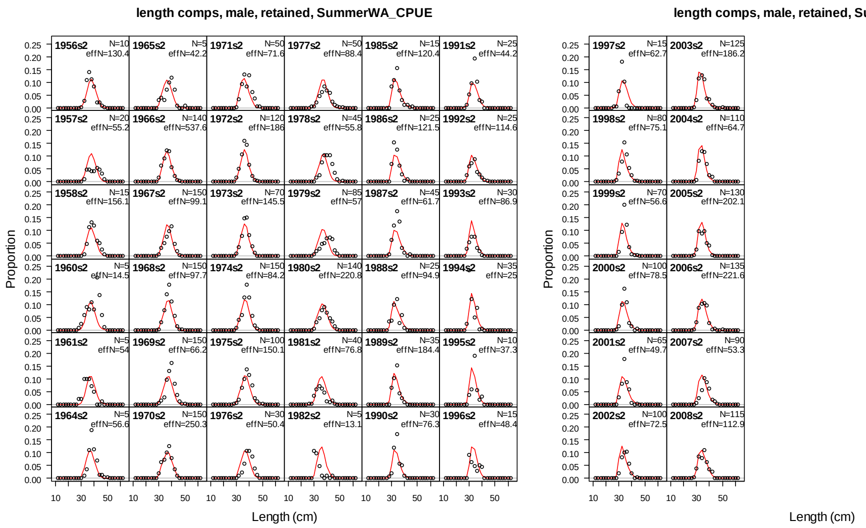


Figure C1. Fit to the Washington fishery length compositions.

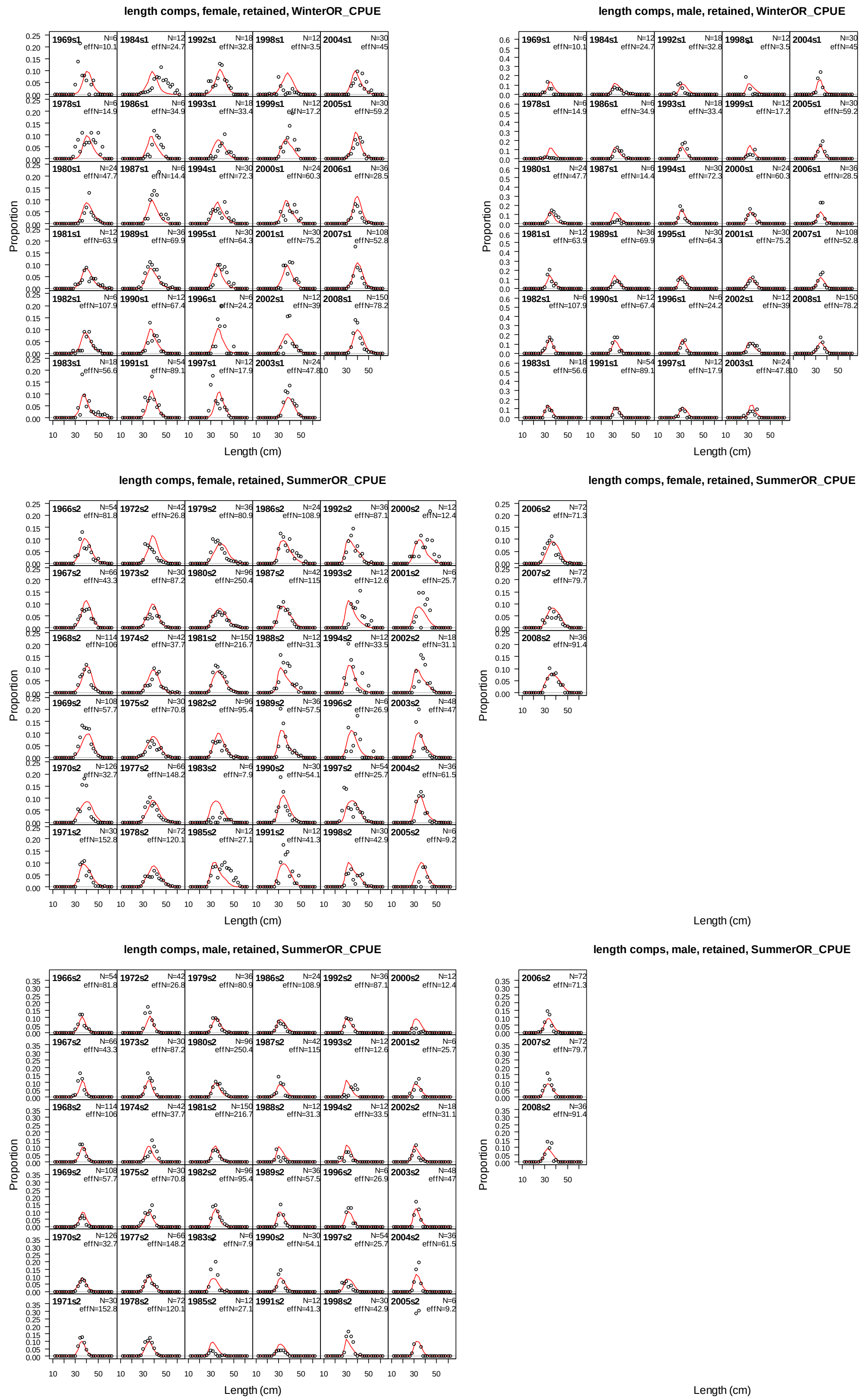
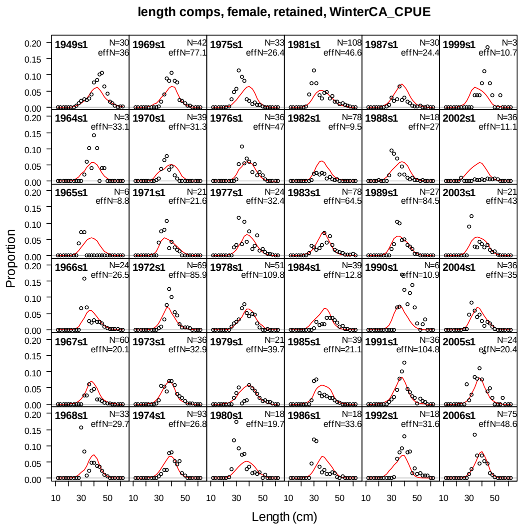
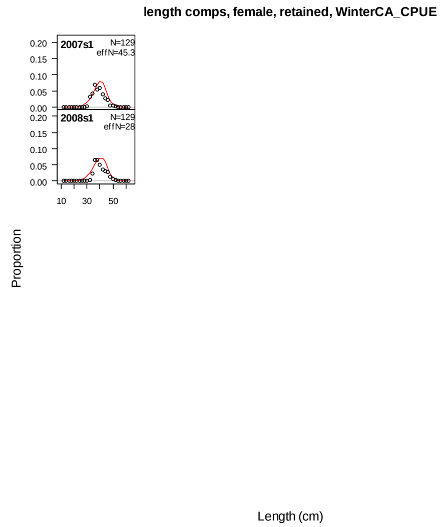
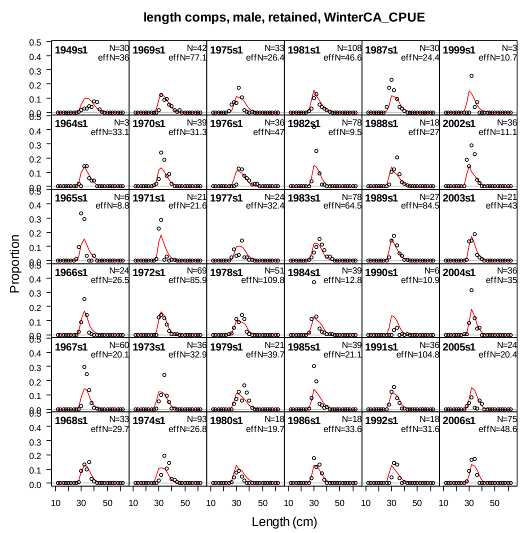
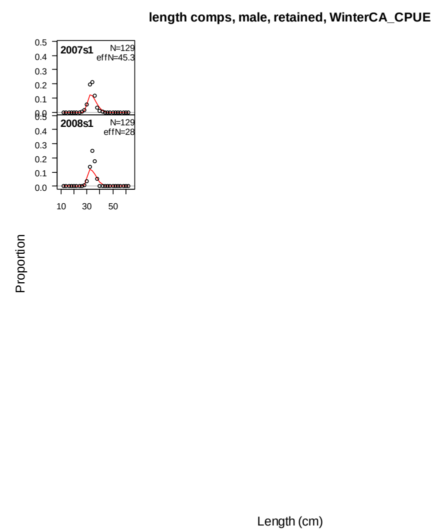


Figure C 2. Fit to the Oregon fishery length compositions.


length comps, female, retained, WinterCA_CPUE
Proportion
Length (cm)


length comps, female, retained, WinterCA_CPUE
Proportion
Length (cm)


length comps, male, retained, WinterCA_CPUE
Proportion
Length (cm)


length comps, male, retained, WinterCA_CPUE
Proportion
Length (cm)

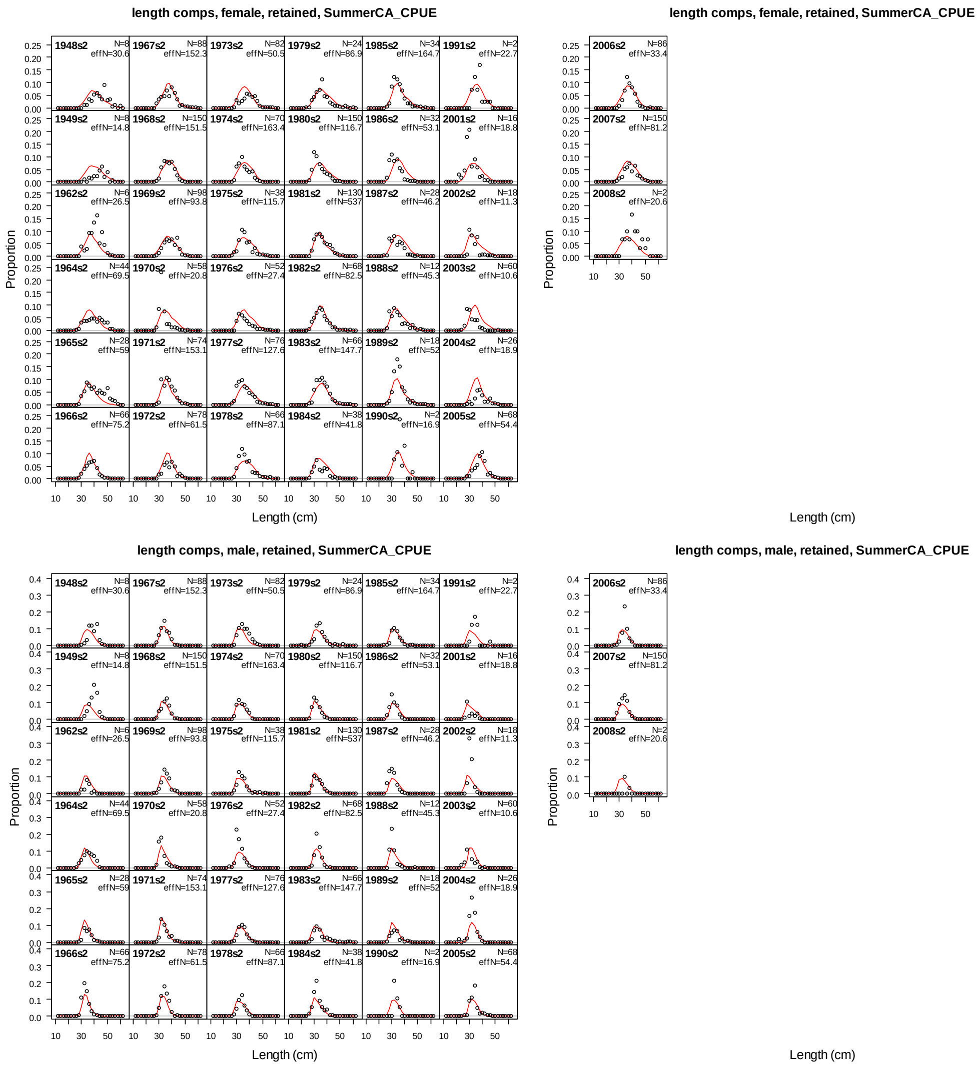


Figure C 3. Fit to the California fishery length compositions.

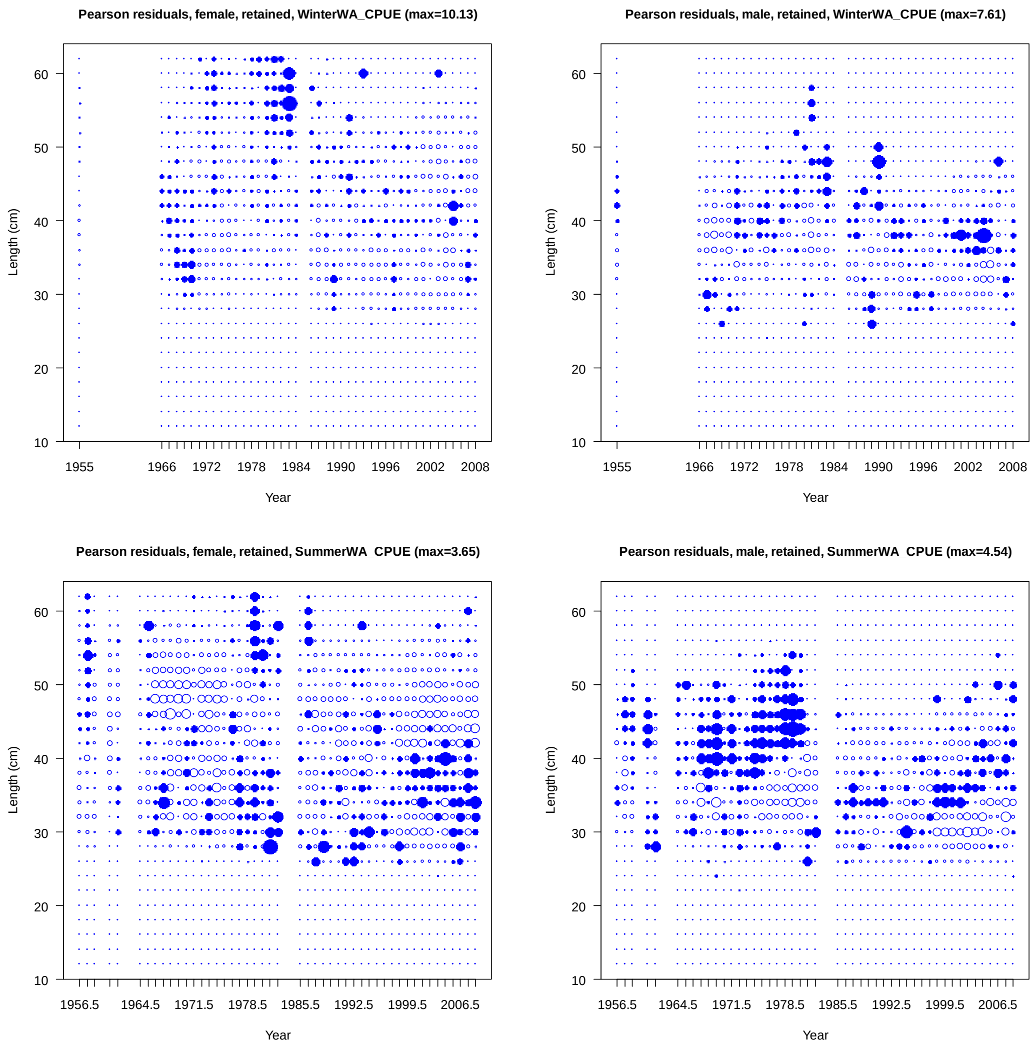


Figure C4. Pearson residuals for the Washington fishery length compositions.

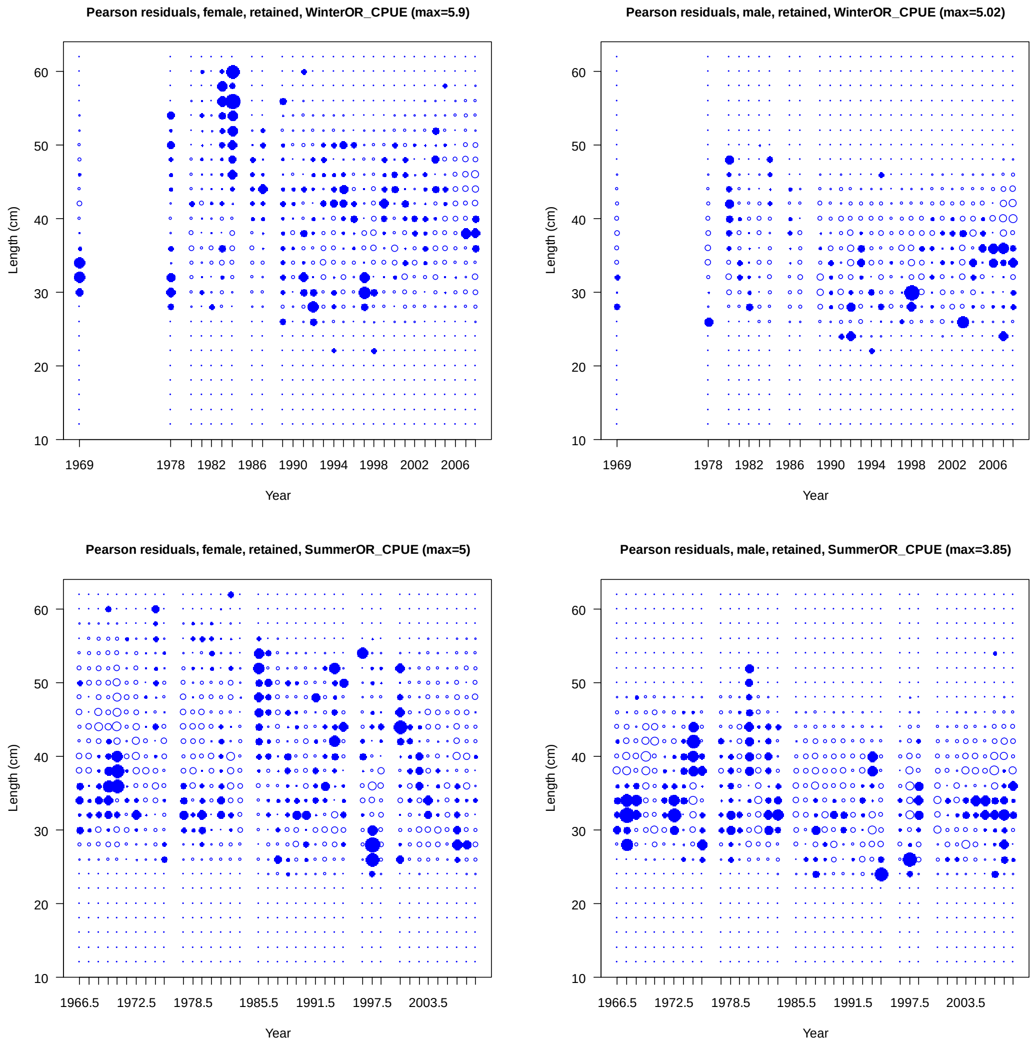


Figure C5. Pearson residuals for the Oregon fishery length compositions.

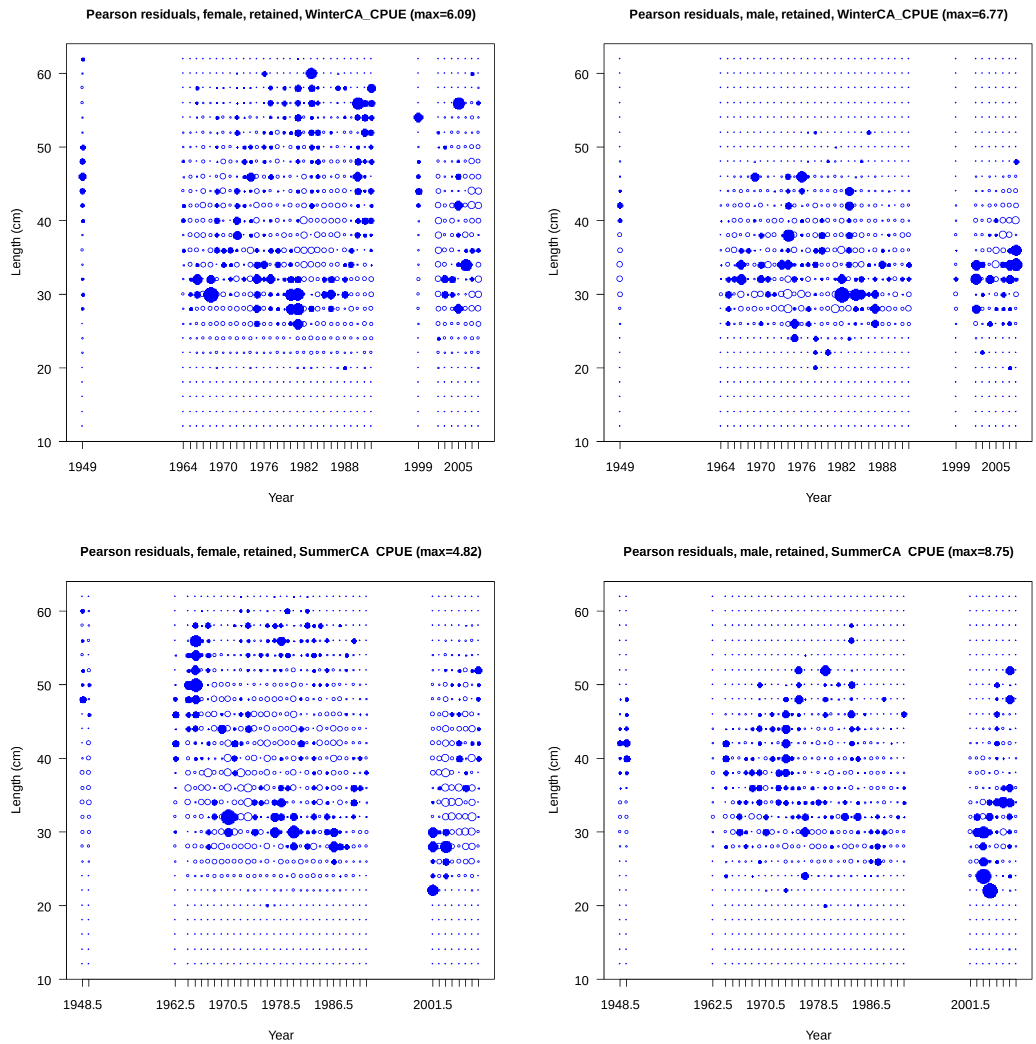


Figure C 6. Pearson residuals for the California fishery length compositions.

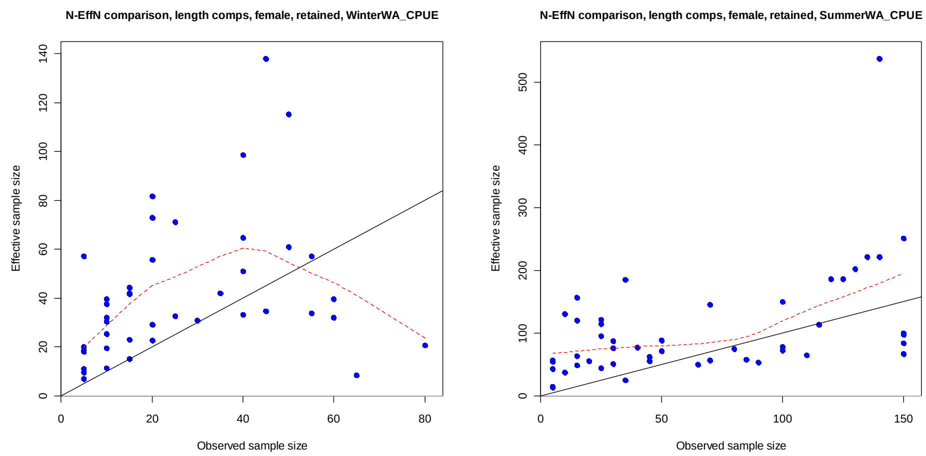


Figure C7. Effective N for the Washington fishery length compositions.

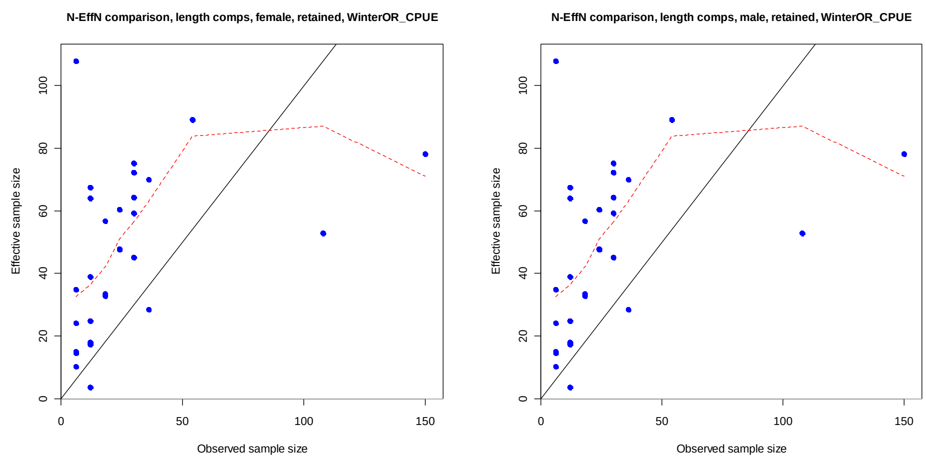


Figure C8. Effective N for the Oregon fishery length compositions.

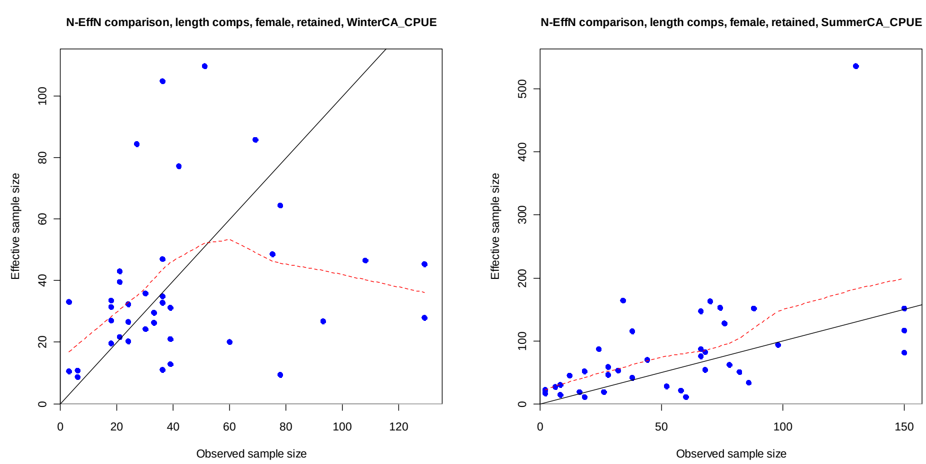
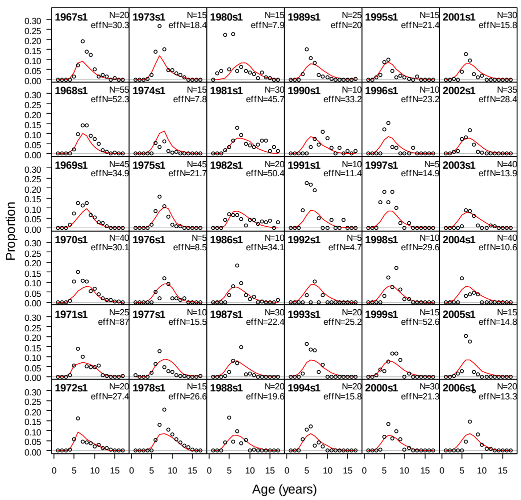
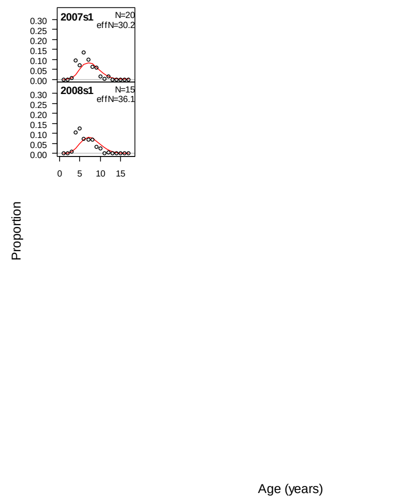


Figure C9. Effective N for the California fishery length compositions.

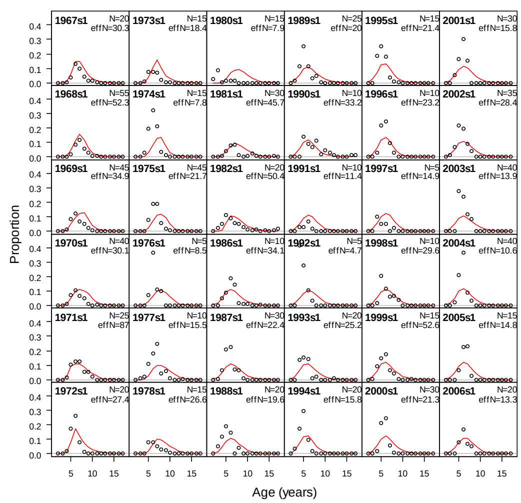
age comps, female, retained, WinterWA_CPUE



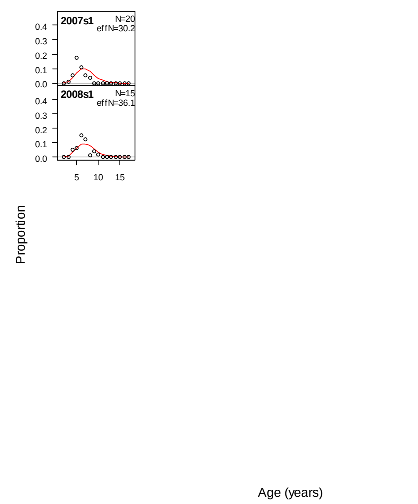
age comps, female, retained, WinterWA_CPUE



age comps, male, retained, WinterWA_CPUE



age comps, male, retained, WinterWA_CPUE



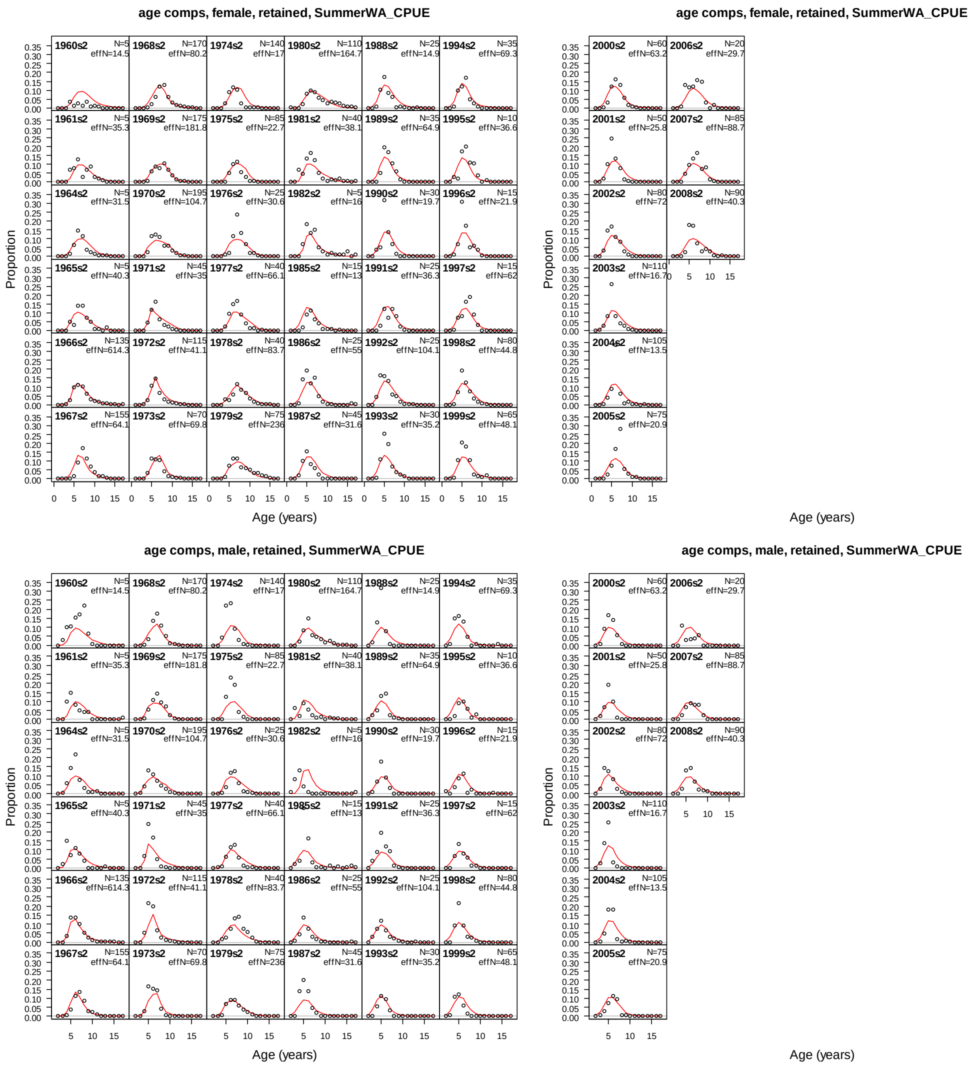


Figure C10. Fit to the Washington fishery age compositions.

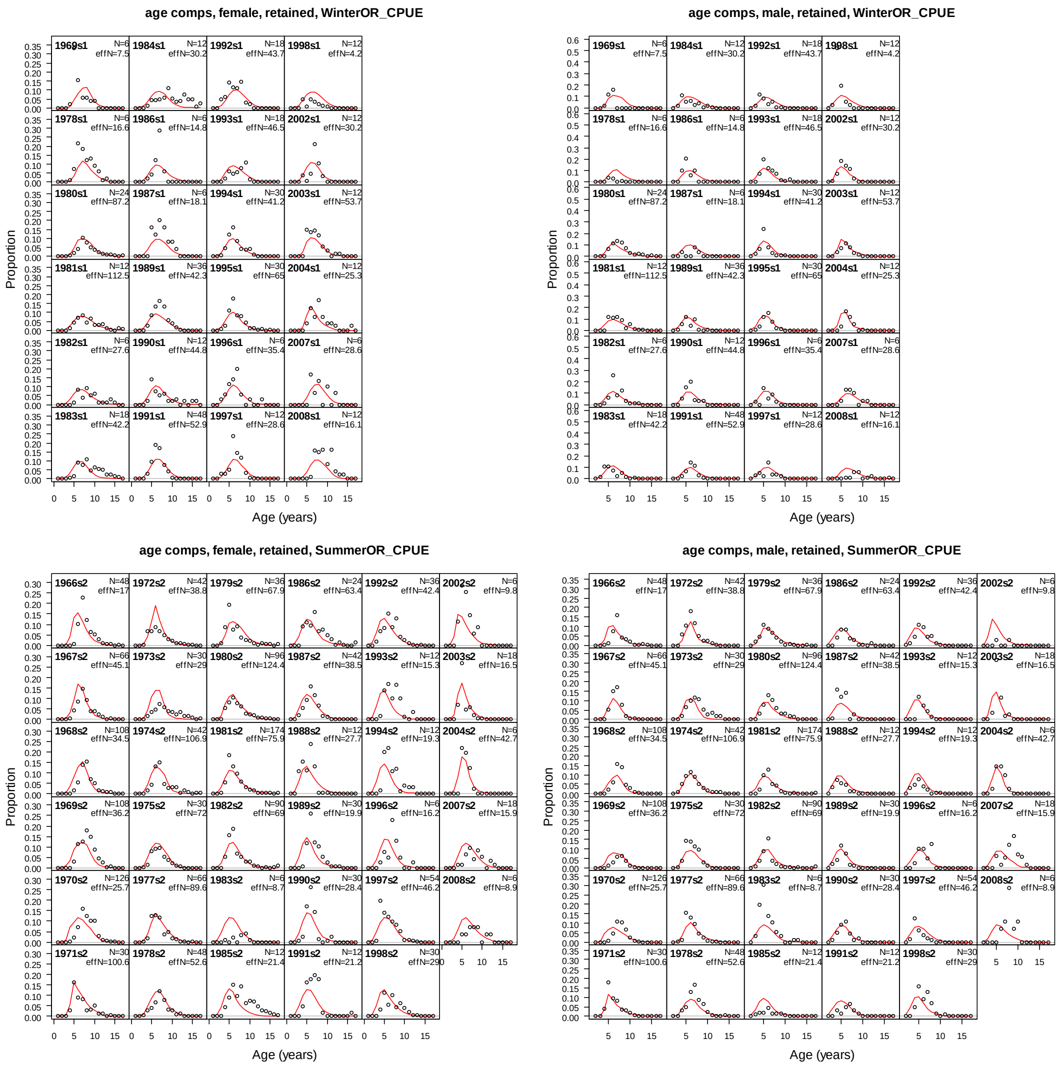


Figure C11. Fit to the Oregon fishery age compositions.

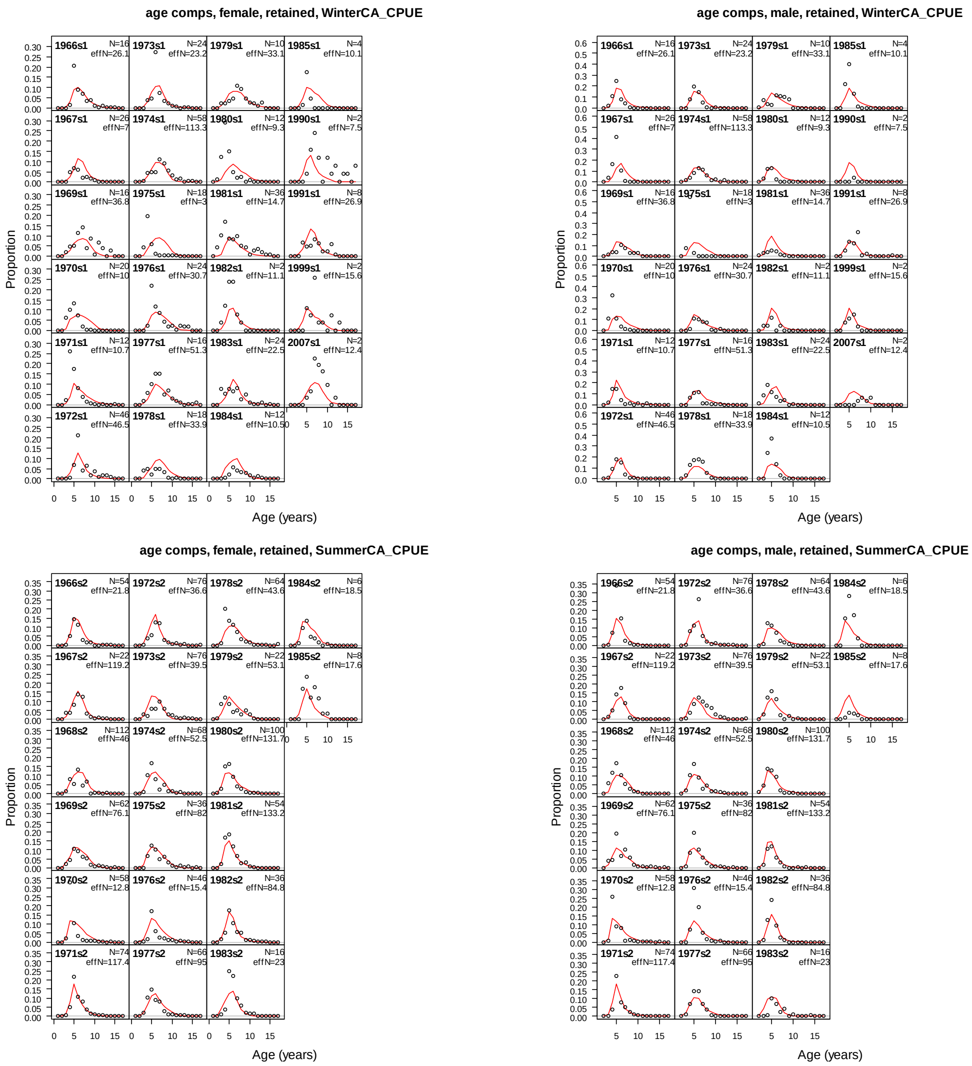


Figure C12. Fit to the California fishery age compositions.

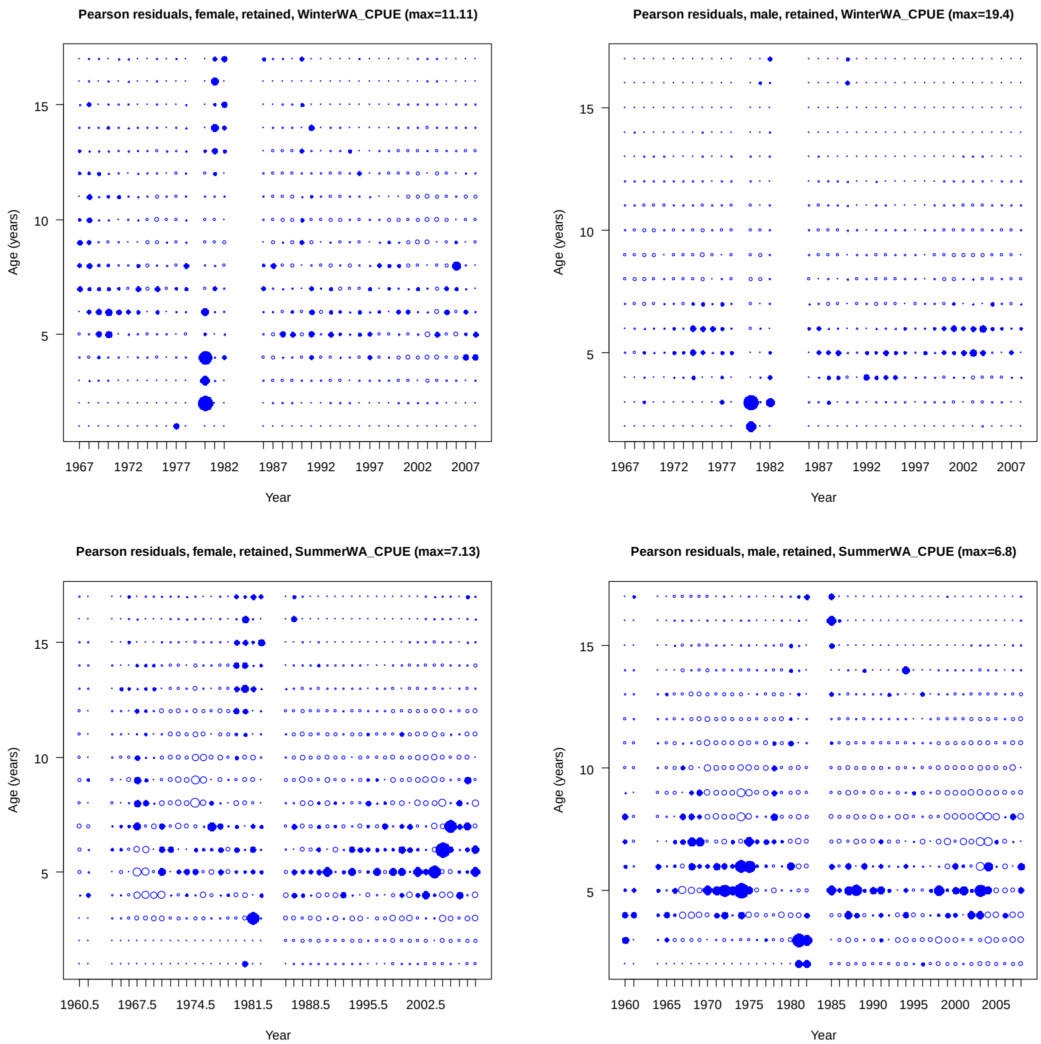


Figure C13. Pearson residuals for the Washington age compositions.

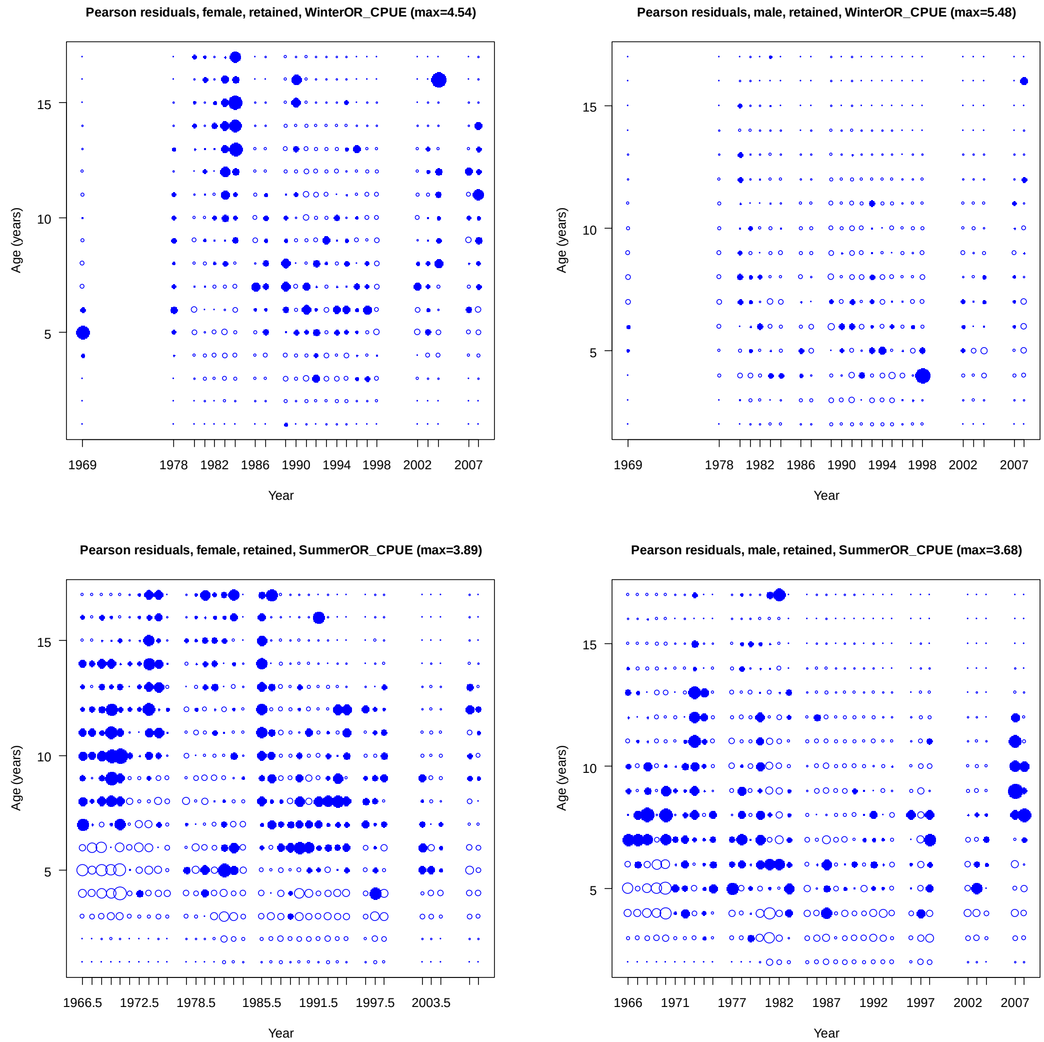


Figure C14. Pearson residuals for the Oregon age compositions.

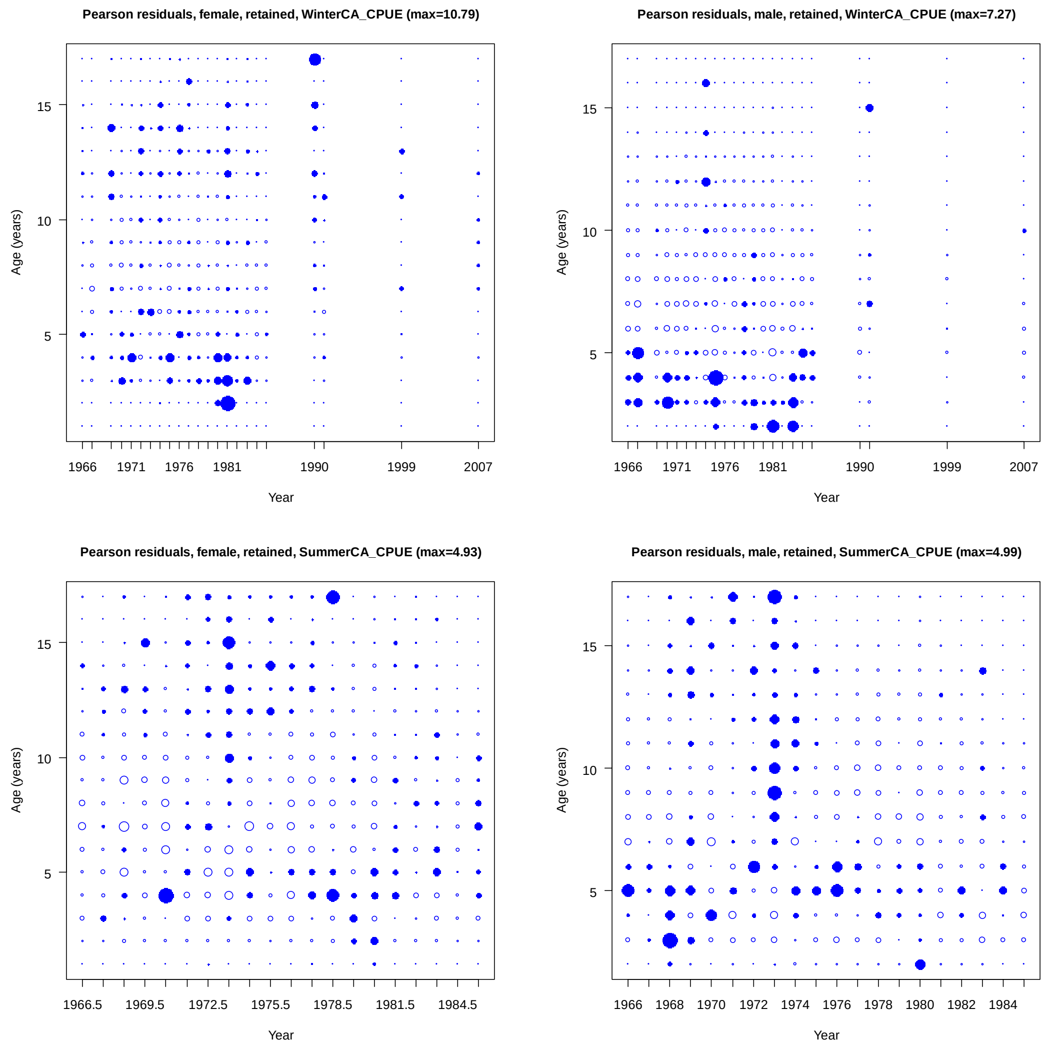


Figure C15. Pearson residuals for the California age compositions.

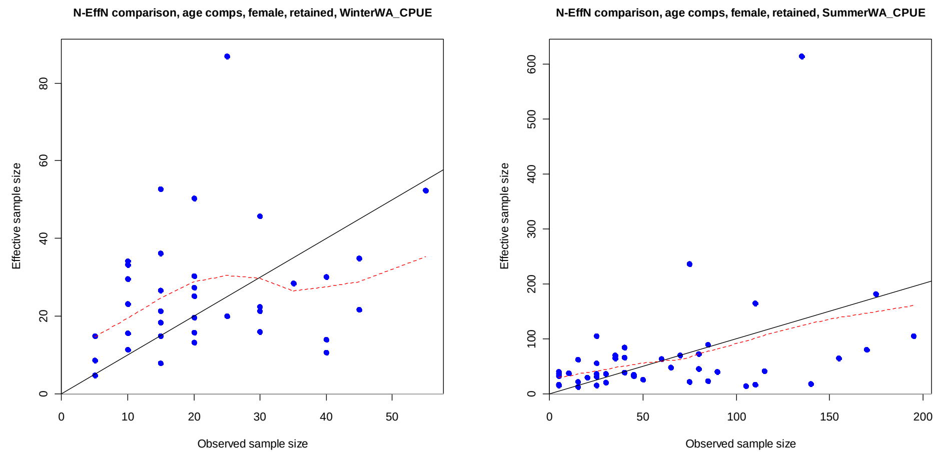


Figure C16. Effective-N for the Washington fishery age compositions.

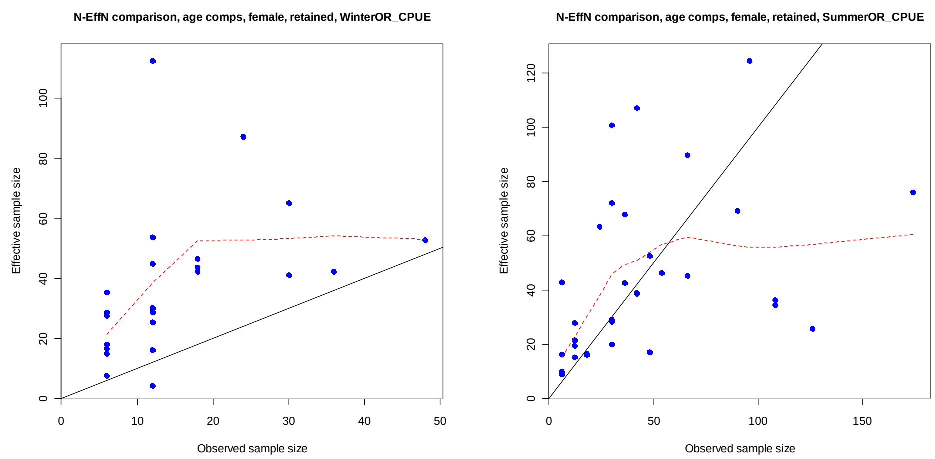


Figure C17. Effective-N for the Oregon fishery age compositions.

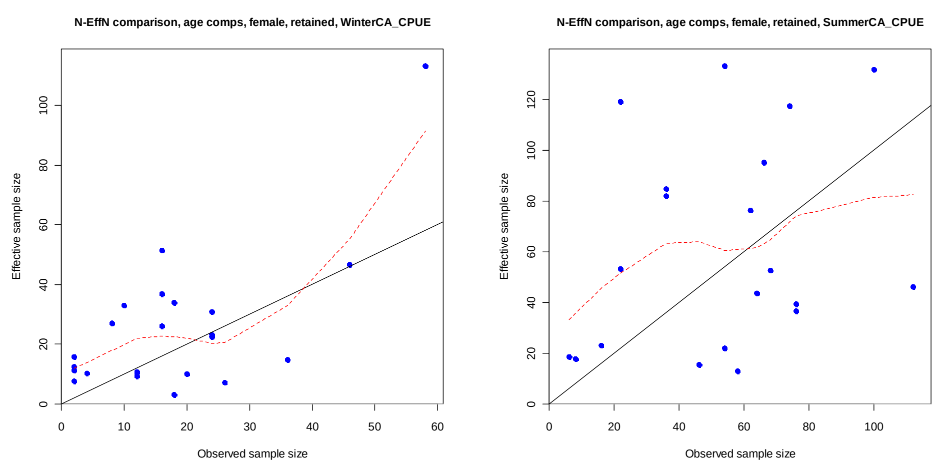


Figure C18. Effective-N for the California fishery age compoisitions.

15. Appendix D: Numbers at age matrix

Time	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1876	0	6154	5295	4556	3920	3373	2902	2497	2148	1849	1591	1369	1178	1013	872	750	645	555	478	411	354	304	262	225	194	167	144	124	106	91	79	68	58	50	43	37	32	27	24	20	125
1890	0	6153	5294	4555	3920	3372	2899	2490	2138	1835	1575	1353	1162	999	858	738	635	546	470	404	348	299	257	222	191	164	141	121	104	90	77	67	57	49	42	36	31	27	23	20	123
1900	0	6150	5292	4554	3918	3371	2896	2483	2126	1819	1557	1333	1142	978	838	718	616	528	453	389	334	287	246	212	182	156	135	116	100	86	74	63	55	47	40	35	30	26	22	19	117
1910	0	6148	5290	4552	3917	3369	2892	2475	2113	1802	1537	1312	1120	956	817	698	597	510	436	373	319	273	234	201	172	147	126	108	93	80	69	59	51	43	37	32	28	24	20	18	108
1920	0	6145	5287	4550	3915	3367	2889	2469	2101	1784	1515	1288	1096	932	794	676	576	491	418	357	304	260	222	189	162	138	118	101	86	74	63	54	46	40	34	29	25	21	18	16	97
1930	0	6142	5285	4548	3913	3364	2879	2446	2068	1746	1476	1248	1057	896	762	648	553	471	400	340	288	245	208	177	151	129	110	93	80	68	58	49	42	36	31	26	22	19	16	14	84
1931	0	6141	5284	4547	3913	3364	2879	2446	2066	1743	1471	1243	1051	890	755	641	546	465	396	337	286	243	206	176	149	127	108	92	79	67	57	49	42	36	30	26	22	19	16	14	83
1932	0	6140	5284	4547	3912	3364	2881	2450	2070	1744	1469	1238	1046	884	749	635	539	459	391	333	283	240	204	174	148	126	107	91	78	66	56	48	41	35	30	25	22	19	16	14	81
1933	0	6139	5283	4546	3912	3363	2880	2450	2071	1743	1465	1232	1037	875	740	626	531	451	384	327	278	237	201	171	145	123	105	89	76	65	55	47	40	34	29	25	21	18	16	13	79
1934	0	6138	5283	4546	3911	3363	2882	2454	2075	1746	1465	1228	1030	866	730	617	522	442	376	320	272	232	197	167	142	121	103	87	74	63	54	46	39	33	29	24	21	18	15	13	77
1935	0	6137	5282	4545	3911	3359	2868	2426	2040	1711	1432	1196	1000	837	703	592	500	422	358	304	259	220	188	159	135	115	98	83	71	60	51	44	37	32	27	23	20	17	14	12	73
1936	0	6134	5281	4545	3910	3359	2866	2416	2019	1683	1403	1168	973	811	678	568	478	403	341	289	245	209	178	151	129	109	93	79	67	57	49	41	35	30	26	22	19	16	14	12	69
1937	0	6131	5278	4544	3910	3361	2874	2431	2030	1683	1394	1155	958	795	662	552	463	389	328	277	235	199	169	144	123	104	89	75	64	54	46	39	34	29	24	21	18	15	13	11	65
1938	0	6128	5275	4541	3909	3358	2865	2416	2014	1663	1366	1123	926	765	633	525	438	367	308	260	219	186	158	134	114	97	83	70	60	51	43	37	31	27	23	19	16	14	12	10	60
1939	0	6124	5273	4539	3907	3356	2856	2397	1988	1635	1336	1088	888	728	599	495	410	341	286	240	202	171	144	123	104	89	76	64	55	46	39	33	28	24	21	18	15	13	11	9	55
1940	0	9720	5269	4537	3904	3352	2848	2378	1956	1597	1298	1049	848	688	562	461	380	314	262	219	184	155	131	110	94	80	68	58	49	42	35	30	26	22	19	16	13	11	10	8	49
1941	0	8190	8363	4534	3903	3351	2851	2379	1944	1568	1260	1011	809	649	525	427	350	288	238	198	165	139	117	99	83	71	60	51	44	37	31	27	23	19	16	14	12	10	9	7	43
1942	0	6662	7047	7196	3900	3352	2857	2393	1957	1567	1242	985	782	622	496	400	325	266	218	180	150	125	105	88	75	63	54	46	39	33	28	24	20	17	15	12	11	9	8	7	38
1943	0	5762	5732	6062	6189	3347	2845	2362	1904	1498	1163	903	706	556	439	350	281	228	186	153	126	105	88	73	62	52	44	37	32	27	23	20	17	14	12	10	9	7	6	5	31
1944	0	5738	4957	4931	5214	5308	2831	2330	1849	1425	1083	821	627	486	380	299	237	190	154	126	103	85	71	59	50	42	35	30	25	22	18	16	13	11	10	8	7	6	5	4	25
1945	0	6514	4937	4265	4241	4472	4495	2333	1851	1419	1063	791	591	447	344	268	210	167	133	108	88	72	60	50	41	35	29	25	21	18	15	13	11	9	8	7	6	5	4	3	20
1946	0	6837	5604	4247	3668	3638	3791	3713	1863	1431	1067	784	575	425	320	245	190	149	118	94	76	62	51	42	35	29	24	21	17	15	12	11	9	8	7	6	5	4	3	3	17
1947	0	6549	5882	4821	3652	3139	3042	3022	2796	1334	986	717	517	375	275	206	157	122	95	75	60	49	40	33	27	22	19	16	13	11	9	8	7	6	5	4	4	3	3	2	13
1948	0	6110	5634	5060	4146	3126	2631	2446	2318	2060	953	689	492	352	253	185	138	105	81	63	50	40	32	26	22	18	15	12	10	9	7	6	5	4	4	3	3	2	2	2	10
1949	0	5707	5257	4847	4351	3539	2583	2036	1758	1567	1332	598	424	299	212	151	110	82	62	48	38	30	24	19	16	13	11	9	7	6	5	4	4	3	3	2	2	2	1	1	7
1950	0	5403	4910	4523	4168	3711	2913	1983	1447	1173	997	821	360	252	176	124	88	64	47	36	28	22	17	14	11	9	7	6	5	4	4	3	3	2	2	2	1	1	1	1	5
1951	0	5281	4648	4223	3887	3548	3024	2168	1325	880	666	542	433	186	129	89	62	44	32	24	18	14	11	9	7	6	4	4	3	3	2	2	1	1	1	1	1	1	1	0	3
1952	0	5361	4544	3999	3631	3318	2930	2333	1544	879	554	404	320	252	107	73	51	35	25	18	13	10	8	6	5	4	3	3	2	2	1	1	1	1	1	1	1	0	0	0	2
1953	0	5379	4612	3909	3438	3100	2743	2269	1672	1033	558	339	241	187	145	61	42	29	20	14	10	8	6	4	3	3	2	2	1	1	1	1	1	1	0	0	0	0	0	0	1
1954	0	5458	4628	3968	3361	2938	2577	2157	1675	1171	697	367	220	155	120	93	39	27	18	13	9	6	5	4	3	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	1
1955	0	5715	4696	3982	3412	2868	2420	1976	1521	1101	732	422	219	129	90	70	54	23	15	11	7	5	4	3	2	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1
1956	0	5503	4916	4040	3423	2909	2356	1842	1376	984	676	435	246	126	74	51	39	30	13	9	6	4	3	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1957	0	4660	4735	4230	3474	2925	2414	1842	1344	945	646	431	272	152	77	45	31	24	18	8	5	4	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	0	4337	4010	4073	3636	2960	2395	1822	1265	851	566	373	243	151	84	42	25	17	13	10	4	3	2	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1959	0	4879	3732	3449	3502	3102	2439	1839	1287	831	531	341	220	142	87	48	24	14	10	7	6	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	6144	4198	3211	2966	2989	2563	1879	1290	825	497	303	188	119	76	46	25	13	7	5	4	3	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	7919	5286	3611	2760	2529	2458	1951	1298	811	483	276	163	99	62	39	24	13	6	4	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	4086	6813	4547	3103	2344	2039	1783	1246	738	423	236	129	74	44	27	17	10	5	3	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	4030	3515	5861	3908	2638	1897	1491	1152	721	392	212	114	61	34	20	12	8	5	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1964	0	5183	3467	3024	5036	3316	2116	1355	925	629	357	182	94	49	26	14	8	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	4182	4459	2983	2599	4273	2659	1518	857	526	330	177	87	44	22	11	6	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0	13594	3598	3836	2563	2206	3429	1903	948	475	266	157	80	38	19	9	5	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	6161	11696	3095	3297	2178	1781	2506	1242	563	262	139	79	40	19	9	5	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1968	0	7729	5301	10062	2661	2803	1762	1307	1646	744	315	141	73	41	20	9	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	5666	6650	4560	8650	2264	2279	1311	881	1025	437	178	77	39	22	11	5	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1970	0	5713	4875	5721	3920	7362	1842	1696	885	552	610	252	101	43	22	12	6	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	6497	4915	4193	4917	3328	5908	1321	1069	501	288	302	121	47	20	10	5	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	4299	5590	4229	3605	4182	2699	4355	871	639	278	152	153	60	23	10	5	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	3491	3699	4809	3635	3066	3394	1992	2867	517	349	143	75	73	28	11	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	4776	3004	3182	4131	3079	2479	2550	1389	1873	320	208	82	42	40	15	6	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	3736	4109	2584	2733	3486	2452	1802	1690	850	1079	176	111	43	21	20	8	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	6269	3214	3535	2219	2301	2751	1747	1157	995	469	567	89	55	21	10	10	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	7499	5394	2765	3036	1874	1837	2010	1166	715	580	262	308	48	29	11	5	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	3919	6452	4640	2376	2574	1520	1388	1407	763	445	347	153	176	27	16	6	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	3985	3371	5550	3984	2000	2029	1084	897	837	425	235	177	75	85	13	7	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	7313	3429	2900	4762	3328	1528	1355	636	474	408	195	103	75	31	34	5	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	4596	6292	2949	2489	3993	2583	1052	831	355	247	203	94	49	35	14	16	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	4714	3955	5413	2532	2095	3141	1815	652	458	178	115	89	39	20	14	6	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	3808	4055	3401	4645	2127	1633	2155	1082	344	220	80	49	36	16	8	5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	7055	3276	3480	2875	3701	1514	1015	1186	546	165	103	37	22	16	7	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	5812	6070	2813	2955	2337	2760	1016	620	676	298	87	53	19	11	8	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	3228	5000	5217	2402	2444	1798	1941	660	378	395	168	48	29	10	6	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	2861	2777	4298	4453	1988	1888	1267	1252	398	218	222	93	26	16	5	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	4177	2461	2386	3656	3625	1465	1220	723	648	193	101	99	40	11	7	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	5670	3594	2114	2027	2967	2663	942	688	368	308	88	44	43	17	5	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	5983	4878	3087	1797	1644	2172	1699	525	344	172	137	38	19	18	7	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	7060	5148	4191	2628	1468	1227	1438	999	279	170	80	61	16	8	7	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	2973	6074	4423	3566	2138	1077	774	771	468	119	68	31	23	6	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	4024	2558	5218	3762	2897	1566	684	424	374	209	50	27	12	9	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	7848	3462	2198	4448	3073	2144	1002	373	203	165	87	20	11	5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	4215	6752	2976	1877	3657	2320	1443	598	202	103	79	40	9	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	4647	3626	5805	2542	1548	2790	1591	885	336	107	52	39	20	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	4429	3998	3118	4955	2086	1164	1876	958	488	175	53	25	19	9	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	8742	3811	3437	2659	4046	1545	762	1089	507	243	84	25	12	9	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	8987	7521	3276	2932	2184	3063	1056	473	628	279	130	44	13	6	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	5413	7732	6466	2799	2428	1689	2167	685	288	368	160	74	25	7	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	4932	4657	6647	5522	2315	1872	1182	1372	401	160	199	85	38	13	4	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	3873	4243	4003	5675	4557	1775	1300	743	798	221	85	103	43	19	6	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	3691	3332	3647	3417	4693	3519	1246	826	436	442	118	44	53	22	10	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	3241	3176	2866	3129	2888	3803	2655	860	524	258	249	64	24	28	11	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	5381	2788	2732	2459	2645	2339	2860	1814	531	296	136	124	31	11	12	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	7134	4630	2398	2341	2059	2074	1653	1800	1027	276	145	63	56	14	5	5	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	5763	6137	3982	2055	1964	1628	1503	1101	1119	608	159	81	35	31	7	3	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	5450	4958	5279	3417	1732	1563	1178	972	643	609	316	80	40	17	15	4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	5658	4689	4265	4532	2885	1385	1136	763	567	347	312	157	39	19	8	7	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

16. Appendix E: Management Actions Potentially Impacting the Petrale Sole Fishery

Dan Erickson, ODFW Marine Resource Program, in collaboration with Brad Pettinger and members of industry compiled the following summaries of how management actions may have impacted the petrale sole fishery.

Major Management Shifts that could Impact Stock Assessments.

Effective October 18, 1982

- First trip limits established (widow rockfish and sablefish).

Effective January 1, 1992

- First **cumulative trip limits** for various species and species groups (widow RF; Sebastes complex; Pacific ocean perch; deepwater complex; non-trawl sablefish).

Effective May 9, 1992

- Increased the **minimum legal codend mesh size** for roller trawl gear north of Point Arena, California (40^o 30' N latitude) from 3.0 inches to 4.5 inches; prohibited double-walled codends; removed provisions regarding rollers and tickler chains for roller gear with codend mesh smaller than 4.5 inches.

Effective January 1, 1994

- Divided the commercial groundfish fishery into two components: the **limited entry** fishery and the open access fishery.
    - A federal limited entry permit is required to participate in the limited entry segment of the fishery. Permits are issued based on the fishing history of qualifying fishing vessels.

Effective September 8, 1995

- The **trawl minimum mesh size** now applies throughout the net; removed the legal distinction between bottom and roller trawls and the requirement for continuous riblines; clarified the distinction between bottom and pelagic (midwater) trawls; modified chafing gear requirements;

Effective January 1, 1999:

- Dividing line between north and south management areas moved to 40^o 10'.

Effective January 1, 2000

- **chafing gear** may be used only on the last 50 meshes of a small footrope trawl, running the length of the net from the terminal (closed) end of the codend.

New rockfish categories in 2000.

- Rockfish (except thornyheads) are divided into new categories north and south of 40° 10' N. lat., depending on the depth where they most often are caught:

nearshore, shelf, or slope. New trip limits have been established for "minor rockfish" species according to these categories.
  - Nearshore: numerous minor rockfish species including black and blue rockfishes.
  - Shelf: shortbelly, widow, yellowtail, bocaccio, chilipepper, cowcod rockfishes, and others.
  - Slope: Pacific ocean perch, splitnose rockfish, and others

<u>New Limited Entry Trawl Gear Restrictions in 2000</u>.

- Limited entry trip limits may vary depending on the type of trawl gear that is onboard a vessel during a fishing trip: large footrope, small footrope, or midwater trawl gear.
  - **Large footrope trawl gear** is bottom trawl gear, with a footrope diameter larger than 8 in. (20 cm) (including rollers, bobbins or other material encircling or tied along the length of the footrope).
  - **Small footrope trawl gear** is bottom trawl gear, with a footrope diameter 8 in. (20 cm) or smaller (including rollers, bobbins or other material encircling or tied along the length of the footrope), except chafing gear may be used only on the last 50 meshes of a small footrope trawl, running the length of the net from the terminal (closed) end of the codend.
  - **Midwater trawl gear** is pelagic trawl gear, The footrope of midwater trawl gear may not be enlarged by encircling it with chains or by any other means.

<u>Effective during 2001</u>:

- First conservation area was established (Cowcod Conservation Area)
- The West Coast Observer Program was initiated
- It is unlawful to take and retain, possess or land petrale sole from a fishing trip if large footrope gear is onboard and the trip is conducted at least in part between May 1 and October 31

<u>Effective during 2002</u>:

- Darkblotched Conservation Area was established.

<u>Effective during 2003</u>:

- Vessel buyback program was initiated (December 4, 2003)
- Yelloweye Rockfish Conservation Area was established
- Rockfish Conservation areas for several rockfish species were established.

<u>Effective during 2004</u>:

- Vessel Monitoring System (VMS) was initiated.

<u>Effective during 2005:</u>

- Selective flatfish trawl required shoreward of the RCA North of 40^o 10'.

Petrale Sole – First Major Regulations

Effective 1983

- First established coast-wide ABC limits for annual harvest of petrale sole.

Effective April 1, 1999 (April 16, 1999 for "B" platoon vessels)

- Limited Entry and Open Access *Sebastes* complex: north and south of Cape Mendocino, if a vessel takes and retains, possesses, or lands any splitnose or chilipepper rockfish south of Cape Mendocino, then the more restrictive *Sebastes* complex cumulative trip limit applies throughout the same cumulative limit period, no matter where the *Sebastes* complex is taken and retained, possessed, or landed.

Effective during 2000:

- For Limited Entry: large footrope trawl gear may be used to take………petrale sole from January 1-February 29 and November 1-December 31……., but these exceptions apply only on a trip that is conducted entirely during the periods in which use of large footrope gear is authorized. The presence of rollers or bobbins larger than 8 in. (20 cm) in diameter on board the vessel, even if not attached to a trawl, will be considered to mean a large footrope trawl is on board. Dates will be adjusted for the "B" platoon.

Effective during 2001:

- It is unlawful to take and retain, possess or land petrale sole from a fishing trip if large footrope gear is onboard and the trip is conducted at least in part between May 1 and October 31

Effective 2002:

- First cumulative trip limits for petrale sole
    - In 2001, no restrictions except requirement for small footrope.
    - In 2002, monthly limit of 15,000 pounds during July and August.

Effective 2003:

- Bimonthly cumulative trip limits for petrale sole were initiated.

Table E1. Annual RCA depth boundaries 2002 – 2009 (does not include in-season changes).

Year	Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008	North 48 10	0 - [m]200		0 - 200		0 - 150						0 - [m]200	
	48 10 - 46 38.17	75 - [m]200		60 - 200		60 - 150					75 - 150	75 - [m]200	
	46 38.17 - 46 16			60 - 200				60 - 150					
	46 16 - 45 46			75 - 200		75 - 150				75 - 200			
	45 46 - 43 20.83			75 - 200									
	43 20.83 - 42 40.50	0 - [m]200		0 - 200								0 - [m]200	
	42 40.5 - 40 10	75 - [m]200		75 - 200		60 - 200					75 - 200	75 - [m]200	
	40 10 - 34 27	100 - 150											
	South 34 27 (mainland)												
	South 34 27 (islands)	0 - 150											
2007	North 48 10	0 - [m]200		0 - 200		0 - 150						0 - [m]200	
	48 10 - 46 16	75 - [m]200		60 - 200		60 - 150				75 - 150		75 - [m]200	
	46 16 - 43 20.83			75 - 200									
	43 20.83 - 42 40.50	0 - [m]200		0 - 200								0 - [m]200	
	42 40.50 - 40 10	75 - [m]200		75 - 200								75 - [m]200	
	40 10 - 34 27	100 - 150											
	South 34 27 (mainland)												
	South 34 27 (islands)	0 - 150											
2006	North 40 10	75 - [m]200		75 - 200				100 - 250		75 - 250		75 - [m]200	
	40 10 - 38	75 - 150		100 - 150				100 - 200		100 - 250		75 - [m]250	
	38 - 34 27							100 - 150				75 - 150	
	South 34 27 (mainland)												
	South 34 27 (islands)	0 - 150											
2005	North 40 10	75 - [m]200		100 - 200							0 - 250		
	40 10 - 38	75 - 150		100 - 200		100 - 150							
	38 - 36			100 - 150							0 - 200		
	36 - 34 27										50 - 200		
	South 34 27 (mainland)												

	South 34 27 (islands)	0 - 150					0 - 200	
2004	North 40 10	75 - [m]200	60 - 200	60 - 150	75 - 150		0 - 250	
	40 10 - 38	75 - 150		100 - 150		75 - 150		
	38 - 36						0 - 200	
	36 - 34 27						0 - 150	
	South 34 27 (mainland)							
	South 34 27 (islands)	0 - 150						
2003	North 40 10	100 - [m]250	100 - 250	50 - 200	75 - 200	50 - 200		0 - [m]200
	40 10 - 38	50 - [m]250	60 - 250	60 - 200				
	38 - 34 27	50 - 150	60 - 150					
	South 34 27 (mainland)	100 - 150		100 - 200				0 - 200
	South 34 27 (islands)	0 - 150		0 - 200				
2002	North 40 10	Within DBCA - CLOSED TO TRAWLING;						Special footrope requirments outside DBCA

[m]The "modified" depth" line is modified to exclude certain petrale sole areas from the RCA.

17. Appendix F: SS2 Data file

#_bootstrap file: 1
#year is from Nov-Oct
#Winter 2008 includes Nov-Dec from 2007
#Last data is from Summer (March-October) 2008
1876 #_styr
2008 #_endyr
2 #_nseas
4 8 #_months/season
1 #_spawn_seas
6 #_Nfleet
3 #_Nsurveys
1 #_N_areas
WinterWA_CPUE%SummerWA_CPUE%WinterOR_CPUE%SummerOR_CPUE%WinterCA_CPUE%SummerCA_CPUE%Triennial%NWFSC%TriLate
0.5 0.5 0.5 0.5 0.5 0.5 0.6 0.5 0.5 #_surveytiming_in_season
1 1 1 1 1 1 1 1 1#_area_assignments_for_each_fishery_and_survey
1 1 1 1 1 1 #_units of catch: 1=bio; 2=num
0.01 0.01 0.01 0.01 0.01 0.01 #_se of log(catch) only used for init_eq_catch and for Fmethod 2 and 3
2 #_Ngenders
40 #_Nages

0 0 0 0 0 0 #_init_equil_catch_for_each_fishery
266 #_N_lines_of_catch_to_read

#WA-Winter	WA-Summer	OR-Winter	OR-Summer	CA-Winter	CA-Summer	Year	Season
0.00	0.00	0.00	0.00	0.00	0.00	1876	1
0.00	0.00	0.00	0.00	0.00	0.00	1877	1
0.00	0.00	0.00	0.00	0.00	0.00	1878	1
0.00	0.00	0.00	0.00	0.00	0.00	1879	1
0.00	0.00	0.00	0.00	0.00	0.00	1880	1
0.00	0.00	0.00	0.00	0.00	0.00	1881	1
0.00	0.00	0.00	0.00	0.00	0.00	1882	1
0.00	0.00	0.00	0.00	0.00	0.00	1883	1
0.00	0.00	0.00	0.00	0.00	0.00	1884	1
0.00	0.00	0.00	0.00	0.00	0.00	1885	1
0.00	0.00	0.00	0.00	0.00	0.00	1886	1
0.00	0.00	0.00	0.00	0.00	0.00	1887	1
0.00	0.00	0.00	0.00	0.00	0.00	1888	1
0.00	0.00	0.00	0.00	0.00	0.00	1889	1
0.00	0.00	0.00	0.00	0.00	0.00	1890	1
0.00	0.00	0.00	0.00	0.00	0.00	1891	1
0.00	0.00	0.00	0.00	0.00	0.00	1892	1

0.00	0.00	0.00	0.00	0.00	0.00	1893	1
0.00	0.00	0.00	0.00	0.00	0.00	1894	1
0.00	0.00	0.00	0.00	0.00	0.00	1895	1
0.00	0.00	0.00	0.00	0.00	0.00	1896	1
0.00	0.00	0.00	0.00	0.00	0.00	1897	1
0.00	0.00	0.00	0.00	0.00	0.00	1898	1
0.00	0.00	0.00	0.00	0.00	0.00	1899	1
0.00	0.00	0.00	0.00	0.00	0.00	1900	1
0.00	0.00	0.00	0.00	0.00	0.00	1901	1
0.00	0.00	0.00	0.00	0.00	0.00	1902	1
0.00	0.00	0.00	0.00	0.00	0.00	1903	1
0.00	0.00	0.00	0.00	0.00	0.00	1904	1
0.00	0.00	0.00	0.00	0.00	0.00	1905	1
0.00	0.00	0.00	0.00	0.00	0.00	1906	1
0.00	0.00	0.00	0.00	0.00	0.00	1907	1
0.00	0.00	0.00	0.00	0.00	0.00	1908	1
0.00	0.00	0.00	0.00	0.00	0.00	1909	1
0.00	0.00	0.00	0.00	0.00	0.00	1910	1
0.00	0.00	0.00	0.00	0.00	0.00	1911	1
0.00	0.00	0.00	0.00	0.00	0.00	1912	1
0.00	0.00	0.00	0.00	0.00	0.00	1913	1
0.00	0.00	0.00	0.00	0.00	0.00	1914	1
0.00	0.00	0.00	0.00	0.00	0.00	1915	1
0.00	0.00	0.00	0.00	0.00	0.00	1916	1
0.00	0.00	0.00	0.00	0.00	0.00	1917	1
0.00	0.00	0.00	0.00	0.00	0.00	1918	1
0.00	0.00	0.00	0.00	0.00	0.00	1919	1
0.00	0.00	0.00	0.00	0.00	0.00	1920	1
0.00	0.00	0.00	0.00	0.00	0.00	1921	1
0.00	0.00	0.00	0.00	0.00	0.00	1922	1
0.00	0.00	0.00	0.00	0.00	0.00	1923	1
0.00	0.00	0.00	0.00	0.00	0.00	1924	1
0.00	0.00	0.00	0.00	0.00	0.00	1925	1
0.00	0.00	0.00	0.00	0.00	0.00	1926	1
0.00	0.00	0.00	0.00	0.00	0.00	1927	1
0.00	0.00	0.00	0.00	0.00	0.00	1928	1
0.00	0.00	0.00	0.00	0.00	0.00	1929	1
0.00	0.00	0.00	0.00	0.00	0.00	1930	1
0.00	0.00	0.00	0.00	63.39	0.00	1931	1
1.99	0.00	0.00	0.00	36.40	0.00	1932	1
5.96	0.00	0.00	0.00	38.57	0.00	1933	1
9.93	0.00	0.00	0.00	139.41	0.00	1934	1
13.90	0.00	0.00	0.00	155.38	0.00	1935	1
15.88	0.00	0.00	0.00	95.49	0.00	1936	1
19.75	0.00	0.00	0.00	74.53	0.00	1937	1
27.49	0.00	0.00	0.00	47.86	0.00	1938	1

35.22	0.00	0.00	0.00	30.84	0.00	1939	1
39.09	0.00	0.00	0.00	162.53	0.00	1940	1
41.40	0.00	0.00	0.00	110.81	0.00	1941	1
46.00	0.00	0.00	0.00	24.37	0.00	1942	1
50.61	0.00	0.00	0.00	71.66	0.00	1943	1
55.21	0.00	0.00	0.00	85.53	0.00	1944	1
59.82	0.00	0.00	0.00	101.75	0.00	1945	1
64.43	0.00	0.00	0.00	71.91	0.00	1946	1
69.03	0.00	0.00	0.00	153.68	0.00	1947	1
73.64	0.00	0.00	0.00	272.66	0.00	1948	1
75.94	0.00	0.00	0.00	615.70	0.00	1949	1
156.21	0.00	0.00	0.00	410.94	0.00	1950	1
117.97	0.00	0.00	0.00	207.05	0.00	1951	1
131.01	0.00	0.00	0.00	318.12	0.00	1952	1
46.07	0.00	0.00	0.00	525.77	0.00	1953	1
26.56	0.00	0.00	0.00	797.19	0.00	1954	1
57.14	0.00	0.00	0.00	520.17	0.00	1955	1
120.46	0.00	19.09	0.00	504.50	0.00	1956	1
106.45	0.00	83.20	0.00	517.79	0.00	1957	1
29.12	0.00	37.86	0.00	557.95	0.00	1958	1
73.98	0.00	389.39	0.00	370.52	0.00	1959	1
123.30	0.00	84.95	0.00	514.39	0.00	1960	1
133.94	0.00	56.76	0.00	540.53	0.00	1961	1
156.57	0.00	93.82	0.00	510.21	0.00	1962	1
118.57	0.00	151.70	0.00	530.82	0.00	1963	1
103.21	0.00	75.67	0.00	372.19	0.00	1964	1
127.72	0.00	82.28	0.00	373.44	0.00	1965	1
91.56	0.00	59.43	0.00	324.71	0.00	1966	1
60.01	0.00	73.88	0.00	521.08	0.00	1967	1
137.39	0.00	41.26	0.00	360.61	0.00	1968	1
52.02	0.00	34.88	0.00	420.97	0.00	1969	1
143.76	0.00	114.24	0.00	472.37	0.00	1970	1
152.49	0.00	133.52	0.00	539.72	0.00	1971	1
186.61	0.00	157.97	0.00	703.21	0.00	1972	1
200.86	0.00	106.25	0.00	417.44	0.00	1973	1
167.91	0.00	161.63	0.00	664.63	0.00	1974	1
189.29	0.00	178.26	0.00	560.51	0.00	1975	1
161.12	0.00	176.45	0.00	712.75	0.00	1976	1
161.77	0.00	152.86	0.00	484.15	0.00	1977	1
246.92	0.00	141.07	0.00	419.09	0.00	1978	1
248.02	0.00	200.94	0.00	352.88	0.00	1979	1
56.44	0.00	67.13	0.00	518.33	0.00	1980	1
262.96	0.00	166.68	0.00	352.88	0.00	1981	1
121.26	0.00	133.20	0.00	261.53	0.00	1982	1
229.54	0.00	491.38	0.00	272.72	0.00	1983	1
241.92	0.00	228.42	0.00	260.56	0.00	1984	1

286.38	0.00	173.60	0.00	273.29	0.00	1985	1
206.97	0.00	264.52	0.00	402.99	0.00	1986	1
422.20	0.00	431.99	0.00	310.94	0.00	1987	1
333.64	0.00	409.10	0.00	349.17	0.00	1988	1
298.05	0.00	396.63	0.00	393.89	0.00	1989	1
383.28	0.00	257.06	0.00	319.63	0.00	1990	1
352.01	0.00	440.45	0.00	447.94	0.00	1991	1
298.02	0.00	339.67	0.00	273.54	0.00	1992	1
271.41	0.00	413.08	0.00	237.99	0.00	1993	1
237.33	0.00	280.06	0.00	246.13	0.00	1994	1
235.31	0.00	354.51	0.00	236.03	0.00	1995	1
264.64	0.00	310.87	0.00	406.09	0.00	1996	1
247.73	0.00	366.99	0.00	451.30	0.00	1997	1
217.87	0.00	303.30	0.00	221.71	0.00	1998	1
134.65	0.00	323.37	0.00	292.03	0.00	1999	1
241.94	0.00	323.49	0.00	408.47	0.00	2000	1
308.96	0.00	358.42	0.00	317.31	0.00	2001	1
346.36	0.00	295.64	0.00	340.01	0.00	2002	1
295.56	0.00	241.76	0.00	260.70	0.00	2003	1
683.93	0.00	322.90	0.00	177.27	0.00	2004	1
555.51	0.00	374.93	0.00	339.46	0.00	2005	1
252.38	0.00	277.56	0.00	125.64	0.00	2006	1
303.55	0.00	557.89	0.00	469.05	0.00	2007	1
286.74	0.00	448.62	0.00	617.62	0.00	2008	1
0.00	0.00	0.00	0.00	0.00	1.00	1876	2
0.00	0.00	0.00	0.00	0.00	1.00	1877	2
0.00	0.00	0.00	0.00	0.00	1.00	1878	2
0.00	0.00	0.00	0.00	0.00	1.00	1879	2
0.00	0.00	0.00	0.00	0.00	11.55	1880	2
0.00	0.00	0.00	0.00	0.00	22.10	1881	2
0.00	0.00	0.00	0.00	0.00	32.65	1882	2
0.00	0.00	0.00	0.00	0.00	43.20	1883	2
0.00	0.00	0.00	0.00	0.00	53.75	1884	2
0.00	0.00	0.00	0.00	0.00	64.30	1885	2
0.00	0.00	0.00	0.00	0.00	74.85	1886	2
0.00	0.00	0.00	0.00	0.00	85.40	1887	2
0.00	0.00	0.00	0.00	0.00	95.95	1888	2
0.00	0.00	0.00	0.00	0.00	106.50	1889	2
0.00	0.00	0.00	0.00	0.00	117.05	1890	2
0.00	0.00	0.00	0.00	0.00	127.60	1891	2
0.00	0.00	0.00	0.00	0.00	138.15	1892	2
0.00	0.00	0.00	0.00	0.00	148.71	1893	2
0.00	0.00	0.00	0.00	0.00	159.26	1894	2
0.00	0.00	0.00	0.00	0.00	169.81	1895	2
0.00	0.00	0.00	0.00	0.00	180.36	1896	2
0.00	0.00	0.00	0.00	0.00	190.91	1897	2

0.00	0.00	0.00	0.00	0.00	201.46	1898	2
0.00	0.00	0.00	0.00	0.00	212.01	1899	2
0.00	0.00	0.00	0.00	0.00	222.56	1900	2
0.00	0.00	0.00	0.00	0.00	233.11	1901	2
0.00	0.00	0.00	0.00	0.00	243.66	1902	2
0.00	0.00	0.00	0.00	0.00	254.21	1903	2
0.00	0.00	0.00	0.00	0.00	264.76	1904	2
0.00	0.00	0.00	0.00	0.00	275.31	1905	2
0.00	0.00	0.00	0.00	0.00	285.86	1906	2
0.00	0.00	0.00	0.00	0.00	296.41	1907	2
0.00	0.00	0.00	0.00	0.00	306.96	1908	2
0.00	0.00	0.00	0.00	0.00	317.51	1909	2
0.00	0.00	0.00	1.00	0.00	328.06	1910	2
0.00	0.00	0.00	1.00	0.00	338.61	1911	2
0.00	0.00	0.00	1.00	0.00	349.16	1912	2
0.00	0.00	0.00	1.00	0.00	359.71	1913	2
0.00	0.00	0.00	1.00	0.00	370.26	1914	2
0.00	0.00	0.00	1.00	0.00	380.81	1915	2
0.00	0.00	0.00	1.00	0.00	386.42	1916	2
0.00	0.00	0.00	1.00	0.00	526.41	1917	2
0.00	0.00	0.00	1.00	0.00	423.85	1918	2
0.00	0.00	0.00	1.00	0.00	333.44	1919	2
0.00	0.00	0.00	1.00	0.00	230.49	1920	2
0.00	0.00	0.00	1.00	0.00	293.76	1921	2
0.00	0.00	0.00	1.00	0.00	424.78	1922	2
0.00	0.00	0.00	1.00	0.00	427.36	1923	2
0.00	0.00	0.00	1.00	0.00	532.86	1924	2
0.00	0.00	0.00	1.00	0.00	528.47	1925	2
0.00	0.00	0.00	1.00	0.00	521.67	1926	2
0.00	0.00	0.00	1.00	0.00	632.04	1927	2
0.00	0.00	0.00	0.00	0.00	620.09	1928	2
0.00	0.00	0.00	3.08	0.00	706.04	1929	2
0.00	0.00	0.00	1.00	0.00	658.83	1930	2
0.00	80.59	0.00	0.98	0.00	530.88	1931	2
0.00	241.77	0.00	6.80	0.00	519.91	1932	2
0.00	402.95	0.00	4.31	0.00	392.08	1933	2
0.00	564.13	0.00	2.90	0.00	896.36	1934	2
0.00	644.72	0.00	5.71	0.00	777.21	1935	2
0.00	752.33	0.00	18.60	0.00	431.51	1936	2
0.00	967.53	0.00	81.39	0.00	741.05	1937	2
0.00	1182.73	0.00	4.10	0.00	890.00	1938	2
0.00	1290.33	0.00	2.50	0.00	1028.96	1939	2
0.00	1280.50	0.00	352.70	0.00	596.69	1940	2
0.00	1260.83	0.00	464.20	0.00	331.32	1941	2
0.00	1241.16	0.00	1868.70	0.00	215.56	1942	2
0.00	1221.48	0.00	1898.56	0.00	344.72	1943	2

0.00	1201.81	0.00	1007.50	0.00	446.58	1944	2
0.00	1182.14	0.00	785.42	0.00	439.34	1945	2
0.00	1162.46	0.00	1488.90	0.00	1115.57	1946	2
0.00	1142.79	0.00	720.46	0.00	1092.65	1947	2
0.00	1123.12	0.00	1326.50	0.00	1544.35	1948	2
0.00	1113.27	0.00	755.79	0.00	1476.28	1949	2
0.00	957.31	0.00	1643.80	0.00	1346.41	1950	2
0.00	774.51	0.00	949.08	0.00	938.14	1951	2
0.00	743.76	0.00	729.70	0.00	857.63	1952	2
0.00	354.35	0.00	502.68	0.00	778.53	1953	2
0.00	418.07	0.00	692.80	0.00	891.57	1954	2
0.00	398.57	0.00	882.91	0.00	925.76	1955	2
0.00	356.24	0.00	500.90	0.00	683.23	1956	2
0.00	361.57	0.00	739.29	0.00	954.42	1957	2
0.00	443.81	0.00	529.90	0.00	729.26	1958	2
0.00	678.12	0.00	364.92	0.00	625.42	1959	2
0.00	587.40	0.00	634.64	0.00	592.71	1960	2
0.00	802.19	0.00	595.02	0.00	927.43	1961	2
0.00	497.80	0.00	549.73	0.00	783.04	1962	2
0.00	535.59	0.00	473.51	0.00	810.08	1963	2
0.00	455.02	0.00	297.23	0.00	912.61	1964	2
0.00	434.58	0.00	468.00	0.00	845.83	1965	2
0.00	414.37	0.00	304.21	0.00	916.97	1966	2
0.00	312.00	0.00	307.81	0.00	858.30	1967	2
0.00	222.56	0.00	318.96	0.00	845.90	1968	2
0.00	161.12	0.00	369.51	0.00	848.19	1969	2
0.00	356.86	0.00	457.86	0.00	1070.97	1970	2
0.00	418.93	0.00	296.50	0.00	1015.59	1971	2
0.00	553.63	0.00	297.19	0.00	1000.27	1972	2
0.00	545.65	0.00	407.14	0.00	741.68	1973	2
0.00	712.88	0.00	428.64	0.00	893.27	1974	2
0.00	703.09	0.00	611.08	0.00	900.92	1975	2
0.00	494.31	0.00	283.54	0.00	736.71	1976	2
0.00	437.19	0.00	294.20	0.00	494.81	1977	2
0.00	578.04	0.00	352.58	0.00	800.66	1978	2
0.00	514.70	0.00	505.39	0.00	944.80	1979	2
0.00	444.24	0.00	347.00	0.00	680.05	1980	2
0.00	417.96	0.00	420.06	0.00	533.63	1981	2
0.00	580.12	0.00	714.50	0.00	502.05	1982	2
0.00	750.63	0.00	340.79	0.00	364.76	1983	2
0.00	595.04	0.00	152.39	0.00	329.98	1984	2
0.00	282.35	0.00	124.38	0.00	471.93	1985	2
0.00	327.23	0.00	123.83	0.00	355.49	1986	2
0.00	439.51	0.00	126.17	0.00	556.37	1987	2
0.00	449.18	0.00	160.73	0.00	411.28	1988	2
0.00	397.97	0.00	184.84	0.00	414.79	1989	2

0.00	300.53	0.00	158.15	0.00	373.52	1990	2
0.00	246.91	0.00	149.91	0.00	310.28	1991	2
0.00	204.76	0.00	159.65	0.00	307.39	1992	2
0.00	213.33	0.00	173.93	0.00	235.66	1993	2
0.00	173.72	0.00	175.63	0.00	303.99	1994	2
0.00	236.41	0.00	201.96	0.00	290.53	1995	2
0.00	247.53	0.00	182.23	0.00	401.93	1996	2
0.00	233.34	0.00	176.33	0.00	461.33	1997	2
0.00	330.41	0.00	242.54	0.00	302.80	1998	2
0.00	308.16	0.00	193.18	0.00	268.39	1999	2
0.00	425.75	0.00	136.28	0.00	241.95	2000	2
0.00	366.51	0.00	225.93	0.00	261.34	2001	2
0.00	514.31	0.00	185.37	0.00	195.69	2002	2
0.00	541.41	0.00	166.43	0.00	180.25	2003	2
0.00	550.18	0.00	188.51	0.00	267.84	2004	2
0.00	763.67	0.00	286.19	0.00	534.42	2005	2
0.00	618.63	0.00	363.47	0.00	464.78	2006	2
0.00	331.03	0.00	173.78	0.00	493.46	2007	2
0.00	179.39	0.00	136.28	0.00	410.51	2008	2

#Abundance indices

37 #nobs

#Year	Seas	Fleet	Value	SE(log(B))		
1987	1	3	200.5	0.5	#	OR-Winter
1988	1	3	135.8	0.5	#	OR-Winter
1989	1	3	124.7	0.5	#	OR-Winter
1990	1	3	122.9	0.5	#	OR-Winter
1991	1	3	87.9	0.5	#	OR-Winter
1992	1	3	80.1	0.5	#	OR-Winter
1993	1	3	75.6	0.5	#	OR-Winter
1994	1	3	70.5	0.5	#	OR-Winter
1995	1	3	141.6	0.5	#	OR-Winter
1996	1	3	133.6	0.5	#	OR-Winter
1997	1	3	87.7	0.5	#	OR-Winter
1987	2	4	54.3	0.5	#	OR-Summer
1988	2	4	30.6	0.5	#	OR-Summer
1989	2	4	26.5	0.5	#	OR-Summer
1990	2	4	29.8	0.5	#	OR-Summer
1991	2	4	18.3	0.5	#	OR-Summer
1992	2	4	18.5	0.5	#	OR-Summer
1993	2	4	17.8	0.5	#	OR-Summer
1994	2	4	13.9	0.5	#	OR-Summer
1995	2	4	34.5	0.5	#	OR-Summer
1996	2	4	34.2	0.5	#	OR-Summer
1997	2	4	18.5	0.5	#	OR-Summer
#Year	Season	Fleet	Value		seLogB	

```
1980	2		7		1087.625	0.2103654
1983	2		7		1041.779	0.1750205
1986	2		7		1120.639	0.174408
1989	2		7		1806.327	0.1710698
1992	2		7		 998.072	0.1682171
1995	2		9		1164.989	0.170984
1998	2		9		1707.132	0.1644474
2001	2		9		1743.905	0.1721106
2004	2		9		4646.915	0.1719107
#Year	Season	Fleet	Value		seLogB
2003	2		8		19131.02	0.1332327
2004	2		8		22167.83	0.1478154
2005	2		8		23493.97	0.1252356
2006	2		8		19573.3			0.1358262
2007	2		8		15892.02	0.1292938
2008	2		8		13532.48	0.1274826

#_Discards
1	#disc_type	#(1=biomass,2=fraction)
41	#nobs_disc
#Year	Seas	Fleet	Biomass		CV
1986	2		4		11.88	0.5 #Pikitch
1987	2		4		12.17	0.5 #Pikitch
2002	1	1	2.962	0.207
2003	1	1	3.121	1.088
2004	1	1	1.860	0.506
2005	1	1	1.600	0.449
2006	1	1	1.753	0.256
2007	1	1	1.768	0.541
2008	1	1	8.143	0.824
2002	2	2	157.418		0.131
2003	2	2	106.134		0.302
2004	2	2	67.541	0.221
2005	2	2	55.660	0.149
2006	2	2	42.433	0.236
2007	2	2	32.551	0.300
#2008	2	2	0.610	0.573
2002	1	3	6.680	0.433
2003	1	3	0.641	0.399
2004	1	3	0.167	0.606
2005	1	3	3.329	0.712
2006	1	3	2.150	0.426
2007	1	3	1.474	0.625
2008	1	3	18.017	0.569
2002	2	4	32.116	0.177
2003	2	4	12.649	0.318
```

2004	2	4	7.639	0.568
2005	2	4	10.335	0.383
2006	2	4	34.425	0.182
2007	2	4	28.060	0.316
#2008	2	4	0.203	0.256
2002	1	5	9.115	0.364
2003	1	5	14.736	0.649
2004	1	5	1.659	1.702
2005	1	5	2.057	0.396
2006	1	5	7.082	0.336
2007	1	5	5.648	0.179
2008	1	5	0.786	0.323
2002	2	6	12.749	0.216
2003	2	6	7.737	0.214
2004	2	6	7.532	0.279
2005	2	6	5.432	0.218
2006	2	6	19.404	0.279
2007	2	6	36.729	0.279
#2008	2	6	4.924	0.238

#_Mean_BodyWt
39 #nobs_mnwt #N_observations
#from Eliza Heery. Observer data.
#converted pounds to kilograms

#YEAR	SEASON	Fleet	Partition	Value	CV
2002	1	1	1	0.251494506	0.37566349
2002	2	2	1	0.440379037	0.450094176
2002	1	3	1	0.20674581	0.484416392
2002	2	4	1	0.340817491	0.536126025
2002	1	5	1	0.190468703	0.900302405
2002	2	6	1	0.409963409	0.658202015
2003	1	1	1	0.258824784	0.560178165
2003	2	2	1	0.388033409	0.527295899
2003	1	3	1	0.190986028	0.453567402
2003	2	4	1	0.280719613	0.382745202
2003	1	5	1	0.175144082	0.408831844
2003	2	6	1	0.17819576	0.40686274
2004	1	1	1	0.276220008	0.351541708
2004	2	2	1	0.336294807	0.500064846
2004	1	3	1	0.262462298	0.455029267
2004	2	4	1	0.326095345	0.377502619
2004	1	5	1	0.183139401	0.47245741
2004	2	6	1	0.308563264	0.393827606
2005	1	1	1	0.309580384	0.386269476
2005	2	2	1	0.304282942	0.608578161
2005	1	3	1	0.281369609	0.471241102

2005	2	4	1	0.378378781	0.391726503
2005	1	5	1	0.251940986	0.437513829
2005	2	6	1	0.270195308	0.664186516
2006	1	1	1	0.268167159	0.479955216
2006	2	2	1	0.37423087	0.74778404
2006	1	3	1	0.26579564	0.272187554
2006	2	4	1	0.442844434	0.408942969
2006	1	5	1	0.318455215	0.642855376
2006	2	6	1	0.283956712	0.668245725
2007	1	1	1	0.236528007	0.349096152
2007	2	2	1	0.380615449	0.281934778
2007	1	3	1	0.284921288	0.497038596
2007	2	4	1	0.451858101	0.317272602
2007	1	5	1	0.364290824	0.608735944
2007	2	6	1	0.218025226	0.465842432
2008	1	1	1	0.306975307	0.438951873
#2008	2	2	1	0.59492934	0.478065859
2008	1	3	1	0.319782621	0.109233767
#2008	2	4	1	0.396380027	0.402940346
2008	1	5	1	0.249521688	0.50384834
#2008	2	6	1	0.300154419	0.44548394

#Population length bins
2 # length bin method: 1=use databins; 2=generate from binwidth,min,max below; 3=read vector
2 # binwidth for population size comp
4 # minimum size in the population (lower edge of first bin and size at age 0.00)
78 # maximum size in the population (lower edge of last bin)

#Length bins
-1 #min_tail
#min_proportion_for_compressing_tails_of_observed_composition
0.0001 #min_comp #constant_added_to_expected_frequencies
0 #_combine males into females at or below this bin number
#_Length_Composition_Data

26 #nlength #N_length_bins

#len_bins(1,nlength) #_lower_edge_of_length_bins

12 14 16 18 20 22 24 26 28 30 32 34 36 38
40 42 44 46 48 50 52 54 56 58 60
62

#LENGTH_COMPOSITIONS:Replicates_(by_state)_must_be_contigent_within_Year-Seas-Fleet-Sex

266 #nobs length nSamp adj Flt1
Flt2 Flt3 Flt4 Flt5 Flt6 max

#lendata(1,nobsl,1,6+gender*nlength)
#Sorted_by_year_fleet_mkt:_0:Survey_1:Discard_2:Fisheries
5 5 6 6 3 2 150

#1 year Season Fleet gender partition nSamps F12 F14 F16
F18 F20 F22 F24 F26 F28 F30 F32 F34 F36 F38
F40 F42 F44 F46 F48 F50 F52 F54 F56 F58 F60
F62 M12 M14 M16 M18 M20 M22 M24 M26 M28 M30
M32 M34 M36 M38 M40 M42 M44 M46 M48 M50 M52
M54 M56 M58 M60 M62 nSamps
1955 1 1 3 2 5 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0.788954635
3.15581854 4.733727811 5.522682446 5.719921105 4.930966469
4.142011834 1.775147929 1.972386588 0.394477318 0 0 0
0 0 0 0 0 0 0 0 0 0
0.394477318 4.142011834 11.04536489 18.93491124 21.69625247
8.08678501 2.169625247 0.394477318 0 0 0 0 0
0 0 # 1
1966 1 1 3 2 5 0 0 0 0 0
0 0 0 0 0 0 0 0 2 9 17
16 13 3 2 2 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 4 4

8 9 4 4 1 1 0 0 0 0 0
0 0 0 # 1
1967 1 1 3 2 20 0 0 0 0 0
0 0 0 0 0.603315608 1.659720647 1.056405039
2.716125686 8.523215583 16.07914297 11.67512749 8.827481926
7.034841809 3.661850656 2.034840061 0.868481872 0.978435022 0
0 0 0 0 0 0 0 0 0 0 0
0.528202519 3.922756902 3.737690664 8.555198716 6.7473819
6.29429247 2.758528723 1.736963745 0 0 0 0 0
0 0 0 0 0 # 4
1968 1 1 3 2 55 0 0 0 0 0
0 0 0 0 0.139874863 1.374020654 4.625996463
7.390789722 7.188150968 9.796847201 10.89363384 9.772587809
5.114066544 5.358086425 2.326464266 1.502352969 0.293894099 0
0 0 0 0 0 0 0 0 0 0 0
0 1.298279801 3.441719077 8.152902058 9.190520983 6.028280785
4.573996101 0.695692159 0.694896166 0.14694705 0 0 0
0 0 0 0 0 # 11
1969 1 1 3 2 45 0 0 0 0 0
0 0 0 0 1.242809566 3.519833902 4.834840005
3.541849007 3.980797849 7.129351522 7.161138122 10.25341679
5.556381776 3.862873609 1.863135782 1.228900909 0.787468202
0.262489401 0 0 0 0 0 0 0 0 0
0 0.211136728 0 0.316978209 1.032539884 6.032029714
11.23353233 12.02925469 7.405826525 4.489453057 1.761473021
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9
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0 0 0 # 11

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0	0	0.081115295	0.16223059	1.353247688	4.588223481
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1979	1	1	3	2	10	0	0	0	0	0
0	0	0	0	0	0	0	0	0.396913175
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4.346324479	2.236027695	0.396913175	0.396913175	0	1.045288172
0.522644086	0	0	0	0	0	0	0	0	0
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2.427476773	1.104761431	0.32521901	0.296203491	0	0	0
0	0	0	0	0.134910083	0	0.57458115	1.484661012
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1982	1	1	3	2	20	0	0	0	0	0
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0	#	1
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0	0	0	0	0	#	2
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1961 2 2 3 2 5 0 0 0 0 0
0 0 0 0 2 2 6 9 6 10 7
6 1 2 1 0 0 1 0 0 0 0
0 0 0 0 0 0 0 2 2 10 10
10 7 5 0 0 1 0 0 0 0 0
0 0 0 # 1
1964 2 2 3 2 5 0 0 0 0 0
0 0 0 0 0 0.5 1 2.5 6 8.5 6.5
7 3 3 2.5 1.5 0.5 0.5 0 0 0 0
0 0 0 0 0 0 0 0 0 1 3.5
11 19 11.5 7 1.5 1.5 0.5 0.5 0 0 0
0 0 0 # 1
1965 2 2 3 2 5 0 0 0 0 0
0 0 0 0 2 2 1 1 3 4 11
7 10 5 2 0 2 0 2 0 0 0
0 0 0 0 0 0 0 0 3 4 3
7 10 12 7 1 0 0 1 0 0 0
0 0 0 # 1
1966 2 2 3 2 140 0 0 0 0 0
0 0 0 0.02273712 1.260276045 3.051699557 5.386168954
6.962240624 6.91955468 6.9089734 6.924012278 5.843679323
3.238656885 0.886236893 0.668700956 0.160275719 0.1087053
0.024439502 0.026613494 0.004368787 0 0 0 0 0
0 0 0 0 0.018992189 1.773483859 6.56756668
9.399733228 12.38516126 11.96230526 5.862380052 2.320543818
0.872836777 0.347537494 0.079013508 0.013106361 0 0 0
0 0 0 # 28
1967 2 2 3 2 150 0 0 0 0 0
0 0 0 0.039060182 0.434849586 0.976512643 6.946292335
8.493590824 8.482402753 9.015043671 8.141705657 7.075030165
2.903868454 1.004519554 0.670878584 0.388630812 0 0.089220001
0.062886235 0 0 0 0 0 0 0 0 0
0 0.032565374 0.690870609 3.142275662 4.960159935 7.480713148
9.92708051 11.59883603 4.897350448 1.891630833 0.515508153
0.138517847 0 0 0 0 0 0 0 # 31
1968 2 2 3 2 150 0 0 0 0 0
0 0 0 0.023966388 0.37370297 0.69954837 2.208112507
2.898547878 4.895348087 6.651939849 8.007384166 7.18698363
1.666481565 1.702999717 0.679352885 0.390437149 0.168274706
0.092376016 0.016563016 0.004245182 0 0 0 0 0
0 0 0 0.018554319 0.042618998 0.246699365 3.155731964
7.781662485 14.15120644 17.91778742 11.29628683 5.577779218
1.704312777 0.291647655 0.149448445 0 0 0 0 0
0 0 # 38
1969 2 2 3 2 150 0 0 0 0 0
0 0 0 0.067155371 0.991158449 1.889598779 3.644275579

4.455144756 4.298912575 5.123055503 7.035704204 7.386801676
5.336501942 1.719044941 0.647151034 0.272845876 0.135201268
0.00171814 0.000286357 0.009368046 0.000286357 0 0 0
0 0 0 0.017097858 0 0.049465687 0.585031446
1.416864788 2.781909226 9.679966367 12.94777698 16.19752154
8.119914104 3.793588715 1.031658915 0.196344682 0.168362481 0
0 0.000286357 0 0 0 # 37
1970 2 2 3 2 150 0 0 0 0 0
0 0 0 0.06646708 1.00261671 2.191983863 2.970572529
5.428904592 7.833573917 7.162714542 8.190998483 7.145314957
3.063272104 1.614731806 0.775069684 0.380148247 0.18083158
0.045275255 0.040670708 0.004195009 0 0 0 0 0
0 0 0 0.015558756 0.11224874 1.967330439 6.484894053
7.466978572 10.13401746 12.69140091 8.008268798 3.677680655
0.995498888 0.225658912 0.085630356 0.037492398 0 0 0
0 0 0 # 40
1971 2 2 3 2 50 0 0 0 0 0
0 0 0 0.008684359 0.094660588 0.968765238 2.825528966
4.302969743 2.698010372 5.745807237 8.00337709 7.622090355
4.233746027 3.117957048 0.858606774 0.684365735 0.277485046
0.151419171 0.098918348 0.017832964 0.024086372 0 0 0
0 0 0 0 0 0.00973469 0.179365551 3.300829827
9.397737598 13.06130715 8.276767058 12.91544975 6.223460849
3.680769582 0.649992861 0.57027365 0 0 0 0 0
0 0 # 10
1972 2 2 3 2 120 0 0 0 0 0
0 0 0.005938297 0.040319235 1.048254345 2.279588693
4.587632753 4.629371557 6.981102898 6.470565876 7.246209177
3.229623222 2.664872656 1.153163463 0.36622546 0.147861892
0.158013671 0.065952218 0.043307278 0.002138016 0.013688881 0
0 0 0 0 0.005938297 0 0 0.155219916
1.558197469 5.195719305 10.84683648 16.13970679 14.533987
6.8553893 2.274267431 0.804718994 0.412313457 0.039727781
0.025596934 0 0.018551256 0 0 0 0 # 24
1973 2 2 3 2 70 0 0 0 0 0
0 0 0 0.079822945 1.053254793 3.859312512 5.92379308
6.823692039 6.607892095 7.037862347 6.758457793 3.963265639
0.928513164 0.475741379 0.263734256 0.259491198 0.112950318
0.018233569 0.00149906 0 0.015702908 0 0 0 0
0 0 0 0 0.019732629 1.041741118 3.372681729
7.950065278 14.6949978 15.12421278 8.101066867 3.925544663
1.441823225 0.097588982 0.047325836 0 0 0 0 0
0 0 # 14
1974 2 2 3 2 150 0 0 0 0 0
0 0 0 0.001840986 0.229588835 1.186269309 1.99524446
2.38522673 3.9261905 6.325345059 8.065925193 6.500235518

4.453350856 1.463481343 0.297197496 0.431745015 0.150439668
0.044853376 0.032572573 0.004223025 0.001012711 0 0 0
0 0 0 0 0 0.044048711 0.864519699 4.0201848
5.874912411 12.73259342 17.7832686 12.72073235 5.647494251
1.995396659 0.633815622 0.126914326 0.027832661 0.025460242
0.008083596 0 0 0 0 # 35
1975 2 2 3 2 100 0 0 0 0 0
0 0 0 0 0.343835344 0.80727587 2.618461764
3.970014796 5.08990679 5.903859433 7.922238338 7.45151603
5.885839455 2.205421741 1.227750663 0.475410259 0.099195239
0.119938688 0.03734999 0.021526248 0.008348239 0 0 0
0 0 0 0 0 0.085874498 0.574261278 1.896496074
6.395518408 9.933017677 13.72728776 11.64289014 7.554898664
2.394972038 1.070758736 0.361218249 0.125450203 0.032770916
0.016696478 0 0 0 0 # 20
1976 2 2 3 2 30 0 0 0 0 0
0 0 0 0 0.008657572 0.123656798 1.031323311
1.907123651 3.339174449 7.316761817 9.492395642 13.0296458
9.9097101 4.40176476 2.284085675 1.013854488 0.548473273
0.399290725 0.011503788 0.011503788 0.051490543 0 0 0
0 0 0 0 0 0 0.093406788 0.915635577
2.476133637 5.745247809 10.67892595 10.94553933 8.537782263
3.839596252 1.406645644 0.171727311 0.154471629 0.137215946 0
0.017255682 0 0 0 # 6
1977 2 2 3 2 50 0 0 0 0 0
0 0 0 0.336984757 1.005939661 2.394171699 6.746511997
8.792020139 7.729616562 10.49731383 7.472749843 5.585104074
4.32135632 3.099716077 1.291767242 0.483153701 0.444350975
0.065949272 0.045178047 0 0.01654343 0 0 0 0
0 0 0 0 0.394569883 0.492012318 2.240278983
4.621631282 6.242959484 8.383616032 6.893422448 5.871349199
2.545231443 1.161458075 0.574577525 0.149146327 0.101319379 0
0 0 0 0 # 10
1978 2 2 3 2 45 0 0 0 0 0
0 0 0.016341977 0 0.849923992 3.04434092 3.476076112
2.671158251 3.294521482 6.640531673 5.393277086 4.374460473
5.804937205 5.150744061 0.968065837 0.890612314 0.344154081
0.236468104 0.119694816 0.016341977 0 0 0 0 0
0 0 0 0 0.054185745 0.294460667 1.797996107
2.80362161 7.718706503 10.44828291 10.52936535 10.66302034
7.204568817 3.506847298 0.974395701 0.294155586 0.386059059
0.032683954 0 0 0 0 # 9
1979 2 2 3 2 85 0 0 0 0 0
0 0 0 0.131292897 0.78927728 3.29888798 6.266682927
6.700435214 6.803357448 6.299278229 5.338608305 7.210705446
5.186265649 2.359159948 2.5936397 2.497953575 1.74944546

1.154793849 0.732848242 0.293464849 0.185050783 0 0 0
0 0 0 0 0 0.01957547 0.577167829 2.048279018
2.972546359 4.876516591 5.044330131 6.988073605 7.439729094
6.804494351 2.23807871 1.120048849 0.145434097 0 0.134578115
0 0 0 0 # 17
1980 2 2 3 2 140 0 0 0 0 0
0 0 0 0.026277032 0.657650093 1.653900749 4.277206091
5.860434873 6.859714287 7.318212726 8.18539112 6.590278087
4.695852012 3.594648126 3.710780886 1.764275262 2.100719552
0.369574288 0.094356933 0.034560252 0.009384715 0 0 0
0 0 0 0 0 0.086524681 0.59308856 3.10815434
4.592860084 7.699137638 9.15814118 6.777452196 4.83387865
3.326912356 1.66178547 0.233817817 0.066613223 0.032569111
0.025847607 0 0 0 0 # 28
1981 2 2 3 2 40 0 0 0 0 0
0 0 0 1.933476628 3.685654928 4.339135575 8.448635435
8.475015665 11.41841982 6.406796357 5.27393 6.24534164
3.967312793 3.367944265 1.901114744 1.414103818 0.536219658
0.858465762 0.026177623 0 0.016259058 0 0 0 0
0 0 0 0.322246105 0.338505162 3.504554788 5.935176316
7.13022314 6.252400471 4.530386694 1.191788748 0.874931529
1.386862462 0.166565573 0.052355247 0 0 0 0 0
0 0 # 8
1982 2 2 3 2 5 0 0 0 0 0
0 0 0 0 5.940594059 18.81188119 4.95049505
5.940594059 11.88118812 6.930693069 2.97029703 3.96039604
0.99009901 2.97029703 0 2.97029703 0.99009901 0
1.98019802 0 0 0 0 0 0 0 0 0
0 0 10.89108911 9.900990099 4.95049505 0.99009901 0
0.99009901 0 0.99009901 0 0 0 0 0 0
0 0 0 # 1
1985 2 2 3 2 15 0 0 0 0 0
0 0 0 0 5.07420337 5.514872531 8.957654604
8.187111572 5.925970448 9.117134024 5.709152378 1.181640947
2.537101685 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 8.360931363
11.02974506 15.53768694 6.822996313 2.93954508 1.225095895
1.162528064 0.251618496 0.465011226 0 0 0 0 0
0 0 0 # 3
1986 2 2 3 2 25 0 0 0 0 0
0 0 0 0.92927948 2.287802496 5.346615293 6.840989463
8.009293448 6.325149897 6.687230881 4.375408328 3.631766601
5.3073714 0.246595245 0.862456496 0.621088225 0.068962363
0.586607043 0.327784703 0.25882234 0.034481182 0 0 0
0 0 0 0 0.261541608 0 7.106223124 15.67941177
12.75873883 6.425344003 2.989646047 0.614088103 0.951592196

0.293303521 0.103443545 0.034481182 0.034481182 0 0 0
0 0 0 # 5
1987 2 2 3 2 45 0 0 0 0 0
0 0 0.502349711 0.212954328 1.375637729 5.46629224
8.07070387 6.443470628 6.971759411 7.657972109 5.20346988
1.292104988 0.159957914 0.783162277 0.565900331 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0.750845323 6.361121207 11.84520144 17.68728443 13.51445019
3.135091162 1.218731563 0.215638939 0.565900331 0 0 0
0 0 0 0 0 0 # 9
1988 2 2 3 2 25 0 0 0 0 0
0 0 0 4.198165956 6.163559039 6.693262011 13.58953017
9.629155611 8.804924536 4.711525917 4.227311286 1.365999426
0.83540785 0 0.530591576 0 0 0 0 0 0
0 0 0 0 0 0 0 0 3.455690944
3.871609555 10.07441239 12.08112598 2.75645407 5.957696684
1.053577006 0 0 0 0 0 0 0 0 0
0 0 # 5
1989 2 2 3 2 35 0 0 0 0 0
0 0 0 0.547730997 3.232771643 9.984290017 12.38454824
9.835134106 10.05512791 5.277374025 4.086373743 3.302156851
0.9716407 0.26573464 0.257971462 0.26573464 0 0 0
0 0 0 0 0 0 0 0 0 0
0.032523435 6.343883832 10.31531416 15.3894996 4.29417755
2.376334889 0.781677565 0 0 0 0 0 0 0
0 0 0 0 # 7
1990 2 2 3 2 30 0 0 0 0 0
0 0 0 0.576146522 2.426856771 9.027596612 12.34371709
16.56325552 7.924167793 4.880099799 1.586219616 0.474212944
0.379708723 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0.745460438 1.965958257
12.02386985 17.25418917 5.801631586 5.077637503 0.949271808 0
0 0 0 0 0 0 0 0 0 0 #
6
1991 2 2 3 2 25 0 0 0 0 0
0 0 0.482896363 0.482896363 2.676268959 3.871347438
3.759874029 9.222161585 6.154289999 11.41967119 3.531612733
1.823022842 3.786133971 0.342808076 0.482896363 0.482896363 0
0 0 0 0 0 0 0 0 0 0 0
0 1.053055107 5.24198331 9.797060558 19.47812697 10.37992753
3.194045222 2.337025031 0 0 0 0 0 0 0
0 0 0 0 # 5
1992 2 2 3 2 25 0 0 0 0 0
0 0 0.878985951 2.086600103 9.15656268 10.55264439
9.058027037 10.70276333 3.971452771 6.611354675 3.490477219
4.93816028 0.992468057 0.992468057 0.992468057 0.496234028 0

0 0 0 0 0 0 0 0 0 0 0
0 2.636957852 6.147170682 7.471953803 9.007590178 3.914248166
2.844976725 1.864870555 0.695331375 0.496234028 0 0 0
0 0 0 0 0 0 # 5
1993 2 2 3 2 30 0 0 0 0 0
0 0 0 1.964336853 5.590106986 13.40558427 10.59675155
13.53994234 9.552573482 4.181893356 4.989003406 2.302307346
2.352126014 1.10197063 0.630276466 0.471694165 0 0
0.315138233 0 0 0 0 0 0 0 0 0
0 2.952015625 5.348443891 7.712600621 7.462372907 3.198559853
2.017163781 0.315138233 0 0 0 0 0 0 0
0 0 0 0 # 6
1994 2 2 3 2 35 0 0 0 0 0
0 0 0 0.214294284 9.840659768 6.762627454 10.17669988
11.81443518 3.556762855 1.559494892 1.99095349 0.743547794
0.023228873 0.013068625 0 0.024072312 0 0 0 0
0 0 0 0 0 0 0 0 0 2.572956009
23.43917745 12.2222198 4.966529361 8.875106301 0.450160362
0.754005311 0 0 0 0 0 0 0 0 0
0 0 # 7
1995 2 2 3 2 10 0 0 0 0 0
0 0 0 0 3.398670351 4.967365181 7.451047771
9.281023292 9.019742602 5.882352941 7.189767081 8.104754841
4.706084491 0.91498776 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 3.659951041
5.882352941 19.08460796 5.489926561 1.82997552 3.137389661 0
0 0 0 0 0 0 0 0 0 0 #
2
1996 2 2 3 2 15 0 0 0 0 0
0 0 0 0 5.195458626 11.11331042 13.88304481
10.6124191 13.21150277 4.699439905 3.89483485 3.090229795
0.850583592 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 9.185364023
6.53678358 4.919587404 3.044251258 5.28389746 4.479292405 0
0 0 0 0 0 0 0 0 0 0 #
3
1997 2 2 3 2 15 0 0 0 0 0
0 0 0 0 1.159684542 6.211386303 11.49759817
11.34554676 10.84849824 9.716842007 5.714337786 4.002504221
3.146922498 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0.386561514 0.386561514
6.487460814 18.19154078 10.13143183 0.773123028 0 0 0
0 0 0 0 0 0 0 0 0 0 #
3
1998 2 2 3 2 80 0 0 0 0 0
0 0 0.137906343 1.375959679 1.432931908 7.210198279

9.498705216 7.20362947 8.977530782 8.39378272 3.01356145
2.510308692 1.249178412 0.633634863 0.524522762 0.060022384
0.089767245 0 0 0 0 0 0 0 0 0
0 0 0 0.817747043 3.318198031 8.089394554 15.4238004
10.76626196 5.545952113 2.639252268 0.550688434 0.330234177 0
0.206830825 0 0 0 0 0 0 0 # 16
1999 2 2 3 2 70 0 0 0 0 0
0 0 0 0.051771968 1.362127056 5.300222865 11.21542303
11.28589673 9.234791837 5.091121205 2.820781219 1.953007322
1.606082988 0.760266218 0.442755109 0.046160303 0 0.010661626
0 0 0 0 0 0 0 0 0 0 0
0.002991103 1.748323545 9.636431449 20.16927867 12.36597067
3.566256824 0.711336746 0.36088886 0.257452654 0 0 0
0 0 0 0 0 0 # 14
2000 2 2 3 2 100 0 0 0 0 0
0 0 0 0.073097701 0.749167927 4.728203478 6.477188067
11.42366891 12.99550613 12.28759103 2.961884825 1.855837536
1.082122391 0.927922246 0.245907255 0.059992782 0 0 0
0 0 0 0 0 0 0 0 0 0
0.198382795 1.527163665 10.06845013 16.46568093 11.04527503
2.902892474 1.459959555 0 0.464105133 0 0 0 0
0 0 0 0 0 # 20
2001 2 2 3 2 65 0 0 0 0 0
0 0 0 0.043007187 0.906726207 4.045960081 15.01091807
10.05124718 13.08480619 8.236059521 2.172745338 1.895076331
0.340281776 0.235107859 0.018769977 0.197808553 0.050957356 0
0 0 0 0 0 0 0 0 0 0 0
0.041131914 2.800523725 7.994855418 17.83734361 8.573633415
5.851526094 0.535078165 0.020126103 0.05630993 0 0 0
0 0 0 0 0 0 # 13
2002 2 2 3 2 100 0 0 0 0 0
0 0 0 0.127869429 1.65025854 5.77923701 9.436164467
9.779346739 13.16200924 8.122320648 5.885956567 4.926938765
0.980105693 0.31077226 0.075711859 0.102334869 0.152255605
0.0137405 0 0 0 0 0 0 0 0 0
0 0.012300071 0.15962667 1.857969905 8.213459147 10.02063451
10.59510444 5.699171287 2.125294055 0.2102003 0.447715115 0
0.153502304 0 0 0 0 0 0 0 # 20
2003 2 2 3 2 125 0 0 0 0 0
0 0.000822309 0.000822309 0.063271923 2.066396751 8.217660884
9.176942081 10.0693291 8.380306519 7.862720243 3.45075572
1.842409779 1.03503278 0.371283106 0.130565535 0.15435519
0.030111715 0 0.079531509 0 0 0 0 0 0
0 0 0 0.023233169 0.122362772 3.002381543 11.47938097
12.83084696 11.16919114 3.837690007 3.260047779 1.028322612

0.238329161 0 0 0.075896435 0 0 0 0 0
0 # 25
2004 2 2 3 2 110 0 0 0 0 0
0 0 0 0.00465706 0.523117929 3.07111946 4.306105823
11.58396525 10.22966226 14.65283477 7.658433063 1.788803373
1.233086775 0.645789038 0.278905597 0.189909473 0 0 0
0 0 0 0 0 0 0 0 0 0
0.00685651 0.631699428 8.175287623 12.01430223 11.64907096
6.908182616 2.553156498 1.874898395 0.003531272 0.009196007
0.007428597 0 0 0 0 0 0 0 # 22
2005 2 2 3 2 130 0 0 0 0 0
0 0 0.041818348 0.013821933 2.31019231 3.12787622
8.767579747 10.03101824 10.80234828 11.21166017 5.431319729
2.561560638 2.082190311 0.899386818 0.505386358 0.249480881
0.23744789 0.041818348 0.011278252 0 0 0 0 0
0 0 0 0 0 0.530624362 2.708003306 9.850633972
8.934336132 9.936796529 5.174249782 4.155474026 0.349862661
0.033834755 0 0 0 0 0 0 0 0 0
26
2006 2 2 3 2 135 0 0 0 0 0
0 0 0.089382461 0.478989481 1.581827702 5.086224666
8.151384911 7.391613782 7.316179062 8.430737238 4.986920209
5.111925361 2.505304505 1.027154088 0.351947111 0.470319512
0.017375851 0.028083326 0.000863772 0.002014959 0 0 0
0 0 0 0 0 0.002679261 0.35027287 3.016036186
8.884681444 10.42707166 10.75720269 9.705633661 2.740310448
0.329025507 0.528893898 0.038222872 0.007773952 0.139256326 0
0.04469123 0 0 0 0 # 27
2007 2 2 3 2 90 0 0 0 0 0
0 0 0 0 0.172827612 2.22636428 7.020333263
10.34598433 12.37535564 11.14895178 11.41614891 3.665937331
2.127539291 1.467710783 0.488975685 0.343930019 0.232286282
0.169380609 0.010016757 0.141521986 0 0 0 0 0
0 0 0 0 0.01501833 0.612139829 2.324070506
5.672113504 10.30473055 8.668195572 6.162119613 1.635773489
1.021957462 0.197257844 0.033358748 0 0 0 0 0
0 0 # 18
2008 2 2 3 2 115 0 0 0 0 0
0 0 0.008306665 0.183899638 1.963282761 5.612937452
10.60672144 7.395164242 8.863249356 7.966464589 3.918052643
2.709432815 2.646549025 1.742850123 0.551021182 0.402246268
0.091462494 0.043384884 0.032814146 0.004059452 0.010648898 0
0 0 0 0 0 0.012958904 0.024206185 0.338165033
3.859081452 8.61687581 7.907369911 11.05645934 6.263050884
3.548415792 2.788373555 0.260976685 0.193778546 0.26663988
0.11109995 0 0 0 0 0 0 # 23

1969 1 3 3 2 6 0 0 0 0 0
0 0 0 0 3.921568627 13.7254902 21.56862745
7.843137255 7.843137255 5.882352941 0 3.921568627 5.882352941
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1.960784314 1.960784314 13.7254902
5.882352941 5.882352941 0 0 0 0 0 0 0
0 0 0 0 0 0 # 1
1978 1 3 3 2 6 0 0 0 0 0
0 0 0 1 5 8 3 11 6 7 7
11 8 7 11 2 5 0 0 0 0 0
0 0 0 0 0 0 1 0 2 2 1
1 1 0 0 0 0 0 0 0 0 0
0 0 0 # 1
1980 1 3 3 2 24 0 0 0 0 0
0 0 0 0 0 0 1.20673396 1.192760433
4.477257392 6.916742176 12.96575608 4.809787225 3.374927405
1.875199813 1.560734986 0.918086163 0.286971964 0 0 0
0 0 0 0 0 0 0 0 0 0
0.170978845 2.049328298 9.849716999 14.99726725 13.11555379
9.65019594 6.760005802 2.197536574 0.692653563 0.931805333 0
0 0 0 0 0 0 # 4
1981 1 3 3 2 12 0 0 0 0 0
0 0 0 0 1.639247887 1.639247887 2.458871831
3.448970841 7.547090559 8.707664635 3.003048418 4.471821239
4.163622494 3.993147428 1.842474341 1.193325464 1.501524209
0.170475066 0 0.170475066 0 0 0 0 0 0
0 0 0 0 1.501524209 15.29740757 20.69382504
7.442118268 2.662098285 5.599643927 0.852375332 0 0 0
0 0 0 0 0 0 0 # 2
1982 1 3 3 2 6 0 0 0 0 0
0 0 0 1 0 1 1 1 9 7 9
5 3 2 1 1 0 0 0 0 0 0
0 0 0 0 0 0 0 3 5 13 17
14 7 0 0 0 0 0 0 0 0 0
0 0 0 # 1
1983 1 3 3 2 18 0 0 0 0 0
0 0 0 0 0 4.192230621 1.397410207 18.49314601
9.463924236 4.74194692 7.289419949 2.868734594 2.597438785
1.653623695 2.504631955 1.253973154 1.194476827 1.642520194
1.019966668 0.157854907 0 0 0 0 0 0 0
0 0 0.698705103 6.987051034 12.18814482 8.486134175
8.349821803 1.96535469 0.512426976 0.111035013 0.18561366 0
0.011103501 0.033310504 0 0 0 0 0 0 #
3
1984 1 3 3 2 12 0 0 0 0 0
0 0 0 0.39954503 0.799090059 0.799090059 1.198635089

1.598180118 2.680080966 6.300657385 7.265823992 6.866278962
11.47669314 5.809049267 6.067188903 4.72714842 3.245702543
4.044792602 0.540950424 1.622851271 0 0 0 0 0
0 0 0 0 1.598180118 5.194085385 7.616026715
5.901112356 5.64297272 4.161526843 0.940495453 2.163801695
0.39954503 0.540950424 0.39954503 0 0 0 0 0
0 0 # 2
1986 1 3 3 2 6 0 0 0 0 0
0 0 0 0 0 0.99009901 1.98019802 0.99009901
5.940594059 11.88118812 9.900990099 8.910891089 5.940594059
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0 0 0 0 0 0 0 0 2.97029703
8.910891089 12.87128713 8.910891089 8.910891089 3.96039604 0
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1
1987 1 3 3 2 6 0 0 0 0 0
0 0 0 0 0 2 2 10 12 14 12
22 4 2 4 2 0 0 0 0 0 0
0 0 0 0 0 0 0 0 2 2 4
4 0 2 0 0 0 0 0 0 0 0
0 0 0 # 1
1989 1 3 3 2 36 0 0 0 0 0
0 0 0.551898172 0 2.713729167 6.344750729 8.990851383
11.29166609 10.1474927 7.989991831 8.061670288 4.672042203
2.463182713 1.750597705 1.354172607 0 0.199341799 0.551898172
0 0 0 0 0 0 0 0 0 0
0.148945597 1.114292034 4.728568918 6.952493839 8.588483322
6.94773848 3.78865908 0.64753317 0 0 0 0 0
0 0 0 0 0 0 # 6
1990 1 3 3 2 12 0 0 0 0 0
0 0 0 0 0.908310157 1.091689843 4.183379687
12.73351875 5.091689843 7.458449217 7.27506953 5.27506953
0.908310157 0.908310157 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 3.816620313
11.09168984 17.44986094 17.08310157 2 2.72493047 0 0
0 0 0 0 0 0 0 0 0 0 #
2
1991 1 3 3 2 54 0 0 0 0 0
0 0 0 0 3.039306724 8.609187576 7.106935444
8.30775688 17.4428693 7.849528206 4.633085104 5.358403119
1.830119656 1.128349134 0.118069172 0.165467454 0 0 0
0.123583292 0 0 0 0 0 0 0 0.162509691
0 0.57636218 3.443230358 9.890586627 10.4365697 6.005073439
2.797279628 0.487863662 0.487863662 0 0 0 0 0
0 0 0 0 0 # 9

1992 1 3 3 2 18 0 0 0 0 0
0 0 1.079995849 5.399979244 5.399979244 3.239987547
3.712912418 6.755867244 12.8297199 12.17941924 6.050279906
5.423551998 3.515879697 2.435883848 0 0 0 0 0
0 0 0 0 0 0 0 0 1.079995849
0.09851636 10.58695295 11.7138626 6.432056647 1.572577651
0.394065441 0.09851636 0 0 0 0 0 0 0
0 0 0 0 0 # 3
1993 1 3 3 2 18 0 0 0 0 0
0 0 0 0 1.344773708 0 1.014644801 3.236029571
5.554404059 6.723868541 10.3702308 2.592557699 3.099880099
2.728707171 1.344773708 0 0 0 0 0 0 0
0 0 0 0 0 0 0 3.196869817 10.33107104
16.47488554 17.62379555 10.93349889 3.430009006 0 0 0
0 0 0 0 0 0 0 0 0 # 3
1994 1 3 3 2 30 0 0 0 0 0
0.128920998 0 0 1.804893977 4.586515498 5.936952546
5.2676212 6.315209315 4.371566021 2.476473087 9.330760603
4.700458893 2.436035745 0.79652248 1.427805484 0 0 0
0 0 0 0 0 0 0 0 0.128920998 0
1.031367987 6.095251226 19.01368459 14.36004874 5.167404184
3.276989719 1.346596712 0 0 0 0 0 0 0
0 0 0 0 0 # 5
1995 1 3 3 2 30 0 0 0 0 0
0 0 0 0 0.664872731 1.556750529 5.716740762
9.974452111 9.916848325 7.950004642 9.11240359 6.656255503
2.50884868 0.777309262 2.107292567 0 0 0 0 0
0 0 0 0 0 0 0 0 0.891877798
8.896001657 11.17989116 9.847300166 6.880091081 4.471181636
0.665110574 0 0 0 0.226767225 0 0 0 0
0 0 0 0 # 5
1996 1 3 3 2 6 0 0 0 0 0
0 0 0 0 0 2.857142857 2.857142857 14.28571429
11.42857143 20 11.42857143 0 0 0 2.857142857 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 5.714285714 11.42857143 14.28571429 2.857142857
0 0 0 0 0 0 0 0 0 0 0
0 0 # 1
1997 1 3 3 2 12 0 0 0 0 0
0 0 0 3.155848534 13.88573355 17.67275179 7.308804741
5.913849457 4.020340336 7.908064802 4.518894172 3.389170629
1.129723543 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1.893509121 1.893509121
8.937082121 10.33203741 6.910957129 0 1.129723543 0 0
0 0 0 0 0 0 0 0 0 0 #
2

1998 1 3 3 2 12 0 0 0 0 0
0.274803849 0 0.274803849 0 7.366695726 3.408544014
1.704272007 0 0.549607697 0.549607697 2.198430789 0.824411546
0.824411546 0.274803849 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 18.74699208
57.06538778 5.662423719 0 0.274803849 0 0 0 0
0 0 0 0 0 0 0 0 0 # 2
1999 1 3 3 2 12 0 0 0 0 0
0 0 0 0 0.967408032 4.837040159 3.004073996
6.873706123 9.114071889 13.95111205 19.19555181 8.044813956
3.971482028 3.971482028 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 3.004073996
3.971482028 4.93889006 3.971482028 10.18332982 0 0 0
0 0 0 0 0 0 0 0 0 0 #
2
2000 1 3 3 2 24 0 0 0 0 0
0 0 0 0.343585869 0.636664763 5.193620492 3.286133262
1.563901361 7.917972369 5.33016434 4.900897381 8.113984085
5.090099482 1.272973744 1.98882444 0 0 0 0 0
0 0 0 0 0 0 0 0 0.132199968
4.378592665 9.655345862 16.58494146 10.92831961 9.126901772
1.00892959 2.545947488 0 0 0 0 0 0 0
0 0 0 0 # 4
2001 1 3 3 2 30 0 0 0 0 0
0 0 0 0 0.212004644 0 9.803489668 9.709558351
6.096341843 11.29276834 10.78564039 3.409294851 4.09626727
2.774208666 0 0 0 0 0 0 0 0
0 0 0 0 0 0 2.266152259 5.507309826
8.391529899 12.15060771 7.346371458 5.676352878 0.482101949 0
0 0 0 0 0 0 0 0 0 0 #
5
2002 1 3 3 2 12 0 0 0 0 0
0 0 0 0 0 2.443222889 0 4.560085505
15.39140837 15.71776864 4.030869851 2.972438543 2.972438543
1.221611444 1.221611444 0 0 0 0 0 0 0
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7.532524048 10.34178246 10.3814577 7.898559566 8.061739702
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0 0 # 2
2003 1 3 3 2 24 0 0 0 0 0
0 0 0 0 0.695882162 0.927842883 6.618735949
11.42272405 10.73906436 13.53282564 7.485652157 6.151318734
4.983056325 1.678778731 1.114982541 0 0 0 0 0
0 0 0 0 0 0 0 0 2.265484994 0
4.629190393 7.492337144 7.328614401 3.514207851 9.419301682 0

0	0	0	0	0	0	0	0	0	0	0
#	4									
2004	1	3	3	2	30	0	0	0	0	0
0	0	0	0	0	0	3.48299726		4.545932039		
6.318017802		9.671162806		3.828135581		8.899538514		2.362969005		
5.080106818		0.94445314		1.757696569		0	0	0	0	0
0	0	0	0	0	0	0	0	1.147009353		
2.273864665		17.44564152		24.20685293		7.766126673		0.134747662		0
0.134747662		0	0	0	0	0	0	0	0	0
0	#	5								
2005	1	3	3	2	30	0	0	0	0	0
0	0	0	0	0.590742369		1.710362848		2.171074626		
4.540346176		7.984969454		6.367926326		8.957774543		7.06780623		
1.890845274		0.19942376		1.128390714		0	0	0	0.19942376	
0	0	0	0	0	0	0	0	0	0	0
3.515272254		7.919836616		15.16228303		19.15150519		8.242228901		
3.199787935		0	0	0	0	0	0	0	0	0
0	0	#	5							
2006	1	3	3	2	36	0	0	0	0	0
0	0	0	0	0	1.46450033		2.424830309		5.355617242	
8.386817958		7.453698577		4.726661259		2.523617071		1.048878491		
0.279054207		0.732250165		0.311434521		0	0	0	0	0
0	0	0	0	0	0	0	0	0.727056361		
2.439788009		8.91260345		23.0652299		23.43817404		5.87854443		0
0.831243679		0	0	0	0	0	0	0	0	0
0	#	6								
2007	1	3	3	2	108	0	0	0	0	0
0	0	0	0	0	0.988842645		2.236092318		5.43257202	
17.71672553		8.809430659		7.781141889		4.286310934		1.91192722		
0.704638625		0.454931771		0.275870587		0	0	0	0	0
0	0	0	0	0	0	0.216740177		0	0.587554655	
2.662015616		8.372530307		15.39785521		17.83709759		3.684778729		
0.642943515		0	0	0	0	0	0	0	0	0
0	0	#	18							
2008	1	3	3	2	150	0	0	0	0	0
0	0	0	0	0	0.176007516		2.636681172		8.361316869	
14.00964504		12.99458897		6.293253695		3.965029486		1.580390646		
1.440696471		0.431506335		0.469048875		0.084442947		0	0	0
0	0	0	0	0	0	0	0	0	0.955326189	
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0.974362391		0.014355565		0	0	0	0	0	0	0
0	0	0	#	27						
1966	2	4	3	2	54	0	0	0	0	0
0	0	0	0	2.756292482		3.328708693		10.01044285		
12.95357558		6.456685763		6.114581925		7.154369966		4.539155739		
1.538180583		1.156786878		2.044293964		0.068862367		0.077031606		

0.075551946 0 0 0 0 0 0 0 0 0
0 0 0 2.212299423 5.436379294 12.06552335 12.01833448
4.610211273 3.104585363 2.14042174 0.137724734 0 0 0
0 0 0 0 0 0 # 9
1967 2 4 3 2 66 0 0 0 0 0
0 0 0 0 1.240381427 3.50075246 5.126902796
7.600559256 7.265848401 7.596060222 7.981084815 3.981025447
3.623639483 2.089998301 0.148686375 0.163387159 0 0 0
0 0 0 0 0 0 0 0 0 0
1.014026313 1.743676321 10.95124194 16.09320081 12.24303263
4.826627007 2.081930552 0.558150911 0 0.169787381 0 0
0 0 0 0 0 0 # 11
1968 2 4 3 2 114 0 0 0 0 0
0 0 0 0 0.193917312 3.333877852 6.679164756
7.758478397 9.54291418 11.69491837 8.744025033 3.275042425
2.010506124 1.412606063 0.530314668 0.068722835 0.080047042 0
0 0 0 0 0 0 0 0 0 0 0
0 0.547500523 5.463230781 11.61398531 12.00659562 8.689308011
3.947198285 1.672950638 0.574601689 0.068722835 0.091371249 0
0 0 0 0 0 0 # 19
1969 2 4 3 2 108 0 0 0 0 0
0 0 0 0 1.438630799 4.562720863 8.458240676
13.43725171 12.52784053 12.17116059 11.80874251 5.406180096
3.726370288 2.370425815 0.726315422 0.365176667 0 0 0
0.110362486 0 0 0 0 0 0 0 0 0
0.146056293 0.363331011 2.036388942 5.419252867 7.292991055
5.467603266 1.285223273 0.666684562 0.110362486 0.102687796 0
0 0 0 0 0 0 0 # 18
1970 2 4 3 2 126 0 0 0 0 0
0 0 0 0 0.69682603 5.551466429 4.689002272
15.54560009 18.11566209 15.36444265 5.635695721 2.094666121
1.279340787 0.439566969 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0.387650122
3.418088181 6.424104855 8.469651557 7.234627762 4.133229206
0.434126553 0.08625261 0 0 0 0 0 0 0
0 0 # 21
1971 2 4 3 2 30 0 0 0 0 0
0 0 0 0 0 2.880874608 9.433619938 10.2462117
11.02228133 4.883099493 6.546127239 4.022933859 1.913611662
0.505958246 0.536596467 0.383712712 0.159206163 0.315251121 0
0 0 0 0 0 0 0 0 0 0 0
0 6.872889679 12.41796589 12.95175398 8.999392294 4.454500273
1.135601018 0.318412325 0 0 0 0 0 0 0
0 0 # 5
1972 2 4 3 2 42 0 0 0 0 0
0 0 0.058811766 0.117623531 1.381980193 8.056620981

7.437284859 6.623082657 5.862715226 4.665494408 2.121228036
1.089895699 0.998749145 0.646089804 0.352409311 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0.058114407 2.905608816 12.86431175 16.99856426 13.57287925
8.148604358 5.082078411 0.592517351 0.365335786 0 0 0
0 0 0 0 0 0 # 7
1973 2 4 3 2 30 0 0 0 0 0
0 0 0 0.287936155 0.99318211 4.002623585 4.024067942
5.602462299 4.33981737 8.148077505 5.222644154 4.74068233
2.388760541 1.798896212 0.534196004 0.358434212 0.161533531 0
0 0 0 0 0 0 0 0 0 0
0.171049951 0.57587231 2.257101091 6.882383339 16.25376484
12.67523597 10.7977772 5.743422352 1.847982889 0 0.192096103
0 0 0 0 0 0 0 0 # 5
1974 2 4 3 2 42 0 0 0 0 0
0 0 0 0.071765216 0.910791132 3.105035857 3.029557573
3.373639112 5.71271677 10.3388602 7.852505414 8.935785799
2.74365658 1.975834858 1.773065542 0.708437414 0.053651067
0.291510566 0.145755283 0.291510566 0 0 0 0 0
0 0 0 0 0 0.809647816 2.82206379 4.048884984
6.746955625 14.45361751 10.236508 7.068065001 2.285574061
0.214604266 0 0 0 0 0 0 0 0 #
7
1975 2 4 3 2 30 0 0 0 0 0
0 0 0.497308777 0.994617555 1.208031814 2.415989272
6.620660209 4.451794953 7.106854661 5.521603828 3.238445392
3.609154647 3.998647111 1.733819117 0.296781603 0.445172404
0.329269288 0 0 0 0 0 0 0 0 0
0 0 0.248654389 2.632182244 3.988482416 9.155826957
8.310230454 10.74585417 14.70177312 6.468960265 1.131494557
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5
1977 2 4 3 2 66 0 0 0 0 0
0 0 0 0.260772529 2.271926559 6.444693389 8.461496675
10.42796582 6.973031134 7.872960975 5.266954093 2.95238659
2.031023274 0.939247493 0.85320455 0.346786433 0.199501975
0.089830105 0 0 0 0 0 0 0 0 0
0 0 0.187119712 3.162117834 7.094853002 10.02381003
10.77932451 5.573536603 4.3329102 2.952942454 0.48658441
0.015019649 0 0 0 0 0 0 0 0 #
11
1978 2 4 3 2 72 0 0 0 0 0
0 0 0 0.488764504 2.103557038 4.564664517 4.46530019
4.16607997 4.325140433 6.737869453 5.458589655 3.566662273
3.000346647 2.871324002 1.411163285 1.045384151 0.338471088
0.336531495 0.078826071 0 0 0 0 0 0 0

0 0 0.176508657 0.734537832 5.020233898 9.603940975
10.40642888 12.41666328 9.125576328 5.314111872 1.723839815
0.432923317 0.086560367 0 0 0 0 0 0 0
0 # 12
1979 2 4 3 2 36 0 0 0 0 0
0 0 0 1.263200814 4.50347907 10.17552265 9.005510142
9.642355678 8.195701798 6.039197872 4.225558637 2.013969885
1.351604205 1.138147251 0.859909078 0.922223997 0.06231492
0.610623632 0 0 0 0 0 0 0 0 0
0 0 0.402388077 3.999415616 9.536300015 9.828635996
8.288926414 5.14890649 1.80380923 0.649131753 0 0.333166779
0 0 0 0 0 0 0 0 # 6
1980 2 4 3 2 96 0 0 0 0 0
0 0 0.019245683 0.730997201 2.866702904 4.790423867
5.493723095 6.796395116 6.459138617 5.3775792 6.319366692
3.383922395 2.933892489 1.389604117 1.140702238 0.98944772
0.711985863 0.296559768 0.078466339 0 0 0 0 0
0 0 0 0 0 0.217097166 2.763844372 6.874070186
10.48519225 8.869947246 9.361356063 5.494210614 3.275195809
1.851041453 0.530982912 0.185043272 0.170987975 0.142877382 0
0 0 0 0 # 16
1981 2 4 3 2 150 0 0 0 0 0
0 0 0.034414921 0.507424416 2.907889265 8.506759109
11.47745212 10.78957185 8.849394547 8.108348639 6.664562584
4.543985686 1.925938038 1.299711151 0.681693495 0.463250316
0.169663636 0.087944353 0.016318495 0.009615639 0 0 0
0 0 0 0 0 0.009982762 0.463264544 2.560253916
7.679936373 8.132696745 7.078186087 3.690040236 1.764171965
1.119283339 0.458245772 0 0 0 0 0 0 0
0 0 # 29
1982 2 4 3 2 96 0 0 0 0 0
0 0 0 0.22916231 2.380649687 6.593044544 6.21144785
6.695177563 6.665031488 2.846348658 4.830353055 3.307671394
1.749208347 0.442950858 0.078442264 0.66142664 0.127935063
0.113236473 0 0 0.112458517 0 0 0 0 0
0 0 0 0.083761744 5.621070427 13.45123335 14.30993686
10.24454257 6.766793671 4.13429321 1.619345573 0.708745718
0.015732163 0 0 0 0 0 0 0 0 #
16
1983 2 4 3 2 6 0 0 0 0 0
0 0 0 1 0 2 0 0 2 4 1
1 1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 3 15 35 20
11 1 1 0 1 0 0 0 0 0 0
0 0 0 # 1

1985 2 4 3 2 12 0 0 0 0 0
0 0 0 2.269850744 4.809552231 8.269850744 8.634925372
4 7.460298512 9.095223884 10.36507463 7.904776116 7.82537314
6.730149256 2.730149256 3.904776116 2 0.365074628 0 0
0 0 0 0 0 0 0 0 0.730149256
2.269850744 3.730149256 3.269850744 1.634925372 0.365074628
0.365074628 0.634925372 0.634925372 0 0 0 0 0
0 0 0 0 0 # 2
1986 2 4 3 2 24 0 0 0 0 0
0 0 0.228228709 1.208643768 5.940307437 12.32617351
10.87862483 7.356597983 5.085777223 10.20609443 5.073156444
2.102901373 4.28247976 3.088604058 2.752925146 0 0.679094849
0 0 0 0 0 0 0 0 0 0 0
1.394735448 3.886310243 7.440568388 6.014635997 5.288096614
3.488197683 1.015016229 0.262829878 0 0 0 0 0
0 0 0 0 0 0 # 4
1987 2 4 3 2 42 0 0 0 0 0
0 0 2.394401289 2.413532925 9.017795465 8.602571757
10.81931257 7.401156314 7.611677394 5.904333367 3.173265399
1.449558599 0.423457365 0.208399952 0 0 0 0 0
0 0 0 0 0 0 0 0 0.654003645
1.962455318 3.25138306 14.02182471 9.781500155 8.714298838
1.346973603 0.848098278 0 0 0 0 0 0 0
0 0 0 0 0 # 7
1988 2 4 3 2 12 0 0 0 0 0
0 0.331676476 1.668323524 1.668323524 4.331676476 15.67826467
12.6732941 8.663352952 12.34161762 11.00497057 3.658382379
2.995029428 3.668323524 0.331676476 2 0 0 0 0
0 0 0 0 0 0 0 0 0 1.668323524
8.341617621 3.336647048 0.663352952 2.985088283 1.326705903
0.331676476 0.331676476 0 0 0 0 0 0 0
0 0 0 0 # 2
1989 2 4 3 2 36 0 0 0 0 0
0 0 0 0.173221739 4.574926037 20.42993534 14.29774268
8.805038572 4.561197104 3.417271343 1.87765023 2.902960161
1.784378993 0.418954102 0.780448164 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1.428458083
8.106252906 15.07069911 7.815523173 2.716459585 0.838882686 0
0 0 0 0 0 0 0 0 0 0 0
6
1990 2 4 3 2 30 0 0 0 0 0
0 0 0.843373193 4.627152116 6.345071999 18.7477856
12.78755961 6.679592063 5.000652159 3.094214149 0.77162706
1.26505979 0.765274275 0.256788643 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0.67847524
3.166527631 11.53013348 14.19228428 6.463686971 2.230963323

0.276889208 0.276889208 0 0 0 0 0 0 0
0 0 0 0 # 5
1991 2 4 3 2 12 0 0 0 0 0
0 0 0 2.386580877 1.433456041 10.26305153 17.65919097
13.60275724 14.79227889 4.536764938 6.443014609 1.669852856
1.433456041 4.773161753 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1.669852856 3.583640102
4.056433733 3.820036917 3.820036917 2.386580877 1.669852856 0
0 0 0 0 0 0 0 0 0 0 0
2
1992 2 4 3 2 36 0 0 0 0 0
0 0 0 2.238086638 4.723272556 9.110217041 11.65149253
14.36299966 5.283984019 7.27930116 3.044125382 3.936866267
0.808581112 0.237554678 0.064389173 0.45517837 0 0 0
0 0 0 0 0 0 0 0 0 0
3.964062441 9.776905662 9.34564212 8.787522489 4.342264908
0.587553796 0 0 0 0 0 0 0 0 0
0 0 0 # 6
1993 2 4 3 2 12 0 0 0 0 0
0 0 0 0 0 1.695826652 10.17495991 8.479133261
8.169171673 10.9409018 15.71842017 5.087479957 4.467556781
1.385865065 1.385865065 3.081691717 0 0 0 0 0
0 0 0 0 0 0 0 0 1.695826652 0
1.385865065 6.929325323 5.543460258 8.315190387 5.543460258 0
0 0 0 0 0 0 0 0 0 0 #
2
1994 2 4 3 2 12 0 0 0 0 0
0 0 0 6.139625856 3.585502448 20.48163565 13.82632027
10.75650734 5.64826053 1.547068561 0.51568952 8.202383937 0
0 3.069812928 0 0 0 0 0 0 0 0
0 0 0 0 3.069812928 3.069812928 0.51568952
6.67963957 6.703963765 4.125516163 1.031379041 1.031379041 0
0 0 0 0 0 0 0 0 0 0 0
2
1996 2 4 3 2 6 0 0 0 0 0
0 0 0 0 2.5 12.5 2.5 5 10 17.5 7.5
0 0 0 0 0 2.5 0 0 0 0 0
0 0 0 0 0 0 0 0 10 12.5 12.5
2.5 2.5 0 0 0 0 0 0 0 0 0
0 0 0 # 1
1997 2 4 3 2 54 0 0 0 0 0
0 0.448778313 4.995626938 14.47009165 14.02005412 6.102122172
5.529310574 2.255031988 7.391264974 5.622152337 4.323318593
3.887431529 1.948468327 0.432839856 0.550935161 0.253309102 0
0.044316956 0 0 0 0 0 0 0 0 0
0.448778313 6.142322356 5.500941333 6.694145116 3.203703898

3.978840055 1.275522702 0.292264903 0.123524377 0.044316956 0
0 0.020587396 0 0 0 0 0 0 0 #
9
1998 2 4 3 2 30 0 0 0 0 0
0 0 0 0.834050116 5.380124301 5.734268053 7.434533822
2.940803095 1.137929284 4.753315712 4.853247917 5.426538193
1.60065651 0.49333914 0.49333914 0.318127523 0 0 0
0 0 0 0 0 0 0 0 0 0
2.737032171 13.49705389 16.82261223 13.17413532 9.551717505
1.486549403 0.343948395 0.986678281 0 0 0 0 0
0 0 0 0 0 # 5
2000 2 4 3 2 12 0 0 0 0 0
0 0 2.910179562 2.910179562 2.910179562 8.730538687
2.910179562 11.64071825 6.507784525 6.507784525 9.761676788
21.74610774 9.417964088 3.597604963 0.687425401 2.910179562 0
0 0 0 0 0 0 0 0 0 0 0
0 2.910179562 0 2.910179562 0 0.343712701 0.687425401
0 0 0 0 0 0 0 0 0 0 0
0 # 2
2001 2 4 3 2 6 0 0 0 0 0
0 0 0 0 2.43902439 4.87804878 14.63414634 0
14.63414634 9.756097561 12.19512195 7.317073171 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 2.43902439 0 4.87804878 9.756097561 12.19512195
4.87804878 0 0 0 0 0 0 0 0 0
0 0 0 0 # 1
2002 2 4 3 2 18 0 0 0 0 0
0 0 0 0 2.352329833 9.198586316 4.771089882
15.75407366 14.35328771 11.61734636 3.76672169 4.083902985
1.711564121 0.660774743 0 0 0 0 0 0 0
0 0 0 0 0 0 0 2.008736384 4.334654063
7.797000705 11.14729561 2.722335436 1.004368192 2.055157569
0.660774743 0 0 0 0 0 0 0 0 0
0 0 # 3
2003 2 4 3 2 48 0 0 0 0 0
0 0 0 0.303352427 2.60528699 14.97073098 20.01738231
9.146376748 3.788221856 3.942239661 2.715384237 0.985049625
0.007335813 0.141696617 0.063512495 0.004196154 0 0 0
0 0 0 0 0 0 0 0 0 0 0
7.972638561 16.696456 11.7697429 4.678405805 0.173152861
0.018837953 0 0 0 0 0 0 0 0 0
0 0 # 8
2004 2 4 3 2 36 0 0 0 0 0
0 0 0 0 0.443450358 8.711450038 10.90188947
12.79100005 10.97161023 3.602927235 4.029943092 0.542415649 0
0.542415649 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0.884440235 6.34533731
14.75454066 19.59607709 5.411245505 0.471257428 0 0 0
0 0 0 0 0 0 0 0 0 # 6
2005 2 4 3 2 6 0 0 0 0 0
0 0 0 0 0 0 2.040816327 0 8.163265306
8.163265306 4.081632653 2.040816327 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 2.040816327 8.163265306 28.57142857 30.6122449 6.12244898
0 0 0 0 0 0 0 0 0 0 0
0 0 # 1
2006 2 4 3 2 72 0 0 0 0 0
0 0 0.480190166 3.896481777 6.315956237 8.224130076
9.393256278 11.21943074 8.162777094 3.345289831 3.607782023
2.196625859 1.172210867 0.184099534 0.034847263 0.086437924 0
0 0 0 0 0 0 0 0 0 0
0.16509065 0.16509065 2.075753732 6.920967454 14.39419901
12.21924206 4.6032449 0.766000668 0.090187281 0.245860664 0
0 0 0 0 0.034847263 0 0 0 0 #
12
2007 2 4 3 2 72 0 0 0 0 0
0 0 0 3.352695252 2.249313935 4.597554215 8.321803055
4.289620846 6.898759732 4.067397806 5.086106167 3.741300559
1.534775544 1.15055652 0.740179649 0 0 0 0 0
0 0 0 0 0 0 0 0 0.784720967
4.271303204 7.596853104 15.94938875 12.10299783 8.008089743
5.022217796 0.234365322 0 0 0 0 0 0 0
0 0 0 0 # 12
2008 2 4 3 2 36 0 0 0 0 0
0 0 0 0 2.746543127 5.836151506 10.30973919
7.750380533 7.584648446 8.317404393 4.325528 3.313855257
3.344255628 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0.69545616 2.267777332
5.308430631 13.65423112 9.469922769 12.98476915 0.50379338
1.587113377 0 0 0 0 0 0 0 0 0
0 0 # 6
1949 1 5 3 2 30 0 0 0 0 0
0 0 0.322410404 1.130366164 2.025216495 2.510761851
2.282965022 2.657476731 3.99967893 7.506367639 8.483025142
10.21469273 10.56542377 6.457667711 4.26630268 1.666855211
1.263401816 0.323365513 0 0.197491577 0.267935052 0 0
0 0 0 0 0 0 0.644820807 1.722131371
2.825901233 2.677283195 4.548482345 3.896394373 8.029478675
6.923973382 1.997655448 0.592474731 0 0 0 0 0
0 0 0 # 10
1964 1 5 3 2 3 0 0 0 0 0
0 0 0 0 0 2.040816327 6.12244898 10.20408163

4.081632653 14.28571429 10.20408163 0 4.081632653 4.081632653
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 2.040816327 0 14.28571429 14.28571429
6.12244898 4.081632653 4.081632653 0 0 0 0 0
0 0 0 0 0 0 # 1
1965 1 5 3 2 6 0 0 0 0 0
0 0 0 3.659494966 7.318989933 7.318989933 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 1.460654497
9.988997785 33.65792322 29.27595973 3.659494966 0 0
3.659494966 0 0 0 0 0 0 0 0 0
0 0 # 2
1966 1 5 3 2 24 0 0 0 0 0
0 0 0 0 6.583510467 15.96723382 6.97042628
2.642588762 2.094827651 2.981261102 2.562180019 2.520478376
2.078702704 1.083954152 0.572971608 0.192312581 0.192312581
0.192312581 0.179315143 0 0 0 0 0 0 0
0 0 0 2.117504832 9.083154928 25.60669937 14.16279816
1.651514588 0.371627724 0.192312581 0 0 0 0 0
0 0 0 0 0 0 # 8
1967 1 5 3 2 60 0 0 0 0 0
0 0 0.000410345 0.000205172 0.006654045 2.758737765
2.626117273 6.141480266 4.184400798 4.627958285 1.446755856
1.293204108 0.87708601 0.469718384 0.11533374 0.075237015
0.000637974 0.000537126 0 0 0 0 0 0 0
0 0 0 0 0.001913922 2.225133772 30.07955173
24.70709888 13.14041541 4.264237959 0.83887809 0.118296075 0
0 0 0 0 0 0 0 0 0 # 20
1968 1 5 3 2 33 0 0 0 0 0
0 0 0 0.008363431 15.79653209 8.35655421 0.884088083
2.304353843 4.711659041 4.857000669 3.750192087 3.524728297
2.24820858 1.117796449 0.645305772 0.113596466 0.113596466 0
0 0 0 0 0 0 0 0 0 0 0
0.667215444 8.669904528 13.20624065 9.946589558 14.97815473
2.812826132 1.287093469 0 0 0 0 0 0 0
0 0 0 0 # 11
1969 1 5 3 2 42 0 0 0 0 0
0 0 0 0.043072055 0.238851156 1.709182127 3.790936022
8.851056213 8.045081828 10.58925418 8.048585258 7.582801602
2.16520817 1.884936139 1.088482188 0.493863731 0.367683901
0.051686466 0.017228822 0 0 0 0 0 0 0
0 0 0 0.025843233 1.577449402 12.26943073 8.983846194
9.307132981 5.436557723 4.182532446 1.684810559 0.184948373
1.317889049 0.061649458 0 0 0 0 0 0 0
14

1970 1 5 3 2 39 0 0 0 0 0
0 0 0.133079071 0.399237213 0.814723622 3.788860803
6.476325535 7.695291727 3.642430738 4.492895152 1.934518951
0.853645647 0.173175502 0.017080236 0.115832273 0.066732286 0
0.066732286 0.020377902 0 0 0 0 0 0 0
0 0 0.931553498 2.135349677 5.228177084 24.008805
18.65776624 7.491827666 8.759162272 2.088268459 0 0.008151161
0 0 0 0 0 0 0 0 0 # 13
1971 1 5 3 2 21 0 0 0 0 0
0 0 0 0 3.911770965 7.517036734 7.90037454
10.70840272 2.312732135 4.163564592 2.443481087 1.786316964
1.231491821 0.045722595 0.056516953 0.107804794 0 0 0
0 0 0 0 0 0 0 0 0 0
1.521994324 22.7251717 28.82855833 0.417910459 2.846052565
0.052070447 0.711513141 0.711513141 0 0 0 0 0
0 0 0 0 0 # 7
1972 1 5 3 2 69 0 0 0 0 0
0.011591228 0 0 0.003458185 0.418918425 0.862129258
3.262492373 7.706986054 12.70165049 10.24085411 5.380998296
4.396562278 1.667684205 0.778345032 0.68477075 0.799410628
0.388917625 0.079309013 0.02953583 0.013312453 0 0 0
0 0 0 0 0 0 0.015591229 12.54462414
14.23247094 11.87172192 7.147984782 2.921265353 0.568710823
0.808063155 0.388691367 0.07395005 0 0 0 0 0
0 0 0 # 23
1973 1 5 3 2 36 0 0 0 0 0
0 0 0 0.167347398 1.136141724 5.657184751 5.351544162
3.78140642 7.071152192 7.135306682 5.992630682 3.125884547
2.341960517 2.019166561 0.881382828 0.145862267 0.170293173
0.043418558 0.034722592 0 0 0 0 0 0 0
0 0 0 0.605652677 5.270231799 9.761776656 24.1571362
9.259274507 5.118424784 0.16644564 0.605652677 0 0 0
0 0 0 0 0 0 0 # 12
1974 1 5 3 2 93 0 0 0 0 0
0 0.01309474 0.002257013 0.009028052 0.666643139 1.362931296
2.513914107 2.697839983 7.804812631 8.095224684 5.386960352
4.430416041 5.27778892 1.587220227 0.908938673 0.185642618
0.005926624 0.002376388 0.015241598 0 0 0 0 0
0 0 0 0 0.028446493 0.146664338 1.710918676
5.926459389 19.7339543 10.19358621 14.57421793 2.853102354
2.754402153 0.647857414 0.464133668 0 0 0 0 0
0 0 0 # 31
1975 1 5 3 2 33 0 0 0 0 0
0 0.257137809 2.379252088 4.617885996 5.548761428 11.34608157
9.45896876 8.126608837 2.369784215 1.959941117 0.9776026
1.307674938 0.65209408 0.742294613 0.146313807 0.013752667

0.013752667 0 0 0 0 0 0 0 0 0
0 0.771413428 5.272779794 7.082972774 6.8316461 17.36290474
10.82788123 1.40970825 0.250394638 0 0.272391863 0 0
0 0 0 0 0 0 0 0 # 11
1976 1 5 3 2 36 0 0 0 0 0
0 0 0 0.032329774 0.649675477 5.201388311 10.68053047
5.661019354 7.183224841 6.076499656 2.849165224 5.320335486
1.904662358 2.745386836 1.765936082 0.722361791 0.104200072
0.048051745 0 0.156165363 0 0 0 0 0 0
0 0 0 0.048494661 1.162133852 12.45785524 12.24966329
7.523800854 5.989290963 3.977736715 1.48476617 1.797096897
2.20822852 0 0 0 0 0 0 0 0 #
12
1977 1 5 3 2 24 0 0 0 0 0
0 0 0.018925548 2.507344508 3.366470751 11.70144055
3.626915061 10.5828286 4.331173975 7.500231046 2.095574249
3.048603792 6.371916775 1.469341435 2.024445749 1.046607819
0.444187974 0.632690247 0.212525297 0 0 0 0 0
0 0 0 0 2.436561021 8.154802462 3.359610558
4.239222792 14.02190711 2.206426317 2.626529154 0.496176935
0.737191258 0.312140665 0.364285063 0.037851095 0 0.026072199
0 0 0 0 0 # 8
1978 1 5 3 2 51 0 0 0 0 0
0 0.087884015 0.996537324 1.919547994 2.420556912 3.160185509
6.795377916 7.951583037 5.272030793 4.166380957 4.844926589
4.817915009 1.908539444 0.612197211 0.092066464 0 0.254113537
0 0 0 0 0 0 0 0 0.104801569
0.104801569 0.351536058 0.83392411 4.935510119 11.00935622
8.853795077 14.27735084 11.28032858 2.321600294 0.418744586 0
0.169957593 0 0 0 0.038450667 0 0 0 0
0 # 17
1979 1 5 3 2 21 0 0 0 0 0
0 0 0.031432732 1.843873631 3.394195091 5.013719672
0.19493405 0.978720169 1.105504996 5.942362138 4.867547219
4.178597485 3.124428509 1.93775847 0.916554456 1.046112406
0.75135092 0.718582823 0.19552662 0 0 0 0 0
0 0 0 0 0 3.568676556 7.212568591 12.03875924
5.911658415 16.57323177 11.76933945 5.770520765 0.914043821 0
0 0 0 0 0 0 0 0 0 # 7
1980 1 5 3 2 18 0 0 0 0 0
0 0.455618352 2.952404486 11.72030801 17.54413664 9.320705013
7.378168948 7.572366656 2.776497141 3.614785825 1.520553028
1.876305349 1.342676868 1.790235824 0 1.115034343 0.156238867
0 0 0 0 0 0 0 0 0 0.312477735
0 0.802076962 4.002237802 7.749227111 8.585779905 4.690508238

2.09622178 0.447558956 0 0 0 0 0.17787616 0
0 0 0 0 0 0 # 6
1981 1 5 3 2 108 0 0 0 0 0
0 0.183782793 3.998029919 7.417801049 11.32591241 7.483233447
3.761776092 2.685756985 4.450078769 4.747858737 2.774794092
3.307355794 1.724451976 1.761328735 1.038527571 1.238037928
0.773003508 0.359969389 0.249556688 0.003446099 0.002596554 0
0 0 0 0 0 0.02943569 0.845093641 2.877589841
10.16757814 12.90216535 5.591961805 3.772615986 2.505649692
1.422988766 0.492905554 0.077637711 0 0 0.027079288 0
0 0 0 0 0 # 36
1982 1 5 3 2 78 0 0 0 0 0
0 0 0.003920042 0.376101178 2.465704658 2.565941714
2.220568711 2.48125964 2.388622648 0.749436001 1.405875638
0.709029355 0.33297989 0.558062531 0.15993225 0.068662423
0.028883679 0.05125814 0.008419366 0 0 0 0 0
0 0 0 0 0.04711043 3.670818298 42.22776849
25.22528059 9.048537564 1.19336209 1.57708095 0.230166517
0.16344639 0.041770823 0 0 0 0 0 0 0
0 0 # 26
1983 1 5 3 2 78 0 0 0 0 0
0 0 0.744573561 3.12764534 2.635356825 1.660876509
2.363134607 3.277011337 7.061797602 3.994823362 5.99028097
3.253131666 1.856939284 1.273693928 1.051703557 0.867295054
0.265938326 0.361415965 0.276601733 0.464813331 0 0 0
0 0 0 0 0.18614339 0.57145976 2.206228188
5.792613968 10.01060705 15.13135394 11.21638597 7.424486366
2.810459316 2.72281099 1.370208235 0.030209866 0 0 0
0 0 0 0 0 # 26
1984 1 5 3 2 39 0 0 0 0 0
0 0 0 0 0.417836523 2.365175477 1.351903132
1.754919851 1.608341196 3.692765031 3.751371725 3.646257097
3.080197089 2.123016359 0.899124995 1.133251007 0.148816608
0.227768359 0.085614772 0 0 0 0 0 0 0
0 0 1.576344773 11.25690552 37.25797744 13.18045289
4.620255176 2.476193661 1.820607848 0.778720819 0.340394813
0.275594757 0.130193087 0 0 0 0 0 0 0
0 # 13
1985 1 5 3 2 39 0 0 0 0 0
0 0 0 1.152917569 7.114429162 7.656699529 3.50267084
2.294580248 3.00502564 2.299762339 1.878399589 1.909760159
1.053861518 0.537471946 0.37441102 0 0.021165895 0.011905993
0 0 0 0 0 0 0 0 0 0
0.503893531 7.949676308 30.45706697 19.57458171 3.768382497
2.727166764 0.826741793 1.25855733 0 0.023811986 0
0.097059661 0 0 0 0 0 0 0 # 13

1986 1 5 3 2 18 0 0 0 0 0
0 0 0 4.681674213 11.92612115 11.46325554 3.654612388
1.82793913 2.611992697 1.451476131 1.279959346 1.741705085
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0.019422747 0.195444621 0.005932107 0 0 0 0 0
0 0 0 0.133861448 0.24087844 1.431382885 8.756293422
10.45084283 8.604881121 4.723718197 2.904121128 0.885520963
0.063644457 0.357510335 0.178755167 0 0 0 0 0
0 0 0 # 17
1986 2 6 3 2 32 0 0 0 0 0
0 0 1.860189689 8.664700574 10.92639083 8.453919558
8.874276535 5.58668955 4.385897974 0.990496541 0.82660856
0.350502016 0.393924776 0.356778306 0.033265661 0.073168371
0.034520108 0 0 0 0 0 0 0 0 0
0 0.078923257 2.763876212 7.367907134 14.84468568 10.13793884
8.151559346 3.270755323 1.192248804 0.380776347 0 0 0
0 0 0 0 0 0 0 0 # 16
1987 2 6 3 2 28 0 0 0 0 0
0 0.459935726 0.510045511 7.196746911 6.190487113 7.929723213
4.629850087 5.821376438 5.060148579 3.185981567 0.636803886
0.542044004 0.332735007 0.151340249 0.261224173 0.094214686 0
0.00402665 0.080025317 0 0 0 0 0 0 0
0 0 6.235089032 13.49704496 14.92200381 12.6098735
5.551501931 2.525948503 0.853132762 0.535203173 0.183493213 0
0 0 0 0 0 0 0 0 0 # 14
1988 2 6 3 2 12 0 0 0 0 0
0 0 0.875121392 7.753680538 5.690427882 8.95757403
7.181897271 6.148803058 2.44088212 2.713759954 2.417987823
0.913548272 2.195201514 0.870915009 0.36810497 0.522549005
0.362798174 0 0 0 0 0 0 0 0 0
0 0 0 10.89136793 23.20125771 10.64533579 2.381230162
1.740994782 0.990352672 0.174183002 0.193921968 0 0
0.36810497 0 0 0 0 0 0 0 # 6
1989 2 6 3 2 18 0 0 0 0 0
0 0 0.528752504 1.586257512 4.951886165 13.14190539

18.11727261 15.23269501 6.902160118 5.36619235 2.255240482
0.995077555 1.552448733 0.66468518 0.103384796 0.206769593
0.103384796 0.310154389 0 0 0 0 0 0 0
0 0 0 0.264376252 3.703882285 5.808668253 7.068271125
6.508649714 1.280400913 2.165875109 0.310154389 0.66468518
0.206769593 0 0 0 0 0 0 0 0 0
9
1990 2 6 3 2 2 0 0 0 0 0
0 0 0 0 0 7.894736842 10.52631579 23.68421053
5.263157895 13.15789474 0 0 2.631578947 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 21.05263158 10.52631579 5.263157895 0
0 0 0 0 0 0 0 0 0 0 0
0 # 1
1991 2 6 3 2 2 0 0 0 0 0
0 0 0 0 0 7.317073171 12.19512195 7.317073171
17.07317073 2.43902439 2.43902439 2.43902439 2.43902439 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 2.43902439 12.19512195 17.07317073
12.19512195 0 0 0 0 2.43902439 0 0 0
0 0 0 0 0 # 1
2001 2 6 3 2 16 0 0 0 0 0
2.855639282 1.846104271 4.652900205 18.05219475 20.85675968
6.331607402 8.99982093 5.865256724 2.036725502 2.422661947
0.822092427 0.687044996 0.047144966 0.266094932 0.047144966
0.047144966 0 0 0 0 0 0 0 0 0
0 0 0 1.25485389 10.53111824 2.217535278 3.39970595
2.231546042 3.498597665 0.747435194 0.282869796 0 0 0
0 0 0 0 0 0 0 0 # 8
2002 2 6 3 2 18 0 0 0 0 0
0 0 0 0.588139052 10.4184025 8.215668281 4.67822485
7.666704295 0.251140567 0.64952962 0.613516626 0.401081448
0.317538882 0.306022305 0.182038045 0.153011152 0.029026893 0
0 0 0 0 0 0 0 0 0 0
0.028787066 6.079117493 33.16915602 20.72817393 4.133765657
1.242168315 0.119760108 0.029026893 0 0 0 0 0
0 0 0 0 0 0 # 9
2003 2 6 3 2 60 0 0 0 0 0
0 0.443090816 1.964099617 8.398953039 8.375758641 4.563002445
3.946994607 4.158287983 1.309999743 1.016043472 0.364000416
0.014453973 0.109277273 0.005724129 0 0.358866138 0.000577277
0 0 0 0 0 0 0 0 0 0
1.99590783 3.523323493 11.15936843 35.6247352 5.171737818
2.816437696 3.857359091 0.422764001 0.044608841 0.354628023 0
0 0 0 0 0 0 0 0 0 # 30

```
2004	2	6	3	2	26	0	0	0	0	0
0	0	0	0.082018259	1.079543886	0.343935424	2.465137244
5.566892205	5.898771236	3.802894332	1.143659683	1.300753645
2.276583121	0.481372064	0.631574161	0.250712104	0.017430576	0
0	0	0	0	0	0	0	0	1.74262699
0.037935141	0.927800016	2.238596291	15.7302307	26.38676453
17.71864609	6.133629656	3.074236039	0.668256603	0	0	0
0	0	0	0	0	0	0	0	#	13
2005	2	6	3	2	68	0	0	0	0	0
0	0.010554485	0	1.073959564	0.983892536	3.424174797
4.32326928	5.525420588	8.990546321	10.55450176	7.150343733
1.593788102	2.302804136	0.987837654	0.627465077	0.40281954
0.081709896	0	0	0	0	0	0	0	0	0
0	0	0.726847504	0.82939519	9.251886407	11.24913345
18.40498834	4.806649291	1.687325491	2.21439031	1.522067382
0.550302039	0.491473019	0.079508946	0.152945172	0	0	0
0	0	0	#	34
2006	2	6	3	2	86	0	0	0	0	0
0	0	0	0.041334318	0.720916563	3.020533671	6.745242981
12.19344959	9.68326957	8.049969144	5.610635955	2.561100061
0.798321623	0.493711784	0.043336125	0.011475491	0.131999033	0
0.024565832	0	0	0	0	0	0	0	0
0.025165499	0.115152594	0.452672174	2.21662843	7.507774335
23.0514772	9.892996615	4.146872513	2.324260904	0.109998594
0.027139399	0	0	0	0	0	0	0	0	0
#	43
2007	2	6	3	2	150	0	0	0	0	0
0.001537629	0	0.006150515	0.344678583	1.277721509	2.080319824
5.119753947	5.752352468	7.303540462	4.229136837	6.571198665
2.774051834	2.226957671	1.532461338	0.643979904	0.460709502
0.077509235	0.005682923	0	0	0	0	0.009864525	0
0	0	0.024725997	0.118814845	0.223152289	3.991976211
9.307104727	12.49243549	14.34558382	11.09433082	4.316669575
2.1117629	0.508176288	0.410345153	0	0.389203336	0.019137513
0.228973662	0	0	0	0	0	#	102
2008	2	6	3	2	2	0	0	0	0	0
0	0	0	0	0	6.666666667	6.666666667	10
6.666666667	16.66666667	10	10	3.333333333	6.666666667
3.333333333	6.666666667	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	10	0
3.333333333	0	0	0	0	0	0	0	0	0
0	0	0	#	1
#	#DISCARDS
```

	#										
#	#Year	season	fleet	sex	prt	Nsamp	12	14	16	18	20
	22	24	26	28	30	32	34	36	38	40	42
	44	46	48	50	52	54	56	58	60	62	12
	14	16	18	20	22	24	26	28	30	32	34
	36	38	40	42	44	46	48	50	52	54	56
	58	60	62	#	Nsamp						
	1986	2	4	3	1	50	0	0	0	1	7
	11	13	19	20	9	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
	0	2	2	6	6	3	13	15	2	0	0
	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	#	50						
	1987	2	4	3	1	50	0	0	0	0	3
	13	17	30	5	1	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	2	13	28	17	7	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	#	50						
#	#year	Season	Fleet	gender	partition		nSamps		U12	U14	U16
	U18	U20	U22	U24	U26	U28	U30	U32	U34	U36	U38
	U40	U42	U44	U46	U48	U50	U52	U54	U56	U58	U60
	U62	U12.1	U14.1	U16.1	U18.1	U20.1	U22.1	U24.1	U26.1	U28.1	U30.1
	U32.1	U34.1	U36.1	U38.1	U40.1	U42.1	U44.1	U46.1	U48.1	U50.1	U52.1
	U54.1	U56.1	U58.1	U60.1	U62.1	#	nSamps				
	2006	1	1	0	1	7	0	0	0	0	0
	0	9.8628982		30.1076		37.9376732		18.66241		0	
	3.4294174		0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
	9.8628982		30.1076		37.9376732		18.66241		0	3.4294174	
	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	#	7						
	2007	1	1	0	1	6	0	0	0	0	0
	0	0.3895674		0	0.3895674		18.85506		53.1369914		
	22.3981768		4.8306356		0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
	0	0.3895674		0	0.3895674		18.85506		53.1369914		
	22.3981768		4.8306356		0	0	0	0	0	0	0
	0	0	0	0	0	0	#	6			
	2008	1	1	0	1	7	0	0	0	0	0
	0	0	2.268713		6.5638742		19.48375		12.1541167		
	14.6504999		33.791279		0	0	0	11.0877634		0	0
	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	2.268713		6.5638742		19.48375		12.1541167	

14.6504999 33.791279 0 0 0 11.0877634 0 0
0 0 0 0 0 0 0 # 7
2006 2 2 0 1 53 0 0.0145547 1.400822
1.5834835 3.674926 3.7290985 10.5953416 15.075532
19.7043435 23.61028 11.2126292 4.7461738 3.0954613
0.1309923 0.1339032 1.2924574 0 0 0 0 0
0 0 0 0 0 0 0.0145547 1.400822
1.5834835 3.674926 3.7290985 10.5953416 15.075532
19.7043435 23.61028 11.2126292 4.7461738 3.0954613
0.1309923 0.1339032 1.2924574 0 0 0 0 0
0 0 0 0 0 # 53
2007 2 2 0 1 33 0 0 0 0.2428436
1.1081138 8.3647316 7.1079386 13.308321 27.3843514
26.18828 7.10749 3.013289 1.828234 1.2871137
1.8867053 0.8884057 0.1301862 0 0.1539952 0 0
0 0 0 0 0 0 0 0 0.2428436
1.1081138 8.3647316 7.1079386 13.308321 27.3843514
26.18828 7.10749 3.013289 1.828234 1.2871137
1.8867053 0.8884057 0.1301862 0 0.1539952 0 0
0 0 0 0 0 # 33
2008 2 2 0 1 1 0 0 0 0 0
0 0 0 0 60 20 20 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 60 20 20
0 0 0 0 0 0 0 0 0 0 0
0 0 0 # 1
2006 1 3 0 1 2 0 0 0 0 0
0 0 0 0 0 23.6021301 34.7850894 41.6127805
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 23.6021301 34.7850894 41.6127805 0 0 0 0
0 0 0 0 0 0 0 0 0 # 2
2007 1 3 0 1 5 0 0 0 0 0
0 17.6785714 17.678571 0 17.67857 38.2142857
2.3214286 3.75 2.6785714 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 17.6785714 17.678571 0 17.67857 38.2142857
2.3214286 3.75 2.6785714 0 0 0 0 0 0
0 0 0 0 0 0 # 5
2008 1 3 0 1 7 0 0 0 0 0
0.4190349 0 0 9.3565128 41.47866 23.4659561
17.9886323 6.034103 0 0 1.2571048 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0.4190349 0 0 9.3565128 41.47866 23.4659561
17.9886323 6.034103 0 0 1.2571048 0 0 0
0 0 0 0 0 0 0 # 7

2006 2 4 0 1 23 0 0.5698264 4.237238
2.2613913 13.9656002 10.1472687 7.3674479 10.308824
11.1746035 27.81766 7.7192164 4.0592208 0.1858534
0.1858534 0 0 0 0 0 0 0 0 0
0 0 0 0 0.5698264 4.237238 2.2613913
13.9656002 10.1472687 7.3674479 10.308824 11.1746035
27.81766 7.7192164 4.0592208 0.1858534 0.1858534 0
0 0 0 0 0 0 0 0 0 0 0
23
2007 2 4 0 1 13 0 0 1.921435 0
0.9718087 2.6320164 1.5988078 10.050175 29.8480643
39.3052 7.3496369 2.636585 1.9740089 0.0444113
1.6234406 0 0.0444113 0 0 0 0 0 0
0 0 0 0 0 1.921435 0 0.9718087
2.6320164 1.5988078 10.050175 29.8480643 39.3052
7.3496369 2.636585 1.9740089 0.0444113 1.6234406 0
0.0444113 0 0 0 0 0 0 0 0 0
13
2006 1 5 0 1 2 0 0 0 0 0
0.08 0 0 59.952 19.984 19.984 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0.08 0 0 59.952 19.984 19.984 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 # 2
2007 1 5 0 1 15 0 0.0817351 0
0.8377853 0.0817351 3.1982964 15.35331 6.446179
31.8273019 41.23662 0.5283594 0.2452054 0.0817351 0
0 0 0 0.0817351 0 0 0 0 0 0
0 0 0 0.0817351 0 0.8377853 0.0817351
3.1982964 15.35331 6.446179 31.8273019 41.23662
0.5283594 0.2452054 0.0817351 0 0 0 0
0.0817351 0 0 0 0 0 0 0 0 #
15
2008 1 5 0 1 10 0 0.0815827 0 0
0 1.2441362 6.2900265 4.164797 15.4476851 15.04385
34.117887 11.2257801 11.2257801 0.5547624 0.0815827
0.4405466 0 0.0815827 0 0 0 0 0 0
0 0 0 0.0815827 0 0 0 1.2441362
6.2900265 4.164797 15.4476851 15.04385 34.117887
11.2257801 11.2257801 0.5547624 0.0815827 0.4405466 0
0.0815827 0 0 0 0 0 0 0 0 #
10
2006 2 6 0 1 62 0 0 0.138187
0.1439448 0.5815369 7.3770714 7.2056735 8.451895
22.6088617 21.47204 16.6067372 13.6188223 1.3230915
0.4145609 0.028789 0 0 0 0.028789 0 0

```
	0	0	0	0	0	0	0	0.138187	0.1439448
	0.5815369	7.3770714	7.2056735	8.451895	22.6088617
	21.47204	16.6067372	13.6188223	1.3230915	0.4145609
	0.028789	0	0	0	0.028789	0	0	0	0
	0	0	0	#	62
	2007	2	6	0	1	34	0	0	0	0.95884
	1.7330146	2.2159858	8.1110763	16.083858	28.2490681
	23.43394	11.3587881	6.6693078	0.1704604	0.2485882	0
	0	0.191768	0.191768	0.383536	0	0	0	0
	0	0	0	0	0	0	0.95884	1.7330146
	2.2159858	8.1110763	16.083858	28.2490681	23.43394
	11.3587881	6.6693078	0.1704604	0.2485882	0	0
	0.191768	0.191768	0.383536	0	0	0	0	0
	0	0	#	34
#	2008	2	6	0	1	12	0	0	0	0.3221909
	7.7325816	10.2456706	13.2098268	15.940395	24.0837696
	22.79501	3.221909	2.1264599	0.3221909	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
	0	0	0.3221909	7.7325816	10.2456706	13.2098268
	15.940395	24.0837696	22.79501	3.221909	2.1264599
	0.3221909	0	0	0	0	0	0	0	0	0
	0	0	0	0	#	12
#	#Early LFs from Demory & Bailey 1967 (no expansions)


						#
#	#Year	season	fleet	sex	mkt	Nsamp	Fem12	14	16	18	20
	22	24	26	28	30	32	34	36	38	40	42
	44	46	48	50	52	54	56	58	60	62
	MAL12		14	16	18	20	22	24	26	28	30
	32	34	36	38	40	42	44	46	48	50	52
	54	56	58	60	62	#	Nsamp
#	1949	2	4	3	2	28	0	0	0	0	0
	0	0	0	0.290275762	0.725689405	2.757619739	2.757619739
	6.095791001	6.095791001	8.127721335	8.127721335	9.869375907
	10.59506531	8.708272859	5.079825835	2.90275762	0.290275762
	0.435413643	0	0	0	0	0	0	0	0	0
	0	0.145137881	0.725689405	0.435413643	1.45137881	3.193033382
	5.079825835	7.692307692	5.660377358	1.596516691	0.580551524
	0.145137881	0.435413643	0	0	0	0	0	0	0
	#	23
#	1949	2	2	3	2	82	0	0	0	0	0
	0	0	0	0.389294404	1.070559611	2.530413625	3.114355231
	4.671532847	4.866180049	6.569343066	6.763990268	4.330900243
```

```
	3.698296837	2.04379562	0.681265207	0.291970803	0.194647202	0
	0.0486618	0	0	0	0	0	0	0	0	0
	0.097323601	0.291970803	0.827250608	3.406326034	6.180048662
	11.58150852	15.47445255	12.11678832	5.936739659	2.481751825
	0.291970803	0.0486618	0	0	0	0	0	0	0
	#	69
#	1950	2	4	3	2	52	0	0	0	0	0
	0	0	0	0	1.607963247	2.756508423	4.82388974
	5.28330781	7.427258806	8.039816233	8.039816233	9.954058193
	10.10719755	7.656967841	2.756508423	1.378254211	0.153139357
	0.076569678	0	0	0	0	0	0	0	0	0
	0	0	0.153139357	1.761102603	3.598774885	5.436447167
	6.661562021	6.967840735	3.36906585	1.45482389	0.535987749	0
	0	0	0	0	0	0	0	0	#	44
#	1950	2	2	3	2	115	0	0	0	0	0
	0	0	0.10460251	0.383542538	1.569037657	2.405857741
	3.69595537	3.626220363	4.637377964	8.193863319	8.751743375
	8.647140865	7.531380753	5.020920502	3.172942817	1.080892608
	0.523012552	0.10460251	0.034867503	0	0	0	0	0
	0	0	0	0	0	0.453277545	1.429567643	2.649930265
	5.19525802	6.90376569	10.25104603	7.461645746	4.60251046
	1.255230126	0.313807531	0	0	0	0	0	0	0
	0	#	96
#	1951	2	4	3	2	8	0	0	0	0	0
	0	0	0	1.005025126	2.010050251	3.015075377	3.51758794
	5.527638191	5.025125628	8.542713568	3.51758794	9.045226131
	9.547738693	9.547738693	4.020100503	1.507537688	0	0	0
	0	0	0	0	0	0	0	0	0	0
	1.005025126	2.010050251	4.020100503	5.527638191	9.045226131
	6.030150754	3.015075377	2.010050251	1.005025126	0.502512563	0
	0	0	0	0	0	0	0	#	7
#	1951	2	2	3	2	71	0	0	0	0	0
	0	0	0	0.22675737	1.303854875	2.891156463	4.024943311
	4.931972789	4.761904762	4.308390023	5.158730159	5.839002268
	6.065759637	6.009070295	3.344671202	2.721088435	0.907029478
	0.113378685	0	0	0	0	0	0	0	0	0
	0	0	0.340136054	2.040816327	4.421768707	6.292517007
	9.693877551	9.070294785	9.467120181	4.081632653	1.41723356
	0.340136054	0.22675737	0	0	0	0	0	0	0
	#	59
#	1960	2	4	3	2	8	0	0	0	0	0
	0	0	0	0	0	3	5.5	10.5	6.5	8	6
	3	2.5	1	1	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	2	5	11	12.5
	10	6.5	5	1	0	0	0	0	0	0	0
	0	0	0	#	7
```

#	1963	2	4	3	2	4	0	0	0	0	0
	0	0	0	0	0	1	3	5	3	7	8
	10	5	6	2	2	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	3
	6	7	5	8	2	6	6	4	1	0	0
	0	0	0	#	3						
#	1963	2	2	3	2	8	0	0	0	0	0
	0	0	0	0	1.5	8.5	9	18.5	15.5	11.5	8.5
	2.5	2.5	1	1.5	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	1	3
	3	3.5	6	2	0.5	0	0.5	0	0	0	0
	0	0	0	#	7						
#	1964	2	4	3	2	3	0	0	0	0	0
	0	0	0	0	0	0	0	0	5.797101449		
	7.246376812		15.94202899		13.04347826		4.347826087		7.246376812		
	8.695652174		0	0	0	1.449275362		0	0	0	0
	0	0	0	0	0	0	0	0	7.246376812		
	15.94202899		8.695652174		2.898550725		0	0	0	1.449275362	
	0	0	0	0	0	0	0	0	#	2	
#	1964	2	2	3	2	82	0	0	0	0	0
	0	0	0	0.048947626		0.685266765		1.468428781		2.692119432	
	4.013705335		6.999510524		10.08321096		10.23005384		8.370044053		
	5.286343612		3.622124327		1.908957416		1.223690651		0.342633382		
	0.097895252		0.048947626		0	0	0	0	0	0	0
	0	0	0	0.097895252		0.881057269		3.377386197		8.272148801	
	11.06216349		9.64268233		5.726872247		2.300538424		0.930004895		
	0.440528634		0.146842878		0	0	0	0	0	0	0
	#	68									
#	1965	2	4	3	2	16	0	0	0	0	0
	0	0	0	0	1.75	7	6	5.25	6	6.25	5.25
	3.5	2.25	1	0	0.25	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	4.5	10.25	12.75
	11	11.25	3.25	1.25	1	0.25	0	0	0	0	0
	0	0	0	#	13						
#	1965	2	2	3	2	88	0	0	0	0	0
	0	0	0	0.182648402		1.643835616		2.785388128		4.383561644	
	4.748858447		5.570776256		8.493150685		8.858447489		9.497716895		
	6.347031963		3.378995434		2.146118721		0.821917808		0.228310502		
	0.319634703		0	0	0	0	0	0	0	0	0
	0	0.091324201		0.182648402		3.105022831		5.707762557		7.853881279	
	8.949771689		9.086757991		3.835616438		1.232876712		0.319634703		
	0.182648402		0.0456621		0	0	0	0	0	0	0
	#	73									
#Triennial		#year	season	fleet	gender	partition		Nsamp	F120	F140	F160
	F180	F200	F220	F240	F260	F280	F300	F320	F340	F360	F380
	F400	F420	F440	F460	F480	F500	F520	F540	F560	F580	F600

F620 M120 M140 M160 M180 M200 M220 M240 M260 M280 M300
M320 M340 M360 M380 M400 M420 M440 M460 M480 M500 M520
M540 M560 M580 M600 M620 # Nsamp
1980 2 7 3 0 3 0 0 0 0 0
0 0 0 0 6.25 6.25 12.5 6.25 0 0 6.25
12.5 12.5 6.25 12.5 0 0 0 0 6.25 0 0
0 0 0 0 0 0 0 0 6.25 0 6.25
0 0 0 0 0 0 0 0 0 0 0
0 0 0 # 3
1983 2 7 3 0 6 0 0 0 0 0
0 0 0 0 0 0 6.822302 0 3.231572
6.642723 6.822302 3.231572 3.231572 3.4111508 0
0 0 0 0 0 0 0 0 0 0
0 0 0 3.411151 3.411151 6.463144 13.285446
26.570891 0 13.4650245 0 0 0 0 0 0
0 0 0 0 0 # 6
1986 2 7 3 0 108 0 0 0 0
1.6596962 1.0041337 0.8354633 2.303782 4.058277
4.182472 4.791801 7.88288 7.350428 6.827802
5.986836 4.478384 3.434614 1.3090633 1.2332347
0.1166741 0.16013406 0.11667405 0 0.779496 0.4666962
0.3500223 0 0 0.3109241 0 1.740464 0.1373429
1.674172 3.482537 6.477298 7.342662 6.517345
5.345761 4.046476 2.4557747 0.8926017 0.08997406
0.15810508 0 0 0 0 0 0 0 0 0
108
1989 2 7 3 0 423 0 0 0 0.1052069
0.3588284 0.5028671 1.2169388 3.259815 6.730053
6.187266 7.194915 6.631582 6.421608 5.175934
2.302481 1.90465 1.934135 1.8950102 1.1990297
0.2007844 0.61579352 1.0539511 0.20778636 0 0.1142395
0 0 0 0.1828081 0.24676949 0.2584429 0.789397
3.079195 4.484612 9.072959 10.093828 8.410339
4.135139 2.788852 0.8127312 0.1065291 0.32552306 0
0 0 0 0 0 0 0 0 0 # 423
1992 2 7 3 0 348 0 0.32474368 0
0.1394901 0.8133533 2.4790727 3.320116 6.583255
6.061974 6.79271 7.625509 6.235333 2.576828
3.017801 2.67297 1.521939 1.628344 0.5814746
0.3306431 0.5680355 0.06839995 0 0 0 0 0
0.11792894 0 0.1749639 0.19041256 1.1222446 4.70739
4.696595 8.496584 8.70146 6.313356 5.073841
3.679695 1.466543 1.2328105 0.6198415 0 0.06434122
0 0 0 0 0 0 0 0 0 # 348
1995 2 9 3 0 435 0 0 0.07113167
0.3083666 0.3002779 1.0183571 1.615746 3.182806

4.682894 7.976058 9.403384 8.463475 7.125601
4.737101 4.117477 2.183041 2.379451 0.6279602
0.4756187 0.353512 0.17624917 0 0 0 0 0
0 0 0.1479033 0.06763529 1.0742453 1.6033388
2.028175 4.437839 10.357724 8.828668 5.842812
3.848924 1.624353 0.4160944 0.2297767 0.06059428
0.23341073 0 0 0 0 0 0 0 0 0
435
1998 2 9 3 0 708 0 0 0 0.1586272
0.6080436 1.2437724 2.2963795 4.126429 5.761948
7.596899 7.509087 6.218312 4.620368 3.801603
3.741353 3.456325 2.447267 1.0059622 0.262176
0.2705981 0 0.0443206 0 0 0 0 0
0.10668527 0.2330066 1.0904484 1.8345259 2.6689145
3.175284 6.063336 7.278262 7.960775 6.49672
4.838427 2.206804 0.67589 0.1366078 0.06484532 0
0 0 0 0 0 0 0 0 0 # 708
2001 2 9 3 0 762 0 0 0.32694347
0.9743474 2.105 2.51571 3.2258802 3.558763 4.257112
3.832461 4.541249 4.756083 5.675763 4.643002
3.300652 2.971125 1.746044 0.9005112 1.0294343
0.249347 0.02490968 0.02289351 0.02402995 0 0 0
0.04157596 0.10822993 0.4084969 2.58638596 3.2142443
4.7297788 5.427194 5.973989 6.624309 7.334986
5.207461 3.781314 2.034424 1.1740123 0.5313371
0.02555972 0.02484693 0.09059624 0 0 0 0 0
0 0 0 # 762
2004 2 9 3 0 717 0 0.02139436 0.08299942
0.5802772 1.0488736 1.1848177 2.3620079 2.879266
3.638375 4.819311 5.524271 7.105853 6.528354
5.366425 4.13232 3.02099 1.742089 1.3468938
0.3893162 0.3487207 0.12168253 0.05431382 0.04138902 0
0 0 0.01373919 0.01136348 0.215975 1.00410174
2.1033238 2.0606149 3.217523 5.016838 5.432054
8.442793 9.185533 6.038449 3.555717 0.7214951
0.3462715 0.14573032 0.04220321 0 0.02931007 0.0269788
0 0.02253336 0.02751366 0 0 0 # 717
#NWFSC #year Season Fleet gender partition nSamps F12 F14
F16 F18 F20 F22 F24 F26 F28 F30 F32 F34 F36
F38 F40 F42 F44 F46 F48 F50 F52 F54 F56 F58
F60 F62 M12 M14 M16 M18 M20 M22 M24 M26 M28
M30 M32 M34 M36 M38 M40 M42 M44 M46 M48 M50
M52 M54 M56 M58 M60 M62 # nSamps
2003 2 8 3 0 493 0 0 0.01877643
0.40938952 0.3125195 0.5485925 0.801338 1.706796
2.772621 5.782943 6.314213 5.599588 6.02302

4.733309 3.68086 3.441981 2.229069 0.869815
0.9133759 0.7659347 0.2466838 0.1817079 0.06385544 0
0 0 0 0 0 0.1973245 0.4359071 0.995766
2.216433 5.445056 8.941569 10.790088 11.661486
5.950402 4.024553 1.392444 0.3322417 0.1724648 0
0.02787445 0 0 0 0 0 0 0 0 #
493
2004 2 8 3 0 715 0 0 0.0674172
0.12823294 0.2596461 0.8886104 1.567845 1.729331
3.486215 3.999988 5.070125 6.165554 6.948147
5.754094 4.560612 4.101817 2.727049 1.328842
0.8024231 0.8117775 0.3399389 0.1173192 0.09074055 0
0 0.02211853 0 0 0.0358443 0.4262148 0.6043179
1.605769 3.189877 4.242105 5.607728 8.233125
9.930771 8.374688 4.562269 1.464345 0.432132
0.2275731 0.02139565 0.03940873 0.03459175 0 0 0
0 0 0 0 # 888
2005 2 8 3 0 400 0 0 0.0189594
0.09704056 0.3923734 0.8129282 1.48417 1.684573
1.968721 2.784068 4.802026 5.16024 5.744723
7.356768 5.252322 4.166974 2.190004 1.429004
1.3400072 0.2640078 0.2099209 0.3682885 0.07373302
0.02411111 0 0 0 0 0.02893454 0.4212878
1.2950154 1.798336 2.337493 2.857662 4.755684
7.193623 10.25173 9.349382 6.519004 3.20883
1.6998875 0.424341 0.21884677 0 0 0.01497982 0
0 0 0 0 0 # 618
2006 2 8 3 0 650 0 0 0 0.38905396
0.2484907 0.9908918 1.29679 2.209467 2.249322
3.400046 4.117683 5.427163 5.653915 6.708127
5.636122 5.891209 3.648475 1.816476 1.2075807
0.6925664 0.5029241 0.2428963 0.10635415 0 0 0
0 0 0.05181557 0.8181597 1.1667544 1.650285
3.292664 3.628642 4.393952 5.854331 7.28206
8.874523 6.892426 2.205878 0.9927107 0.2970759
0.1115627 0 0.02337908 0.02822869 0 0 0 0
0 0 # 1164
2007 2 8 3 0 900 0 0 0 0.27565458
0.4654033 1.405391 1.52235 1.711185 3.248635 4.7081
4.832215 5.716683 6.405386 5.534528 6.139135
5.43838 3.745655 2.896406 1.2565027 0.8758471
0.3605776 0.219202 0.07993635 0.0388256 0.02395023 0
0 0.03204842 0 0.2514884 1.1923495 2.955485
3.548982 4.296 4.277412 6.750812 6.076102 6.116831
4.204365 2.213094 0.5998826 0.311594 0.20896582

0.02856122 0.0360803 0 0 0 0 0 0 0
1326
2008 2 8 3 0 1006 0 0 0.07010762
0.57848649 1.3000447 1.4989521 2.993416 3.416637
4.198241 4.911097 3.727493 4.765384 5.83626
4.514046 3.584713 3.556828 2.872904 2.091704
1.4243352 1.0165623 0.3504387 0.1569903 0.04928623 0
0 0 0.04206115 0 0.32817021 1.0762901 1.8220267
2.363253 4.565726 5.202579 6.573746 5.8888 6.320536
5.461118 3.906732 2.013987 0.9521366 0.3379088
0.13307933 0.06908919 0.02883517 0 0 0 0 0
0 0 # 1006

#_AGE_DATA
17 #n_abins #_N_agebins
#(<=_#_of_age,_the_model_always_start_at_age_0)
#age_bins1(1,n_abins) #_lower_age_of_agebins
1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17

#_Age_error

5 #N_ageerr #3_ageerr_types_see_belows

#age_err(1,N_ageerr,1,2,0,nages)
#_vector_with_stddev_of_ageing_precision_for_each_AGE_and_type

#Age0 1 2 3 4 5 6 7 8 9 10 11
12 13 14 15 16 17 18 19 20 21 22
23 24 25 26 27 28 29 30 31 32 33
34 35 36 37 38 39 40
#perfect_age_(ageerr=1_given_but_not_used)

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1

-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
-1 -1 -1 -1 -1 -1 -1
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001
#bias and stdev from CAP bomb v. bb; bb1 v. bb2 for survey bb ages

use this for survey ages (except 2004) and OR commerical ages 07-08

0 0.98167 1.96334 2.94501 3.92668 4.90835
5.89002 6.87169 7.85336 8.83503 9.8167 10.7984
11.78 12.7617 13.7434 14.7251 15.7067 16.6884
17.6701 18.6517 19.6334 20.6151 21.5967
22.5784 23.5601 24.5418 25.5234 26.5051
27.4868 28.4684 29.4501 30.4318 30.4327
31.4144 32.3961 33.3778 34.3595 35.3412
36.3229 37.3046 38.2863
0.127912 0.127912 0.255825 0.383737 0.511649 0.639562
0.767474 0.895386 1.0233 1.15121 1.27912 1.40704
1.53495 1.66286 1.79077 1.91868 2.0466 2.17451
2.30242 2.43033 2.55825 2.68616 2.81407
2.94198 3.0699 3.19781 3.32572 3.45363 3.58155
3.70946 3.83737 3.96528 3.9585 4.0857 4.2129 4.3401 4.4673
4.5945 4.7217 4.8489 4.9761
#bia and stdev from CAP bomb v. bb v. surface reads

#use this for all CA ages, WA ages up to 1982, and OR commerical ages from 2000-2004/5

0 0.936529 1.87306 2.80959 3.74612 4.68264
5.61917 6.5557 7.49223 8.42876 9.36529 10.3018
11.2383 12.1749 13.1114 14.0479 14.9845 15.921
16.8575 17.794 18.7306 19.6671 20.6036 21.5402
22.4767 23.4132 24.3498 25.2863 26.2228

27.1593 28.0959 29.0324 29.0315 29.968 30.9045
31.841 32.7775 33.714 34.6505 35.587 36.5235
0.0917434 0.0917434 0.183487 0.27523 0.366973 0.458717
0.55046 0.642204 0.733947 0.82569 0.917434
1.00918 1.10092 1.19266 1.28441 1.37615
1.46789 1.55964 1.65138 1.74312 1.83487
1.92661 2.01835 2.1101 2.20184 2.29358 2.38533
2.47707 2.56881 2.66056 2.7523 2.84404 2.8381 2.9293
3.0205 3.1117 3.2029 3.2941 3.3853 3.4765 3.5677
#bias and stdev from CAP combo methods

#use this for OR commercial ages from 1981-1999 where a combination of methods were used

0 0.968652 1.9373 2.90596 3.87461 4.84326 5.81191
6.78056 7.74921 8.71787 9.68652 10.6552
11.6238 12.5925 13.5611 14.5298 15.4984
16.4671 17.4358 18.4044 19.373 20.3417 21.3103
22.279 23.2477 24.2163 25.1849 26.1536 27.1223
28.0909 28.0923 29.061 30.0297 30.9984 31.9671
32.9358 33.9045 34.8732 35.8419 36.8106
37.7793
0.195255 0.195255 0.39051 0.585766 0.781021 0.976276
1.17153 1.36679 1.56204 1.7573 1.95255 2.14781
2.34306 2.53832 2.73357 2.92883 3.12408
3.31934 3.51459 3.70985 3.9051 4.10036 4.29562
4.49087 4.68613 4.88138 5.07664 5.27189
5.46715 5.6624 5.6508 5.8448 6.0388 6.2328 6.4268 6.6208 6.8148 7.0088
7.2028 7.3968 7.5908
#bias and stdev from WDFW combo method, post 1982

1.64587 2.29561 2.96139 3.6436 4.34264 5.05894
5.79292 6.54502 7.31568 8.10536 8.91453
9.74367 10.5933 11.4639 12.3559 13.27 14.2066
15.1664 16.1498 17.1576 18.1902 19.2482
20.3324 21.4434 22.5818 23.7482 24.9435
26.1683 27.4233 28.7092 30.0269 31.3772
31.2006 32.5181 33.8586 35.2221 36.6086
38.0181 39.4506 40.9061 42.3846

0.207122 0.207122 0.414244 0.621367 0.828489 1.03561
1.24273 1.44986 1.65698 1.8641 2.07122 2.27834
2.48547 2.69259 2.89971 3.10683 3.31396
3.52108 3.7282 3.93532 4.14244 4.34957 4.55669
4.76381 4.97093 5.17806 5.38518 5.5923 5.79942
6.00654 6.21367 6.42079 6.4076 6.6135 6.8194 7.0253 7.2312
7.4371 7.643 7.8489 8.0548

#_AGE_COMPOSITIONS(duplicates_must_be_contigent_within_Year-Seas-Fleet-Sex_because_of_ageerr_and_states)

396 #nobsa #ageerr:_2:imprecision_age(BB)_3:Biased_age(Surface)
nsampls adj Flt1 Flt2 Flt3 Flt4 Flt5 Flt6

3 #_Lbin_method: 1=poplenbins; 2=datalenbins; 3=lengths
5 5 6 6 2 2

1 #_combine males into females at or below this bin number

#1 year Season Fleet gender partition ageErr LbinLo LbinHi nSamps
F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11
F12 F13 F14 F15 F16 F17 M1 M2 M3 M4 M5
M6 M7 M8 M9 M10 M11 M12 M13 M14 M15 M16
M17 nSamps
1967 1 1 3 2 3 4 76 20 0 0
0 0 1.656863719 7.061838006 19.2127911 14.039827
12.37724942 5.225621903 1.58175063 2.453089431 1.58175063 0
0.528202519 0 0 0 0 0 0.450232503 3.624880586
13.01870805 9.573460736 4.153083105 1.428667525 1.428667525
0.603315608 0 0 0 0 0 0 # 4
1968 1 1 3 2 3 4 76 55 0 0
0.190901241 0.190901241 2.033612774 9.711561923 14.03237056
14.39454372 9.047060391 7.257007518 5.124650243 1.775533808
0.899647721 0.146875082 0.778604044 0 0.146875082 0 0
0 0.501153822 1.916734982 8.642543494 12.10857824 6.01992669

3.054348934 0.818980472 0.792962915 0.244486556 0.170138548 0
0 0 0 # 11
1969 1 1 3 2 3 4 76 45 0 0
0 1.524588261 7.417834053 12.38507574 11.43733515 12.38649971
6.406557923 5.313039556 3.037322725 2.303474204 0.937969368
0.130757371 0.142458196 0 0.130757371 0 0 0.384067263
1.158882794 8.379459059 12.20562344 6.503566806 4.848458479
2.089088182 0.484912233 0.392272114 0 0 0 0 0
0 # 9
1970 1 1 3 2 3 4 76 40 0 0
0 0.909505262 10.46505786 15.23196261 10.78647866 10.27269
5.492814822 6.599310912 4.132994097 2.049183231 1.130796488
0.985584875 0.227719486 0.176962636 0.075906495 0 0 0
0.974552421 7.047631776 10.3831722 6.365112101 4.90859086
1.234957273 0.227719486 0.321296467 0 0 0 0 0
0 # 8
1971 1 1 3 2 3 4 76 25 0 0
0 0.803277242 5.378918479 13.81514542 9.813887741 5.014706571
4.544503808 4.599121235 5.513464323 0.803277242 0.330432084 0
0 0 0.330432084 0 0 0 1.308038831 10.19617451
12.47965615 12.69469816 5.39687088 5.132227324 1.84516792 0
0 0 0 0 0 0 # 5
1972 1 1 3 2 3 4 76 20 0 0
0 0.668283508 5.862510025 16.2613514 4.546876246 4.161851339
3.675838457 2.366313245 3.017559394 1.325498555 1.251837245
0.674097365 0.300218027 0.249252892 0.249252892 0 0
0.008605123 2.080532866 17.46479457 26.45574635 7.825104959
1.452545271 0.101930271 0 0 0 0 0 0 0
0 # 4
1973 1 1 3 2 3 4 76 15 0 0
0 0.18756618 2.358882207 14.05539888 26.55558395 14.9320941
4.558881934 4.704123738 3.256333699 2.328917823 0.994460235 0
0 0 0 0 0 0 1.162477053 7.35275149
7.413418322 7.296933998 2.259928496 0.300898631 0.28134927 0
0 0 0 0 0 0 # 3
1974 1 1 3 2 3 4 76 15 0 0
0 0.060549523 0.121099046 5.403698057 3.322627831 6.088531977
1.448250584 0.64497559 1.10602261 0.302747616 0.18164857 0
0 0 0 0 0 0 2.770464147 19.50049689
32.58940096 21.36081616 3.792588068 1.245532849 0.060549523 0
0 0 0 0 0 0 # 3
1975 1 1 3 2 3 4 76 45 0 0
0 0.050834015 1.749478717 8.518143699 15.77695958 10.70616462
5.819352178 1.798335188 0.724305041 0.787400953 0.238165198
0.219922733 0 0 0 0 0 0 0.28457118
7.820043796 18.83099563 18.71268044 5.772810457 1.697986129

0.394304835 0.097545602 0 0 0 0 0 0 #
9
1976 1 1 3 2 3 4 76 5 0 0
0 0 0 5.050505051 2.02020202 12.12121212 9.090909091
2.02020202 2.02020202 1.01010101 2.02020202 0 0 0
0 0 0 0 0 7.070707071 36.36363636 11.11111111
10.1010101 0 0 0 0 0 0 0 0 0
1
1977 1 1 3 2 3 4 76 10 0.714966054
0 0 0 1.901537061 6.419577236 12.73787778 4.502922928
2.844746968 2.129780914 0.786008256 0.157201651 0.314403302 0
0 0 0.157201651 0 0 0.872167705 2.144898161
10.79553301 18.1023952 24.53708968 4.289796322 5.719728429
0.714966054 0 0 0.157201651 0 0 0 0 #
2
1978 1 1 3 2 3 4 76 15 0 0
0 0 0 5.319700326 12.89360106 20.78780186 10.41667692
7.984413029 5.836869055 3.972592284 2.716422829 1.606138274
0.654385657 0 0 0 0 0 0.297366959 7.765502993
8.030691369 5.432845659 2.81530303 2.564214411 0.905474276 0
0 0 0 0 0 0 # 3
1980 1 1 3 2 3 4 76 15 0
3.083415845 4.111221126 22.27222719 5.234444491 22.71410725
4.257838622 6.301745607 4.27404247 3.548480491 2.534628922
0.688316279 3.639175738 1.013851569 0.506925784 0 0 0
2.569513204 8.736344894 0.181390495 1.413878258 1.36042871
1.467327806 0 0.090695247 0 0 0 0 0 0
0 0 # 3
1981 1 1 3 2 3 4 76 30 0 0
0.31254353 1.622904285 3.224743967 6.633991529 12.945501
9.449399275 5.078450977 4.284396562 3.459394121 4.708665768
6.43105058 6.511196617 1.496895427 3.448012726 1.325151102 0
0 0.104181177 0.778417399 3.918112523 7.877507148 8.389517014
1.503333759 0.475815372 1.011976865 2.456281915 0.933442014
0.490043857 0.220447348 0.049149161 0.785994531 0.073482449 #
6
1982 1 1 3 2 3 4 76 20 0 0
0 3.909176189 6.698915585 6.435357761 6.392984416 4.341417816
1.394869698 4.175600021 4.178603046 2.030379928 3.133724346
2.917401139 3.864539809 0.173949863 2.705088716 0 0
2.491425009 5.37498966 11.1726089 9.168673382 5.914282907
5.101208494 3.111625923 1.033743606 0.415237502 1.033743606 0
0.637601504 0.116663666 0.415237502 1.660950006 # 4
1986 1 1 3 2 5 4 76 10 0 0
0 0.159768325 3.6330983 7.824298338 18.28368664 9.461379972
3.6330983 1.477313309 2.834256674 0.159768325 0.319536651

0.159768325 0 0 0.998008333 0 0 0 4.830273339
8.982074996 18.68202006 14.56961678 1.676480015 0.838240008
0.998008333 0 0 0.319536651 0.159768325 0 0 0
2
1987 1 1 3 2 5 4 76 30 0 0
0 0.450380211 2.303449527 7.89372194 6.857406486 14.50044535
1.22322787 1.291987788 0.796983036 0.070043014 0.014008603 0
0.068016034 0 0 0 0 0.363470011 6.6648719
20.63865108 22.41144192 7.1794079 6.482028604 0.790458729 0
0 0 0 0 0 0 0 # 6
1988 1 1 3 2 5 4 76 20 0 0
0 4.216468266 16.44723662 4.373589329 9.973345762 3.733957175
5.351747608 0 0.378426447 0 0 0 0 0
0.202564944 0 0 5.346513728 11.67914874 19.23643145
14.84410168 0 4.216468266 0 0 0 0 0 0
0 0 0 # 4
1989 1 1 3 2 5 4 76 25 0 0
0 2.595901276 14.9991968 10.86841367 8.312546123 2.199381124
1.508051558 0.896824189 0.205494623 0 0 0 0 0
0.125392426 0 0 1.768905573 11.4739407 25.49179344
11.35745333 2.915009657 4.795860567 0.485834943 0 0 0
0 0 0 0 0 # 5
1990 1 1 3 2 5 4 76 10 0 0
0 0 0 3.507910059 7.382488198 4.711862971 10.99434693
7.853104951 3.14124198 0 3.14124198 0 1.57062099 0
1.57062099 0 0 0 0 14.39830832 8.953109188
7.015820119 11.25706634 1.937289069 4.711862971 3.14124198
1.57062099 0 0 0 1.57062099 1.57062099 # 2
1991 1 1 3 2 5 4 76 10 0 0
0 9.068969501 22.36476176 21.82988293 18.75326299 4.842146745
0 0 4.226822756 0 0 4.226822756 0 0 0
0 0 0 3.076619943 3.076619943 6.68811871 1.845971966
0 0 0 0 0 0 0 0 0 0 #
2
1992 1 1 3 2 5 4 76 5 0 0
0 0 3.448275862 0 10.34482759 0 3.448275862 0
0 0 0 0 0 0 0 0 0 0
41.37931034 27.5862069 10.34482759 3.448275862 0 0 0
0 0 0 0 0 0 0 # 1
1993 1 1 3 2 5 4 76 20 0 0
0 1.495065241 16.34841192 13.61849637 12.95820737 2.345823349
5.708939505 0 0 0 0 0 0 0 0 0
0 0 13.8010716 15.16047611 14.38544224 0.810016143
2.174767497 0 0 0 1.193282657 0 0 0 0
0 # 4

1994 1 1 3 2 5 4 76 20 0 0
0 5.772655262 10.68656967 12.33073048 2.558429365 4.176056533
2.03453691 0.106982712 0 0 0 0 0 0 0
0 0 3.612148904 17.67036842 29.65913303 9.405832604
1.986556107 0 0 0 0 0 0 0 0 0
0 # 4
1995 1 1 3 2 5 4 76 15 0 0
1.168074464 2.336148928 8.764823881 10.09538422 4.133147494
1.168074464 2.030217678 1.168074464 0.273840582 0 1.482536515
0 0 0 0 0 0 0 18.70823193 25.41927827
17.98303582 3.786594775 1.208695933 0.273840582 0 0 0
0 0 0 0 0 # 3

1996 1 1 3 2 5 4 76 10 0 0
0 0.09386624 12.37093392 15.5810002 3.21006628 3.11620004
0 0 0.09386624 3.0223338 0 0 0 0
0.09386624 0 0 0 3.11620004 21.6256678 24.6480016
9.536332599 3.303932519 0.187732479 0 0 0 0 0
0 0 0 # 2
1997 1 1 3 2 5 4 76 5 0 0
0 12.82051282 17.94871795 12.82051282 17.94871795 10.25641026
2.564102564 0 2.564102564 0 0 0 0 0 0
0 0 0 10.25641026 5.128205128 5.128205128 0
2.564102564 0 0 0 0 0 0 0 0 0
1
1998 1 1 3 2 5 4 76 10 0 0
0 0 3.233728502 12.38231573 7.531722973 17.21244318
6.446991707 1.616864251 1.616864251 0 0 0 0 0
0 0 0 0 1.616864251 20.46663698 11.78878685
5.894393426 6.446991707 3.745396191 0 0 0 0 0
0 0 0 # 2
1999 1 1 3 2 5 4 76 15 0 0
0.521275967 3.593165666 2.623387994 7.463977475 11.33478928
11.35179745 8.104697543 0 1.405625858 0 0 0 0
0 0 0 0 0.260637983 9.010797215 15.03039089
17.75582785 6.370014082 4.097046493 0.538284127 0 0
0.538284127 0 0 0 0 0 # 3

2000 1 1 3 2 5 4 76 30 0 0
0.071136371 0.607537001 7.015238487 13.24388448 6.012215099
9.616948951 5.678830902 0.449828452 1.414700532 0 0
0.322991518 0 0 0 0 0 0.394127889 2.159729643
21.44268375 24.77099907 6.026327888 0.772819969 0 0 0
0 0 0 0 0 0 # 6

2001 1 1 3 2 5 4 76 30 0 0
0.302507761 0 3.774601825 12.66844367 9.536089747 2.804509783
1.002087014 1.742345875 0.066169734 0 0 0 0 0
0 0 0 0 5.648479545 16.55431005 30.3494874
15.48479787 0.066169734 0 0 0 0 0 0 0
0 0 # 6
2002 1 1 3 2 5 4 76 35 0
0.231510527 1.012885406 1.292247622 7.510265398 8.143341911
11.86156544 4.625329991 0.794678521 0.632778434 0 0 0
0 0 0 0 0 0.231510527 1.597526981 6.965807001
21.92988322 19.89396524 9.052897788 4.112905615 0.110900374 0
0 0 0 0 0 0 0 # 7
2003 1 1 3 2 5 4 76 40 0 0
0.012359518 0.140984623 0.827425705 8.831748389 8.541983649
6.207978717 1.329644336 0 0 1.083287768 0.889248442 0
0.006179759 0 0 0 0.006179759 0.013664932 0.215616473
27.56471834 23.92555032 11.62985989 8.700646964 0.072922418 0
0 0 0 0 0 0 0 # 8
2004 1 1 3 2 5 4 76 40 0
0.008935662 0.071485294 0.040210478 11.79852739 3.238888055
3.792547829 4.60384474 4.024384112 0.118142273 0.07685756 0
0 0.041284712 0 0 0 0 0 0.1260037
2.050106569 20.76649665 36.69672087 8.615925121 3.565772482
0.181933252 0 0 0.181933252 0 0 0 0 0
8
2005 1 1 3 2 5 4 76 15 0 0
0.082796579 1.282315166 2.630867596 20.37546344 17.32625582
2.29968128 1.14984064 0.016559316 0 0 0 0 0
0 0 0 0 0.016559316 0.049677947 6.457310199
22.38118529 23.21493251 2.716554893 0 0 0 0 0
0 0 0 0 # 3
2006 1 1 3 2 5 4 76 20 0
0.059444747 0.355614996 0.205942831 0.064753044 4.69600111
14.40051107 29.89567497 8.330999328 3.159929534 0.862350985
0.862350985 0 0 0 0 0 0 0.018045484
0.174093053 0.095535714 7.797401417 16.66503477 6.895771763
5.460544198 0 0 0 0 0 0 0 0 0
4
2007 1 1 3 2 5 4 76 20 0 0
0.701045512 9.682562272 7.000645691 13.36393665 9.850719534
6.466988065 6.046445686 1.463646255 0.198526314 1.463646255 0
0 0 0 0 0 0 1.049769525 5.245754257
17.37414277 10.95672775 5.188536825 3.946906635 0 0 0
0 0 0 0 0 0 # 4

2008 1 1 3 2 5 4 76 15 0 0
0.929774789 10.7688688 12.52548669 7.363962921 7.00284947
7.178007963 3.318168894 2.485927554 0 0.646286382 0 0
0 0 0 0 0 0.185954958 5.441298472 6.560397268
15.30164075 12.45999798 1.473129489 4.419388467 1.938859146 0
0 0 0 0 0 0 # 3
1960 2 2 3 2 3 4 76 5 0 0
0 3.571428571 1.19047619 2.380952381 1.19047619 3.571428571
0.595238095 1.19047619 0.595238095 0 0 0 0 0
0 0 0 2.976190476 10.11904762 10.71428571 15.47619048
17.26190476 22.02380952 6.547619048 0.595238095 0 0 0
0 0 0 0 # 1
1961 2 2 3 2 3 4 76 5 0 0
0 7 8 13 3 7 9 3 2 1 0
0 0 0 0 0 0 0 10 15 8 5
4 4 0 0 0 0 0 0 0 1 #
1
1964 2 2 3 2 3 4 76 5 0 0
0 1.5 6.5 14.5 11.5 3.5 2.5 1.5 0.5 0.5 0.5
0 0 0 0 0 0 0.5 6 14.5 22 7.5
3 1 1 1.5 0 0 0 0 0 0 #
1
1965 2 2 3 2 3 4 76 5 0 0
0 5 3 14 14 7 5 1 1 0 2
0 0 0 0 0 0 2 15 7 11 8
4 0 0 0 0 1 0 0 0 0 #
1
1966 2 2 3 2 3 4 76 135 0 0
0.129395654 2.547778439 9.954600111 11.08135053 10.48820539
6.267982287 2.990652454 2.251355519 1.564313633 0.78762892
0.663052241 0.221611709 0.193440706 0.027088484 0.176338513 0
0 0.025006289 3.59885369 13.6398081 13.65344781 9.956080338
5.065220923 2.370663669 1.256547645 0.491242643 0.276425267
0.12097085 0.099967656 0.100970542 0 0 # 27
1967 2 2 3 2 3 4 76 155 0 0
0 0.397976064 1.622274801 9.288035599 17.53624458 11.39671632
7.072059025 3.918040079 1.540056093 1.382984582 0.517646557
0.362200513 0.098694151 0.082663597 0.066040181 0 0
0.037227169 0.410749127 3.681540457 11.49362868 13.43291713
8.632692484 3.070250399 2.419335123 1.031016349 0.386919868
0.122091065 0 0 0 0 # 31
1968 2 2 3 2 3 4 76 170 0 0
0.012317022 0.242147303 2.246444049 6.076689517 12.06417582
12.94525302 6.173558711 2.85480186 1.880119549 1.087583086
0.567127956 0.353729564 0.108972563 0.036396284 0.036245331 0
0 0.058694494 0.508464199 3.441367154 13.54305789 17.51581876

10.96556925 4.994408629 1.201436174 0.767996762 0.20283133
0.019287661 0.066221486 0.029284583 0 0 # 34
1969 2 2 3 2 3 4 76 175 0 0
0 0.647439924 6.018259333 8.80939229 7.996042218 10.80125453
6.85729263 3.701961213 1.696627359 0.776055917 0.701837308
0.374265387 0.108254826 0.060716007 0.030522942 0 0
0.05744122 0.820598893 5.341035771 10.86742792 14.26977655
9.743331788 7.335610948 2.369037898 0.448420816 0.075044643
0.031305786 0.030522942 0 0.030522942 0 # 35
1970 2 2 3 2 3 4 76 195 0 0
0.114571754 2.13535841 11.2352904 12.11771444 11.14769466
6.054378498 6.138223915 3.384663213 1.8590855 0.51786064
0.437543702 0.157615119 0.135747639 0.041460068 0.071618557 0
0 0.43540178 3.958383165 12.90533432 10.86144658 7.417834786
4.569221451 2.897007941 0.846827994 0.392622561 0.109238624
0.04645901 0.011395282 0 0 0 # 39
1971 2 2 3 2 3 4 76 45 0 0
0.023896894 4.60026 11.76104639 16.06229338 6.367425679
3.123700468 2.016430324 1.015615832 0.237117075 0.190231088
0.054428348 0.011900295 0 0 0 0 0 0.147219638
6.770704049 24.22903572 16.93501801 4.956361245 0.849780051
0.606588841 0.039909854 0.001036818 0 0 0 0 0
0 # 9
1972 2 2 3 2 3 4 76 115 0 0
0.093765423 2.676789456 10.72446747 14.91551271 6.770746544
2.9439239 1.454659558 1.175529062 0.650881459 0.195557478
0.181457495 0.02356197 0.047636852 0.014077923 0.014077923 0
0 0.035707373 5.360379837 21.74678528 19.80464412 6.630017143
2.472412007 1.003090466 0.731949096 0.231976836 0.059184678
0.027130023 0.014077923 0 0 0 # 23
1973 2 2 3 2 3 4 76 70 0 0
0.130880553 3.271866694 11.49412927 11.26324991 10.52705862
4.440833927 1.609557729 0.952436389 0.509054373 0.524135285
0.207335546 0.186239829 0.079398798 0.097388964 0.077348579 0
0 0.126261785 2.84694141 16.72098111 15.20988154 14.33822105
4.097983555 0.692799606 0.327917563 0.073626157 0.118530605 0
0.023873171 0.017121417 0.017121417 0.017825136 # 14
1974 2 2 3 2 3 4 76 140 0 0
0.010915433 2.404832005 8.997332484 11.79253592 10.10579983
2.499312913 0.551952114 0.376884034 0.30659583 0.122712814
0.028727542 0.032785636 0.006912891 0.013273809 0.01209604 0
0 0.069778837 4.399393802 21.95504755 23.52571918 9.113937512
2.780323901 0.560785944 0.114048506 0.077996233 0.090081696
0.02539966 0.006360919 0.01209604 0 0.006360919 # 28
1975 2 2 3 2 3 4 76 85 0 0
0.03428851 0.205947002 5.178322809 10.28865358 11.32811114

5.78800768 3.121934137 0.76189498 0.442469987 0.219965904
0.252378987 0.107183086 0.040949313 0 0.040348395 0 0
0.033304093 0.332131382 12.67062135 23.48481681 19.38157405
4.365849186 1.353883807 0.208727393 0.16998328 0.01301733
0.175635815 0 0 0 0 # 17
1976 2 2 3 2 3 4 76 25 0 0
0 0.91616329 1.732713098 11.2772249 23.52138291 13.27004951
6.996442954 2.074722203 2.090530531 0.42063077 0.280420513 0
0 0 0 0 0 0.181858442 0.597201652 3.62929888
11.48464395 12.53985273 5.982724903 1.422733775 0.905633232
0.675771762 0 0 0 0 0 0 # 5
1977 2 2 3 2 3 4 76 40 0 0
0.118288652 2.292322038 9.701601171 15.05844041 16.67298534
8.890503117 4.165971519 1.2814722 1.372161199 0.065222639
0.224244554 0.02674225 0 0 0 0 0 0.343088143
0.959812231 6.083284682 11.62337387 12.94979158 5.72797781
1.494100776 0.57773759 0.215011277 0.155866951 0 0 0
0 0 # 8
1978 2 2 3 2 3 4 76 40 0 0
0 3.178072963 2.541946671 5.901510053 11.53458123 8.599553582
6.813648973 3.368047871 1.837188872 0.640433681 0.513538308
0.111990571 0.114160289 0.028306409 0.049729996 0 0 0
1.769822361 2.490498324 7.582323699 12.96163667 13.92109306
7.255569154 5.709461448 2.685536348 0.30643024 0.056612817
0.028306409 0 0 0 # 8
1979 2 2 3 2 3 4 76 75 0 0
0.107200508 1.164763323 7.647272377 11.44618467 11.43498557
6.412253067 6.00101407 5.288233003 3.529165847 3.503899209
1.991239163 1.536880894 0.770621931 0.093581021 0.295573377 0
0 0 0.607757634 6.760744761 8.900309322 9.242288426
5.839148582 3.843640406 2.186490978 0.886721086 0.298983195
0.160044689 0.051002896 0 0 0 # 15
1980 2 2 3 2 3 4 76 110 0.113740611
0 0.099690374 2.228078972 8.11960365 10.01009403 8.761694992
5.831165293 4.499100536 2.667373374 3.304636998 2.826320354
2.720875451 1.339265152 0.787529005 0.676663905 0.180987648 0
0 0.009353591 1.90966037 8.312658397 14.84857838 5.831998647
4.832262653 3.264054169 1.879584907 2.430054514 1.18631537
0.45567426 0.504842767 0.308264781 0.056870306 0.003006537 #
22
1981 2 2 3 2 3 4 76 40 0 0
6.906312598 4.770690099 13.4449554 16.72143709 12.34125867
5.019329998 1.822192961 0.761468792 1.72284394 1.010831713
2.083695652 0.498668667 0.482120504 0.137952586 0.562634352 0
0.321991428 6.596024826 1.915513799 9.000363791 5.358426674
2.504466849 1.297735049 1.32551693 0.310203528 0.950194393

0.594772628 0.710389809 0.372112665 0.204450119 0.072628508
0.17881597 # 8
1982 2 2 3 2 3 4 76 5 0 0
0 7.070707071 18.18181818 13.13131313 15.15151515 5.050505051
3.03030303 1.01010101 2.02020202 1.01010101 1.01010101
1.01010101 3.03030303 0 1.01010101 0 1.01010101
8.080808081 13.13131313 4.04040404 1.01010101 0 0 0
0 0 0 0 0 0 0 1.01010101 # 1
1985 2 2 3 2 5 4 76 15 0 0
0 1.693370811 9.220285073 11.14864083 6.255037173 4.164410728
0.988415967 0.988415967 0.988415967 0 0.494207983 0 0
0 0 0 0 2.398325655 3.765525282 33.15622488
16.30129411 2.991992476 0.494207983 0.58953052 0 1.179061041
0 0.824515468 0 0.58953052 1.179061041 0.58953052 #
3
1986 2 2 3 2 5 4 76 25 0 0
0.745764039 14.22223463 19.25350977 11.88855336 15.08943546
4.785374852 1.615644857 0.367690525 0.119716519 0 0.074269256
0 0 0.586842538 0.293421269 0 0 0.744178425
4.433336543 13.43703383 7.388799739 2.867511351 1.450737482
0.367690525 0.148538512 0 0 0 0 0 0.119716519
0 # 5
1987 2 2 3 2 5 4 76 45 0 0
2.04164113 10.21817727 15.67269145 8.496100319 6.213771137
2.502403219 0.251982645 0 0 0 0 0 0 0
0 0 0 0.226327101 13.99891324 20.18075087 13.80730351
4.520927924 1.869010202 0 0 0 0 0 0 0
0 0 # 9
1988 2 2 3 2 5 4 76 25 0 0
0.818253483 10.12902013 17.3559654 8.697631244 6.23152247
0.334902888 0.856308735 0.223268592 0 0 0.111634296 0
0 0 0 0 0 1.591726841 12.86303862 32.04023777
8.023246152 0.723243381 0 0 0 0 0 0 0
0 0 0 # 5
1989 2 2 3 2 5 4 76 35 0 0
0 5.215759835 19.48754352 16.79500573 10.68114857 5.952257807
1.739503755 0.267055546 0.262085791 0 0 0.262085791 0
0 0 0 0 2.352892596 5.199475652 13.19651592
14.26709503 2.386552111 1.14379522 0.529141336 0 0 0
0 0.262085791 0 0 0 # 7
1990 2 2 3 2 5 4 76 30 0 0
3.524264175 5.020157266 31.95799175 13.6422003 6.884564665
1.430656866 0 0 0 0 0 0 0 0 0
0 0 0.779435053 6.804053139 17.99215743 8.846497846
3.118021506 0 0 0 0 0 0 0 0 0
0 # 6

1991 2 2 3 2 5 4 76 25 0 0
0 2.893670192 12.17407103 7.360015131 12.18717933 7.985178429
2.10100045 0.41719203 0 0 0 0 0 0 0
0 0 3.783621089 8.952111399 19.58053021 11.94306275
9.252419566 1.161352381 0.208596015 0 0 0 0 0
0 0 0 # 5
1992 2 2 3 2 5 4 76 25 0 0
4.390145765 16.39136239 16.3373271 13.60964865 5.764528463
4.876752263 1.70705647 0.328800213 0.496493769 0.496493769 0
0 0 0 0 0 0 2.750739519 7.394914586
11.93875236 6.727960677 3.053231537 2.14573404 0.894363098
0.328800213 0 0 0.366895115 0 0 0 0 #
5
1993 2 2 3 2 5 4 76 30 0 0
0.471694165 11.09607689 25.53838559 19.61436746 7.062892342
3.603097981 2.271103907 1.336086756 0 0 0 0 0
0 0 0 0 0 5.331092288 11.10383674 9.419939431
3.151426456 0 0 0 0 0 0 0 0 0
0 # 6
1994 2 2 3 2 5 4 76 35 0 0
0.829740938 9.768539776 12.30890469 17.10574848 4.861215684
2.748150058 0.828845599 0.051911854 0.03257453 0 0 0
0 0 0 0 0 0.814111731 15.19212671 16.26139398
13.13391339 4.690481443 0.067697326 0.650924776 0.017684397 0
0 0 0.636034643 0 0 0 # 7
1995 2 2 3 2 5 4 76 10 0 0
2.883174101 1.821013814 17.60235137 20.18221871 11.22938964
10.47053612 3.642027628 0 1.062160287 0 0 0 0
0 0 0 0 0 2.124320574 9.256135823 10.01498935
5.766348202 1.062160287 2.883174101 0 0 0 0 0
0 0 0 # 2
1996 2 2 3 2 5 4 76 15 0 0
0.928721982 7.048743289 30.76515525 17.38410624 5.25577732
6.131428198 3.703481036 0.464360991 0 0 0 0 0
0 0 0 1.387379527 0 3.75655214 8.601039572
11.32272752 0.464360991 2.321804955 0 0 0 0
0.464360991 0 0 0 0 # 3
1997 2 2 3 2 5 4 76 15 0 0
0.386780597 7.378579126 8.299539304 16.14526076 19.06953679
9.006063248 3.180080943 0 0 0 0 0 0 0
0 0 0 0 6.741468051 13.1241997 8.124096127
5.85950093 1.410672269 1.27422215 0 0 0 0 0
0 0 0 # 3
1998 2 2 3 2 5 4 76 80 0 0
0.494925845 7.030019614 19.14345521 12.64074397 7.779177969
3.59271908 1.576696255 0.636907928 0.473118255 0.081109383 0

0 0.029416882 0 0 0 0 0.066781365 9.363701196
21.69333857 9.215777574 2.952042441 2.53127416 0.631563175
0.050849532 0.016381595 0 0 0 0 0 0 #
16
1999 2 2 3 2 5 4 76 65 0
0.227244178 0.721480746 10.41833804 20.53765932 18.1248335
10.63320523 2.531297358 1.750879185 1.049254876 1.825687761
0.227244178 0.198475756 0 0.043098117 0 0 0
0.005585359 0.551913159 10.98243144 12.29472056 5.818591323
1.597221248 0.284520307 0.014329082 0.10297216 0.014329082
0.030358951 0 0 0 0 0.014329082 # 13
2000 2 2 3 2 5 4 76 60 0 0
0.164716944 2.952781787 12.11097836 16.06017022 13.22270604
5.546362522 1.723057814 0.732003443 0.379464289 0.080684795 0
0 0 0 0 0 0 0.657650184 9.372970259
16.66016645 13.88311873 5.690724075 0.762444081 0 0 0
0 0 0 0 0 0 # 12
2001 2 2 3 2 5 4 76 50 0
0.115889046 1.956465569 10.19878222 24.88618927 13.27828821
7.698196947 1.533002197 0.609396545 0.120699156 0.02745534 0
0.067574626 0.019835204 0 0 0 0 0.265067417
1.8569755 6.727477821 19.29775205 10.03751437 1.249354404
0.034248905 0.019835204 0 0 0 0 0 0 0
0 # 10
2002 2 2 3 2 5 4 76 80 0
0.079025647 3.479080381 14.64897302 16.71053456 11.13483636
8.391098944 2.682666303 0.953420164 0.141852514 0.071121248
0.116040823 0.132849904 0 0 0 0 0 0.084157086
2.60649211 14.20078501 12.7441901 7.880038112 2.976975383
0.933518477 0 0.032343862 0 0 0 0 0 0
0 # 16
2003 2 2 3 2 5 4 76 110 0
0.417751325 2.714997037 8.247461743 26.32301472 8.038495214
4.144752668 2.856054434 0.966620013 0.250131674 0 0
0.11806836 0 0 0.04606571 0.088917052 0 0.123758898
2.477047133 13.52334682 25.33758006 3.070269655 0.976729791
0.17919382 0.053678155 0.04606571 0 0 0 0 0
0 0 # 22
2004 2 2 3 2 5 4 76 105 0
0.00272205 0.117699754 3.733297293 8.825306343 33.80763777
6.248189585 0.853399746 1.815770277 0.493136069 0.375176768
0.037076438 0.177929734 0 0 0 0 0 0.018253611
0.116516922 4.551540558 18.04448245 17.88365484 1.832007382
0.424788585 0.537731241 0.103682588 0 0 0 0 0
0 0 # 21

2005 2 2 3 2 5 4 76 75 0
0.00195851 0.313730311 2.480776571 7.61710802 16.7600972
28.37027579 5.825044835 3.071190034 1.313155103 1.036430977
0.344833641 0.173655609 0.036927207 0 0 0 0 0
0.516227494 2.707546753 7.469863984 11.20277021 9.388824693
0.620764595 0.447011537 0.110603011 0.191203909 0 0 0
0 0 0 # 15
2006 2 2 3 2 5 4 76 20 0 0
0.816539702 13.01077775 11.86431027 12.11797938 15.93630324
14.77968895 2.828878795 0 1.487816923 0 0 0 0
0 0 0 0 0.091703437 11.15697007 2.811519715
3.55371506 3.819364568 5.72443215 0 0 0 0 0
0 0 0 0 # 4
2007 2 2 3 2 5 4 76 85 0 0
0.184875211 4.74332906 9.817340625 13.23143748 16.30503681
7.418516701 8.508215279 1.769575384 0.575176251 0.24588166
0.117697761 0.112668059 0.145249911 0 0.213273521 0 0
0.064146293 2.283418886 6.711366137 9.10185954 8.08524895
8.021842208 2.214010667 0.047407147 0.054950971 0.015802382 0
0.011673103 0 0 0 # 17
2008 2 2 3 2 5 4 76 90 0 0
0.21424098 2.439897158 17.9421078 17.41274184 7.16078216
2.772638402 4.090795619 3.000341756 0.635599794 0.30297961
0.354284993 0.010574684 0.168726604 0.128972739 0.073130186 0
0 0.113488227 2.978057741 13.10460953 14.5110394 6.880258428
2.143822163 1.760843622 1.505329301 0.247534087 0 0
0.047203169 0 0 0 # 18
1969 1 3 3 2 3 4 76 6 0 0
0 1.960784314 33.33333333 15.68627451 5.882352941 5.882352941
3.921568627 3.921568627 0 0 0 0 0 0 0
0 0 0 1.960784314 11.76470588 15.68627451 0 0
0 0 0 0 0 0 0 0 0 # 1
1978 1 3 3 2 3 4 76 6 0 0
0 1.020408163 7.142857143 21.42857143 18.36734694 12.24489796
13.26530612 9.183673469 6.12244898 1.020408163 2.040816327 0
0 0 0 0 0 0 0 4.081632653 3.06122449
0 1.020408163 0 0 0 0 0 0 0 0
0 # 1
1980 1 3 3 2 3 4 76 24 0 0
0 0.70830212 1.974000721 4.290458785 10.34161451 7.540629085
4.886873526 3.61469735 2.16718778 1.315592901 1.07332922
1.064493599 0.46603844 0 0.35415106 0 0 0.21289872
0.21289872 6.288482759 11.49665867 13.75429938 11.98749027
7.233341449 2.977589333 1.722131515 2.34125122 1.468674166 0
0.506914697 0 0 # 4

1981 1 3 3 2 4 4 76 12 0 0
0 1.168489653 4.617961035 7.07386951 8.417285911 4.324105118
6.780013594 3.036686296 3.036686296 3.680395707 1.343416401
0.349853495 0.174926747 1.168489653 0.818636158 0 0 0
0.174926747 11.69183054 11.27904546 11.69183054 9.060995322
2.162052559 5.261670446 1.343416401 0.524780242 0.818636158 0
0 0 0 # 2
1982 1 3 3 2 4 4 76 6 0 0
0 0 1.020408163 8.163265306 4.081632653 9.183673469
5.102040816 6.12244898 1.020408163 1.020408163 1.020408163
3.06122449 1.020408163 0 0 0 0 0 1.020408163
6.12244898 25.51020408 8.163265306 12.24489796 3.06122449
1.020408163 1.020408163 1.020408163 0 0 0 0 0
1
1983 1 3 3 2 4 4 76 18 0 0
0 0.853100248 1.713417678 9.128015089 7.723929487 10.7819436
4.498185623 6.400984595 5.730048459 4.913034118 2.310430285
2.346516192 1.36624798 1.064133086 0.203815657 0 0
1.706200496 10.53210069 10.77200226 7.254084843 2.197696684
4.98246463 1.855020004 0.232684382 0.980268212 0.014434363 0
0.014434363 0.134385145 0.021651544 0.26877029 # 3
1984 1 3 3 2 4 4 76 12 0 0
0 1.201131683 4.303243092 4.202336679 4.853355727 5.852674585
10.95342371 5.302561949 3.551317631 3.850788446 7.652747898
4.801278309 4.951013717 0.950489863 2.750563176 0 0
1.751244318 11.25939137 5.702939177 6.454864637 2.301356953
4.202336679 0.550112635 2.050715133 0.550112635 0 0 0
0 0 0 # 2
1986 1 3 3 2 4 4 76 6 0 0
0 2.040816327 4.081632653 12.24489796 28.57142857 6.12244898
0 0 0 0 0 0 0 0 0 0 0
0 10.20408163 20.40816327 6.12244898 10.20408163 0 0
0 0 0 0 0 0 0 0 # 1
1987 1 3 3 2 4 4 76 6 0 0
0 0 16 12 20 16 8 8 4 0 0
0 0 0 0 0 0 0 4 0 0 8
4 0 0 0 0 0 0 0 0 0 #
1
1989 1 3 3 2 4 4 76 36 0 0
0 2.574705437 8.251384298 13.2274197 16.60909999 13.47066895
5.812624659 4.134811635 1.801637689 0.547145045 0 0 0
0 0 0.182381682 0 0.822920164 5.616629459 11.5808747
4.127801947 9.77477734 0.792894793 0.214065715 0.4581568 0
0 0 0 0 0 0 # 6
1990 1 3 3 2 4 4 76 12 0 0
0 2.164855344 14.01133359 7.516767558 5.351912214 6.25366145

2.044403053 2.044403053 3.18705687 0 2.164855344 0
2.164855344 2.164855344 0 0 0 0 5.231459923
15.3330229 19.90363817 4.209258397 3.06660458 3.18705687 0
0 0 0 0 0 0 0 # 2
1991 1 3 3 2 4 4 76 48 0 0
0 2.956092424 9.755088608 18.85805714 17.01570181 7.620109989
4.009167218 0.760687515 0 0 0 0 0 0 0
0 0 0 2.2801268 6.780793975 14.28303643 11.65196445
2.90604124 0.850192391 0 0 0 0.272940009 0 0
0 0 # 8
1992 1 3 3 2 4 4 76 18 0 0
4.910957521 6.338491317 14.24030663 11.5636269 10.97469561
14.82923792 3.169245658 2.112830439 0 0 0 0 0
0 0 0 0 2.112830439 11.63491025 8.183775886
3.569049915 5.396387968 0.578192125 0.289096062 0.096365354 0
0 0 0 0 0 0 # 3
1993 1 3 3 2 4 4 76 18 0 0
0 1.852096109 5.82858727 4.813942469 5.692437798 7.738513342
10.73951946 1.344773708 0 0 0 0 0 0 0
0 0 0 7.134201224 20.04104402 11.94814369 9.806962698
7.037211506 2.085235298 1.247783991 2.689547416 0 0 0
0 0 0 # 3
1994 1 3 3 2 4 4 76 30 0 0
0.316341789 4.411427677 12.14225676 16.36577847 8.414467483
4.027203386 3.458110458 3.966388346 1.081086747 0 0 0
0 0 0 0 0 1.90992021 6.1503696 24.13853667
8.003633418 3.195672382 0.823702033 0.926797819 0.668306748 0
0 0 0 0 0 0 # 5
1995 1 3 3 2 4 4 76 30 0 0
0.666501558 2.58572665 11.35479854 17.61753179 8.575181584
8.051423107 4.314368624 1.478794704 1.148912216 0.369698676
0.666501558 0 0.369698676 0 0 0 0 0.903256555
3.258713254 12.00347684 15.48507626 7.548651399 2.01895981
1.582728204 0 0 0 0 0 0 0 0 #
5
1996 1 3 3 2 4 4 76 6 0 0
2.857142857 5.714285714 11.42857143 14.28571429 20 5.714285714
0 2.857142857 0 0 2.857142857 0 0 0 0
0 0 2.857142857 0 14.28571429 5.714285714 8.571428571
2.857142857 0 0 0 0 0 0 0 0 0
1
1997 1 3 3 2 4 4 76 12 0 0
3.028781114 3.028781114 5.30036695 24.03287261 14.62833874
11.91774815 3.467785865 0.757195279 0 0 0 0 0
0 0 0 0 3.028781114 5.30036695 2.271585836

14.18933399 3.467785865 3.467785865 2.112490572 0 0 0
0 0 0 0 0 # 2
1998 1 3 3 2 4 4 76 12 0 0
0 4.722149728 0.761418901 4.645331567 3.503203216 2.284256703
1.142128352 0.761418901 0 0 0 0 0 0 0
0 0 2.361074864 52.32435646 19.26930836 5.483568629
2.741784315 0 0 0 0 0 0 0 0 0
0 # 2
2002 1 3 3 2 3 4 76 12 0 0
0 3.570780952 0.71415619 4.72534779 21.21052484 10.60526242
3.297035409 0 0 0 0 0 0 0 0 0
0 0.71415619 7.361767228 18.24077519 14.66999424 11.59316415
3.297035409 0 0 0 0 0 0 0 0 0
2
2003 1 3 3 2 3 4 76 12 0 0
0 0 14.68862725 13.36013211 14.24579553 11.62965537
5.593411826 3.01812177 0 1.287645028 1.287645028 0 0
0 0 0 0 0 3.862935084 6.881056854 11.62965537
7.766720281 3.01812177 1.730476742 0 0 0 0 0
0 0 0 # 2
2004 1 3 3 2 3 4 76 12 0 0
0 0 4.029228487 12.60699184 7.356472552 17.1555267
7.356472552 4.029228487 4.029228487 2.625259643 0 0 0
2.625259643 0 0 0 0 0 3.327244065 16.81889837
11.90500742 5.433197331 0 0.701984422 0 0 0 0
0 0 0 # 2
2007 1 3 3 2 2 4 76 6 0 0
0 0 0 16.66666667 6.666666667 13.33333333 0 10
0 6.666666667 0 0 0 0 0 0 0 0
0 3.333333333 13.33333333 13.33333333 10 0 3.333333333
3.333333333 0 0 0 0 0 0 # 1
2008 1 3 3 2 2 4 76 12 0 0
0 0 0 0.887616257 15.77905041 15.10856585 16.44953497
8.441899181 16.44953497 4.22094959 2.445717076 2.445717076 0
0 0 0 0 0 0 0 0.887616257 0.887616257
5.996182104 5.77905041 0 0.887616257 2.445717076 0 0
0 0.887616257 0 # 2
1966 2 4 3 2 3 4 76 48 0 0
0 0 0.779324755 10.32825589 23.02374582 12.12500141
6.431323522 5.417517814 3.104047763 1.092632292 0.634655374
0.802229832 0 0.162803213 0 0 0 0 0.162803213
1.151957052 7.330391331 16.14132067 4.311177309 3.327970879
2.081013336 0.290484082 0.475645748 0.655157366 0.170541314 0
0 0 # 8
1967 2 4 3 2 3 4 76 66 0 0
0 0.519437681 4.373725185 8.597318407 14.78350817 9.376296377

4.046268793 4.05646615 2.51014152 1.305627963 0.163046653
0.477600313 0 0 0 0 0 0 0.327513567
5.102228544 15.04857024 17.12456928 7.961462398 2.07775306
0.700457836 0.818900551 0.31455366 0.31455366 0 0 0
0 # 11
1968 2 4 3 2 3 4 76 108 0 0
0 0.059885966 1.609988738 5.502574285 13.77399605 15.45455114
6.886477444 5.148392492 1.776137277 1.323458276 0.714010046
0.759131846 0.100273124 0.160746335 0 0 0 0
0.056991113 2.004234352 6.029324347 15.77524924 14.06854234
4.553358294 2.893610046 0.751179333 0.396695225 0.160746335 0
0 0.040446357 0 # 18
1969 2 4 3 2 3 4 76 108 0 0
0 0 2.960611479 11.40426302 12.58501647 17.97361436
14.74678227 8.779809665 4.662545821 2.563357769 0.536842916
0.880095542 0.096256775 0.090651967 0 0 0 0 0
1.230037947 3.116413696 6.121427215 6.49908425 3.78310139
1.362520328 0.483616191 0.12395093 0 0 0 0 0
18
1970 2 4 3 2 3 4 76 126 0 0
0 0.071008558 2.147521666 7.251113634 16.11809693 12.39844825
10.05919174 10.28467169 2.890505443 1.199920232 0.686077725
0.212719723 0.187941355 0 0 0 0 0 0
0.68565708 4.459239364 10.91134387 10.5030206 6.507954779
2.343996137 0.682470463 0.327091396 0 0.072009362 0 0
0 # 21
1971 2 4 3 2 3 4 76 30 0 0
0.145176617 2.997077225 16.11004699 8.889206184 8.320027883
2.790657042 3.244257168 4.94507673 1.274558059 1.37880023
0.279274013 0.427714565 0 0 0 0 0 0
4.04252766 17.86297971 9.373946565 8.381313056 3.557444822
3.295521117 1.781722443 0.599776511 0.151447704 0.151447704 0
0 0 0 # 5
1972 2 4 3 2 3 4 76 42 0 0
0.262692555 6.868310929 6.768100711 8.844704131 6.823900877
4.744207185 2.775176558 2.178329013 1.112258478 1.178680338
0.664266792 0.34993787 0.089545164 0.084273845 0.084273845 0
0 0 5.792692949 10.57359475 18.10932066 11.57051055
4.833731013 2.345024675 2.508885601 1.064051173 0.373530336 0
0 0 0 0 # 7
1973 2 4 3 2 3 4 76 30 0 0
0.191876897 1.664172707 3.595460075 4.948797998 7.320077683
6.001065588 3.986521605 3.547671287 2.536352841 3.721762787
1.530198306 1.622128436 0.905860726 0.18990297 0.503058723 0
0 0 2.053831251 6.517683722 9.940553101 11.75366566

10.98708793 5.340898442 2.873356642 3.591598279 2.001934377
2.040030795 0.170854761 0.292741647 0 0.170854761 # 5
1974 2 4 3 2 3 4 76 42 0 0
0.103674551 1.510265425 4.327277761 13.03103696 14.83206171
4.620272306 2.939104104 3.087824026 3.026796868 0.433588358
1.608412882 0.848078204 0.183968615 0.309535837 0.451941924 0
0 0.827210321 4.971132488 9.534520301 11.39591822 9.180037242
5.127869458 3.123598023 1.589351595 0.954265753 1.081402617
0.842453054 0.058401393 0 0 0 # 7
1975 2 4 3 2 3 4 76 30 0 0
0.251720882 1.39682668 8.198604012 9.056006272 9.502286528
5.460027175 3.952474755 2.346729988 1.102522715 0.766388887 0
0.148940381 0 0 0 0 0 0.251720882 3.905337806
14.4165667 14.0508093 11.26253421 9.800246351 3.092261198
1.03799528 0 0 0 0 0 0 0 # 5
1977 2 4 3 2 3 4 76 66 0 0
0.283253678 1.976700915 12.44489497 12.85760551 11.91399672
3.819879005 4.723547307 1.913235422 1.554104277 0.339821278
0.306260817 0.016340566 0.209813935 0 0 0 0
0.103187489 1.332346046 15.48408753 12.84371931 9.80096925
4.5343348 2.406608486 0.67900215 0.209274543 0.247015982 0
0 0 0 0 # 11
1978 2 4 3 2 3 4 76 48 0 0
0.466034116 2.797771905 4.091805749 6.760314 11.91379567
7.724735832 3.291876035 3.005124562 0.96203251 1.435275564
0.282851913 0.282829682 0.141896802 0.099328552 0.099328552 0
0 0.083253119 3.031600019 4.736574633 12.89088105 16.86594537
8.61655947 6.449392852 2.222926504 0.75196875 0.223387811
0.14093288 0.420470771 0.140156924 0 0.070948401 # 8
1979 2 4 3 2 3 4 76 36 0 0
1.10497958 8.724395765 19.23314816 7.489502221 9.223403866
3.807244299 2.627226641 2.275968561 0.961385177 0.398805997
1.214156079 0.736459781 0.519799423 0.077451197 0.677482278 0
0 1.940622708 4.693393848 10.9281595 8.95994364 6.865905777
4.039865904 1.91050754 0.415438478 0.618255772 0.208644323 0
0.077451197 0.270402287 0 0 # 6
1980 2 4 3 2 3 4 76 96 0 0
0.102533285 5.379613791 8.249688073 10.50991648 7.832220672
6.331478476 3.022947861 2.288120419 2.032240904 0.937309133
1.131882735 0.675536565 0.406340046 0.133263478 0.12773519 0
0 0.056152099 3.199384068 7.88473842 12.83170978 10.24596141
6.272978736 3.281500105 3.122564688 1.797975242 1.507241253
0.294426457 0.185859671 0.147513333 0 0.011167624 # 16
1981 2 4 3 2 4 4 76 174 0 0
0.395006214 5.579458887 18.53249583 12.97766541 9.835684352
5.975434136 3.13308322 2.084609843 1.488835153 0.555659343

0.540484998 0.339582938 0.380353794 0.203010532 0.418554471 0
0 0.03512274 2.347137963 9.791440466 13.00877064 5.087375369
4.231027822 1.176574374 0.363141077 0.219897457 0.408874676
0.148010741 0.206132928 0.151767824 0.042154736 0.342652062 #
29
1982 2 4 3 2 4 4 76 90 0 0
0.133176909 5.273899707 15.57720383 18.55138152 7.031863595
5.160837396 3.228646516 3.224091093 0.981193 0.881266925
0.093961995 0.429973197 0.075098357 0.463740766 1.039630261 0
0 0.745365149 3.655555994 8.992799753 15.71033822 3.759182006
2.090526716 0.934284339 0.442919654 0.273821439 0.021374011
0.282525364 0 0.038718812 0 0.906623478 # 15
1983 2 4 3 2 4 4 76 6 0 0
0 1.052631579 0 2.105263158 0 3.157894737 4.210526316
1.052631579 0 0 0 0 0 0 0 0 0
3.157894737 20 30.52631579 13.68421053 10.52631579 5.263157895
3.157894737 0 0 1.052631579 1.052631579 0 0 0
0 # 1
1985 2 4 3 2 4 4 76 12 0 0
0 4.384876711 8.966899154 14.93211151 9.717320853 14.37883555
6.260930958 7.28799064 7.189417774 4.858660426 2.705968197
2.607395331 1.678908515 0.750421698 0.651848833 0 0
1.027059682 1.678908515 1.678908515 4.582022443 1.303697665
1.402270531 1.303697665 0.651848833 0 0 0 0 0
0 0 # 2
1986 2 4 3 2 4 4 76 24 0 0
0.039686367 9.145571012 11.05412473 9.343983416 15.80718923
6.714149277 7.479581737 4.881650463 2.910075085 0.18232772
1.312396189 0.142641353 0 0 1.312396189 0 0 0
4.282461039 8.511756523 8.15724301 3.860499168 2.954842187
0.452387764 0.142641353 0 1.312396189 0 0 0 0
0 # 4
1987 2 4 3 2 4 4 76 42 0 0
2.223127568 5.369447923 9.184352148 15.97768874 11.67828585
6.510246161 1.721364254 1.141857818 0.070944527 0.070944527 0
0 0 0 0 0 0 0.620737839 15.93034165
11.95402835 14.2179237 0.397117807 2.704302905 0.156343713 0
0.070944527 0 0 0 0 0 0 # 7
1988 2 4 3 2 4 4 76 12 0 0
10.67214054 15.50107513 11.30791775 23.8873899 13.21524935
0.635777202 0.635777202 0.635777202 0 0 0 0 0
0 0 0 0 3.557380181 7.114760363 5.464711787
4.828934585 1.271554404 1.271554404 0 0 0 0 0
0 0 0 0 # 2
1989 2 4 3 2 4 4 76 30 0 0
0 0.867911804 11.73439365 25.87304937 12.37253151 10.34967175

5.447207861 2.679052028 0.619293891 0.660641441 0.693843806 0
0 0 0 0 0 2.136577145 4.341340527 11.78839951
7.438975257 1.543107135 1.45400333 0 0 0 0 0
0 0 0 0 # 5
1990 2 4 3 2 4 4 76 30 0 0
0.473837529 2.74191481 17.17786605 26.33182345 14.5037916
1.518531147 0.055342197 0.759265574 2.410327236 0 0 0
0 0 0 0 0 1.003017255 4.95472414 9.389913748
10.97389789 4.347745077 1.265060026 2.092942269 0 0 0
0 0 0 0 0 # 5
1991 2 4 3 2 4 4 76 12 0 0
0 4.849307774 16.05484558 17.89030883 19.72577208 17.89030883
1.506922262 0 0 0 0 0 0 1.506922262 0
0 0 0 3.013844524 1.506922262 4.849307774 6.684771023
3.013844524 1.506922262 0 0 0 0 0 0 0
0 # 2
1992 2 4 3 2 4 4 76 36 0 0
1.771249187 6.615621525 8.484312207 15.19962924 8.526642745
12.9464075 4.085623497 2.692190626 1.09313852 0.221731185 0
0.092360082 0 0 0 0 0.483832535 1.285400742
4.59443941 11.04984488 9.768936335 4.575426914 4.807310611
1.189396255 0.516506001 0 0 0 0 0 0 0
6
1993 2 4 3 2 4 4 76 12 0 0
0 1.795351234 14.03465728 16.96905455 10.11580221 16.64090196
10.11580221 1.467198638 0 3.590702469 0 0 0 0
0 0 0 0 0 12.0657417 7.33599319 4.401595914
1.467198638 0 0 0 0 0 0 0 0 0
2
1994 2 4 3 2 4 4 76 12 0 0
0 1.622365899 19.88163904 22.0192855 10.73924843 11.8208257
1.081577266 3.760012355 3.219223722 3.219223722 0 0 0
0 0 0 0 3.219223722 4.841589622 7.545532787
3.785520432 2.163154533 0 0.540788633 0.540788633 0 0
0 0 0 0 0 # 2
1996 2 4 3 2 4 4 76 6 0 0
0 2.564102564 7.692307692 5.128205128 23.07692308 12.82051282
5.128205128 0 0 2.564102564 0 0 0 0 0
0 0 0 2.564102564 10.25641026 10.25641026 5.128205128
12.82051282 0 0 0 0 0 0 0 0 0
1
1997 2 4 3 2 4 4 76 54 0 0
0.58454382 19.61621688 13.92662968 12.18975564 9.895573507
8.145062566 5.11866107 1.06640407 1.207229987 0.67065836
0.131865199 0.038958884 0 0 0 0 0 1.75363146
12.63385768 6.067501052 3.788916466 2.033324617 0.937946464

0.075295069 0.079008656 0.038958884 0 0 0 0 0
0 # 9
1998 2 4 3 2 4 4 76 30 0 0
0 3.243255096 11.29647743 5.38580182 10.11871107 4.190082801
6.346967425 4.061801587 2.236008874 0.651994005 0.656300822 0
0 0 0 0 0 0 4.861544629 15.91451712
8.980626173 12.88059727 6.770202312 1.248616141 0 1.156495422
0 0 0 0 0 0 # 5
2002 2 4 3 2 3 4 76 6 0 0
0 11.42857143 28.57142857 25.71428571 14.28571429 5.714285714
8.571428571 0 0 0 0 0 0 0 0 0
0 0 0 2.857142857 0 0 2.857142857 0 0
0 0 0 0 0 0 0 # 1
2003 2 4 3 2 3 4 76 18 0 0
0 7.187233515 26.98403139 4.899695947 5.853765149 2.139966831
0.711538577 0.618966386 0 0 0 0 0 0 0
0 0 0 3.713002419 31.65725 11.52159002 1.85610326
2.856856507 0 0 0 0 0 0 0 0 0
3
2004 2 4 3 2 3 4 76 6 0 0
0 0 21.95121951 19.51219512 12.19512195 2.43902439 0
0 0 0 0 0 0 0 0 0 0 0
2.43902439 14.63414634 14.63414634 9.756097561 2.43902439 0
0 0 0 0 0 0 0 0 # 1
2007 2 4 3 2 2 4 76 18 0 0
0 1.485458422 1.485458422 6.568855076 9.372978614 4.191770369
8.583523295 5.445813142 0 3.235521743 1.485458422 0 0
0 0 0 0 0 0 6.402061769 1.831280287
5.429218518 12.30810299 17.14348937 7.391499643 5.791635006
1.847874911 0 0 0 0 0 # 3
2008 2 4 3 2 2 4 76 6 0 0
0 0 3.571428571 3.571428571 7.142857143 7.142857143
7.142857143 0 3.571428571 3.571428571 0 0 0 0
0 0 0 0 0 0 7.142857143 10.71428571
28.57142857 7.142857143 10.71428571 0 0 0 0 0
0 0 # 1
1966 1 5 3 2 3 4 76 16 0 0
0 1.548525009 20.73525062 8.981080185 6.923098759 3.489970042
3.942548779 1.186159132 0.27308884 1.126846797 0.464403876
0.203951613 0.210698884 0 0 0 0 2.235753443
11.17876722 24.93278057 7.75283238 4.126504519 0.687739338 0
0 0 0 0 0 0 0 0 # 8
1967 1 5 3 2 3 4 76 26 0 0
0 4.831767328 6.787565451 6.177460761 2.121817148 2.376186746
1.621105366 0.925875758 0.217120532 0.108560266 0.150647024 0
0 0 0 0 0 3.722605628 16.7140154 41.61826262

10.37298865 1.374347644 0.277085575 0.602588096 0 0 0
0 0 0 0 0 # 13
1969 1 5 3 2 3 4 76 16 0 0
1.885181728 4.810724041 5.063295819 11.42468722 14.16795734
3.846250632 8.499144909 1.056655538 6.635845726 3.805513249
0.114064674 2.814037524 0.016294953 0.02444243 0.057032337 0
0 1.885181728 3.764775865 3.813660725 10.35173673 7.52955173
2.805890047 2.805890047 2.822185001 0 0 0 0 0
0 0 # 8
1970 1 5 3 2 3 4 76 20 0 0
6.076534647 10.15031605 13.28738619 7.305967532 2.117109487
0.531539083 0.397165423 0.027437119 0 0.046806281 0.019369162
0.038738324 0.079499423 0 0 0 0 11.28839238
32.44433865 10.80872605 3.496634144 1.429526809 0.428013439 0
0 0 0 0 0 0.026499808 0 0 # 10
1971 1 5 3 2 3 4 76 12 0 0
2.165424585 26.04847848 17.39630245 8.171331029 3.611867079
1.349471221 0.735245702 0.326006966 0 0.206382733 0 0
0.264431484 0 0 0 0 1.929702848 14.79715813
14.17302666 4.3674427 0.407842787 1.349961714 0 1.349961714
0 1.349961714 0 0 0 0 0 # 6
1972 1 5 3 2 3 4 76 46 0 0
0.011964289 0.684758128 6.968702579 21.10971662 4.165707092
6.37635522 1.763443147 3.568948908 1.089520794 1.751113843
1.848043862 0.93304295 0.134691924 0.005219513 0.04162435 0
0 1.286772415 9.343543243 17.5528288 15.34796859 4.017015027
0.778033839 1.067825264 0.053075232 0.053075232 0.047009139 0
0 0 0 0 # 23
1973 1 5 3 2 3 4 76 24 0 0
0.053104858 3.776601048 4.419418474 27.2991686 7.306552327
3.555611002 2.373669266 1.023583349 0.535702246 0.053104858
0.127032721 0.23448808 0 0 0 0 0 0
8.196544328 19.80817983 14.61999816 5.190877584 0.737207951 0
0.689155309 0 0 0 0 0 0 0 # 12
1974 1 5 3 2 3 4 76 58 0
0.049135718 0.600916946 4.546318465 4.769513398 4.69822636
11.11489208 9.048057317 5.653303951 3.396367926 1.196480856
1.586871881 0.002124478 0.756995072 0.510506369 0.09400519
0.00986405 0 0 1.701035805 3.748887351 8.507491926
12.82993808 11.23754683 6.337404633 1.511342388 2.458713199
0.66637594 1.88751092 0.180358873 0.433448347 0 0.466365651
0 # 29
1975 1 5 3 2 3 4 76 18 0 0
4.470115566 19.6085593 6.001497466 1.363228177 0.310553953
0.576113793 0.498847489 0.521429279 0.289535429 0.023975589 0
0 0 0.023975589 0.023975589 0 0.289660693 7.631922403

54.76629666 2.930279763 0 0 0.23743595 0 0 0
0.43259732 0 0 0 0 0 # 9
1976 1 5 3 2 3 4 76 24 0 0
0.092683759 2.391519078 21.76415248 11.7978647 8.515923752
4.194364276 1.850514863 2.150820307 0.483458379 2.400851492
1.80595675 1.988847124 0 0 0.154043684 0 0
0.023037513 1.343546605 11.07470385 10.36377198 7.866323968
7.364175717 0.816589133 0 1.556850593 0 0 0 0
0 0 # 12
1977 1 5 3 2 3 4 76 16 0 0
1.889964287 5.897356732 10.00689045 14.97377492 15.22086114
5.078816796 6.858549225 3.045610532 1.757797197 1.066124316 0
0.446845404 0.357000503 0.976279414 0 0 0 0
6.289171771 10.75279818 11.37008871 1.480724889 1.240871799
0.486627838 0.357000503 0.446845404 0 0 0 0 0
0 # 8
1978 1 5 3 2 3 4 76 18 0 0
4.074796886 4.822777317 2.114857035 4.98786766 4.745435817
3.130030038 0.666479844 0.29357949 0.5894285 0.044768218
0.146789745 0 0 0 0 0 0 3.364947163
12.90053469 16.99887673 18.21812233 15.67040506 5.229777842
1.387466591 0.613059046 0 0 0 0 0 0 0
9
1979 1 5 3 2 3 4 76 10 0 0
2.284098747 2.219498767 3.554063644 4.538922417 10.87434175
9.112435557 4.538922417 2.539929796 2.284804709 0.89127217
2.635139705 0 0 0 0 0 0.761366249 6.787696261
3.434476796 2.734435696 11.77357551 11.0061412 9.886373076
8.142505541 0 0 0 0 0 0 0 0 #
5
1980 1 5 3 2 3 4 76 12 0
1.529925384 12.37874724 29.22295019 15.01060766 5.01385343
2.142489333 2.432144104 0.325827725 0.890244328 0 0 0
0 0 0 0 0 0 3.492419013 12.16030527
12.80655835 2.268100246 0.325827725 0 0 0 0 0
0 0 0 0 0 # 6
1981 1 5 3 2 3 4 76 36 0
4.281178603 10.24298827 17.10487995 8.633010128 8.352203436
9.949255638 5.313887511 4.576346476 0.940698785 2.648365448
3.562365743 2.051888443 0.760193746 0.907935584 0.178028888
0.054139524 0 1.208153836 3.204003675 3.659130248 5.340589145
4.64492148 1.63784228 0.729906696 0 0 0.018086466 0
0 0 0 0 0 # 18
1982 1 5 3 2 3 4 76 2 0 0
4 12 24 24 8 4 0 0 0 0 0
0 0 0 0 0 0 4 4 12 0 4

0 0 0 0 0 0 0 0 0 0 #
1
1983 1 5 3 2 3 4 76 24 0 0
7.717626403 5.186037323 7.612887893 6.389726803 8.235048558
2.428717903 5.118427878 0.984705181 0.459801169 0.438907018
0.909708965 0 0.264944967 0.067784859 0.067784859 0
1.394933626 8.458510101 18.1353088 11.60521001 7.229712849
3.094298414 3.912678062 0.067784859 0.219453509 0 0 0
0 0 0 0 # 12
1984 1 5 3 2 3 4 76 12 0 0
0 0.49426028 2.265471963 5.590156534 3.904467829 3.140038821
2.758991586 1.702830862 0.450868316 1.352604947 0.450868316 0
0 0.024988856 0 0 0 0 24.02733277 36.87081991
13.28262891 3.430643535 0.253026571 0 0 0 0 0
0 0 0 0 # 6
1985 1 5 3 2 3 4 76 4 0 0
0 1.494991573 17.49499157 4.484974719 0 0 0 0
0 0 0 0 0 0 0 0 0 0
22.02003371 40 13.01001685 1.494991573 0 0 0 0
0 0 0 0 0 0 # 2
1990 1 5 3 2 3 4 76 2 0 0
0 0 4 16 24 12 0 12 4 8 0
4 4 0 8 0 0 0 0 0 4 0
0 0 0 0 0 0 0 0 0 0 #
1
1991 1 5 3 2 3 4 76 8 0 0
0 6.748307398 4.937499444 5.008777442 8.175269763 6.433705873
2.281620507 2.37735125 5.847647382 0.681789234 0 0 0
0 0 0 0 0 5.502008804 13.21436012 11.98544354
22.14724749 1.188675625 2.281620507 0 0 0 0 0
1.188675625 0 0 # 4
1999 1 5 3 2 3 4 76 2 0 0
0 0 11.11111111 7.407407407 25.92592593 3.703703704
3.703703704 0 7.407407407 0 3.703703704 0 0 0
0 0 0 0 7.407407407 11.11111111 14.81481481
3.703703704 0 0 0 0 0 0 0 0 0
0 # 1
2007 1 5 3 2 3 4 76 2 0 0
0 0 3.225806452 6.451612903 22.58064516 19.35483871
16.12903226 9.677419355 0 3.225806452 0 0 0 0
0 0 0 0 0 0 0 3.225806452 6.451612903
3.225806452 6.451612903 0 0 0 0 0 0 0
1
1966 2 6 3 2 3 4 76 54 0 0
0.253292586 5.337412524 14.31048974 11.51833725 3.058901823
1.806681408 1.641152087 0.084877476 0.097689622 0.206201015

0.148350623 0.239703574 0.033502559 0 0 0 0
0.215770387 7.311281505 33.98293014 15.39004793 2.570332252
1.137027393 0.491869957 0.114962815 0.049185331 0 0 0
0 0 0 # 27
1967 2 6 3 2 3 4 76 22 0 0
3.596390159 3.900950085 8.10444048 14.05266671 12.5748711
3.251219887 1.564818371 0.741359585 1.062680941 0.681321328
0.6102526 0 0 0 0 0 0 1.408751933
5.357433617 14.55226832 17.94985436 9.184053263 1.077180116 0
0.258418406 0 0 0.071068729 0 0 0 0 #
11
1968 2 6 3 2 3 4 76 112 0 0
1.508147984 8.202890669 5.501432532 13.28355498 4.306330923
6.88471512 0.263179484 0.518284605 0.391932161 0.07768865
0.638389118 0.028828242 0.074681418 0.011534799 0.0664063 0
0.098193073 5.826895422 12.12690217 17.57038762 10.46990822
5.783624852 3.037225733 1.329206347 1.000274034 0.283078002
0.065829886 0.239941911 0.200256761 0.13486426 0.002518383
0.072896342 # 56
1969 2 6 3 2 3 4 76 62 0 0
2.331565141 4.356330288 10.35940754 9.364556712 6.287504588
5.105652585 1.810896698 0.894785047 1.135839214 0.804217669
0.603227328 0.082485449 0.531629239 0.017213675 0.020475901 0
0 3.87016677 4.350025175 19.40897739 6.581944985 10.62621933
5.881450948 1.83327291 0.801941337 1.102888254 0.265239138
0.674914092 0.489836877 0.06421606 0.303593148 0.039526506 #
31
1970 2 6 3 2 3 4 76 58 0 0
1.932853931 32.94408035 10.23146835 3.59090556 1.254074485
0.741441296 0.630953055 0.573340372 0.173999875 0.150899259
0.018196019 0.127351543 0.008053331 0.008910535 0.024159993 0
0 0.89243835 25.69818784 8.919810754 8.179006232 0.575114427
1.162069268 0.960241381 0.37151537 0.098866231 0.170821473
0.238608672 0.018343934 0.265235713 0.005368887 0.033683509 #
29
1971 2 6 3 2 3 4 76 74 0 0
0.641717706 4.870788964 21.61477698 10.87379523 7.997237452
3.830102922 1.418332524 0.861393101 0.834166843 0.745245675
0.193362449 0.193939304 0.184808311 0 0.125790089 0 0
0.178808021 3.893029816 23.12252397 7.708115404 5.06779307
2.334984414 1.164355465 0.734095675 0.349762989 0.386475541
0.111750137 0 0.033931928 0.174697868 0.354218154 # 37
1972 2 6 3 2 3 4 76 76 0 0
0.454745214 3.848220442 5.705462661 12.66964298 12.34870794
2.78073488 1.657644267 0.686654841 1.226866111 0.43967322
0.578520142 0.038974194 0.068078233 0.097844568 0.151169161

0.011153689	0	0.507937843	8.211124543	11.03905728	26.20896881
5.562087584	2.086123535	0.806417195	1.297349977	0.37280263
0.514421952	0.174970097	0.383394194	0.047888927	0	0.023362886
#	38
1973	2	6	3	2	3	4	76	76	0	0
2.756489175	2.001847701	5.925779308	5.92330337	10.00860829
5.844629341	2.88488939	2.530475764	1.097029291	0.811345458
0.930873238	0.447171751	0.810857785	0.150652288	0.077042282	0
0.079822441	0.563091036	4.053783786	8.836044867	12.42217664
10.23567385	7.730830534	6.753966569	3.009469087	1.371700893
1.07578987	0.345475748	0.157477943	0.27969386	0.160771045
0.723237401	#	38
1974	2	6	3	2	3	4	76	68	0	0
0.850500776	10.06084505	16.97906404	8.156415841	2.245474568
4.72760237	1.542774987	1.470494768	0.326741393	0.822005645
0.236962695	0.181991948	0.01112656	0.01112656	0.062913022	0
0	2.076814869	10.78027659	17.01399228	9.259642111	2.832803892
4.740313726	1.639444999	1.495392391	1.203575231	0.74994399
0.231021569	0	0.204975784	0.027881647	0.057880711	#	34
1975	2	6	3	2	3	4	76	36	0	0
0.194765196	6.733363705	12.18044862	10.17818333	4.883834731
6.106455664	2.942928195	1.423956022	0.387045522	1.436980063
0.267867562	1.04085492	0	0.207580496	0.073361774	0	0
0.843101115	8.457138186	20.12636834	10.63172669	5.926374462
2.918281302	0.893434389	0.781790768	0.745256773	0.207580496	0
0.411321684	0	0	0	#	18
1976	2	6	3	2	3	4	76	46	0	0
0.189064804	1.514890671	17.11841991	5.857719389	2.571948666
1.885269051	1.217896619	1.049142832	0.28038677	0.78606122
0.449622049	0.365570595	0	0	0.071223327	0	0	0
7.054884092	30.78017422	19.93315547	5.453040784	1.569324465
0.76437849	0.423487569	0.609733898	0.013308815	0.027987488
0.013308815	0	0	0	#	23
1977	2	6	3	2	3	4	76	66	0.007864741
0	1.76937299	10.27424992	14.85867857	8.941201928	8.039893986
2.835173438	1.088774714	0.99185138	0.755107532	0.430899431
0.726146936	0.318172622	0.159470224	0.058594065	0.081796523	0
0	1.32138134	6.92478008	14.13727076	14.15272273	6.958597808
3.907566852	0.761262402	0.214249983	0.147580732	0.123306732
0.014031585	0	0	0	0	#	33
1978	2	6	3	2	3	4	76	64	0	0
1.181163256	20.12320001	13.40486566	11.23100552	7.399054842
3.605072681	2.265254066	1.535947436	0.265305984	0.47684503
0.482450752	0.1324844	0	0.015170793	0.960779962	0	0
0.709879514	12.68843957	11.29183647	7.218629581	2.480654956

1.755482924 0.725238809 0.020685284 0.030552507 0 0 0
0 0 0 # 32
1979 2 6 3 2 3 4 76 22 0
0.851826662 8.586149742 12.31111796 8.386441976 4.133230875
5.271561117 2.870101353 4.968559695 2.950440443 0.708025864
0.247866727 0.118336987 0 0 0 0 0 0
3.127268976 12.52686521 16.14321105 11.41889859 2.403705168
0.362471851 1.914053323 0.118336987 0.581529454 0 0 0
0 0 0 # 11
1980 2 6 3 2 3 4 76 100 0.021497645
0.721638555 2.559755855 15.12705452 16.5090493 9.165924436
4.205376082 2.566586365 1.021607019 0.703476724 0.52452167
0.457247678 0.094845338 0.029952915 0.093454381 0 0 0
0.936837235 4.555229568 14.18848067 13.10124537 9.834317293
2.141653562 0.519070754 0.51937906 0.346629868 0 0.055168136
0 0 0 0 0 # 50
1981 2 6 3 2 3 4 76 54 0 0
2.346608582 16.83757367 18.44569484 12.09471351 6.53899003
2.670825027 2.924832041 0.787996362 0.595072625 0.171583567
0.191058153 0.175052221 0.191058153 0.035261054 0 0 0
1.89661153 10.71849151 12.42059076 5.798925848 3.154231479
1.099143089 0.201391697 0.038624208 0.376579984 0.021774883
0.26731517 0 0 0 0 # 27
1982 2 6 3 2 3 4 76 36 0 0
1.719732924 5.092472948 17.65224915 10.46479418 5.733277962
5.082671383 1.072516653 1.111230518 0.548107246 0.166033641
0.164772799 0.245406513 0.066401687 0.036365922 0.022133896 0
0 1.195022688 12.39448021 24.04718368 9.352253471 2.588684447
1.244208087 0 0 0 0 0 0 0 0 0
18
1983 2 6 3 2 3 4 76 16 0 0
1.285122226 3.872256193 24.90625267 22.24559088 9.845795388
6.132640634 1.909534298 1.492214534 1.288428025 0 0 0
0 0.115245584 0 0 0 0 0.762575781 10.37742144
6.807597456 2.517569558 4.443680108 0.082308556 1.26843647 0
0 0 0.647330197 0 0 0 # 8
1984 2 6 3 2 3 4 76 6 0 0
1.415489707 9.68478108 13.5346868 4.564449959 3.993893715
1.711668735 0 0.570556245 0 0 0 0 0 0
0 0 0 0 15.22455373 28.13795394 17.0884135
4.073552595 0 0 0 0 0 0 0 0 0
0 # 3
1985 2 6 3 2 3 4 76 8 0 0
0 16.96340704 23.40855358 11.9488957 17.87344978 11.66535815
3.413379744 3.341447207 0 0 0 0 0 0 0
0 0 0 1.144735994 4.061835202 3.575652001 2.603285598

0 0 0 0 0 0 0 0 0 0 #
4
#NWFSC age-at-length

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0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 100 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
2003 2 8 1 0 2 20 20 1 0 100
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 100 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
2003 2 8 1 0 2 22 22 7 0
28.571429 71.428571 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 28.571429
71.428571 0 0 0 0 0 0 0 0 0
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2003 2 8 1 0 2 24 24 8 0 12.5
62.5 25 0 0 0 0 0 0 0 0 0
0 0 0 0 0 12.5 62.5 25 0 0 0
0 0 0 0 0 0 0 0 0 0
2003 2 8 1 0 2 26 26 11 0 0
45.454545 27.272727 27.272727 0 0 0 0 0
0 0 0 0 0 0 0 0 0 45.454545
27.272727 27.272727 0 0 0 0 0 0 0
0 0 0 0 0
2003 2 8 1 0 2 28 28 16 0 0
31.25 43.75 25 0 0 0 0 0 0 0 0
0 0 0 0 0 0 31.25 43.75 25 0 0
0 0 0 0 0 0 0 0 0 0
2003 2 8 1 0 2 30 30 34 0 0
8.823529 32.352941 47.058824 11.764706 0 0 0
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8.823529 32.352941 47.058824 11.764706 0 0 0
0 0 0 0 0 0 0 0
2003 2 8 1 0 2 32 32 34 0 0
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0 0 0 0 0 0 0 0 0 2.941176
35.294118 50 11.764706 0 0 0 0 0 0
0 0 0 0 0
2003 2 8 1 0 2 34 34 50 0 0
0 16 58 18 6 2 0 0 0 0 0
0 0 0 0 0 0 0 16 58 18 6
2 0 0 0 0 0 0 0 0 0

2003 2 8 1 0 2 36 36 53 0 0
0 11.320755 69.811321 9.433962 9.433962 0 0
0 0 0 0 0 0 0 0 0 0 0
11.320755 69.811321 9.433962 9.433962 0 0 0
0 0 0 0 0 0 0
2003 2 8 1 0 2 38 38 49 0 0
0 4.081633 36.734694 38.77551 14.285714 4.081633
2.040816 0 0 0 0 0 0 0 0 0
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4.081633 2.040816 0 0 0 0 0 0 0
0
2003 2 8 1 0 2 40 40 36 0 0
0 0 22.222222 38.888889 22.222222 11.111111
2.777778 0 2.777778 0 0 0 0 0 0
0 0 0 0 22.222222 38.888889 22.222222
11.111111 2.777778 0 2.777778 0 0 0 0
0 0
2003 2 8 1 0 2 42 42 30 0 0
0 0 3.333333 33.333333 33.333333 16.666667
13.333333 0 0 0 0 0 0 0 0 0
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13.333333 0 0 0 0 0 0 0 0
2003 2 8 1 0 2 44 44 24 0 0
0 0 0 20.833333 37.5 33.333333 8.333333 0
0 0 0 0 0 0 0 0 0 0 0
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0 0 0 0 0
2003 2 8 1 0 2 46 46 13 0 0
0 0 0 0 7.692308 15.384615 23.076923
30.769231 15.384615 0 0 0 0 0 7.692308
0 0 0 0 0 0 7.692308 15.384615
23.076923 30.769231 15.384615 0 0 0 0 0
7.692308
2003 2 8 1 0 2 48 48 13 0 0
0 0 0 7.692308 0 23.076923 30.769231 0
7.692308 0 7.692308 0 0 15.384615 7.692308
0 0 0 0 0 7.692308 0 23.076923
30.769231 0 7.692308 0 7.692308 0 0
15.384615 7.692308
2003 2 8 1 0 2 50 50 8 0 0
0 0 0 0 0 25 12.5 12.5 12.5 0 0
12.5 0 12.5 12.5 0 0 0 0 0 0 0
25 12.5 12.5 12.5 0 0 12.5 0 12.5 12.5
2003 2 8 1 0 2 52 52 1 0 0
0 0 0 0 0 0 0 100 0 0 0

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0	0	100	0	0	0	0	0	0	0	
2003	2	8	1	0	2	54	54	1	0	0
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2003	2	8	1	0	2	56	56	2	0	0
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0	0	0	0	50	0	0	0	0	50	
2004	2	8	1	0	3	16	16	1	0	0
100	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	100	0	0	0	0
0	0	0	0	0	0	0	0	0	0	
2004	2	8	1	0	3	18	18	1	0	100
0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	
2004	2	8	1	0	3	20	20	2	0	50
50	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	
2004	2	8	1	0	3	22	22	8	0	62.5
37.5	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	62.5	37.5	0	0	0	0
0	0	0	0	0	0	0	0	0	0	
2004	2	8	1	0	3	24	24	17	0	
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2004	2	8	1	0	3	26	26	16	0	0
25	68.75	6.25	0	0	0	0	0	0	0	0
0	0	0	0	0	0	25	68.75	6.25	0	0
0	0	0	0	0	0	0	0	0	0	
2004	2	8	1	0	3	28	28	31	0	0
16.129032		58.064516		19.354839		6.451613		0	0	0
0	0	0	0	0	0	0	0	0	0	
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0	0	0	0	0	0	0	0			
2004	2	8	1	0	3	30	30	52	0	0
13.461538		38.461538		38.461538		5.769231		3.846154		0
0	0	0	0	0	0	0	0	0	0	0
13.461538		38.461538		38.461538		5.769231		3.846154		0
0	0	0	0	0	0	0	0	0		

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0 34.693878 42.857143 20.408163 2.040816 0 0
0 0 0 0 0 0 0 0 0 0 0
34.693878 42.857143 20.408163 2.040816 0 0 0
0 0 0 0 0 0 0
2004 2 8 1 0 3 34 34 57 0 0
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0 1.754386 0 0 0 0 0 0 0 0
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3.508772 0 1.754386 0 0 0 0 0 0
0
2004 2 8 1 0 3 36 36 72 0 0
0 9.722222 34.722222 29.166667 20.833333 2.777778
2.777778 0 0 0 0 0 0 0 0 0
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2.777778 2.777778 0 0 0 0 0 0 0
0
2004 2 8 1 0 3 38 38 66 0 0
0 3.030303 16.666667 56.060606 21.212121 3.030303
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0 0 0 0 0 0 0 0 0
2004 2 8 1 0 3 40 40 53 0 0
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3.773585 1.886792 0 0 0 0 0 0 0
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0 0
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2004 2 8 1 0 3 46 46 20 0 0
0 0 0 0 5 25 25 30 15 0 0
0 0 0 0 0 0 0 0 0 0 5
25 25 30 15 0 0 0 0 0 0
2004 2 8 1 0 3 48 48 8 0 0
0 0 0 0 0 25 25 12.5 12.5 25 0
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25 25 12.5 12.5 25 0 0 0 0 0

2004 2 8 1 0 3 50 50 13 0 0
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15.384615 7.692308 23.076923 0 0 0 0 0
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15.384615 7.692308 23.076923 0 0 0 0
2004 2 8 1 0 3 52 52 8 0 0
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12.5 0 12.5 12.5 0 0 0 0 0 0 0
0 0 12.5 12.5 0 37.5 12.5 0 12.5 12.5
2004 2 8 1 0 3 54 54 1 0 0
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0 0 0 0 0 100 0 0 0 0
2004 2 8 1 0 3 56 56 2 0 0
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0 0 0 100 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 100
2004 2 8 1 0 3 62 62 1 0 0
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0 0 0 100 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 100
2005 2 8 1 0 2 18 18 2 0 100
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 100 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
2005 2 8 1 0 2 20 20 2 0 0
100 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 100 0 0 0 0
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2005 2 8 1 0 2 22 22 11 0
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0 0 0 0 0 0 0 0 18.181818
81.818182 0 0 0 0 0 0 0 0 0
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2005 2 8 1 0 2 24 24 17 0
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0 0 0 0 0 0 0 0 0 17.647059
64.705882 17.647059 0 0 0 0 0 0 0
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2005 2 8 1 0 2 26 26 16 0 18.75
37.5 31.25 12.5 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0 0 0
2005 2 8 1 0 2 28 28 26 0 0
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0 0 0 0 0 0 0 0 0 30.769231

53.846154 15.384615 0 0 0 0 0 0 0
0 0 0 0 0
2005 2 8 1 0 2 30 30 26 0 0
11.538462 61.538462 19.230769 7.692308 0 0 0
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2005 2 8 1 0 2 32 32 41 0
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0 0 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0 0 0 0
33.333333 53.846154 10.25641 2.564103 0 0 0
0 0 0 0 0 0 0
2005 2 8 1 0 2 36 36 50 0 0
2 20 46 28 2 2 0 0 0 0 0
0 0 0 0 0 0 2 20 46 28 2
2 0 0 0 0 0 0 0 0 0
2005 2 8 1 0 2 38 38 44 0 0
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11.363636 43.181818 34.090909 11.363636 0 0 0
0 0 0 0 0 0 0
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2005 2 8 1 0 2 42 42 32 0 0
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0 0 0 0 0 0 0 0 0 0
2005 2 8 1 0 2 44 44 16 0 0
6.25 0 18.75 31.25 12.5 18.75 6.25 6.25 0 0 0
0 0 0 0 0 0 6.25 0 18.75 31.25 12.5
18.75 6.25 6.25 0 0 0 0 0 0 0
2005 2 8 1 0 2 46 46 12 0 0
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0 50 25 25 0 0 0 0 0 0
2005 2 8 1 0 2 52 52 3 0 0
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2005 2 8 1 0 2 56 56 2 0 0
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2006 2 8 1 0 2 18 18 1 0 100
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0 0 0 0
2006 2 8 1 0 2 24 24 10 0 10
30 50 10 0 0 0 0 0 0 0 0
0 0 0 0 0 10 30 50 10 0 0
0 0 0 0 0 0 0 0 0 0
2006 2 8 1 0 2 26 26 19 0 0
47.368421 31.578947 10.526316 5.263158 5.263158 0
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2006 2 8 1 0 2 28 28 12 0 0
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0 0 0 0 0 0 0 4 24 26 30
12 4 0 0 0 0 0 0 0 0
2006 2 8 1 0 2 38 38 48 0 0
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4.166667 0 2.083333 0 0 0 0 0 0
0 0 0 6.25 27.083333 35.416667 14.583333
10.416667 4.166667 0 2.083333 0 0 0 0
0
2006 2 8 1 0 2 40 40 38 0 0
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0 0 0 0 0 2.631579 21.052632 31.578947
18.421053 18.421053 5.263158 0 0 2.631579 0
0 0 0
2006 2 8 1 0 2 42 42 57 0 0
0 0 0 8.77193 19.298246 47.368421 14.035088
3.508772 3.508772 0 1.754386 0 0 1.754386
0 0 0 0 0 0 8.77193 19.298246
47.368421 14.035088 3.508772 3.508772 0 1.754386
0 0 1.754386 0
2006 2 8 1 0 2 44 44 45 0 0
0 0 0 2.222222 26.666667 31.111111 17.777778
13.333333 4.444444 2.222222 0 2.222222 0 0
0 0 0 0 0 0 2.222222 26.666667
31.111111 17.777778 13.333333 4.444444 2.222222 0
2.222222 0 0 0
2006 2 8 1 0 2 46 46 15 0 0
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6.666667 0 0 6.666667 0 0 0 0 0
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6.666667 0 0 6.666667 0 0 0

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0	0	0	0	0	9.090909	27.272727	45.454545			
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20	10	0	10	0	0	0	0	0	0	0
0	0	30	0	10	20	20	10	0	10	
2006	2	8	1	0	2	52	52	2	0	0
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0	0	0	50	0	0	0	0	50	0	
2006	2	8	1	0	2	54	54	3	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	33.333333	66.666667	0	0	0	0	0		
0	0	0	0	0	0	0	0	0	0	
33.333333	66.666667									
2006	2	8	1	0	2	56	56	2	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	100	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	100	
2007	2	8	1	0	2	20	20	1	0	100
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	100	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	
2007	2	8	1	0	2	24	24	5	0	40
20	20	20	0	0	0	0	0	0	0	0
0	0	0	0	0	40	20	20	20	0	0
0	0	0	0	0	0	0	0	0	0	
2007	2	8	1	0	2	26	26	8	0	0
25	25	37.5	0	12.5	0	0	0	0	0	0
0	0	0	0	0	0	25	25	37.5	0	12.5
0	0	0	0	0	0	0	0	0	0	
2007	2	8	1	0	2	28	28	10	0	0
0	0	80	20	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	
2007	2	8	1	0	2	30	30	20	0	0
10	10	45	15	5	15	0	0	0	0	0
0	0	0	0	0	0	10	10	45	15	5
15	0	0	0	0	0	0	0	0	0	
2007	2	8	1	0	2	32	32	26	0	0
0	15.384615	34.615385	30.769231	11.538462	7.692308					
0	0	0	0	0	0	0	0	0	0	0

0 15.384615 34.615385 30.769231 11.538462 7.692308
0 0 0 0 0 0 0 0 0
2007 2 8 1 0 2 34 34 40 0 0
0 7.5 22.5 32.5 22.5 12.5 0 2.5 0 0 0
0 0 0 0 0 0 0 7.5 22.5 32.5 22.5
12.5 0 2.5 0 0 0 0 0 0 0
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0 5.405405 18.918919 27.027027 24.324324 16.216216
2.702703 5.405405 0 0 0 0 0 0 0
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16.216216 2.702703 5.405405 0 0 0 0 0
0 0
2007 2 8 1 0 2 38 38 40 0 0
0 0 10 15 30 32.5 10 2.5 0 0 0
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32.5 10 2.5 0 0 0 0 0 0 0
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0 0 4 10 36 26 12 8 2 0 0
2 0 0 0 0 0 0 0 4 10 36
26 12 8 2 0 0 2 0 0 0
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35.294118 17.647059 0 0 0 0 0 0
1.960784
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21.875 40.625 15.625 0 0 0 3.125 0 0 0
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0 0 0 0 0 0 0 0 0 4 8
24 40 12 4 4 4 0 0 0 0
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14.285714 21.428571 14.285714 0 0 0 7.142857
0 0 0 0 0 0 7.142857 0 14.285714
21.428571 14.285714 21.428571 14.285714 0 0 0
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23.076923 7.692308 0 0 15.384615 0

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2007 2 8 1 0 2 60 60 1 0 0
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0 0 0 0 0
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0 0 0 0 0
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0 0
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8.333333 2.777778 0 0 0 0 0 0 0
0
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0
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6.25 6.25 0 0 0 0 0 0 0 0
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25.714286 11.428571 2.857143 0 0 0 0 0
0 0
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17.857143 25 3.571429 0 3.571429 0 0 0
0

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0 0 0 0 0 0 0 0 0 0 15
25 30 15 15 0 0 0 0 0 0
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35.714286 0 14.285714 7.142857 14.285714 7.142857
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0 0 0 0 0 0 0 0 0 0
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0 0 0 0 0 37.5 62.5 0 0 0 0
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2003 2 8 2 0 2 24 24 14 0 0
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0 0 0 0 0
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0 0 0 0 0

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0 0
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2.702703 5.405405 0 0 0 0 0 0 0
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0 0
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48 44 4 0 0 0 0 0 0 0 0
0 0 0 0 0 4 48 44 4 0 0
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2004 2 8 2 0 2 26 26 32 0 0
37.5 50 12.5 0 0 0 0 0 0 0 0
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2004 2 8 2 0 2 28 28 37 0 0
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0
2004 2 8 2 0 2 36 36 42 0 0
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2004	2	8	2	0	2	40	40	10	0	0
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10	0	0	10	0	10	0	0	0	0	
2004	2	8	2	0	2	42	42	4	0	0
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0	0	0	0	0	0	0	0	25	25	0
0	0	25	0	25	0	0	0	0	0	
2004	2	8	2	0	2	44	44	1	0	0
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0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	
2004	2	8	2	0	2	48	48	1	0	0
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0	0	0	0	0	0	0	0	0	0	0
0	0	0	100	0	0	0	0	0	0	
2005	2	8	2	0	2	16	16	1	100	0
0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	
2005	2	8	2	0	2	18	18	10	0	90
10	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	
2005	2	8	2	0	2	20	20	14	0	50
50	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0	0	0	0	0	
2005	2	8	2	0	2	22	22	17	0	
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0	0	0	0	0	0					
2005	2	8	2	0	2	24	24	27	0	
7.407407		74.074074		18.518519		0	0	0	0	0
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0	0	0	0	0	0					
2005	2	8	2	0	2	26	26	28	0	
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0 0 14.285714 0 0 0 0 0
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2006 2 8 2 0 2 18 18 5 0 100
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0 0 0 0 0 50 50 0 0 0 0
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2006 2 8 2 0 2 22 22 13 0
23.076923 15.384615 53.846154 7.692308 0 0 0
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0 0 0 0 0
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0 0 0 0 0 0 12 36 32 16 4
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2006 2 8 2 0 2 30 30 48 0 0
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2006 2 8 2 0 2 38 38 20 0 0
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0 5 0 0 0 0 0 0 0 15 15
20 25 15 5 0 0 0 5 0 0
2006 2 8 2 0 2 40 40 12 0 0
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0 8.333333 0 0 0 0 0 0 0 0
0 0 0 16.666667 50 16.666667 8.333333 0
8.333333 0 0 0 0 0
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0 11.111111 11.111111 11.111111 11.111111 11.11111
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33.333333 0 0 0 0
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0 0 0 0 0 0 0 0 0 100
2007 2 8 2 0 2 14 14 1 100 0
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0 0 0 0 0 0 0 0 0 0
2007 2 8 2 0 2 18 18 1 0 100
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 100 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
2007 2 8 2 0 2 20 20 6 0
66.666667 16.666667 16.666667 0 0 0 0 0
0 0 0 0 0 0 0 0 0 66.666667
16.666667 16.666667 0 0 0 0 0 0 0
0 0 0 0 0 0
2007 2 8 2 0 2 22 22 17 0 0
52.941176 29.411765 11.764706 5.882353 0 0 0
0 0 0 0 0 0 0 0 0 0

52.941176 29.411765 11.764706 5.882353 0 0 0
0 0 0 0 0 0 0 0
2007 2 8 2 0 2 24 24 19 0
10.526316 57.894737 5.263158 26.315789 0 0 0
0 0 0 0 0 0 0 0 0 0
10.526316 57.894737 5.263158 26.315789 0 0 0
0 0 0 0 0 0 0 0 0
2007 2 8 2 0 2 26 26 26 0 0
26.923077 30.769231 30.769231 7.692308 3.846154 0
0 0 0 0 0 0 0 0 0 0 0
26.923077 30.769231 30.769231 7.692308 3.846154 0
0 0 0 0 0 0 0 0 0
2007 2 8 2 0 2 28 28 23 0 0
4.347826 47.826087 30.434783 13.043478 4.347826 0
0 0 0 0 0 0 0 0 0 0 0
4.347826 47.826087 30.434783 13.043478 4.347826 0
0 0 0 0 0 0 0 0 0
2007 2 8 2 0 2 30 30 45 0 0
2.222222 11.111111 51.111111 26.666667 8.888889 0
0 0 0 0 0 0 0 0 0 0 0
2.222222 11.111111 51.111111 26.666667 8.888889 0
0 0 0 0 0 0 0 0 0
2007 2 8 2 0 2 32 32 46 0 0
0 15.217391 39.130435 26.086957 10.869565 6.521739
0 2.173913 0 0 0 0 0 0 0 0
0 0 15.217391 39.130435 26.086957 10.869565
6.521739 0 2.173913 0 0 0 0 0 0
0
2007 2 8 2 0 2 34 34 57 0 0
0 3.508772 15.789474 24.561404 26.315789 22.807018
3.508772 1.754386 0 1.754386 0 0 0 0
0 0 0 0 3.508772 15.789474 24.561404
26.315789 22.807018 3.508772 1.754386 0 1.754386
0 0 0 0 0
2007 2 8 2 0 2 36 36 55 0 0
0 0 10.909091 12.727273 10.909091 30.909091
14.545455 10.909091 5.454545 1.818182 1.818182 0
0 0 0 0 0 0 0 10.909091 12.727273
10.909091 30.909091 14.545455 10.909091 5.454545
1.818182 1.818182 0 0 0 0
2007 2 8 2 0 2 38 38 17 0 0
0 0 11.764706 0 23.529412 23.529412 23.529412
0 5.882353 5.882353 5.882353 0 0 0 0
0 0 0 0 11.764706 0 23.529412 23.529412
23.529412 0 5.882353 5.882353 5.882353 0 0
0 0

2007 2 8 2 0 2 40 40 2 0 0
0 0 0 0 50 0 0 50 0 0 0
0 0 0 0 0 0 0 0 0 0 50
0 0 50 0 0 0 0 0 0 0
2007 2 8 2 0 2 42 42 2 0 0
0 0 0 0 50 0 0 50 0 0 0
0 0 0 0 0 0 0 0 0 0 50
0 0 50 0 0 0 0 0 0 0
2007 2 8 2 0 2 44 44 3 0 0
0 0 0 0 33.333333 0 66.666667 0 0
0 0 0 0 0 0 0 0 0 0 0
0 33.333333 0 66.666667 0 0 0 0 0
0 0 0
2008 2 8 2 0 2 12 12 1 100 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 100 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
2008 2 8 2 0 2 16 16 3 66.66667
33.333333 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 66.66667 33.333333 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0
2008 2 8 2 0 2 18 18 8 0 100
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 100 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
2008 2 8 2 0 2 20 20 17 11.76471
52.941176 35.294118 0 0 0 0 0 0 0
0 0 0 0 0 0 0 11.76471 52.941176
35.294118 0 0 0 0 0 0 0 0 0
0 0 0 0 0
2008 2 8 2 0 2 22 22 16 0 37.5
43.75 18.75 0 0 0 0 0 0 0 0 0
0 0 0 0 0 37.5 43.75 18.75 0 0 0
0 0 0 0 0 0 0 0 0 0
2008 2 8 2 0 2 24 24 25 0 32
44 20 4 0 0 0 0 0 0 0 0
0 0 0 0 0 32 44 20 4 0 0
0 0 0 0 0 0 0 0 0 0
2008 2 8 2 0 2 26 26 34 0
2.941176 26.470588 38.235294 26.470588 5.882353 0
0 0 0 0 0 0 0 0 0 0 0
2.941176 26.470588 38.235294 26.470588 5.882353 0
0 0 0 0 0 0 0 0 0 0
2008 2 8 2 0 2 28 28 28 0 0
28.571429 53.571429 17.857143 0 0 0 0 0

0 0 0 0 0 0 0 0 0 28.571429
53.571429 17.857143 0 0 0 0 0 0 0
0 0 0 0 0
2008 2 8 2 0 2 30 30 41 0 0
9.756098 19.512195 31.707317 26.829268 0 9.756098
2.439024 0 0 0 0 0 0 0 0 0
0 9.756098 19.512195 31.707317 26.829268 0
9.756098 2.439024 0 0 0 0 0 0 0
0
2008 2 8 2 0 2 32 32 54 0 0
3.703704 16.666667 29.62963 22.222222 14.814815
11.111111 1.851852 0 0 0 0 0 0 0
0 0 0 3.703704 16.666667 29.62963 22.222222
14.814815 11.111111 1.851852 0 0 0 0 0
0 0 0
2008 2 8 2 0 2 34 34 43 0 0
0 2.325581 27.906977 27.906977 23.255814 13.953488
4.651163 0 0 0 0 0 0 0 0 0
0 0 2.325581 27.906977 27.906977 23.255814
13.953488 4.651163 0 0 0 0 0 0 0
0
2008 2 8 2 0 2 36 36 37 0 0
2.702703 5.405405 13.513514 10.810811 18.918919
16.216216 18.918919 13.513514 0 0 0 0 0
0 0 0 0 2.702703 5.405405 13.513514
10.810811 18.918919 16.216216 18.918919 13.513514 0
0 0 0 0 0 0
2008 2 8 2 0 2 38 38 26 0 0
0 3.846154 7.692308 7.692308 11.538462 19.230769
15.384615 23.076923 0 3.846154 7.692308 0 0
0 0 0 0 0 3.846154 7.692308 7.692308
11.538462 19.230769 15.384615 23.076923 0 3.846154
7.692308 0 0 0 0
2008 2 8 2 0 2 40 40 11 0 0
0 0 0 9.090909 9.090909 18.181818 18.181818
27.272727 0 9.090909 9.090909 0 0 0 0
0 0 0 0 0 9.090909 9.090909 18.181818
18.181818 27.272727 0 9.090909 9.090909 0 0
0 0
2008 2 8 2 0 2 42 42 3 0 0
0 0 0 0 0 0 33.333333 0 0 0
33.333333 0 33.33333 0 0 0 0 0 0
0 0 0 0 33.333333 0 0 0 33.333333
0 33.33333 0 0
2008 2 8 2 0 2 44 44 2 0 0
0 0 0 0 0 0 50 50 0 0 0

```
        0       0       0       0       0       0       0       0       0       0       0
        0       50      50      0       0       0       0       0       0       0
        2008    2       8       2       0       2       46      46      3       0       0
        0       0       0       0       0       33.333333       0       33.333333       0
        0       0       33.33333        0       0       0       0       0       0       0
        0       0       0       33.333333       0       33.333333       0       0       0
        33.33333        0       0       0
        2008    2       8       2       0       2       48      48      1       0       0
        0       0       0       0       0       0       0       0       0       0       0
        0       0       0       100     0       0       0       0       0       0       0
        0       0       0       0       0       0       0       0       0       100


0       #nobsal         #_Number_of_size_at_age_observations    #Skip_reading
#2003   2       2       2       2       3       110     10      10      10      10      10
        10      10      10      10      10      10      10      10      10      10      10
        10      4       30      62      42      18      19      7       10      1       10
        10      10      10      10      10
#       10      10      10      10      10      10      10      10      10      10      10
        10      10      10      10      10      10      4       30      62      42      18
        19      7       10      1       10      10      10      10      10      10


#_environmental_data
0       #N_envvar
0       #N_observations
#1980   1       1       #env_temp(1,N_envdata,1,3) #Skip


0       # N sizefreq methods to read
#25     #Sizefreq N bins per method
#2      #Sizetfreq units(bio/num) per method
#3      #Sizefreq scale(kg/lbs/cm/inches) per method
#1e-005         #Sizefreq mincomp per method
#0      #Sizefreq N obs per method
#_Sizefreq bins
#26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 68 72 76 80 90
#_Year season Fleet Partition Gender SampleSize <data>
#1 1971 1 1 3 0 125  0 0 0 0 0 0 0 0 0 4 1 1 2 4 1 5 6 2 3 11 8 4 5 0 0 0 0 0 0 0 0 0 0 1 0 1
3 0 3 4 2 4 5 9 17 8 3 8 0 0

0 # no tag data

0 # no morphcomp (stock) data
```

999

ENDDATA

18. Appendix G: SS2 Control file

#C 2009 coastwide Petrale assessment in SS3
#_data_and_control_files: petrale09.dat // petrale09.ctl
#_SS-V3 (with seasonal recruitment fix)
1 #_N_Growth_Patterns
1 #_N_Morphs_Within_GrowthPattern
#_Cond 1 #_Morph_between/within_stdev_ratio (no read if N_morphs=1)
#_Cond 1 #vector_Morphdist_(-1_in_first_val_gives_normal_approx)

#Recruitment occurs in season 2 (summer)
1 # N recruitment designs goes here if N_GP*nseas*area>1
0 # placeholder for recruitment interaction request
1 2 1 # recruitment design element for GP=1, seas=2, area=1

#_Cond 0 # N_movement_definitions goes here if N_areas > 1
#_Cond 1.0 # first age that moves (real age at begin of season, not integer) also cond on do_migration>0
#_Cond 1 1 1 2 4 10 # example move definition for seas=1, morph=1, source=1 dest=2, age1=4, age2=10

2 #_Nblock_Patterns
4 3 #3 2 #_blocks_per_pattern
begin and end years of blocks
1973 1982 1983 1992 1993 2002 2003 2008
1983 1992 1993 2002 2003 2008

0.5 #_fracfemale
0 #_natM_type:_0=1Parm; 1=N_breakpoints;_2=Lorenzen;_3=agespecific;_4=agespec_withseasinterpolate
#2 #_N_breakpoints
4 15 # age(real) at M breakpoints

1 # GrowthModel: 1=vonBert with L1&L2; 2=Richards with L1&L2; 3=not implemented; 4=not implemented
2.833 #_Growth_Age_for_L1 (minimum age for growth calcs. Used 0.8333 for 10 month in year)
15.833 #_Growth_Age_for_L2 (999 to use as Linf) (maximum age for growth calcs)
0.0 #_SD_add_to_LAA (set to 0.1 for SS2 V1.x compatibility) ??????(FIND OUT WHAT THIS PARAMETER IS)???????
3 #_CV_Growth_Pattern: 0 CV=f(LAA); 1 CV=F(A); 2 SD=F(LAA); 3 SD=F(A) #plots of sd at age support a constant sd across ages
1 #_maturity_option: 1=length logistic; 2=age logistic; 3=read age-maturity matrix by growth_pattern; 4=read age-fecundity (Changed from length to age based in this assessment, believe that the ages below 9 are relatively well determined)

#_placeholder for empirical age-maturity by growth pattern
3 #_First_Mature_Age
1 #_fecundity option:(1)eggs=Wt*(a+b*Wt);(2)eggs=a*L^b;(3)eggs=a*Wt^b
0 #hermaphrodite
3 #_parameter_offset_approach (1=none, 2= M, G, CV_G as offset from female-GP1, 3=like SS2 V1.x)
1 #_env/block/dev_adjust_method (1=standard; 2=with logistic trans to keep within base parm bounds)

#_growth_parms
#GP_1_Female
#LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
0.05 0.40 0.2 0.2 0 0.025 5 0 0 0 0 0.5 0 0
#1 F_M_young
10 45 22.0 17.18 -1 10 2 0 0 0 0 0.5 0 0
#2 F_L@Amin (Amin is age entered above)
45 80 53.0 58.7 -1 10 3 0 0 0 0 0.5 0 0
#3 F_L@Amax
0.04 0.5 0.13 0.13 -1 0.8 2 0 0 0 0 0.5 0 0
#4 F_VBK
0.02 8.00 4.00 0.08 -1 0.8 2 0 0 0 0 0.5 0 0
#5 F_SD@AFIX
-1 1.00 0.00 0.08 -1 0.8 5 0 0 0 0 0.5 0 0
#6 F_SD@AFIX2=ln(SD@AFIX2/SD@AFIX)
#GP_1:::Male
-0.5 0.70 0.0 0.0 -1 0.05 5 0 0 0 0 0.5 0 0
#7 M_young
-1 2 0.04 0.04 -1 10 2 0 0 0 0 0.5 0 0 #8 LN(F_L@Amin/M_L@Amin)
-1 2 0.25 0.25 -1 10 3 0 0 0 0 0.5 0 0 #9 LN(F_L@Amax/M_L@Amax)
0.04 0.8 0.24 0.24 -1 0.8 2 0 0 0 0 0.5 0 0
#10 M_VBK
-1.0 1.00 0.00 0.0 -1 0.8 2 0 0 0 0 0.5 0 0
#11 M2_SD@AFIX
-1 1.00 0.00 0.0 -1 0.8 5 0 0 0 0 0.5 0 0 #12 M2_SD@AFIX2
#GP_1:::Male (Direct Estimation)
#0.05 0.40 0.0 0.2 0 0.8 -3 0 0 0 0 0.5 0 0 #M1_M_young (when set to zero and not estimated it will be set equal to females)
#10 45 15.5 15.5 0 10 3 0 0 0 0 0.5 0 0 #M1_L@Amin (Amin is age entered above)
#45 80 42.0 42.0 0 10 3 0 0 0 0 0.5 0 0 #M2_L@Amax
#0.04 0.5 0.24 0.24 0 0.8 3 0 0 0 0 0.5 0 0 #M2_VBK

#0.02 0.15 0.0 0.08 0 0.8 -3 0 0 0 0 0.5 0 0 #M2_CV@AFIX
#-1 0.15 0.0 0.08 0 0.8 -3 0 0 0 0 0.5 0 0 #M2_CV@AFIX2

#LW_female
#LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
-3 3 2.05E-06 2.05E-06 0 0.8 -3 0 0 0 0 0.5 0 0 #WL_intercept_female
1 5 3.476 3.476 0 0.8 -3 0 0 0 0 0.5 0 0 #WL_slope_female
#Female_maturity
10 50 33.1 33.1 0 0.8 -3 0 0 0 0 0.5 0 0 #mat_intercept #L50
-3 3 -0.743 -0.743 0 0.8 -3 0 0 0 0 0.5 0 0 #mat_slope From Hannah et al 2002
#Fecundity___Assume_same_as_spawning_biomass
-3 3 1 1 0 1 -3 0 0 0 0 0.5 0 0 #mat_intercept #L50
-3 3 0 0 0 1 -3 0 0 0 0 0.5 0 0 #mat_slope
#LW_Male
-3 3 3.12E-06 3.12E-06 0 0.8 -3 0 0 0 0 0.5 0 0 #WL_intercept_male
-3 5 3.351 3.351 0 0.8 -3 0 0 0 0 0.5 0 0 #WL_slope_slope_male

#LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
#Allocate_R_by_areas_x_gmorphs
0 1 1 0.2 0 9.8 -3 0 0 0 0 0.5 0 0 #frac to GP 1 in area 1
#Allocate_R_by_areas_(1_areain_this_case)
0 1 1 1 0 9.8 -3 0 0 0 0 0.5 0 0 #frac R in area 1
#Allocate_R_by_season_(2seasons_in_this_case)
#LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
-4 4 -4 1 0 9.8 -3 0 0 0 0 0.5 0 0 #frac R in season 1 (in log space)
-4 4 4 0 0 9.8 -3 0 0 0 0 0.5 0 0 #frac R in season 2 (in log space)

#CohortGrowDev
#SS3 manual says it must be given a value of 1 and a negative phase
#LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev_stddev Block Block_Fxn
0 1 1 1 -1 0 -4 0 0 0 0 0 0 0

#_Cond 0 #custom_MG-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-environ parameters

#_Cond 0 #custom_MG-block_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-block parameters

#_seasonal_effects_on_biology_parms
0 0 0 0 0 0 0 0 0 0 #_femwtlen1,femwtlen2,L1,K,Malewtlen1,malewtlen2,L1,K ??
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no seasonal MG parameters

#_Cond -4 #_MGparm_Dev_Phase

#_Spawner-Recruitment
3 #_SR_function
#_LO HI INIT PRIOR PR_type SD PHASE
5 99 10 9 -1 10 1 #Ln(R0)
0.2 1 0.8 0.8 -1 3 5 #steepness(h)---base_case #Prior from Dorn? (his mu=, sd= in normal space)
0 2 0.4 0.9 0 5 -99 #sigmaR---base_case (tuned to 0.4 from 0.5)
-5 5 0 0 0 1 -99 #Env_link_parameter
-5 5 0 0 0 0.2 -2 # SR_R1_offset
0 0 0 0 -1 0 -99 # SR_autocorr
0 #_SR_env_link
0 #_SR_env_target_0=none;1=devs;_2=R0;_3=steepness

1 #do_recdev: 0=none; 1=devvector; 2=simple deviations

1959 # first year of main recr_devs; early devs can preceed this era
2005 # last year of main recr_devs; forecast devs start in following year
1 #_recdev phase
1 # (0/1) to read 11 advanced options
-20 #_Cond 0 #_recdev_early_start (0=none; neg value makes relative to recdev_start)
3 #_recdev_early_phase
0 #_Cond 0 #_forecast_recruitment phase (incl. late recr) (0 value resets to maxphase+1)
1 #_Cond 1 #_lambda for prior_fore_recr occurring before endyr+1
1949 #_last_early_yr_nobias_adj_in_MPD
1959 #_first_yr_fullbias_adj_in_MPD
2005 #_last_yr_fullbias_adj_in_MPD
2008 #_first_recent_yr_nobias_adj_in_MPD
1 #max bias
0 #reserved for future use
-3 #min rec_dev
3 #max rec_dev
0 #_read_recdevs
#_end of advanced SR options

#Fishing Mortality info

```
0.3 # F ballpark for tuning early phases
-2001   # F ballpark year (neg value to disable)
3   # F_Method:  1=Pope; 2=instan. F; 3=hybrid (hybrid is recommended)
4   # max F or harvest rate, depends on F_Method
# no additional F input needed for Fmethod 1
# read overall start F value; overall phase; N detailed inputs to read for Fmethod 2
# NUM ITERATIONS, FOR CONDITION 3
5   # read N iterations for tuning for Fmethod 3 (recommend 3 to 7)
#Fleet Year Seas F_value se phase (for detailed setup of F_Method=2)

#_initial_F_parms
#_LO HI INIT PRIOR PR_type  SD PHASE
0   1   0   0.0001  0      99  -1  #Fleet1_(WinterWA)
0   1   0   0.0001  0      99  -1  #Fleet2_(SummerWA)
0   1   0   0.0001  0      99  -1  #Fleet1_(WinterOR)
0   1   0   0.0001  0      99  -1  #Fleet2_(SummerOR)
0   1   0   0.0001  0      99  -1  #Fleet1_(WinterCA)
0   1   0   0.0001  0      99  -1  #Fleet2_(SummerCA)

#_Q_setup
# A=do power, B=env-var, C=extra SD,
#D=devtype(<0=mirror, 0/1=none, 2=cons, 3=rand, 4=randwalk)
#E=0=num/1=bio, F=err_type
#DISCUSS WHICH OPTION FOR Q (0 OR 1, OR 2)
#A  B   C   D   E   F
0   0   0   0   1   0   #Fleet1_(WinterWA)
0   0   0   0   1   0   #Fleet2_(SummerWA)
0   0   0   0   1   0   #Fleet1_(WinterOR)
0   0   0   0   1   0   #Fleet2_(SummerOR)
0   0   0   0   1   0   #Fleet1_(WinterCA)
0   0   0   0   1   0   #Fleet2_(SummerCA)
0   0   0   0   1   0   #Triennial
0   0   0   0   1   0   #NWFSC
0   0   0   0   1   0   #Triennial

#_Cond 0 #_If q has random component, then 0=read one parm for each fleet with
random q; 1=read a parm for each year of index
#_Q_parms(if_any)
# LO HI INIT PRIOR PR_type SD PHASE
#-5 5   -0.4462 -0.4    0   5   1   #

#Seltype(1,2*Ntypes,1,4)    #SELEX_&_RETENTION_PARAMETERS
#Size_Slectivity,_enter_4_cols
#N_sel  Do_retain   Do_male Special
24      1          3       0   #Fleet(WinterWA)
24      1          3       0   #Fleet(SummerWA)
```

24 1 3 0 #Fleet(WinterOR)
24 1 3 0 #Fleet(SummerOR)
24 1 3 0 #Fleet(WinterCA)
24 1 3 0 #Fleet(SummerCA)
24 0 3 0 #Triennial
24 0 3 0 #NWFSC
24 0 3 0 #Triennial
#Age_selectivity #set_to_1
10 0 0 0 #Fleet(WinterWA) is Logistic
10 0 0 0 #Fleet(SummerWA) is Logistic
10 0 0 0 #Fleet(WinterOR) is Logistic
10 0 0 0 #Fleet(SummerOR) is Logistic
10 0 0 0 #Fleet(WinterCA) is Logistic
10 0 0 0 #Fleet(SummerCA) is Logistic
10 0 0 0 #Triennial
10 0 0 0 #NWFSC
10 0 0 0 #Triennial

#Selectivity parameters
#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
#Size_selectivity for FISHERY WINTER WA
#FEMALE
#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
15 75 35.0 43.1 -1 5 1 0 0 0 0 0.5 1 1 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -3 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 4.1 3.42 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#-5 5 -4.0 0.15 -1 5 4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#RETENTION
10 40 30 15 -1 9 1 0 0 0 0 0 0 0 # Retain_1 Inflection
0.1 10 3 3 -1 9 2 0 0 0 0 0 0 0 # Retain_2 Slope
0.001 1 0.98 1 -1 9 4 0 0 0 0 0 0 0 # Retain_3 Asymptote
-10 10 0 0 -1 9 -2 0 0 0 0 0 0 0 # Retain_4 Male offset (additive)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 3 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 4 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for FISHERY SUMMER WA
#FEMALE

#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
15 75 35.0 43.1 -1 5 1 0 0 0 0 0.5 1 1 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -3 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 4.1 3.42 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#-5 5 -4.0 0.15 -1 5 4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#RETENTION
10 40 30 15 -1 9 1 0 0 0 0 0 0 0 # Retain_1 Inflection
0.1 10 3 3 -1 9 2 0 0 0 0 0 0 0 # Retain_2 Slope
0.001 1 0.98 1 -1 9 4 0 0 0 0 0 0 0 # Retain_3 Asymptote
-10 10 0 0 -1 9 -2 0 0 0 0 0 0 0 # Retain_4 Male offset (additive)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 3 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 4 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for FISHERY WINTER OR
#FEMALE
#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
25 75 35.0 43.1 -1 5 1 0 0 0 0 0.5 2 1 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -3 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 4.1 3.42 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#-5 5 -4.0 0.15 -1 5 4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#RETENTION
10 40 30 15 -1 9 1 0 0 0 0 0 0 0 # Retain_1 Inflection
0.1 10 3 3 -1 9 2 0 0 0 0 0 0 0 # Retain_2 Slope
0.001 1 0.98 1 -1 9 4 0 0 0 0 0 0 0 # Retain_3 Asymptote
-10 10 0 0 -1 9 -2 0 0 0 0 0 0 0 # Retain_4 Male offset (additive)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 3 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 4 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for FISHERY SUMMER OR
#FEMALE

#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
15 75 35.0 43.1 -1 5 1 0 0 0 0 0.5 1 1 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -3 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 4.1 3.42 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#-5 5 -4.0 0.15 -1 5 4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#RETENTION
10 40 30 15 -1 9 1 0 0 0 0 0 0 0 # Retain_1 Inflection
0.1 10 3 3 -1 9 2 0 0 0 0 0 0 0 # Retain_2 Slope
0.001 1 0.98 1 -1 9 4 0 0 0 0 0 0 0 # Retain_3 Asymptote
-10 10 0 0 -1 9 -2 0 0 0 0 0 0 0 # Retain_4 Male offset (additive)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 3 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 4 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for FISHERY WINTER CA
#FEMALE
#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
15 75 35.0 43.1 -1 5 1 0 0 0 0 0.5 1 1 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -3 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 4.1 3.42 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#-5 5 -4.0 0.15 -1 5 4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#RETENTION
10 40 30 15 -1 9 1 0 0 0 0 0 0 0 # Retain_1 Inflection
0.1 10 3 3 -1 9 2 0 0 0 0 0 0 0 # Retain_2 Slope
0.001 1 0.98 1 -1 9 4 0 0 0 0 0 0 0 # Retain_3 Asymptote
-10 10 0 0 -1 9 -2 0 0 0 0 0 0 0 # Retain_4 Male offset (additive)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 3 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 4 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for FISHERY SUMMER CA
#FEMALE

#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
15 75 35.0 43.1 -1 5 1 0 0 0 0 0.5 1 1 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -3 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 4.1 3.42 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#-5 5 -4.0 0.15 -1 5 4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#RETENTION
10 40 30 15 -1 9 1 0 0 0 0 0 0 0 # Retain_1 Inflection
0.1 10 3 3 -1 9 2 0 0 0 0 0 0 0 # Retain_2 Slope
0.001 1 0.98 1 -1 9 4 0 0 0 0 0 0 0 # Retain_3 Asymptote
-10 10 0 0 -1 9 -2 0 0 0 0 0 0 0 # Retain_4 Male offset (additive)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 3 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 4 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for TRIENNIAL SURVEY
#FEMALE
#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
15 61 33.1 43.1 -1 5 1 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -2 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 3.7 3.42 -1 5 1 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -2 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 2 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -3 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for NWFSC SURVEY
#FEMALE
#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #

15 61 33.1 43.1 -1 5 1 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -2 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 3.7 3.42 -1 5 1 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -2 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 2 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -3 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#Size_selectivity for TRIENNIAL SURVEY
#FEMALE
#LO HI INIT PRIOR PR_TYPE SD PHASE env-var use_dev dev_yr1 dev_yr2 dev_sd nblks blk_pat #
15 61 33.1 43.1 -1 5 1 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-5 3 3.0 0.7 -1 5 -2 0 0 0 0 0.5 0 0 #TOP (see Selex24.xls)
-4 12 3.7 3.42 -1 5 1 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-2 6 6.0 0.21 -1 5 -2 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 5 -5.0 -8.9 -1 5 4 0 0 0 0 0.5 0 0 #INIT (see Selex24.xls)
-5 5 -999 0.15 -1 5 -4 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)
#...DO_MALE (AS OFFSET)
-15 15 0 0 -1 5 2 0 0 0 0 0.5 0 0 #PEAK (see Selex24.xls)
-15 15 0 0 -1 5 2 0 0 0 0 0.5 0 0 #ASC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -3 0 0 0 0 0.5 0 0 #DSC_WIDTH (see Selex24.xls)
-15 15 0 0 -1 5 -3 0 0 0 0 0.5 0 0 #FINAL (see Selex24.xls)

0 #_custom block setup (0/1)
-0.7 0.7 0 0 -1 99 4
2 #logistic bounding

Tag loss and Tag reporting parameters go next
0 # TG_custom: 0=no read; 1=read if tags exist
#_Cond -6 6 1 1 2 0.01 -4 0 0 0 0 0 0 0 #_placeholder if no parameters

0 #_Variance_adjustments_to_input_values
#_1 2 3
0 0 0 #_add_to_fleet and survey_CV
0 0 0 #_add_to_discard_stddev
0 0 0 #_add_to_bodywt_CV
1 1 1 #_mult_by_lencomp_N
1 1 1 #_mult_by_agecomp_N
1 1 1 #_mult_by_size-at-age_N
30 #_DF_for_discard_like
30 #_DF_for_meanbodywt_like

15 #_maxlambdaphase
1 #_sd_offset

12 # number of changes to make to default Lambdas (default value is 1.0)
Like_comp codes: 1=surv; 2=disc; 3=mnwt; 4=length; 5=age; 6=SizeFreq; 7=sizeage; 8=catch;
9=init_equ_catch; 10=recrdev; 11=parm_prior; 12=parm_dev; 13=CrashPen; 14=Morphcomp; 15=Tag-comp; 16=Tag-negbin
#like_comp fleet/survey phase value sizefreq_method
5 1 1 0.5 1 #commercial age comps
5 2 1 0.5 1 #commercial age comps
5 3 1 0.5 1 #commercial age comps
5 4 1 0.5 1 #commercial age comps
5 5 1 0.5 1 #commercial age comps
5 6 1 0.5 1 #commercial age comps
4 1 1 0.5 1 #commercial lgth comps
4 2 1 0.5 1 #commercial lgth comps
4 3 1 0.5 1 #commercial lgth comps
4 4 1 0.5 1 #commercial lgth comps
4 5 1 0.5 1 #commercial lgth comps
4 6 1 0.5 1 #commercial lgth comps
#5 8 1 0.1 1 #survey Age conditionals
#4 8 1 0.1 1 #survey lgth comps
#4 7 1 0.1 1 #triennial survey lgth comps
#2 1 1 20 1
#2 2 1 20 1
#2 3 1 20 1
#2 4 1 20 1
#2 5 1 20 1
#2 6 3 20 1
#2 1 3 5 1
#2 2 3 5 1
#2 3 3 5 1
#2 4 3 5 1

#2 5 3 5 1
#2 6 3 5 1
#2 1 4 1 1
#2 2 4 1 1
#2 3 4 1 1
#2 4 4 1 1
#2 5 4 1 1
#2 6 4 1 1
#3 1 1 10 1
#3 2 1 10 1
#3 3 1 10 1
#3 4 1 10 1
#3 5 1 10 1
#3 6 1 10 1
#4 1 1 1 1
#4 2 1 1 1
#4 3 1 1 1
#5 1 1 1 1
#5 2 1 1 1

0 # (0/1) read specs for more stddev reporting
1 1 -1 5 1 5 # selex type, len/age, year, N selex bins, Growth pattern, N growth ages
-5 16 27 38 46 # vector with selex std bin picks (-1 in first bin to self-generate)
1 2 14 26 40 # vector with growth std bin picks (-1 in first bin to self-generate)

999

19. Appendix H: SS2 Starter file

#C Petrale 2009 assessment (Melissa Haltuch and Allan Hicks)
petrale09.dat
petrale09.ctl
1 # 0=use init values in control file; 1=use ss3.par
1 # run display detail (0,1,2)
1 # detailed age-structured reports in REPORT.SSO (0,1)
0 # write detailed checkup.sso file (0,1)
0 # write parm values to ParmTrace.sso (0=no,1=good,active; 2=good,all; 3=every_iter,all_parms; 4=every,active)
1 # Cumulative Report
0 # Include prior_like for non-estimated parameters (0,1)
1 # Use Soft Boundaries to aid convergence (0,1) (recommended)
1 # Number of bootstrap datafiles to produce (N-2), 1 means reporduce data, 2 means add expected values
10 # Turn off estimation for parameters entering after this phase
10 # MCMC burn interval
2 # MCMC thin interval
0.0001 # jitter initial parm value by this fraction
-1 # min yr for sdreport outputs (-1 for styr)
-2 # max yr for sdreport outputs (-1 for endyr; -2 for endyr+Nforecastyrs
0 # N individual STD years
#vector of year values
1973 1976
0.0001 # final convergence criteria (e.g. 1.0e-04)
0 # retrospective year relative to end year (e.g. -4)
3 # min age for calc of summary biomass
1 # Depletion basis: denom is: 0=skip; 1=rel X*B0; 2=rel X*Bmsy; 3=rel X*B_styr
1 # Fraction (X) for Depletion denominator (e.g. 0.4)
4 # (1-SPR)_reporting: 0=skip; 1=rel(1-SPR); 2=rel(1-SPR_MSY); 3=rel(1-SPR_Btarget); 4=notrel
1 # F_std reporting: 0=skip; 1=exploit(Bio); 2=exploit(Num); 3=sum(frates)
0 # F_report_basis: 0=raw; 1=rel Fspr; 2=rel Fmsy ; 3=rel Fbtgt
999 # check value for end of file

20. Appendix I: SS2 Forecast file

1 # Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=F(endyr); 5=Ave F (enter yrs); 6=read Fmult
-4 # first year for recent ave F for option 5 (not yet implemented)
-1 # last year for recent ave F for option 5 (not yet implemented)
0.74 # F multiplier for option 6 (not yet implemented
0 # first year to use for averaging selex to use in forecast (e.g. 2004; or use -x to be rel endyr)
0 # last year to use for averaging selex to use in forecast
1 # Benchmarks: 0=skip; 1=calc F_spr,F_btgt,F_msy
2 # MSY: 1= set to F(SPR); 2=calc F(MSY); 3=set to F(Btgt); 4=set to F(endyr)
0.4 # SPR target (e.g. 0.40)
0.4 # Biomass target (e.g. 0.40)
12 # N forecast years
1 # read 10 advanced options
0 # Do West Coast gfish rebuilder output (0/1)
2000 # Rebuilder: first year catch could have been set to zero (Ydecl)(-1 to set to endyear+1)
2002 # Rebuilder: year for current age structure (Yinit) (-1 to set to endyear+1)
1 # Control rule method (1=west coast adjust catch; 2=adjust F)
0.4 # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.40)
0.1 # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
1 # Control rule fraction of Flimit (e.g. 0.75)
1 # basis for max forecast catch by seas and area (0=none; 1=deadbio; 2=retainbio; 3=deadnum; 4=retainnum)
0 # 0= no implementation error; 1=use implementation error in forecast (not coded yet)
0.1 # stddev of log(realized F/target F) in forecast (not coded yet)
end of advanced options
max forecast catch
0
0 #Reserved for future use
rows are seasons, columns are areas
1 # fleet allocation (in terms of F) (1=use endyr pattern, no read; 2=read below)
0.225768
12 # Number of forecast catch levels to input (rest calc catch from forecast F
2 # basis for input forecatch: 1=retained catch; 2=total dead catch
#Year Seas Fleet Catch
2009 1 1 323.46
2009 2 2 433.38
2009 1 3 492.89
2009 2 4 258.53
2009 1 5 465.34
2009 2 6 525.39
2010 1 1 323.46
2010 2 2 433.38

2010	1	3	492.89
2010	2	4	258.53
2010	1	5	465.34
2010	2	6	525.39

999 # verify end of input