Status of yelloweye rockfish (*Sebastes ruberrimus*)

off the U.S. West Coast

in 2006

By

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Executive Summary

Stock

This assessment reports the status of the yelloweye rockfish (*Sebastes ruberrimus*) resource off the west coast of the United States, from the Mexican border to the Canadian border. This stock is treated as a single coastwide population as in the previous two assessments (Wallace *et al*. 2005, Methot *et al*. 2002) and additionally as separate sub-populations in area models for Washington, Oregon and California. Although there is no apparent genetic distinction between areas, yelloweye are considered to be sedentary, habitat specific, and non-migratory signifying a slow rate of mixing where area-specific patterns are likely to persist for some time. This life history feature would support area-specific model configurations. Additionally, differences in CPUE trends and exploitation between areas further indicate the need for area-specific model configurations. For these reasons, we believe that separate area models for California and Oregon better represent sub-stock dynamics than the coastwise model and should be used for management considerations.

Catches

NMFS and State personnel expended a significant amount of effort to provide the best possible historical accounting of landings prior to 1983. These estimates are considered to be a significant improvement over previous catch time series for California, Oregon and Washington. This resulted in decreasing total catch between 1955-2005 for the coastwide recreational fishery by 667 mt and increasing the commercial landings by 1,674 mt (compared to the 2005 assessment).

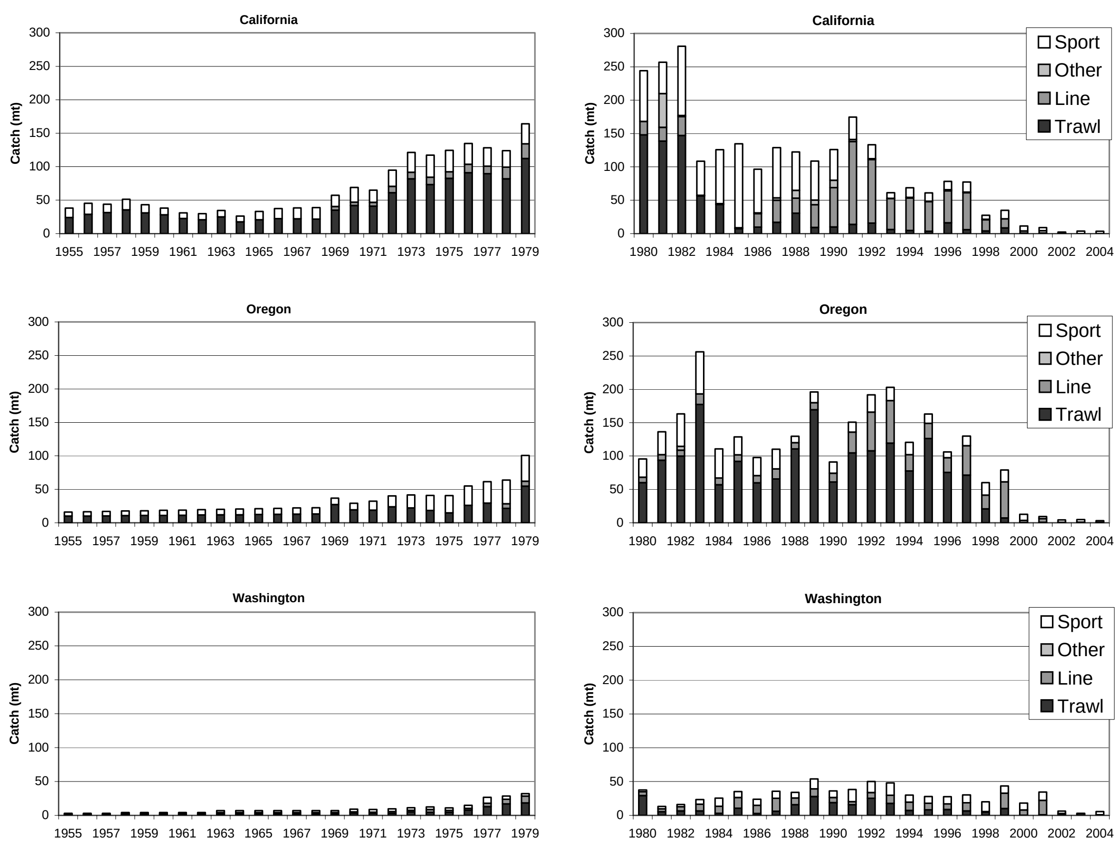

Figure ES1. Reconstructed historical landings (mt) by area and year.

Table ES1. Twenty-five year catch history by State, fishery and year (shaded values indicated where there are no data and catches are based on interpolation) including discard estimates.

Coastal Washington, Oregon and California Yelloweye Rockfish Landings

Source	PacFIN and MRFSS				Tagart, PacFIN, and ODFW				Tagart, PacFIN and WDFW								
	California [1/]				Oregon [2/]				Washington [3/]				Totals				
Year	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Total
1980	147.9	20.2		75.9	60.2	8.0		27.5	29.2	5.8	0	2.4	237.3	34.0	0.0	105.8	377.1
1981	138.7	20.4	50.7	46.9	93.7	8.5		34.2	5.3	4.4	0	3.4	237.7	33.4	50.7	84.5	406.3
1982	146.9	28.3	1.8	103.8	99.9	9.0	5.6	48.7	6.5	6.1	0	3.4	253.3	43.5	7.4	155.8	460.0
1983	56.5	0.3	0.8	51.0	177.3	15.9	0.0	62.9	6.5	10.1	0	6.7	240.3	26.3	0.8	120.6	388.0
1984	43.5	0.5	0.9	80.8	57.1	10.0	0.0	43.6	3.0	10.4	0	12.2	103.6	20.9	0.9	136.6	262.0
1985	7.3	0.9	0.6	125.8	91.9	10.0	0.0	26.8	10.5	15.9	0	8.8	109.7	26.8	0.6	161.4	298.4
1986	9.8	20.0	1.2	65.5	59.8	10.8	0.0	27.2	2.7	12.0	0	9.0	72.3	42.8	1.2	101.7	218.0
1987	16.9	33.1	3.7	75.2	65.7	15	0.0	29.4	6.0	19.1	0	10.5	88.6	67.2	3.7	115.1	274.6
1988	30.6	22.5	11.8	57.5	110.7	9.4	0.0	9.6	15.8	9.8	0	8.3	157.1	41.7	11.8	75.4	286.0
1989	9.4	34.0	6.7	58.7	169.4	10.6	0.0	16.0	27.9	11.3	0	14.6	206.7	55.9	6.7	89.3	358.6
1990	10.1	58.8	10.9	46.12	61.1	13.2	0.0	16.6	18.8	7.5	0	9.9	90.0	79.5	10.9	72.6	253.1
1991	13.9	124.0	3.2	33.57	104.6	31.3	0.0	14.9	15.8	4.6	0	18.0	134.3	159.9	3.2	66.5	363.8
1992	15.8	95.1	1.3	21.02	107.8	58	0.0	25.9	25.1	8.7	0	16.2	148.7	161.8	1.3	63.2	374.9
1993	6.2	46.1	0.6	8.5	119.3	63.9	0.0	19.7	17.6	12.2	0	18.0	143.1	122.2	0.6	46.2	312.1
1994	4.7	48.7	1.0	14	77.6	24.6	0.0	18.3	7.2	12.4	0	10.3	89.5	85.7	1.0	43.0	219.2
1995	3.6	44.2	0.7	12.6	126.3	22.8	0.0	13.8	8.1	9.9	0	9.9	138.0	76.9	0.7	36.3	251.9
1996	16.2	48.0	1.6	12.5	75.5	22.2	0.0	8.4	8.6	8.3	0	10.8	100.3	78.5	1.6	31.7	212.1
1997	6.0	55.3	0.9	15.1	71.4	44.1	0.0	14.4	6.5	12.2	0	11.4	83.9	111.6	0.9	40.9	237.3
1998	4.0	16.7	0.9	5.8	20.8	20.6	0.0	18.9	4.8	0.7	0	14.4	29.6	38.0	0.9	39.1	107.6
1999	8.7	13.4	0.1	12.6	7.1	54.2	0.0	17.8	9.9	23.0	0	10.6	25.7	90.6	0.1	41.0	157.4
2000	0.7	3.3	0.0	7.5	0.3	3.3	0.0	9.2	0.2	7.7	0	10.1	1.2	14.3	0.0	26.8	42.4
2001	0.6	3.9	0.0	4.6	0.7	5.5	0.0	3.1	0.8	21.2	0	12.5	2.1	30.6	0.0	20.3	53.0
2002	0.2	0.0	0.0	2.1	0.4	0.3	0.0	3.6	0.4	2.2	0	3.7	1.0	2.5	0.0	9.4	12.9
2003	0.0	0.0	0.0	3.7	0.8	0.2	0.0	3.8	0.2	0.3	0	2.6	1.0	0.5	0.0	10.1	11.6
2004	0.0	0.0	0.0	3.5	0.2	0.5	0.0	2.4	0.1	0.8	0	4.5	0.3	1.3	0.0	10.4	12.0
2005	1.6	0.0	0.0	3.7	0.2	4.1	0.2	4.3	0.1	4.2	0.1	5.1	1.9	8.3	0.3	13.1	23.6
	Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				
1980's	60.7	18.0	8.7	74.1	98.6	10.7	0.7	32.6	11.3	10.5	0.0	7.9	170.7	39.2	8.4	114.6	263.7
1990's	8.9	55.0	2.1	18.2	77.2	35.5	0.0	16.9	12.2	9.9	0.0	13.0	98.3	100.4	2.1	48.1	109.8
2000-2004	0.5	1.2	0.0	4.2	0.4	2.3	0.0	4.4	0.3	6.1	0.0	6.4	1.3	9.6	0.1	15.0	26.4

Discard was assumed to have not occurred prior to enactment of strict harvest policies beginning in 2002 and estimates in recent years are included in the catch table above. By 2004, all three States instituted regulations that prohibited yelloweye retention in the recreational fishery and most commercial fisheries.

Data and assessment

The first and second full assessments for yelloweye rockfish were conducted in 2001 (Wallace 2001) and 2002 (Methot *et al.* 2002), respectively. Both assessments were length-based models that used an earlier version of the Stock Synthesis program (Methot 1989). Wallace (2001) conducted two separate area assessments for the Northern California and Oregon areas. Methot *et al*. (2002) incorporated Washington catch, recreational abundance indices, and age data, and treated the stock as one single assemblage of the W-O-C coast. The 2005 assessment (Wallace *et al*. 2005) provided an update of the 2002 assessment incorporating a revised catch time series (1982-2004) and employed the Stock Synthesis 2 (**SS2**) modeling framework to estimate model parameters and management quantities. Abundance indices were not revisited and little new composition data were available. Each of the assessments concluded that ending spawning biomass was less than 25% of unfished.

This current (2006) assessment reevaluated all of the available coast-wide catch and effort information and reformulated all indices of abundance. New information included the IPHC survey index of abundance for 1999 and from 2001-2005, a revised historical catch time series from 1955-1982 and new age, length and size composition data. The SS2 modeling framework is again used to estimate model parameters for a coastwide model and for separate area models for W-O-C. Additionally, natural mortality was estimated within the coastwide model to be 0.036 and was then assumed to be 0.036 in all area specific models. This compares to natural mortality estimates of 0.02 and 0.033 (Chi Hong, DFO, Canada pers. communication) used in the SE

Alaska, U.S. and British Columbia, Canada, respectively. Natural mortality was assumed to be 0.045 in the previous two assessments (Wallace et al., 2005 and Methot, et al., 2002) and age specific in the 2001 assessment (Wallace, 2001).

Since natural mortality is confounded with selectivity in age-structured models we explored the trade-off between natural mortality and selectivity relative to our ability to estimate selectivity parameters. Because of the lack of age and length composition information especially for older, larger individuals we concluded that data were insufficient to allow us to satisfactorily estimate the descending limb of a double logistic selectivity curve and chose to assume a logistic form for all area specific and coastwide models. This model form assumes that all ages and sizes of fish are available to the fishery with no refugia for the largest individuals in the population.

Stock biomass and recruitment for the coastwide model and each area model

In agreement with previous assessment(s) yelloweye rockfish biomass is considered to be at near historic low levels with spawning biomass less than 25% of unfished in all models.

Table ES2. Recent trend in spawning biomass and depletion level for the Coastwide and each area model.

Year	Exploitable Biomass	Spawning Biomass	SPB ~95% CI	Estimated Depletion	Depletion ~95% CI	Recruitment (1,000's Age 3)
		Coastwide				
1995	1934	669	593-744	0.201		57.5
1996	1772	614	536-693	0.185		54.2
1997	1639	574	492-656	0.173		51.7
1998	1475	522	437-608	0.157		48.3
1999	1432	517	427-607	0.156		47.9
2000	1337	488	393-583	0.147		45.9
2001	1350	502	402-601	0.151		46.8
2002	1353	509	405-613	0.153		47.4
2003	1391	531	423-640	0.160		48.9
2004	1430	553	440-665	0.166		50.3
2005	1466	573	457-690	0.173	0.139-0.206	51.6
2006	1491	588	467-708	0.177	0.142-0.211	52.6

Year	Exploitable Biomass	Spawning Biomass	SPB ~95% CI	Estimated Depletion	Depletion ~95% CI	Recruitment (1,000's Age 3)
		California				
1995	523	189	136-213	0.110		19.0
1996	483	175	114-192	0.102		17.8
1997	424	153	91-170	0.089		16.0
1998	365	131	86-168	0.076		14.0
1999	354	127	78-162	0.074		13.6
2000	334	120	79-165	0.070		13.0
2001	337	122	80-169	0.071		13.2
2002	343	125	85-175	0.073		13.4
2003	354	130	88-182	0.076		13.9
2004	365	135	92-188	0.079		14.4
2005	375	140	96-194	0.082	0.055-0.108	14.8
2006	383	145	192-388	0.085	0.057-0.112	15.2

Year	Exploitable Biomass	Spawning Biomass	SPB ~95% CI	Estimated Depletion	Depletion ~95% CI	Recruitment (1,000's Age 3)
		Oregon				
1995	888	286	243-329	0.227		23.1
1996	781	254	210-297	0.202		21.3
1997	723	241	195-287	0.192		20.6
1998	635	217	169-265	0.172		19.1
1999	610	215	164-266	0.171		19.0
2000	563	203	149-257	0.162		18.2
2001	578	215	158-272	0.171		19.0
2002	596	228	168-288	0.181		19.8
2003	617	241	178-304	0.192		20.6
2004	637	253	187-319	0.201		21.3
2005	657	265	197-334	0.211	0.16-0.261	22.0
2006	671	274	203-344	0.218	0.165-0.27	22.5

Year	Exploitable Biomass	Spawning Biomass	SPB ~95% CI	Estimated Depletion	Depletion ~95% CI	Recruitment (1,000's Age 3)
		Washington				
1995	374	152	132-173	0.336		12.6
1996	355	144	123-164	0.317		12.2
1997	338	135	115-155	0.298		11.7
1998	316	126	106-146	0.278		11.2
1999	304	121	101-141	0.267		11.0
2000	270	106	85-126	0.233		10.1
2001	262	101	81-122	0.224		9.8
2002	239	90	69-110	0.198		9.0
2003	242	90	70-111	0.199		9.1
2004	249	92	72-113	0.204		9.2
2005	254	94	73-115	0.208	0.172-0.244	9.3
2006	255	95	74-116	0.209	0.173-0.246	9.4

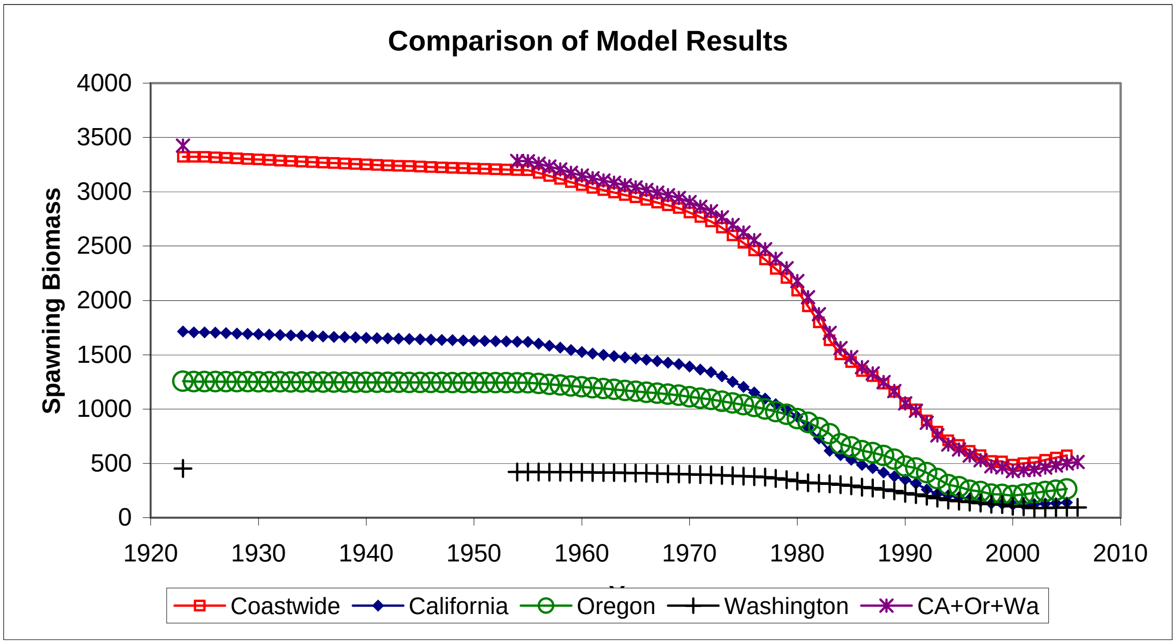

Figure ES2. Estimated spawning biomass time series from area-specific models, coastwide model and the sum of area-specific models.

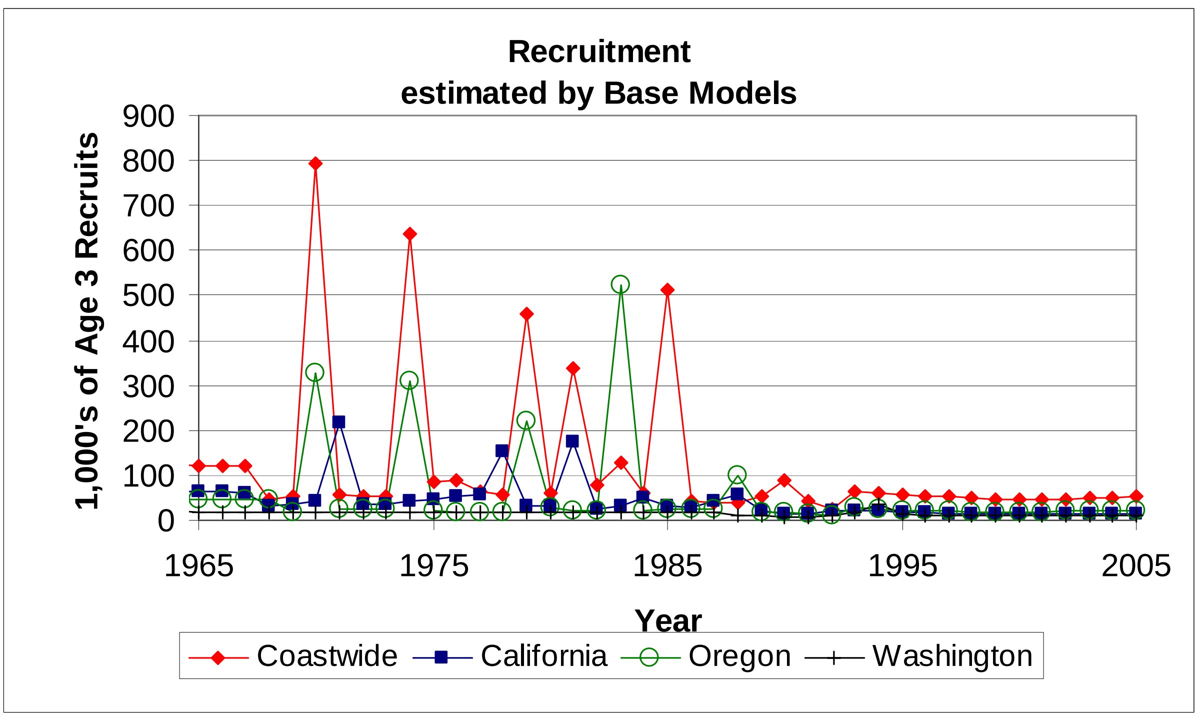

Figure ES3. Estimated recruitment time series from area-specific models, coastwide model and the sum of area-specific models.

Estimated fishing mortality rates for coastwide and each area model

Harvest and consequent fishing mortality rates have declined significantly coastwide in the last 10 years. Plot of F/F_{MSY} and B/B_{MSY} indicate that harvest have far exceeded F_{MSY} and B_{MSY} since the mid 1970's.

Table ES3. Recent trend in average fishing mortality rates for each area model and the coastwide model.

	Average Fishing Mortaily Rates			
Year	**Coastwide**	**California**	**Oregon**	**Washington**
1995	0.1430	0.1793	0.1777	0.0763
1996	0.0720	0.0739	0.0938	0.0878
1997	0.1086	0.0969	0.1281	0.0621
1998	0.0312	0.0339	0.0225	0.1415
1999	0.0387	0.0266	0.0159	0.0656
2000	0.0094	0.0066	0.0071	0.1297
2001	0.0082	0.0103	0.0077	0.0260
2002	0.0083	0.0095	0.0048	0.0126
2003	0.0158	0.0139	0.0132	0.0214
2004	0.0074	0.0073	0.0051	0.0365
2005	0.0144	0.0107	0.0141	0.0290

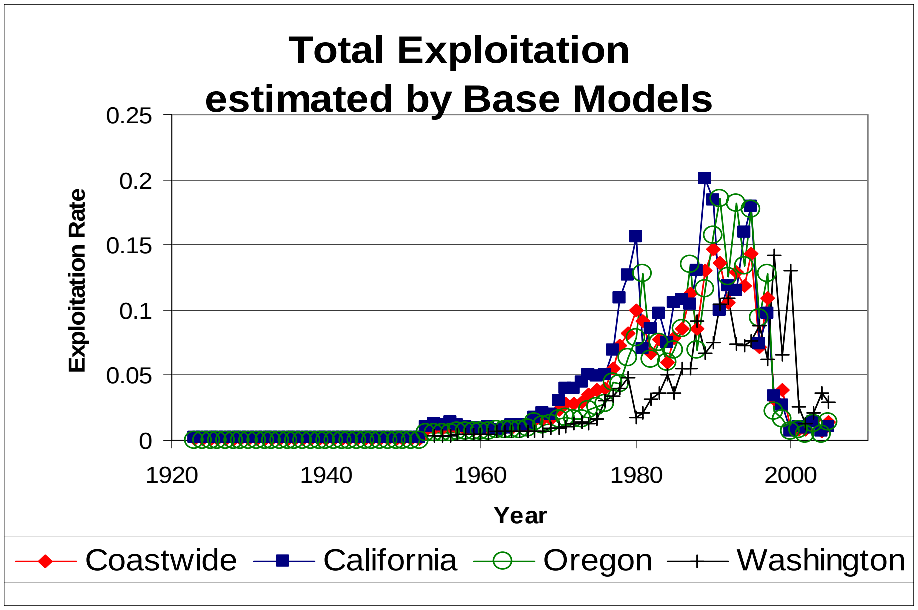

Figure ES4. Estimated exploitation rate time series from area-specific models and the coastwide model.

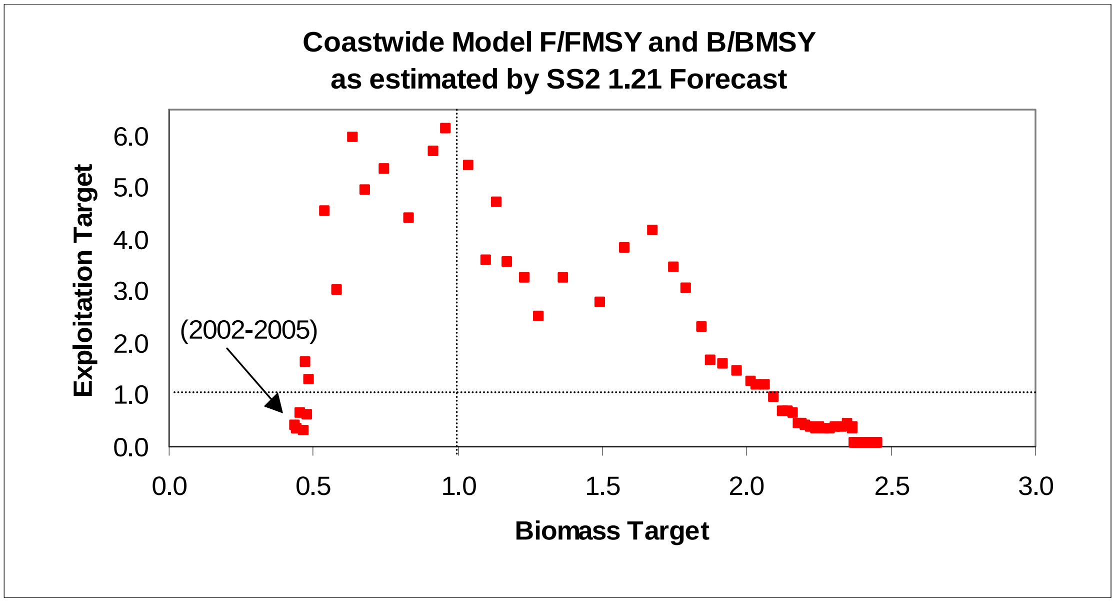

Figure ES5. Estimated (SS2 V2.21 forecast) F/F_{MSY} and B/B_{MSY} time series from the coastwide model.

Reference points

The current assessment uses the F50% Council default harvest policy to make harvest projections for yelloweye rockfish. Given that yelloweye rockfish spawning stock biomass (SB) was less than the Council's default harvest control rule of 25% of the unexploited level (based on coastwide or independent area models) the stock is considered to be "overfished".

Table ES4. Benchmark fishing mortality rates for each area model and the coastwide model based on the SSC default rebuilding analysis simulation software.

	Area (models) for consideration				
Reference Point	**Coastwide**	**California**	**Oregon**	**Washington**	**W-O-C**
[1/] **Unfished Spawning Stock Biomass (SSB_0)**	3,322	1,715	1,258	453	3,425
Unfished Exploitable Biomass (B_0)	7,448	3,877	2,789	1,017	7,683
Unfished Recruitment (R_0)	4.85	4.19	3.85	3.00	
SSB_{2006}	588	145	274	95	514
Depletion Level (2006)	17.7%	8.5%	21.8%	21.0%	15.0%
Depletion -95CI	14.2%	5.7%	16.5%	17.3%	
Depletion +95CI	21.1%	11.2%	27.0%	24.6%	
Target Spawning Biomass ($B_{0.40}$)	1,329	684	502	181	
$F_{MSY\ Proxy\ (SPR=0.50)}$	0.024	0.021	0.021	0.027	
Exploitable Biomass	1491	383	671	255	
[2/] **ABC_{2006}**	36.2	8.1	14.2	7.0	
OY_{2006}	36.2				

[1/] **This value is expressed in female biomass (one-half of the model SSB_0 estimate of 6,644 m for both sexes).**
[2/] **Assumes F_{MSY} Proxy (SPR=0.50)**

Management Performance

As in previous assessments, the current assessment indicated over-exploitation during the last two decades. This is likely the result of managing yelloweye rockfish as part of a larger rockfish complex where regulations were ineffective in constraining yelloweye catches below current harvest policy until 2002. Specifically, there have been few regulations developed to effectively control catch or bycatch of yelloweye rockfish until 2002 (Washington prohibited retention in 2002, California and Oregon in 2004). Recent management decisions have significantly restricted yelloweye rockfish catch and is reflected in the recent low level of yelloweye landings that have not exceeded the yelloweye rockfish coastwide rebuilding ABC/OY target first established in 2003. Total catch between 2002 and 2004 is highly uncertain because sampling programs were insufficient to estimate discard related to management measures. There has been significant improvement in sampling coverage in 2005. Discard prior to 2002 was likely minimal because yelloweye are a highly prized sport fish and commercial value for this species typically exceeded other rockfish species.

Table ES5. Comparison of yelloweye ABC, OY and catch since single species management began in 2002.

Coastal Washington, Oregon and California Yelloweye Rockfish Landings

Source	PacFIN and MRFSS				Tagart, PacFIN, and ODFW				Tagart, PacFIN and WDFW										
	California [1/]				Oregon [2/]				Washington [3/]				Totals				Coastwide		
Year	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Total	ABC	OY $_{(Tmid)}$
2002	0.2	0.0	0.0	2.1	0.4	0.3	0.0	3.6	0.4	2.2	0	3.7	1.0	2.5	0.0	9.4	12.9	52.0	22.0
2003	0.0	0.0	0.0	3.7	0.8	0.2	0.0	3.8	0.2	0.3	0	2.6	1.0	0.5	0.0	10.1	11.6	52.0	22.0
2004	0.0	0.0	0.0	3.5	0.2	0.5	0.0	2.4	0.1	0.8	0	4.5	0.3	1.3	0.0	10.4	12.0	54.0	22.0
2005	1.6	0.0	0.0	3.7	0.2	4.1	0.2	4.3	0.1	4.2	0.1	5.1	1.9	8.3	0.3	13.1	23.6	54.0	26.0

Note: GMT "Scorecard" from Nov. 2005 used for all 2005 catch estimates and prior catches from a varity of sources including PacFIN, RecFIN, CDFG, ODFW and WDFW.

Unresolved problems and major uncertainties

As in the previous assessments, the sparseness of the size and age composition data and the lack of a relevant fishery-independent survey has limited the model's ability to properly assess the status of the resource. This is especially apparent in the Washington model where the wholesale lack of data resulted in our inability to obtain a converged model without placing significant restraints and assumptions within the model relative to the area-specific models for California and Oregon. Further, due to catch restrictions since 2002, catch-per-unit-effort (**CPUE**) data no longer reflect the real changes in population abundance, and discard estimates are highly uncertain.

The landings data are basically derived from total landings of unclassified rockfish times an estimated fraction that are yelloweye. In recent years, actual samples are available in many areas, but because yelloweye are rare in the overall catch and that species composition estimates derived from mixed rockfish categories is limited, substantial substitution for missing cells is required. In earlier years (prior to 1983), estimates of fraction yelloweye had to be borrowed from remote years and areas. The consequence of these estimation steps is that the catch is known only with considerable uncertainty and the current version of SS2 does not allow for uncertainty measurements of landings. This makes it nearly impossible to evaluate the true uncertainty of model results. Internal estimates of standard error on depletion estimates were on the order of 2-2.5% and are likely to be serious underestimates of uncertainty.

Research and Data Needs

Additional effort to collect age and maturity data is essential for improved population assessment. Collection of these data can only be accomplished through research studies and/or by onboard observers because this species is now prohibited. In 2006, IPHC and WDFW scientists are conducting a study to increase our knowledge of current stock biomass off Washington coast. Loss of the study due to declining OY will have significant detrimental effects on our ability to adequately assess this stock in the future. We strongly urge Management to make this study the highest priority. Increased effort toward habitat mapping and in-situ observation of behavior will provide information on the essential habitat and distribution for this species.

Alternative survey such as the in-situ 2002 US Vancouver submersible survey in untrawlable habitat is required for future assessment of yelloweye rebuilding status. This study has demonstrated that submersible visual transect surveys can provide a unique alternative method for estimating demersal fish biomass in habitats not accessible to conventional survey tools. For example, because of the low frequency of yelloweye rockfish encountered in the NMFS shelf trawl survey tows, those data were not considered a reliable indicator of abundance and were not used in the 2002 yelloweye stock assessment for PFMC (Methot *et al.* 2002). Results from this study support this conclusion and illustrate the need for large-scale surveys to assess bottomfish densities in habitats that are not accessible to trawl survey gear. Further, stratified random sampling designs should be employed with sample sizes sufficient to ensure acceptable levels of statistical power (Jagielo *et al.* 2003). At present, the in-situ visual transect submersible survey method appears to be a useful tool for this purpose, and the utility of this method will likely improve further with technological advances such as the 3-Beam Quantitative Mensuration System (**QMS**).

Rebuilding Projections

Rebuilding projections and 10 year forecast yield are based on results from the SSC default rebuilding analysis simulation software. Specific detail can be obtained from PFMC "Updated Rebuilding Analysis for Yelloweye Rockfish Based on the 2006 Stock Assessment" document.

Table ES6. Rebuilding projections and 10 year forecast yield based on results from the SSC default rebuilding analysis simulation software.

	Coastwide		California		Oregon		Washington	
FMSY proxy		0.024		0.021		0.021		0.027
FMSY SPR / SPR(F=0)		0.5		0.5		0.5		0.5
Virgin SPR		52.195		52.189		53.349		44.960
Generation time		50		47		49		46
T_{MIN}		2046		2073		2035		2026
T_{MAX}		2096		2120		2084		2072
Virgin Spawning Output		6643		3421		2510		906
Target Spawning Output		2657		1368		1004		362
Current Spawning Output		1146		281		530		188
Spawning Output (ydecl = 2002)		1019		249		456		180
Natural mortality		0.036		0.036		0.036		0.040
Steepness		0.45		0.45		0.45		0.45
SigmaR		0.50		0.50		0.50		0.50
Depletion level in 2005		17.3%		8.2%		21.1%		20.8%
	OY	Depletion	OY	Depletion	OY	Depletion	OY	Depletion
2007	12.6	18.0%	2.7	8.6%	6.4	22.5%	2.6	20.9%
2008	12.9	18.5%	2.8	8.9%	6.6	23.1%	2.7	21.8%
2009	13.2	18.9%	2.9	9.2%	6.7	23.7%	2.8	22.8%
2010	13.5	19.4%	2.9	9.5%	6.8	24.2%	2.9	23.7%
2011	13.8	19.8%	3.0	9.8%	6.9	24.7%	3.0	24.5%
2012	14.1	20.2%	3.1	10.1%	7.0	25.2%	3.0	25.4%
2013	14.3	20.5%	3.1	10.3%	7.1	25.6%	3.1	26.1%
2014	14.5	20.8%	3.2	10.6%	7.1	25.9%	3.2	26.8%
2015	14.7	21.1%	3.3	10.8%	7.2	26.2%	3.2	27.3%
2016	15.0	21.4%	3.3	11.0%	7.3	26.5%	3.3	27.9%

Note: OY projection is base on P_{MAX} = 0.8.

1.0 Introduction

1.1 Life History

Yelloweye rockfish (*Sebastes ruberrimus*) can be characterized as relatively low in abundance, extremely long-lived (aged up to 120 years), late maturing, and slow growing. They primarily inhabit high-relief rocky areas from northern Baja to the Aleutian Islands in depths 15 to 550 meters (Rosenthal *et al.* 1982, Eschemeyer *et al.* 1983, Love *et al.* 2000). Adult yelloweye are carnivorous feeding primarily on other rockfishes, herring, sand lance, crab and shrimp (Washington *et al.* 1978, Rosenthal *et al.* 1988, Reilly *et al.* 1994, Love 1996).

1.2 Stock Structure

This assessment treats the yelloweye stock as a single coastwide assemblage and evaluates separate WOC (Washington, Oregon, California) models. Evaluation of stock boundaries is reliant upon life history traits associated with a population or sub-population. Data for delineation of stock boundaries for WOC yelloweye are limited. However, the species affinity for hard bottom suggests that they may form stable local populations that, when recognized, could be treated as independent stocks. Thus, the comparison of biological parameters between sub-areas is may be unreliable. Currently, there are three independent studies that give some insight into whether or not local aggregations of fishes can be identified as separate stock units.

Gao and Wallace (2003, unpublished) examined yelloweye rockfish stock structure by evaluating ratios of C^{13}/C^{12} and O^{18}/O^{16} in aragonite powder samples of 200 yelloweye rockfish otoliths from the Washington and Oregon coast. For each otolith, three samples were taken; one from the nucleus (the starting time of otolith growth) and the other two from the first and fifth annual zone (assumed to be year 1 and 5 in life history). The isotopic signature of the nuclei is used to provide information on the natal development and spawning stock separation of the fish, whereas signatures of age-1 and age-5 indicate the behavior of the fish over the sampling period. Isotopic differences were not identified in otolith nuclei samples, suggesting there might be a single spawning stock for yelloweye rockfish along the Washington and Oregon coast. Distinct isotopic differences between samples from otolith nuclei and the fifth annual zones from both sample areas indicate yelloweye rockfish may move to other habitat as they grow from age-1 to age-5. Further, comparison within the fifth annual otolith zones between Washington and Oregon samples show clear differences in $\delta^{13}C$, but not in $\delta^{18}O$ variations, suggesting that the food sources or composition of the two areas are slightly different. In conclusion, the isotopic signatures from otolith nuclei showed there may possibly be a single spawning stock for yelloweye rockfish along the Washington and Oregon coast and age-1 to age-5 fish may change their habitat or associated bottom substrates for food.

Yamanaka *et al*. (2001) conducted a genetic analysis of yelloweye rockfish collected from northern Vancouver, B.C. and SE Alaskan waters. Though the authors found little variability among samples and suggested a well-mixed panmictic stock in their study area, specific habitat requirements for yelloweye rockfish support the hypothesis for site fidelity, and little mixing may occur after settlement. It is likely that discrete sub-populations corresponding to high-relief rocky areas form a much larger genetically diverse meta-population. Preliminary results from a DNA analysis of yelloweye collected off Oregon, Washington, Vancouver Island B.C., and the Strait of Georgia B.C. (Personal communications, Lynne Yamanaka DFO) suggest a distinct genetic separation of Strait of Georgia samples from West Coast samples, indicating the possibility of separate area stocks.

1.3 Fishery

Yelloweye rockfish are highly prized by sport fishers due to their size, beauty, and quality. Commercial fishers value their high market demand and ex-vessel price. Yelloweye rockfish inhabit areas typically inaccessible to trawl gear and catch in the coastal trawl fishery primarily results from incidental harvest associated with other target fisheries operating at the fringes of this habitat. However, due to lack of information it is impossible to determine if yelloweye distribution is now limited due to past intense fishing pressure in more easily accessible habitats. Yelloweye are also caught incidentally in both commercial hook-and-line and sport fisheries targeting other species found in association with the yelloweye habitat preferences. This species has been subjected to a periodic target fishery for both commercial hook-and-line and sport fisheries at least since the 1970's.

Specific catches of yelloweye are not well documented, but rockfish landings are reported back to 1916 (Table 3) in California (Heimann and Carlisle 1970). The earliest account of detailed yelloweye catch is in the April 1937- March 1938 from the wholesale rockfish markets in Monterey (Phillips, 1939). Yelloweye accounted for 0.6 % (4.1 mt) of the total rockfish landed accounting for 4.1 mt of a 669 mt fishery (Table 4). Nitsos and Reed (1965) also reported yelloweye catch in the 1961-1962 animal- food fisheries in California. Rockfish have been a mainstay of the fresh fish markets in California since the early 1900's and the catch increased significantly to 8 million pounds in 1918. The catch was as high as 13.5 million pounds during the 1943-1947 time period as demand rose during WW I and WW II. There was a significant shift in the California rockfish fishery in 1943. The fishery was first conducted primarily in Southern California and Central California, with Hook-and-line, trawl lines or long lines with baited hooks. In 1943, the balloon drag net proved successful and the frozen filet industry began in Northern California (Bureau of Marine Fisheries 1949). Immediately following WW II there was a significant increase in the party boat business along with increases recreational catches of rockfish in Central and Northern California (Young 1969). In the 1960 Commercial Passenger Fishing Vessel (**CPFV**) fishery from Crescent City to Aliva, yelloweye rockfish are reported to comprise 0.5% of total rockfish catch with body weight averaging 2.41 kg in weight (Miller and Gotshall 1965).

Significant increases in rockfish landings in Oregon during WW II are also reported in the literature. Landings of rockfish increased from 1.3 million pounds in 1941 to a peak of over 17 million pounds by 1947 in 1945 (Cleaver 1949). The report further states "The principle fish caught by the long-line fishery is the "Red Snapper" *S. ruberrimus*. The report does not state what portion of the rockfish catch was by the long-line fishery. Statistical reports of rockfish landings in Washington indicate that the annual rockfish catch was around 1 million pounds between 1949 and 1951 (Table 5). For Washington, no summary documents were found prior to 1953 (Table 6). Thus, further investigation is needed to verify rockfish catches from the earlier time period.

1.4 Management history

Management of rockfish has had a long history beginning in 1983 when the Pacific Fisheries Management Council (PFMC) first imposed trip limits on landings (Figure 1) from the *Sebastes* complex-- a group of about 50 species. Yelloweye were managed as part of the *Sebastes* complex until 2000, when the Council abandoned the *Sebastes* complex in favor of a finer scale portioning of mixed rockfish categories dividing it into three minor rockfish groupings: Nearshore, Shelf and Slope. Based on results from the 2001 assessment (Wallace, 2001) the Council enacted an interim level OY of 13.5 m that allowed for fisheries to take place and potentially catch yelloweye along with other fish, but did not allow fisheries that target yelloweye. Yelloweye were also separated into their own management category. Because the 2002 assessment did not assess yelloweye coastwide a coastwide ABC was not available until the 2002 assessment, which used all available coastwide information to develop a coastwide stock assessment for Washington, Oregon and California. Based on the 2002 assessment and rebuilding plan results (Methot et.al., 2002 and Methot and Piner, 2002), the Council adopted an OY of 22 metric tons and rebuilding measures with consistent harvest levels for the 2003 fisheries (Table 42).

1.4.1 Commercial Fishery

Prior to 2001 trip limit, regulations on the *Sebastes* complex probably had little or no impact in restricting harvest of yelloweye in the trawl fishery and yelloweye were likely never targeted. Open access and limited entry line gear trip limits for rockfish, which remained at or above 10,000 lbs in all years prior to 1999, did not constrain yelloweye catch because yelloweye landings rarely exceeded 10,000 lbs. Trip and bag limits were significantly reduced following completion of the 2002 yelloweye stock assessment (Figure 1). Commercial retention of yelloweye rockfish was prohibited except for a 300-pound trip limit in the trawl fishery so that yelloweye that are caught dead may be retained.

In addition to restrictive trip limits for yelloweye, managers instituted Rockfish Conservation Areas (**RCAs**) in 2002. These areas are large coastal closure areas intended to protect overfished rockfish species. The boundaries of the RCA's and landings limits outside them have varied by year, gear type, and season. The seaward boundary of the trawl RCA has ranged from 150-250 fm, while the shoreward boundary has ranged from 100 fm to the shore. Trawl gear that is used shoreward of the RCA is required to have small footropes (<8" diameter), which increases the risk of gear loss in rocky areas and diminishes incentive to fish close to these areas. Reductions in landings limits for shelf rockfish species have also reduced incentives to fish in rocky areas shoreward of the RCA.

1.4.2 Sport Fishery

Sport CPUE indices used in this assessment indicate that catch rates for yelloweye rockfish are low. Sport rockfish limits for WOC have remained at or above ten-fish until 1999 and it is likely that a ten-fish bag limit had little effect on restricting yelloweye harvest. In response to concerns for declining rockfish stocks, management of sport fisheries started becoming much more restrictive beginning in 2000. WDFW first adopted a two-fish bag limit for yelloweye in 2000, and an either/or two fish limit for yelloweye or canary rockfish in 2001 (Figure 1). In 2002, ODFW began a daily bag limit of one yelloweye rockfish, while California imposed a limit of no more than two yelloweye allowed per day per vessel. In addition to reductions in yelloweye retention, California also closed areas and limited recreational fishing seasons. WDFW first prohibited retention of yelloweye rockfish in coastal recreational fisheries in 2002. Both Oregon and California followed suit prohibiting retention beginning in 2004.

1.5 Management performance

The current and previous assessment(s) indicated over-exploitation during the last two decades, and regulations have most likely been ineffective in constraining yelloweye catch until most recent years. Specifically, there have been no regulations developed to significantly control catch or bycatch of yelloweye rockfish until 2002 (Washington prohibited retention in 2002, California and Oregon in 2004). Recent management decisions have significantly restricted yelloweye rockfish catch and is reflected in the recent low level of yelloweye landings that have not exceeded the yelloweye rockfish coastwide rebuilding ABC/OY target first established in 2002 (Table 42). There are a variety of sources (Westcoast Observer Program, WDFW and Oregon recreational observers and WDFW salmon troll observers) to estimate discard related to recent management measures. These estimates are highly uncertain and most sampling programs were not in place until 2004. Historical discard was likely minimal until enactment of recent regulations because yelloweye are a highly prized sport fish and commercial value for this species typically exceeded other rockfish species.

2.0 Assessment

2.1 Fishery Dependent Data

2.1.1 Catch and discard

Catch data are treated as known without error and, due to the high market value for yelloweye rockfish, discarding was assumed to have not occurred prior to enactment of strict harvest policies beginning in 2002. Discard estimates in the sport fishery are provided by Marine Recreational Fishery Statistical Survey (**MRFSS**), Oregon Department of Fish and Wildlife (**ODFW**), and Washington Department of Fish and Wildlife (**WDFW**) and are included in the catch estimates since 2002. Commercial trawl catch and discard of yelloweye rockfish are likely minimal due to trawl closure areas (Rockfish Conservation Areas) on the shelf since 2001 and in earlier years catch was not restrictive because they were infrequently caught. Observations of yelloweye catch from the West Coast Observer Program (NMFS) from commercial fisheries are very rare and the overall magnitude of discard cannot be estimated.

Catch data were compiled and analyzed for three independent coastal areas: California, Oregon and Washington (Table 1). California Department of Fish and Game (**CDFG**) and/or the MRFSS intermittently collected length, weight, effort and catch data on recreational fisheries in northern California ports of landing beginning in 1978. Rockfish catches have been reported in the California CPFV fishery logbooks since the mid 1930's, but specific yelloweye catch and effort data was rarely reported prior to 1987. These data provide the most complete and longest time series of information on yelloweye rockfish. Data collection by MRFSS and ODFW in Oregon spans back to the early 1980s, but sampling levels were low and sporadic until most recent years. Washington sport catch data are available in annual Department reports back to 1975. Yelloweye commercial catch data prior to 1980 do not exist with the exception of Oregon and Washington trawl catch during the 1970's as estimated by Tagart and Kimura (1982). In 2005, nearly all data sources including MRFSS, PacFIN, ODFW and WDFW provided updated catch estimates based on revised expansion algorithms intended to more accurately define rockfish catch since 1980. The Catches reported on the Council's Groundfish Management Team "Scorecard" from Nov. 2005 was used for the 2005 total catch estimates,

This year, considerable effort by both Federal and State personnel was expended on searching records for catch and species composition information to provide more accurate estimates of catch prior to 1980. This resulted in complete revision of the catch time series for each State for the early time period. For some years and fisheries, there were significant differences in catch estimates compared to those provided during the last stock assessment. Overall catch estimates for recreational fisheries were revised downward and catch estimates for commercial fisheries increased. The total catch for the entire time series increased approximately 1,000 mt (Table 2).

California

A revised California historical commercial catch time series is based on the average California Commercial database (**CALCOM**) proportion of yelloweye rockfish observed in commercial landings of rockfish between 1978 and 1982 after removing widow rockfish (Don Pearson, SWFSC, NMFS, personnel communication). These observations suggest that yelloweye constitute 1.0% of both the hook-and-line and trawl landings of rockfish. This fraction is applied to commercial rockfish landings to estimate yelloweye rockfish catch back to 1969. This fraction was then declined to 0.05% to model decline in technology and rock-tending gear in the earlier years of the trawl fishery.

Trawl landings of yelloweye rockfish declined from well over 100 mt in the late 1970's and early 1980s to 50-75 mt in the 1990s and in recent years to less than 1 mt. The commercial line fishery catch reached a historic high of almost 121 mt in 1991 and declined to less than 20 mt's by the late 1990's. Trawl and hook-and-line catches are grouped with the trawl fishery catch time series prior to 1969. Sport catches of yelloweye rockfish averaged 75 mt during the 1980's and sharply declined to less than 20 mt in the 1990s averaging only 5 mt in 2000 – 2004 (Table 1 and Figure 2).

Rockfish catches have been reported in the California CPFV fishery (Kevin Hill, NMFS personal communication) since the mid 1930's. Miller and Gottshall (1965) reported in 1960 that yelloweye represented 0.5% of the Northern California rockfish catch with an averaged body weight of 2.41 kg in weight. Based on this information, yelloweye catch prior to 1980 is assumed to be equal to 0.5% of all CPFV rockfish catches reported in Northern California waters and 0.025% of Southern California CPFV rockfish catches. The 1980-2004 recreational catches of yelloweye are based on RecFIN catch estimates.

Oregon

Trawl landings of yelloweye rockfish increased in the late 1970's and averaged 80-100 mt in the 1980's. Landings decreased significantly in the mid to late 1990's and fell to less than 1 mt since 2000. A commercial line fishery was developed in the early 1990's and has averaged 37 mt annually until management restrictions in 2000 reduced catches to less than 5 mt. Sport catches of yelloweye rockfish averaged 30 mt during the 1980s, declined to 20 mt in the 1990's and have averaged less than 5 mt between 2000 – 2004 (Table 1 and Figure 2).

Trawl catches are projected using species composition estimates of mixed rockfish categories collected by State port sampling personnel as early as 1963 (in at least some ports). Catch estimates for the most current time period (1984-2004) were obtained from the PacFIN database and for the 1978-1983 time period from Tagart and Kimura (1982). For years between 1969 and 1976, yelloweye are assumed to represent 1.0 % of the total rockfish catch reported in various Fisheries and Statistics of Oregon publications. This fraction was then declined to 0.05% by 1955 to model a presumed decreased in yelloweye catches resulting from absence of technological and rock-tending gear in the earlier years of the trawl fishery.

Commercial gear type was not reported prior to 1980 and few species composition estimates were taken before 1990. The most current hook-and-line rockfish catches were obtained from the PacFIN database and 1982-1990 yelloweye catches are a product of species composition estimates (Table 7) taken from various Washington line fisheries.

Washington

Washington trawl landings of yelloweye rockfish have been variable and less than 20 mt annually and have declined to less than 1 mt by 2000. A small target commercial line fishery developed in the late 1990's and catch peaked at 23 mt in 1999. Insignificant catches are reported since strict regulations went into effect in 2001. Sport yelloweye rockfish landings averaged 8 mt in the 1980's, 13 mt during the 1990's and have declined to less than 7 mt in 2000.

Caches from the trawl fishery between 1983 and 2004 are obtained from PacFIN; 1976-1982 from Tagart and Kimura (1982) and are then assumed to decline to 1 mt by 1955. Commercial line catch estimates from 1970-1999 are estimated from species composition data taken between 1986-1999 applied to "other rockfish" catch across all years, catch is then assumed to decline to 1 mt by 1955. Recreational catches from various WDF reports back to 1975, catch then assumed to decline to 1 mt.

2.1.2 Life History

Weight-at-length

An allometric length-weight function (weight=0.000021*length$^{2.9659}$) was computed from over 3,000 observations to estimate weight for a fish of known length for combined sexes. This relationship is used in the current assessment for all area models and in the previous assessment (Figure 3).

Growth

The von Bertalanffy growth function (Linf(1-e-k(age-to)) was used to estimate the length of a fish of a known age. Estimated parameter values are compared among estimates derived from age data collected from Washington, Oregon, California and other locales (Table 8). Differences in growth between Washington, Oregon and California fish were not apparent (Figure 4) and a single growth function for combined sexes was used for W-O-C areas (Table 8).

Growth parameters Lmin, Lmax, vBK, CV young and CV old are re-estimated within the model to adjust for the effects of size-selectivity and ageing error on the expected value of size-at observed age. Comparison of model results indicates that model estimates are very similar to the previous SS2 model estimates (Table 26).

In an effort to examine yelloweye growth independent of model estimates, we compared results from several model fits including the von Bertalanffy growth curve. These models were only used to explore model fit to the data and results were not incorporated into the current assessment.

(von Bertalanffy, 1938), which has the form:

Model I: $$L_t = L_\infty(1 - e^{-K(t-t_0)}) + \varepsilon \ ,$$

where L_t (cm) is the length of captured yelloweye rock at age t (years), L_∞ is the limited growth size (cm), K (per year) is the growth parameter and t_0 is the age with zero length. In Model I, there are three unknown parameters,

We have assumed $\varepsilon \sim N(0, \sigma^2)$. Most of the captured yelloweye rockfish are with age greater than or equal to 5 years, it would possibly induce bias in the estimation of t_0, and subsequently affects the estimation of L_∞ and K because they are highly correlated. We proposed to fit the growth curve with length zero at age zero. The proposed model is

Model II: $$L_t = L_\infty(1 - e^{-Kt}) + \varepsilon \ ,$$

where there are two unknown parameters, L_∞ and K to be determined.

We compared both Models I and II with fitting data with age greater than or equal to 5, 10,…, 30 years, and investigate the bias of estimating t_0, K and L_∞ in fitting Models I and II.

From Table 34, $\hat{t}_0$ decrease from –11.16 to 45.10 years with the age of data in fitting Model I. It is unlikely that the initial length of yelloweye rockfish at age zero is 25.5 cm. even with the full data set available. We believe that the yelloweye rockfish at age zero is around 1 to 2 cm. So the estimated $\hat{L}_\infty$ and $\hat{K}$ by fitting the data with Model II are reasonable and should be close to the actual mean values. The estimated $\hat{K}$ of Model II, 0.083 is nearly two times the estimated $\hat{K}$ of Model II, 0.046 indicating growth may be twice as fast than expected. This will affect the time to recover the depleted stock at the moment. In Figure 26, plots of fits by Models I and II with different set of data shows that the more captured yelloweye with age near zero, the less the bias we have in the estimation of the expected von Bertalanffy growth curve.

The estimation of L_∞ and K may vary with other factors, location annual and gender effect. Model III was examined

Model III: $$L_t = (L_\infty + r_L z_s + s_L z_a + \sum_j y_{L,j} z_j)(1 - e^{-(K + r_K z_s + s_K z_a + \sum_j y_{K,j} z_j)t}) + \varepsilon,$$

Where j = 1999, 2001, 2002, 2003, 2004 (2005 = control), z_s is a dummy variable (1=female, 0= control), z_a is a dummy variable (1=Columbia, 0=control), z_i are dummy variables(1= year j, 0=elsewhere). r_L, s_L, $y_{L,j}$ s, r_k, s_K, $y_{K,j}$ s are additional unknown parameters to be determined. We used both Akaike information criteria (AIC) (Akaike, 1974) and Bayesian information criteria (BIC) (Schwarz, 1978) to select the optimal sub-model within Model III, the final sub-model is compared with Model II fit by likelihood ratio test.

In Table 35, there is a summary of the number of yelloweye used in modeling the growth of yelloweye rock fish. The smallest group of yelloweye rock fish was captured near Vancouver Island, US in year 2003. The smaller the no. of fish in the group, the higher the chance to induce bias in the estimation. In Table 36, there is a summary of all estimated parameters in the final optimal sub-model from Model III. The estimated residual standard error is 4.013 with 724 degrees of freedom. We used likelihood ratio test (P=0.043) to select the optimal sub-model. The optimal sub-model was Model III. Compared Model II and III, the optimal sub-model was Model III (P=0.00). Female yelloweye rockfish has a small $\hat{L}_\infty = (64.44 - 7.444)$ cm but grows faster ($\hat{r}_K$ =0.022, P <0.05) compared with male yelloweye rockfish. Columbia yelloweye grows slower ($\hat{s}_K$ =-0.0009, P<0.05) compared with Vancouver Island, US yelloweye. The annual effect of year 2003 did significantly ($\hat{y}_{K,2003}$ =-0.086, P <0.05) affect the growth rate of yelloweye compared with the growth rate of year 2005 yelloweye.

Maturity-at-age

Length and age at 50% maturity for female yelloweye collected from coastal waters off Vancouver Island, B.C., was estimated to be 42.1-42.4 cm and 16.5-17.2 years of age (Yamanaka and Kronlund 1997). Length at 50% maturity for yelloweye collected off Oregon was estimated to be 41 cm by Barss (1989) and 45 cm by McClure (1982); and for fish collected off California, 40 cm by Reilly *et al.* (1994). Misspecification of length at 50% maturity at a larger size than actual will tend to lower allowable rates of fishing. As in the previous assessment, model runs were made with 50% maturity occurring at 42 cm (Table 10).

Natural mortality

Several procedures to derive estimates of natural mortality have been explored in the past (Wallace 2001). Robson and Chapman (1961) method was investigated, but Chi-square testing indicated that at least one of the critical assumptions of the data was not met. Catch curve estimates (Ricker 1975) of total mortality were derived from age data collected from various locales (Table 6). Estimates of mortality from an exploited stock off Neah Bay Washington (0.076) is higher compared to mortality estimates of an unexploited stock (0.025) located at the Bowie Seamount, Queen Charlotte Islands, B.C. (data provided by Yamanaka, DFO). Mortality estimates from Bowie Seamount using five-year age bins were 0.086 males and 0.043 females (Yamanaka, 2000) and no age bins were quite different (0.021 males and 0.033 females). Catch curve estimates of natural mortality assume constant recruitment and large variation in recruitment makes it difficult to interpret results derived from catch curve procedures. Yelloweye natural mortality estimates are further complicated due to ambiguity in making bin specifications for large year class(s) recruited in the late 1960s.

An estimated natural mortality rate near 0.045 was used in the 2002 assessment (Methot *et al.* 2002) and the 2005 assessment (Wallace *et al.* 2005) and represents a compromise between a low value of 0.02 (O'Connell *et al.* 2000) and high estimates of 0.043 for females and 0.086 for males (Yamanaka *et al.* 2001) and is equivalent to that estimated using Hoenig's (1983) method (Tables 11 and 12).

Natural mortality in the this assessment was estimated within the coastwide model to be 0.036 across all ages and then assumed (fixed) to be 0.036 in all area specific models. This compares to natural mortality estimates of 0.02 (O'Connell, 2004) and 0.033 (Chi Hong, DFO, Canada pers. communication) used in the SE Alaska, U.S. and British Columbia, Canada, respectively. We believe that the lower rate (compared to previous assessments) better represents the life history of this species whose life span can well exceed 100 years and corresponds better to other rockfish species with similar life history.

2.1.3 Age Validation and Ageing Error

Break-and-burn aging techniques for yelloweye rockfish were corroborated using radiometric aging techniques. Andrews *et al.* (2001) verified growth zone age estimates between 30 and 100 years, substantiating that longevity likely exceeds 100 years.

Aging error was assessed using data collected from an exchange of 100 otoliths between the Department of Fisheries and Oceans, Canada (**DFO**) and WDFW. Aging error increased with age and was assumed unbiased, but imprecise and equivalent differences between DFO and WDFW age readings. Comparison of DFO and WDFW age readings indicate that 75% of fish 9-13 years old and 89% of fish older than 70 years of age are mis-aged by at least one year (Wallace 2001). These data were incorporated in both of the last two assessments.

A revised aging error vector was incorporated in this assessment. The previous analysis included a single large outlier at the end of the data series that influenced the results. The revised ageing error is based on the same dataset, but excludes the outlier and results in an opposite slightly decreasing trend in age error for older aged fish (Figure 5). Age readers (Sandy Rosenfield, WDFW personnel communication) found older fish easer to age than younger fishes where demarcations between annuli are often difficult to interpret corroborated this result.

2.1.4 Fishery Size and age composition

Northern California data provide the most complete and longest time series of length information for yelloweye rockfish. Data collection in Oregon began in the early 1980's, though sampling levels were low and sporadic until most recent years. Washington data is essentially limited to the last five years (Tables 13-15).

Size frequency distribution data are used to estimate proportion at each size/age for combined sexes and gear for each assessment area. Due to scarcity of data, no weighting is applied in combining samples within State/gear/year strata. As in the last assessment, because of the small sample sizes, some samples are combined across years (super years) in order to provide the model with observations that reflect average conditions, although blurring any potential annual signal. The fish within one or a few fishery samples within a year/state/gear cannot represent a good random sample of the entire fishery catch. For example, inspection of the raw data often indicated a cluster of small fish in one year and a cluster of much larger fish in the following year. This occurs because fish within a sample tend to be more similar in size and age than the diversity of size and age that appears when many independent samples are taken. Because the model believes that the fish within a size or age composition observation are from a multinomially distributed random sample, it may attempt to infer recruitment events from what is sampling variability. Since inspection of the data do not reveal any obviously strong recruitment events moving through the population, we felt it was better continue (as in the last two assessments) to blend the small sample size years into multi-year observations. The procedure involved: (1) combining sample data across the range of selected years (see boxed data in Tables 13-15) to create a multi-year observation; (2) assign these proportions at age/size back to each of the source years; (3) assign a multinomial sample size for each of these years so that the sum of these sample sizes equals the sum of the original sample sizes for those years. All blended data time series and proportions are unchanged from the last assessment for years prior to 2000 and have only been revised in most current years. Age, length and size composition data are tabulated in Appendix A data input section.

2.1.5 Fishery CPUE

Abundance indices are assumed to be proportional to population abundance. The catchability coefficient (**Q**) is the factor that relates the units of the index to the abundance of the population. Random variability in the coefficient may occur, but if there is a trend over time or if the coefficient varies with population abundance, then the assessment may be biased. Sport fishery catch rates will be influenced by undocumented search time at sea; and the observed decline in CPUE indices would be underestimated. There is no information to evaluate annual differences in effort for specific individual target species such as yelloweye. It is unlikely that discard or bag limits influenced CPUE historically because yelloweye are a highly valued species and fishers rarely caught their bag limit of yelloweye. To minimize influence of non-bottomfish effort, data were restricted to rockfish or bottomfish-targeted trips. Described below are the statistical models used to explain some of the overall variability in sport CPUE in order to come closer to having indexes that are proportional to the abundance of fish available to the sport fishery.

We explored recreational fishery creel survey data provided by CDFG, ODFW, WDFW, NWFSC, and RecFIN. Data for 2002–2005 were not included in the assessment due to the significant management changes restricting the harvest of yelloweye rockfish since 2001 (Tables 16 and 17, Figure 6). All annual mean CPUE, except for Oregon recreational fishery, was calculated by two methods: 1) total annual catch divided by annual total efforts, and 2) delta lognormal modeling.

Delta lognormal model

Delta lognormal model (Lo *et al.* 1992) has been commonly used in the in modeling of the abundance of marine species from trawling data. It uses generalized linear models GLMs in both stages. The relative abundance of yelloweye in Pacific Northwest among years could be expressed as the product of density and a measure of area:

$$I = DA,$$

where I is the index of relative abundance (tons) for a given year, D is the density (tons per sq. km), A is the total fishing area. If the area of fishing did not change with time, D can be used as the index of relative abundance because A is a constant. Assuming there is i blocks in the fishing with density D_i and area A_i. If A_i s are not known, the annual catch in A_i can be used as substitutes. The density of fish for each year was

$$D_i = P_i C_i$$

where P_i is the probability of abundance and C_i (tons per sq. km) is standard measure of density within the fishing block *i*. In recreational data, we can use the catch per unit effort (CPUE) to replace *C* on the condition that the speeds of hauling are similar among all the trawling boat and it does not vary among years. CPUE can be catch per angler hr, catch per trip, or catch per angler. The distribution of $C_i > 0$ usually follows a lognormal distribution. The distribution of P_i follows a binomial distribution. The modeling of P_i and C_i through a two stages process with other predictor variables is commonly called delta lognormal model (Lo *et al.* 1992). The advantage of delta lognormal model can help to investigate the probability of abundance in a spatial scale with other predictor variables, which include both geographical information, and environmental variables. In most of catch data, a large proportion of zero catch would be affected the predictability of the model and it can be avoided by delta lognormal model, which only fit the positive catch data. There is possible bias induced by a two stages model process. Lo *et al.* (1992) and Syrjala (2000) attempted to estimate the bias of estimated variance by both simulation and approximation. No much literature has attempted to discuss the bias of the estimates. In fact, neither P_i nor C_i assumes normal distribution (binomial, lognormal) in the 2-stage model process and there is possible correlation between them. The use of delta lognormal method to estimate the variance of final estimate is questionable. This can be overcome by non-parametric bootstrapping.

First stage model
The response variable P_{ij} is a Bernoulli component (presence-absence) of CPUE *j* in year *i*. The choice of logit link function is standard (McCullagh and Nelder 1989, Cheng and Gallinat 2004). The link function is

$$g(P_{ij}) = \log(\frac{P_{ij}}{1-P_{ij}}) = x_i,$$

where x_i is a factor variable (annual effect).

Second stage model
We model $C_{ij} > 0$ in terms of the covariates $x_{ij.}$ It is a truncated Poisson distribution.

Bootstrapping method and non-parametric coefficient of variation
The nonparametric bootstrap method (Efron 1982, Hall 1992, Jackson and Cheng 2001) was used to estimate the 95% confidence intervals for the mean CPUE in both mean estimates and estimates resulted from delta lognormal model. Due to the intensity computing of GLMs and large data set, K = 200 to 1000 samples have been used. We have rerun the bootstrapping thee times and compared the precision of estimates of 2.5%, 15.87%, 84.13%, 97.5% quantiles. The estimates of the quantiles are correct to the first 3 significant places due to huge dataset. Coefficient of variation of a data X,

$$CV_X = \frac{\sigma_X}{\mu_X} \approx \frac{\hat{\sigma}_X}{\overline{X}},$$

is commonly used to describe variation (one standard deviation) of the data compared with the mean of the data. σ_X and $\hat{\sigma}_X$ are population X standard deviation and estimate population X standard deviation. It is commonly used in marine research and has been widely applied or accepted by fisheries managers and scientists as a measure the quality of data or estimates. Let define $q_{X,0.025}$ be the 2.5% quantile of data X. We define the ad hoc CV for non-normal distribution as

$$CV_X = \frac{q_{X,0.8413} - q_{X,0.1587}}{2\mu_X} \approx \frac{\hat{q}_{X,0.8413} - \hat{q}_{X,0.1587}}{2\overline{X}} \ .$$

For the sample mean, we use

$$CV_{\overline{X}} = \frac{q_{X,0.8413} - q_{X,0.1587}}{2\sqrt{n}\mu_X} \approx \frac{\hat{q}_{X,0.8413} - \hat{q}_{X,0.1587}}{2\sqrt{n}\overline{X}} \ ,$$

where n is the sample mean.

The sample mean of the CPUE in each year was compared with the estimates resulted from delta lognormal model. Delta method (Seber 1982) was used to estimate the overall variance in the sample mean.

Northern California CPFV CPUE

The CDFG Central California Marine Sport Fish Project has been collecting catch and effort data onboard recreational Commercial Passenger Fishing Vessels (CPFV) from 1987 to 1998. Data were collected from trips originating out of northern California ports from Port San Luis to Fort Bragg. Observers collected data on catch, number of fishers and time spent fishing at each location fished for the entire day (personal communication, Deb Wilson-VanDanberg CDFG, 2005). We also explored another version of CPFV data provided by Don Pearson at the SWFSC NOAA. CPUE was calculated as yelloweye catch per angler-hour (Table 16, Figure 6).

Oregon CPUE

Since the late 1970s, samplers with the Oregon Department of Fish and Wildlife (**ODFW**) have conducted dockside interviews and collected recreational catch and effort data from marine sport anglers fishing from boats as they returned to ports along the Oregon coast. Until the mid-1990s the program focused on the ocean sport fishery for Pacific salmon, with sampling effort concentrated during the summer salmon fishing seasons. There was limited sampling to measure the species compositions of the non-salmonid, general categories (rockfish, flatfish, and miscellaneous), but the data collection procedures for bottom-fish were ad hoc, involving weekly data sheets with running tallies of the species seen during some unknown fraction of the interviewed angling trips. More detailed and rigorous sampling for species composition began in 1999. Through 1987 the species composition data were collected on the basis of the *Trip-Type* (bottom-fish versus salmon), but from 1988 through 1998 they were collected by *Boat-Type* (charter versus private), without regard to the *Trip-Type*. During all years of the sampling program the interviewers collected data on rockfish catch (numbers of fish) and effort (number of boat trips and number of angler trips) on the basis of both *Trip-* and *Boat-Type*.

The Oregon sport boat catch and effort data series for yelloweye rockfish was used in the 2001 stock assessment (as well as the 2002 and August 2005 updates) to develop a catch-per-unit-effort (**CPUE**) abundance index. The data series provided previously by ODFW suffered from two major flaws. First, in the previous data series the species composition estimates (yelloweye rockfish as a percent of the total catch of rockfish) that were used for estimating the catch of yelloweye rockfish were not derived consistently over the entire time series. For the period 1979-87 the species composition estimates were derived only from bottom-fish trips. In later years, when the species composition data were collected by *Boat-* but not *Trip-Type*, the species composition estimates included data from "combination trips", which were directed at catching salmon and possibly bottom-fish as well. The data available for 1979-87 indicate that there can be large differences in rockfish species composition between bottom-fish versus combination trips. Second, the previous catch and effort data series was inconsistent in its measure of fishing effort. The rockfish catch and effort data for 1979-87, and 1999 was based only on bottom-fish trips, but for 1994-98 the series included trips directed at salmon and combination trips.

The revised Oregon sport boat catch and effort data series for yelloweye rockfish, compiled for CPUE analysis in the current assessment, rectified the flaws in the previous data series. First, the species composition data (used to estimate percent yelloweye rockfish by *Year*, *Month*, *Port*) were pooled across bottom-fish and salmons trips (by *Year*, *Month*, *Port*) to maintain consistency across the entire time series. Second, the rockfish catch and effort data (by *Year*, *Month*, *Port*) were taken only from trips designated in the database as bottom-fish trips.

Another change in the process for estimating the revised catch, effort, and CPUE series for yelloweye rockfish was in the treatment of *Year*, *Month*, *Port* cells for which there were no or few species composition data. A GLM with terms for *Year* + *Month* + *Port* was applied to the logits of the available data on the percent yelloweye. Coefficients from the GLM were then used to estimate the percent yelloweye and applied to any *Year*, *Month*, *Port* cells that had less than 100 rockfish sampled for species composition. These GLM coefficients were not used in developing the estimates of total Oregon recreational catch of yelloweye rockfish.

Annual mean CPUE was then estimated by applying a general linear model to the revised catch and effort information. Data were log transformed and normality was assumed. Factors included in the final model were Year, Month, and Port. Back-transformed least square means of the Year factor were calculated as annual mean CPUE used in the current assessment (Table 16, Figure 6).

Washington CPUE

April-September estimates of catch and effort (by trip type) for coastal Washington ports are available from the WDFW Ocean Sampling Program since 1984. Directed halibut trips were pooled with bottomfish trips until 1989. However, pre-1990 sample data are not currently available and are therefore not included in this analysis. Yelloweye abundance trends for bottomfish-only and directed halibut trips were explored (Figure 7).

MRFSS CPUE

RecFIN Trip-level summaries of party-boat catch and angler-effort for northern California and Oregon were provided by Wade VanBuskirk, (personal communication). These RecFIN intercept data reflect sampling and interviews conducted at the end of a fishing trip, and do not include information on specific fishing locations. These data include both relevant trips, in which yelloweye rockfish were reasonably likely to be taken, and non-relevant trip such as trips targeting salmon or tuna, two methods were used to obtain a sub-set of the trip data that would be appropriate for calculating yelloweye rockfish CPUE. The first method was by selecting trips targeting bottomfish, lingcod, and rockfish. Delta-lognormal model was applied to this sub-set to calculate CPUE. The second method was by using the logistic regression method (Stephens and MacCall 2004). This method uses the species composition from each trip catches to determine whether yelloweye rockfish were likely to have been encountered on that trip. Alec McCall at Southwest Fisheries Science Center (**SWFSC**) graciously provided this analysis for the northern California.

For the logistic filtering method, the top 50 species in frequency of occurrence for each region were extracted, and yelloweye rockfish were separated as being the target species. The remaining 49 species served as potential explanatory variables. Three species of salmon were combined into a single category. This resulted in 47 “species” other than yelloweye rockfish being considered in the northern California analysis. Logistic regression of yelloweye rockfish presence/absence on categorical presence/absence of these explanatory species provided predicted probabilities that yelloweye rockfish would be taken on a trip, given the other species that were taken on that trip. Prior to the analysis, some trips were excluded from the data set if they were too short (<0.25hr) or too long (>14hr).
Defining the appropriate subset of the data for use in calculating CPUE requires establishing a

threshold probability for inclusion. The threshold probability recommended by Stephens and MacCall (2004) is based on an equal number of false negatives (trips that are excluded from the selected set, but the target is present) and false positives (trips that are included in the selected set, but for which the target is absent). This threshold probability values was 0.4 for the northern California RecFIN data. However it may be possible to gain precision by increasing the number of positive occurrences of the target species in the subset, i.e., by reducing the number of false negatives despite an increase in false positives. Because yelloweye rockfish are relatively rare in the RecFIN data, the threshold was reduced to 0.08, and 59 additional trips below this threshold that caught yelloweye were also included. One year did not appear to be sampled well: Waves 1 to 4 in year 1993 were sampled too thinly to be of use, so trips from year 1993 were deleted from consideration.

The abundance index is calculated from the retained trips by a GLM using a delta-lognormal distribution (R language code provided by Edward Dick, NMFS). A gamma distribution was considered for the positive record, but was rejected based on a large difference in AIC (AIC for gamma model was –2118.55; AIC for lognormal model was –2230.46).

The final northern California GLM included 21 year-effects, 6 wave effects. The year effects serve as the abundance index (Figure 9). Precision of the estimated year effects was estimated by use of a jackknife procedure.

Northern California CPUE indices calculated from the two methods both showed a declining trend (Figure 9). Oregon yelloweye CPUE trend based on RecFIN data is similar to the trend based on ODFW survey data (Figure 8). RecFIN data collected during 1987 and 1988 were excluded from the assessment models due to species identification problem in these two years (Russ Porter, pers. comm.).

2.2 Fishery Independent data

NMFS Trawl Survey

The National Marine Fisheries Service (**NMFS**) triennial trawl survey has covered a wide range of depths off California, Oregon and Washington since 1977. Yelloweye rockfish inhabit areas typically inaccessible to trawl gear and, as a result, were infrequently caught. Most yelloweye rockfish are caught on and near Hecate Bank off central Oregon and off northern Washington (Figure 16). Estimated biomass by statistical area is summarized in Table 21. Given the low frequency of positive tows, NMFS trawl survey probably does not sample yelloweye habitat consistently and may not be a reliable indicator of abundance. NMFS trawl survey data were not incorporated into this or any of the last assessments.

IPHC longline survey

The International Pacific Halibut Commission (**IPHC**) has conducted longline surveys off Oregon and Washington coast since 1997 (Figures 10-14). These are standardized fixed station surveys with 78, 71, 84, and 85 stations in 1999, 2001, and 2002-2005, respectively. Data collected during 1997 survey were excluded due to the differences in station locations (Figures 10-14). In 1997 and 2001, yelloweye catches were observed for the first 20 hooks of each skate. There were 100 hooks on each skate. Yelloweye catches were expanded from the observed catches. For 2002 – 2005, all hooks were observed for rockfish catches. Fishing gear between the Washington line fishery and the IPHC survey is comparable and both fish the Northern Washington waters off shore of Cape Flattery; and length composition between the fishery and survey is similarly comparable (Figure 18).

2002 US Vancouver Submersible Survey

Only one survey has been conducted (Jagielo, WDFW personal communication) and we therefore do not have inter-annual comparison of biomass estimates. This point estimate was incorporated into an alternate Washington model to allow for useful comparison to other model runs. If additional surveys were conducted on a more routine basis, a time series of yelloweye rockfish density data could be used to develop a more reliable estimate of abundance. Further, because this species cannot be sampled using traditional survey techniques, these data will likely provide the only alternative for development of future demographic models of the yelloweye rockfish population abundance.

To our knowledge, submersible survey data have been used in only two other assessments. In Southeast Alaska, O'Connell *et al.* (2004) have used the submersible visual transect approach to estimate the biomass of yelloweye rockfish for the North Pacific Fishery Management Council (**NPFMC**); and in California, submersible survey information collected by Yoklavich *et al.* (to quantify the biomass of cowcod (*Sebastes levis*) for PFMC management was used in the most recent assessment.

Fifty submersible dive sites ranging in depth from 102 to 225m were randomly sampled throughout the untrawlable habitat sampling stratum between August 18th-28th, 2002 (Figure 19a). In total, an estimated 276,258 m^2 was covered across all sites (Table 22). Overall, transect duration averaged 61 min., width averaged 2.52m, length averaged 2183m, and submersible speed averaged 0.60 m/second.

While yelloweye rockfish occurred in 24 of the 50 nominally untrawlable submersible dive sites in 2002, they occurred in only 2 of the 25 of the 2001 NMFS trawl survey tows within the 55-183m U.S (Figure 19b). Vancouver INPFC Area strata. With the exception of Dover sole, densities of the seven target species were higher in the untrawlable area compared to the trawlable area. Approximately 16% of the US Vancouver INPFC statistical area is considered untrawlable, vs. 84% deemed to be trawlable (Zimmermann 2003). When the relative size of these survey sampling strata are accounted for, point estimates of population numbers were higher in the untrawlable area by a factor of 9 (canary rockfish), 5 (yelloweye rockfish), 4 (Pacific halibut), and 3 (lingcod), respectively; and higher in the trawlable area by a factor of 11 (Dover sole), 3 (petrale sole), and 2 (yellowtail rockfish), respectively.

Size distributions of fish sampled in the submersible survey were similar to those of fish sampled in the trawl survey, with the exception of Pacific halibut, which tended to be larger than those in the trawl survey. Mean sizes of fish collected in the submersible survey were 47.9 cm (yelloweye rockfish), 44.1 cm (canary rockfish), 44.2 cm (yellowtail rockfish), 58.6 cm (lingcod), 34.8 cm (petrale sole), 33.0 cm (Dover sole), and 65.8 cm (Pacific halibut). Mean sizes from the trawl survey were 45.3 cm (canary rockfish), 46.4 cm (yellowtail rockfish), 58.2 cm (lingcod), 35.2 cm (petrale sole), 36.0 cm (Dover sole), and 86.2 cm (Pacific halibut), respectively.

Estimates of yellow biomass compared favorably with estimates reported by Methot *et al.* (2002) that estimated a total coastal Washington biomass of 542 mt. This compares to a submersible survey estimate of 292 mt in the untrawlable zone; and a NMFS Trawl survey estimate of 101 mt in the trawlable portion of the U.S. Vancouver INPFC statistical area, which represents only the northern portion of the Washington coast (Tables 23 and 24).

2.3 History of modeling approaches

Yelloweye were first addressed as part of the "remaining rockfish" assessment completed in 1996. This assessment included a number of previously un-assessed rockfish species managed as the "*Sebastes* complex". Rogers *et al.* (1996) estimated a yelloweye rockfish Allowable

Biological Catch (**ABC**) of 39 mt for the Northern area (Columbia and Vancouver) based on biomass estimates from the triennial trawl survey and assumptions about natural mortality (**M**) and catchability (**Q**). No separate yelloweye ABC was estimated for the Southern area (Monterey and Conception), where yelloweye rockfish were incorporated with the "other rockfish" assemblage ABC.

Model description for the 2001 stock assessment
Wallace (2001) used the length-based version of Stock Synthesis (Methot 1990) to model the northern California and Oregon regions separately. Growth was estimated externally to the model. Sport CPUE and sport and commercial size composition data were included in the model. The modeled time period extended from 1970 through 2000 and year-specific recruitments were estimated without constraint by a spawner-recruitment curve. The assessment examined both increasing natural mortality with age and dome-shaped selectivity with size as alternative factors to improve the fit to the data. Alternative model configurations found that increasing natural mortality with age provided a somewhat better fit to the data, but there were no age data included in the 2001 model, and much of an increase in M would be inconsistent with direct examination of age data through the catch curve analysis documented above.

Model description for the 2002 stock assessment
The length-based version of Stock Synthesis was also employed in the 2002 evaluation (Methot *et al.* 2002). There were a number of important differences in model configuration from Wallace (2001) that include: 1) inclusion of Washington catch, CPUE, size and age data, 2) inclusion of age composition data from all three states as available and update of size composition data, 3) inclusion of mean length-at-age data from each data source to aid in the simultaneous estimation of growth parameters and size-selectivity, 4) allowing all fishery sectors to have dome-shaped selectivity 5) including emphasis (0.5) on the spawner-recruitment curve and estimating the curvature (steepness) of this curve, 6) starting in 1955 rather than 1970 to better allow for potential long-term patterns in recruitment, and 7) use of constant natural mortality of 0.045.

Model description for the 2005 stock assessment
The 2005 assessment was a simple update of the 2002 model that included a revised catch time series and additional age and length composition information. The assessment used the Stock Synthesis 2 V1.19 modeling framework written by Dr. Richard Methot at the NOAA Fisheries Northwest Fisheries Science Center (**NWFSC**).

2.4 Model description for the current stock assessment

This assessment employed the Stock Synthesis 2 V1.21 modeling framework written by Dr. Richard Methot at the NWFSC and modeling framework is described in documentation available from NWFSC (Methot, 2005). The 2006 yelloweye stock assessment includes a number of model specifications carried over from the previous assessments, which are described in each of the sub-sections below.

A coastwide model treats yelloweye as one coastwide stock such that the information from each of the States (WOC) is applied across all three areas to represent the sum of l the processes operating in each area. This presumes that differences in recruitment and mortality off each state are negligible and that a coastwide model captures the common recruitment and mortality trends.

Although there is no apparent genetic distinction between areas, yelloweye are considered to be sedentary, habitat specific, and non-migratory signifying a slow rate of mixing where area-specific patterns are likely to persist for some time. This life history feature would support area-specific model configurations. Additionally, differences in CPUE trends and exploitation between areas further indicate the need for area-specific model configurations. For these reasons, we believe that separate area models for California and Oregon better represent sub-stock dynamics than the coastwise model and should be used for management considerations.

Area Modeling

The 2002 assessment (Methot *et al.* 2002) explored area-specific model configurations by constructing models that included data from subsets of the coast, and compared these results to the baseline coastwide model. The authors (Methot *et al.* 2002) concluded that the estimated differences between the areas (states) were neither sufficiently different nor sufficiently precisely estimated to recommend that management be based on area-specific population models. They suggested that area-specific modeling should remain in consideration as new data become available.

In the current assessment, we explored separate area models for each Washington, Oregon and California. For a single coastwide model the implicit assumption is that either: (1) similar recruitment and mortality occur off each state, or (2) there is sufficient mixing between areas within the coast so that any differences in recruitment or mortality among areas are obscured in the coastwide mixing. Thus, a coastwide model will either capture the common recruitment and mortality trends or it will represent the sum of all the processes operating in each area.

The independent area model for California waters included all data elements (Indices, compositions etc.) originating from California waters. A similar construct was used for both Oregon and Washington models, with the exception of including all (Oregon and Washington) IPHC length compositions in both area model specifications. A separate IPHC survey index was constructed for data originating from coastal waters off each state. The IPHC survey does not extend into California waters. Each area included a sport CPUE index and combined catch, age and length composition information for separate commercial and sport fisheries. In addition, Washington included a commercial line fishery that began targeting yelloweye rockfish in 2000. CPUE time series are assumed to occur instantaneously at the middle of the year.

As in the last assessment, the model combines male and female data into a single morph. Growth is modeled by using the von Bertalanffy growth equation and is assumed to be equal between female and male. A constant (but estimated) CV is used over time. Maturity is assumed to be a logistic function of length and is estimated externally to SS2. Size data were condensed into 2-cm length bins ranging from 18 cm to 76 cm. Only 0.1% of the observed fish are greater than 76 cm, thus 76 cm was considered to be a reasonable accumulator bin. Age data were condensed into 1-age bins for ages 3 to 29, and into 5-age bins for ages 30-70. All fish above age 70 were accumulated in the 70+ age bin. In addition to providing the model with size and age composition vectors, we calculated the mean length at each age-bin for each gear/state strata (and the number of fish in each age-bin used for the calculation) and assigned this vector to a year that supplied much of the age data. In SS2, the mean size at-age-bin is compared to the expected value for this quantity that takes into account the effects of ageing error and size-selectivity of the fishery. Sample sizes used in this assessment are the number of individual fish sampled for all length and age frequencies with a maximum sample size set at 200.

Natural Mortality and Recruitment

In the current assessment natural mortality was estimated within the coastwide model to be 0.036 across all ages and then assumed to be 0.036 in all area specific models. This compares to natural mortality estimates of 0.02 (O'Connell, 2005) and 0.033 (Chi Hong, DFO, Canada pers. communication) used in the SE Alaska, U.S. and British Columbia, Canada, respectively. The stock-recruitment function was a Beverton-Holt parameterization, with the log of mean unexploited recruitment estimated and steepness (h) of the stock recruit function fixed at 0.45, which compares to 0.437 in the last two assessments. The range of years where year-specific recruitment deviations were estimated was determined by examination of the CV of the recruitment and recruitment deviation estimates. The standard deviation of the recruitment (σ_R) is treated as a fixed input quantity where the initial value examined was set at the 2002 model (Methot 2002) derived value of 0.4 and following a series of model sensitivity analyses was set at STAR Panel recommended 0.5 for all models with the exception of the Washington model that would not converge at values higher than 0.4 and therefore σ_R fixed at the initial value of 0.4.

Selectivity
Natural mortality is confounded with selectivity in age-structured models. In this assessment we assumed logistic form of selectivity and then estimated natural mortality in the current model.

Selectivity is assumed to be length based for all fleets, and to be logistic in all base model runs (SS2 Type1). During model development we did explored a double logistic shape (SS2 Type 2) for all fisheries and various combinations of logistic and double logistic. Selectivity for the CPUE indices was mirrored from the respective State sport fisheries. Fishery selectivity was assumed to be time-invariant for all model runs.

Lambdas
Model runs for the 2005 assessment indicated that the model's ability to fit the age and size composition data implied an effective sample size that was approximately 60% of the observed sample size values. Because sample size and emphasis factors are algebraically equivalent, this reduction in each observation's sample size was subsequently implemented by reducing all the size and age composition emphasis factors from 1.0 to 0.6. Emphasis factors (lambdas) for size, age and mean size likelihood components were set similarly for all base model runs. We also set CPUE likelihood components to 1.0 and the baseline model was set to have an emphasis level of 0.5 on deviations from the S/R curve and 0.0001 for the S/R time series as was done in the previous assessment. Lastly, lambda for the initial equilibrium catch was set to 1.0 and parameter prior lambda to 1.0.

Model estimated parameters
Table 26 lists all estimated and assumed model parameters.

Model time period
The modeling time period begins in 1925 and the population is assumed to be in equilibrium.

2.5 Priors

No informative priors were set for most model parameters and parameter bounds were set to be sufficiently wide to avoid truncating the searching procedure during maximum likelihood estimation. Informative priors were set for both steepness and natural mortality and were based on values derived during the STAR Panel meeting stock assessment. The Washington model differed significantly to other area models in that we had to set informative priors on the indices (10) and severely limit our estimated recruitment deviations to years 1987-1992 to obtain convergence.

2.6 Model selection and evaluation

The final base model represents a close approximation to the SS2 model with logistic selectivity while re-estimating all parameters estimated in the last assessment with data time series appended since 2005. Steepness was fixed at the slightly revised value of 0.45 (instead of 0.437) and SigR = 0.5 in all model runs with the exception of the sensitivity analysis. The Coastwide model fit all of the indices fairly well with the exception of the IPHC Halibut survey (Figure 30).

We evaluated the convergence status of the base model(s) with multiple model runs that explored the ability of the model to recover similar maximum likelihood estimates when initialized from disperse starting values. All model parameters were jittered by 0.5% of the range of the bounds from the maximum likelihood values for a set of 24 convergence runs. Starting values in some runs were outside the range of the model's ability to successfully complete and the run was either terminated early or Hessian matrix was not positive definite. Results for all successful runs show little variability in the objective function and current depletion for all completed runs (Table 27), indicating that the base case model estimates are unlikely to represent local minima.

2.6 Base-run(s) results selection and evaluation

The base case model population trajectory is similar to that predicted during the last stock, although estimated logistic selectivity is quite dissimilar compare to double logistic used in the last two assessments (Figures 20 and 21). Decline in biomass is significant and uninterrupted beginning in the 1970's reaching lowest levels in 2000 (Table 28 and Figure 22). Population numbers at age indicate a substantial loss of the oldest age classes related to poor recruitment and/or overexploitation across the time series (Table 29 and Figure 23). Model fit the declining trend observed in the indices of abundance from all States fairly well, but fit the shorter more recent time series from the IPHC survey poorly (Figures 30-32). The lack of fit to the IHPC CPUE series is likely partially due to assuming average recruitment in the most recent years based on minimal data on younger age classes. There were no major conflicts between Model estimates and observed size/age composition data (Figures 33-39).

2.7 Uncertainty and sensitivity analyses.

We used a number of alternate models (SS2 version 1.21) to assess the sensitivity of the assessment results to the specific model configuration used in the base case. A profile of likelihood and other model outcomes over a range of fixed values for the initial recruitment level (virgin recruitment) are presented in Table 30 and Figure 25. In Table 31 and Figure 25 we show likelihood values and other model results over a range of fixed values for steepness. To assess the effect on model fit to emphasis on the SR curve we profiled across increasing lambda values on the SR curve and display the results in Table 32 and Figure 24. In Table 33 we assess the effect on model fit to increasing emphasis on length, age and size compositions.

2.8 Alternate model(s)

Double logistic selectivity was evaluated and presented during the STAR Panel (Table 26 b). Both the STAR Panel and STAT Team were in agreement that the descending limb parameters were poorly estimated and confounded with other parameters.

3.0 Rebuilding projections

Rebuilding projections are based on results from the SSC default rebuilding analysis simulation software and specific detail can be obtained from PFMC "Updated Rebuilding Analysis for Yelloweye Rockfish Based on the 2006 Stock Assessment" document (Tsou and Wallace, 2006).

The results from this analysis indicate that the yelloweye rockfish stock is behind in rebuilding schedule and will take longer time to rebuild then as indicated in the 2002 rebuilding analysis (Methot and Piner 2002). New TMIN of 2046 and TMAX of 2096 are 19 and 25 years longer than the TMIN of 2027 and TMAX of 2071 reported in the previous analysis. Probabilities of recovery by current TTARGET (2058) and TMAX (2071) based on current SPR are low. Probability of recovery by re-estimated TMAX (2080) with current SPR is also low. The current harvest control rule (F = 0.0153) is too high to rebuild the stock by current TTARGET and current TMAX. Based on SSC run 6 settings, where TMAX and SPR are re-estimated and Po = 80%, OY is projected to be 12.6 mt in 2007 and the coastwide stock is estimated to rebuild in year 2096 (Table 41).

4.0 Reference Points (biomass and exploitation rate)

The current assessment uses the F50% Council default harvest policy to make harvest projections for yelloweye rockfish. Given that yelloweye rockfish spawning stock biomass (SB) was less than the Council's default harvest control rule of 25% of the unexploited level (based on coastwide or independent area models) the stock is considered to be "overfished". Benchmark fishing mortality rates for each area model and the coastwide model are presented in Table 39. Plot of F/F_{MSY} and B/B_{MSY} indicate that harvest have far exceeded F_{MSY} since the mid 1970's (Figure 29).

5.0 Harvest projections

Fishing mortality benchmarks and 10-year yield projections based on SS2 V1.21 model output can be found in Table 40 and Table 41 respectively.

6.0 Research Needs

Additional effort to collect age and maturity data is essential for improved population assessment. Collection of these data can only be accomplished through research studies and/or by onboard observers because this species is now prohibited. Increased effort toward habitat mapping and in-situ observation of behavior will provide information on the essential habitat and distribution for this species. A study of the role of Marine Protected Areas in harvest management will be beneficial for sedentary species like yelloweye rockfish. Genetic study is required as a first step in delimiting stock boundaries for this species.

Alternative survey such as the in-situ 2002 US Vancouver submersible survey in untrawlable habitat is required for future assessment of yelloweye rebuilding status. This study has demonstrated that submersible visual transect surveys can provide a unique alternative method for estimating demersal fish biomass in habitats not accessible to conventional survey tools. For example, because of the low frequency of yelloweye rockfish encountered in the NMFS shelf trawl survey tows, those data were not considered a reliable indicator of abundance and were not used in the 2002 yelloweye stock assessment for PFMC (Methot *et al.* 2002). Results from this study support this conclusion and illustrate the need for large-scale surveys to assess bottomfish densities in habitats that are not accessible to trawl survey gear. Further, stratified random sampling designs should be employed with sample sizes sufficient to ensure acceptable levels of statistical power (Jagielo *et al.* 2003). At present, the in-situ visual transect submersible survey method appears to be a useful tool for this purpose, and the utility of this method will likely improve further with technological advances such as the 3-Beam Quantitative Mensuration System (**QMS**).

7.0 Acknowledgments

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8.0 Literature cited

Andrews, A.H., G. Cailliet, K. Cole, K. Munk, M. Mahoney and V. O'Connell. 2001. Radiometric age validation of the yelloweye rockfish *(Sebastes ruberrimus*) from southeastern Alaska. Manuscript recently submitted to the Indo-Pacific Fish Conference Proceedings.

Barss, W.H. 1989. Maturity and reproductive cycle for 35 species from the family *Scorpaenidae* found off Oregon. Portland, OR: Oregon Department of Fish and Game. Report No. 89-7. 36 p. Crone, P. 1995. CJFAS.

Bureau of Marine Fisheries, (*staff of*). 1949. The commercial fish catch of California for the year 1947 with an historical review 1916-1947. Calif. Fish and Game *Fish Bulletin*, No. 74.

Cheng, Y.W. and M. Gallinat. 2004. Statistical analysis of the relationship among environmental variables, inter-annual variability and smolt trap efficiency of salmonids in the Tucannon River, *Fisheries Research*, 70, 229-238.

Efron, B. 1982. The Jacknife, the Bootstrap and Other Resampling Plans. SIAM (Regional Conference Series in Applied Mathematics, 38). Philadelphia.

Eschmeyer, W.N. and E.S. Herald. 1983. A field guide to Pacific coast fishes North America. HoughtonMifflin CO., Boston, MA. 336 p.

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Canadian Journal of Fisheries and Aquatic Science. Vol. 37: 2272—2275.

Hall P. 1992. *The Bootstrap and Edgeworth Expansion*, Springer, New York.

Heimann R.F.G. and J.G Carlisle. 1970. The California marine fish catch for 1968 *and* historical review 1916-68. Calif. Fish and Game Fish Bulletin 149.

Heincke, F., 1913. Investigations on the plaice. Plaice Fisheries and Protective Measures. Report 1. Rapp. PV. Reun. Cons. Perm. Int. Explor. Mer. 16. 67p.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fish. Bull. 82(10):898-903.

Jackson, J. and Y.W. Cheng. 2001. Improving parameter estimation for daily egg production method of stock assessment of pink snapper in Shark Bay, Western Australia. *Journal of Agricultural, Biological and Environmental Statistics* 6: 243-257.

Love, M.S., L. Thorsteinson, C.W. Mecklenburg, and T.A. Mecklenburg. *In Preparation (January 2000*). A checklist of marine and estuarine fishes of the Northeast Pacific, from Alaska to Baja California. National Biological Service. Located at website http://id www.ucsb.edu/lovelab/home.html

Love, M. 1996. Probably More Than You Want To Know About The Fishes Of The Pacific Coast. Really Big Press, Santa Barbara, California, 381 p.

MacCall A.D., S.Ralston, D. Pearson and E. Williams. 1999. Status of Boccaccio off California in 1999 and Outlook for the next Millennium. *In* Appendix to the Status of the Pacific Coast

Groundfish Fishery Through 1999 and Recommended Acceptable Biological Catches for 2000 Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, Ore. 97210.

McCullagh, P. and J.A. Nelder. 1989. *Generalized Linear Models*. London: Chapman and Hall.

McClure, R.E. 1982. Neritic reef fishes off central Oregon: Aspects of life histories and the recreational fishery. M.S. Thesis, Oregon State University. 94 p.

Methot, R.D. 1990. Synthesis model: an adaptive framework for analysis of diverse stock assessment data. Int. N. Pac. Fish. Comm. Bull. 50:259-277.

Methot, R., F. Wallace, and K. Piner. 2002. Status of Yelloweye Rockfish off the U.S. West Coast in 2002. *In* Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, Ore. 97210.

Miller, D.J. and D. Gotshall. 1965. Ocean sportfish catch and effort from Oregon to Point Arguello, California. Calif. Fish and Game *Fish Bulletin* 130.

Nitsos, R.J. and P.H. Reed. 1965. The animal food fishery in California, 1961-1962. *Calif. Fish and Game*, 51(1):16-27.

O'Connell 2005. Demersal rockfish assessment. NPFMC

Phillips, J.B. 1939. The rockfish of the Monterey wholesale fish markets. *California Fish and Game*, 25(3).

Reilly, P.N. D. Wilson-Vandenberg, R.N. Lea, C. Wilson, and M. Sullivan. 1994. Recreational angler's guide to the common nearshore fishes of Northern and Central California. California Department of Fish and Game, Marine Resources Leaflet.

Ricker, W.E. 1975. Computation And interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. 191 p.

Robson, D.S. and D.G. Chapman, 1961. Catch curves and mortality rates. Trans. Am. Fish. Soc. 90(2): 181- 189

Rogers, J.B., M. Wilkins, D. Kamikawa, F. Wallace, T. Builder, M. Zimmerman, M. Kander and B. Culver. 1996. Status of the Remaining Rockfish in the Sebastes Complex in 1996 and recommendations for DRAFT #2 post-STAR Page 18 8/23/02 management in 1997. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210.

Rosenthal, R.J., L.J. Field, D. Myer. 1981. Survey of nearshore bottomfish in the outside waters of southeastern Ala ska. Alaska Department of Fish and Game. 91 p.

Rosenthal, R.J., L. Haldorson, L.J. Field, V. Moran-O'Connell, and M.G. LaRiviere. 1982. Inshore and shallow offhshore bottomfish resources in the southeastern Gulf of Alaska. Alaska Coastal Research. 166 p.

Rosenthal, R.J., V. Moran-O'Connell, and M.C. Murphy. 1988. Feeding ecology of ten species of rockfishes (*Scorpaenidae*) from the Gulf of Alaska. California Department of Fish and Game 74(1):16-37.

Seber, G.A.F. 1982. The estimation of animal abundance and related parameters. 2nd ed. Charles Griffin & Co. London.

Syrjala, S.E. 2000. Critique on the use of the delta distribution for the analysis of trawl survey data. ICES Journal of Marine Science 57: 831-842.

Tagart J.V., F. Wallace and J. Ianelli. 2000. Status of the yellowtail rockfish resource in 2000. *In* Appendix to the Status of the Pacific Coast Groundfish Fishery Through 2000 and Recommended Acceptable Biological Catches for 2001 Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210.

Tagart J.V. and D.K. Kimura. 1982. Review of Washington's coastal trawl fisheries. Wash. Dept. Fisheries Tech. Rept. No. 68, 66p.

Wallace, F. 2001. Status of the yelloweye rockfish resource in 2001 for northern California and Oregon waters. *In* Appendix to the Status of the Pacific Coast Groundfish Fishery Through 2001 and Recommended Acceptable Biological Catches for 2002 Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, OR 97210.

Wallace, F., T. Tsou. and t. Jagielo 2005. Status of Yelloweye Rockfish off the U.S. West Coast in 2005. *In* Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 2130 SW fifth Ave. Suite 224, Portland, Ore. 97210.

Washington, P.M., R. Gowan, and D.H. Ito. 1978. A biological report on eight species of rockfish *(Sebastes* spp.) from Puget Sound, Washington. NOAA/NMFS, Northwest and Alaska Fisheries Center Processed Report, Reprint F, 50 p.

Wilson-VanDanberg, . 2005. data supplied via *personal communication.* p. 16, 1st paragraph

Yamanaka, K.L. and A.R. Kronlund. 1997. Inshore rockfish stock assessment for the west coast of Canada in 1996 and recommended yields for 1997. Canadian Technical Report of Fisheries and Aquatic Sciences No. 2175, 80 p.

Yamanaka, L., R. Withler, and K. Miller. 2001. Limited genetic structure in yelloweye rockfish *(Sebastes rubberimus*) populations of British Columbia. Abstract, 11th Western Groundfish Conference, April 24-28, 2000, Sitka, Alaska, p. 123.

Young, P.H. 1969. The California partyboat fishery 1947-1967. Calif. Fish and Game *Fish Bulletin* 145.

9.0 Tables and Figures

Table 1. Summary of estimated yelloweye rockfish catch by State and fishery since 1955. Italicized catch data indicate years where there are no data to estimate catch, but presumed by authors. Grey areas indicate an interpolated catch time series from the earliest to latest years catch estimates. Blank cells indicate catch grouped into the trawl gear column.

Coastal Washington, Oregon and California Yelloweye Rockfish Landings

Source	PacFIN and MRFSS				Tagart, PacFIN, and ODFW				Tagart, PacFIN and WDFW								
	California [1/]				Oregon [2/]				Washington [3/]				Totals				
Year	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Total
1955	24.1			14.2	*9.9*			*6.2*	*1*	*1*		1	34.9	1.0	0.0	21.4	57.3
1956	28.8			16.6	*10.1*			*6.5*	*1*	*1*		1	39.9	1.0	0.0	24.0	64.9
1957	31.5			12.4	*10.4*			*6.7*	*1*	*1*		1	42.9	1.0	0.0	20.1	64.0
1958	35.5			15.8	*10.6*			*7.0*	*1*	*1*		2	47.1	1.0	0.0	24.7	72.8
1959	30.9			12.4	*10.9*			*7.2*	*1*	*1*		2	42.7	1.0	0.0	21.6	65.3
1960	28.1			10.0	*11.1*			*7.5*	*1*	*1*		2	40.2	1.0	0.0	19.5	60.7
1961	22.6			8.3	*11.4*			*7.7*	*1*	*1*		2	34.9	1.0	0.0	18.0	53.9
1962	20.8			9.1	*11.6*			*8.0*	*1*	*1*		2	33.4	1.0	0.0	19.1	53.4
1963	25.2			9.4	*11.9*			*8.2*	*2*	*2*		3	39.0	2.0	0.0	20.6	61.6
1964	17.7			8.5	*12.1*			*8.5*	*2*	*2*		3	31.8	2.0	0.0	20.0	53.7
1965	20.7			12.5	*12.4*			*8.7*	*2*	*2*		3	35.1	2.0	0.0	24.2	61.2
1966	22.5			15.0	*12.6*			*9.0*	*2*	*2*		3	37.1	2.0	0.0	26.9	66.0
1967	22.2			16.1	*12.9*			*9.2*	*2*	*2*		3	37.1	2.0	0.0	28.3	67.4
1968	21.7			17.3	*13.1*			*9.5*	*2*	*2*		3	36.8	2.0	0.0	29.8	68.5
1969	35.2	5.3		16.8	27.2			*9.7*	*2*	*2*		3	64.4	7.3	0.0	29.5	101.2
1970	42.0	5.1		21.8	19.2			10.0	3.4	1.7	*0*	4	64.6	6.8	0.0	35.8	107.2
1971	40.9	5.9		18.1	19.0			13.1	3.2	1.4	*0*	4	63.1	7.3	0.0	35.2	105.7
1972	61.1	9.4		24.2	24.0			16.3	3.1	2.4	*0*	4	88.2	11.8	0.0	44.5	144.6
1973	81.8	9.9		29.6	22.2			19.5	5.2	2.2	*0*	4	109.3	12.1	0.0	53.1	174.4
1974	73.3	11.0		33.0	18.2			22.6	4.3	4.2	*0*	4	95.8	15.2	0.0	59.7	170.7
1975	82.6	9.8		32.0	14.8			25.8	4.3	2.8	*0*	4.0	101.7	12.6	0.0	61.7	176.0
1976	91.0	12.6		31.0	25.9			29.0	7.7	2.6	*0*	4.3	124.7	15.3	0.0	64.2	204.2
1977	89.5	11.2		27.5	29.3			32.1	12.9	4.9	0	8.8	131.7	16.1	0.0	68.4	216.2
1978	82.0	17.4		24.5	21.5	7.0		35.3	17	6.9	0	4.5	120.5	31.2	0.0	64.4	216.1
1979	112.3	22.0		29.9	54.7	7.5		38.5	18.4	10.1	0	3.5	185.4	39.6	0.0	71.8	296.8
1980	147.9	20.2		75.9	60.2	8.0		27.5	29.2	5.8	0	2.4	237.3	34.0	0.0	105.8	377.1
1981	138.7	20.4	50.7	46.9	93.7	8.5		34.2	5.3	4.4	0	3.4	237.7	33.4	50.7	84.5	406.3
1982	146.9	28.3	1.8	103.8	99.9	9.0	5.6	48.7	6.5	6.1	0	3.4	253.3	43.5	7.4	155.8	460.0
1983	56.5	0.3	0.8	51.0	177.3	15.9	0.0	62.9	6.5	10.1	0	6.7	240.3	26.3	0.8	120.6	388.0
1984	43.5	0.5	0.9	80.8	57.1	10.0	0.0	43.6	3.0	10.4	0	12.2	103.6	20.9	0.9	136.6	262.0
1985	7.3	0.9	0.6	125.8	91.9	10.0	0.0	26.8	10.5	15.9	0	8.8	109.7	26.8	0.6	161.4	298.4
1986	9.8	20.0	1.2	65.5	59.8	10.8	0.0	27.2	2.7	12.0	0	9.0	72.3	42.8	1.2	101.7	218.0
1987	16.9	33.1	3.7	75.2	65.7	15	0.0	29.4	6.0	19.1	0	10.5	88.6	67.2	3.7	115.1	274.6
1988	30.6	22.5	11.8	57.5	110.7	9.4	0.0	9.6	15.8	9.8	0	8.3	157.1	41.7	11.8	75.4	286.0
1989	9.4	34.0	6.7	58.7	169.4	10.6	0.0	16.0	27.9	11.3	0	14.6	206.7	55.9	6.7	89.3	358.6
1990	10.1	58.8	10.9	46.12	61.1	13.2	0.0	16.6	18.8	7.5	0	9.9	90.0	79.5	10.9	72.6	253.1
1991	13.9	124.0	3.2	33.57	104.6	31.3	0.0	14.9	15.8	4.6	0	18.0	134.3	159.9	3.2	66.5	363.8
1992	15.8	95.1	1.3	21.02	107.8	58	0.0	25.9	25.1	8.7	0	16.2	148.7	161.8	1.3	63.2	374.9
1993	6.2	46.1	0.6	8.5	119.3	63.9	0.0	19.7	17.6	12.2	0	18.0	143.1	122.2	0.6	46.2	312.1
1994	4.7	48.7	1.0	14	77.6	24.6	0.0	18.3	7.2	12.4	0	10.3	89.5	85.7	1.0	43.0	219.2
1995	3.6	44.2	0.7	12.6	126.3	22.8	0.0	13.8	8.1	9.9	0	9.9	138.0	76.9	0.7	36.3	251.9
1996	16.2	48.0	1.6	12.5	75.5	22.2	0.0	8.4	8.6	8.3	0	10.8	100.3	78.5	1.6	31.7	212.1
1997	6.0	55.3	0.9	15.1	71.4	44.1	0.0	14.4	6.5	12.2	0	11.4	83.9	111.6	0.9	40.9	237.3
1998	4.0	16.7	0.9	5.8	20.8	20.6	0.0	18.9	4.8	0.7	0	14.4	29.6	38.0	0.9	39.1	107.6
1999	8.7	13.4	0.1	12.6	7.1	54.2	0.0	17.8	9.9	23.0	0	10.6	25.7	90.6	0.1	41.0	157.4
2000	0.7	3.3	0.0	7.5	0.3	3.3	0.0	9.2	0.2	7.7	0	10.1	1.2	14.3	0.0	26.8	42.4
2001	0.6	3.9	0.0	4.6	0.7	5.5	0.0	3.1	0.8	21.2	0	12.5	2.1	30.6	0.0	20.3	53.0
2002	0.2	0.0	0.0	2.1	0.4	0.3	0.0	3.6	0.4	2.2	0	3.7	1.0	2.5	0.0	9.4	12.9
2003	0.0	0.0	0.0	3.7	0.8	0.2	0.0	3.8	0.2	0.3	0	2.6	1.0	0.5	0.0	10.1	11.6
2004	0.0	0.0	0.0	3.5	0.2	0.5	0.0	2.4	0.1	0.8	0	4.5	0.3	1.3	0.0	10.4	12.0
2005	1.6	0.0	0.0	3.7	0.2	4.1	0.2	4.3	0.1	4.2	0.1	5.1	1.9	8.3	0.3	13.1	23.6
	Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				Mean Annual Catch				
1980's	60.7	18.0	8.7	74.1	98.6	10.7	0.7	32.6	11.3	10.5	0.0	7.9	170.7	39.2	8.4	114.6	263.7
1990's	8.9	55.0	2.1	18.2	77.2	35.5	0.0	16.9	12.2	9.9	0.0	13.0	98.3	100.4	2.1	48.1	109.8
2000-2004	0.5	1.2	0.0	4.2	0.4	2.3	0.0	4.4	0.3	6.1	0.0	6.4	1.3	9.6	0.1	15.0	26.4

Note: GMT "Scorecard" from Nov. 2005 used for all 2005 catch estimates, [1/] 1983-2004 commercial catches from PacFIN, 1969-1982 catch assumed to be 1% of total Rockfish based on CalCom species composition estimates taken 1978-1982 after removing widow rock. Yelloweye are assumed to decline from 1% in 1969 to 0.08% of total rockfish by 1955. Trawl and hook-and-line catches grouped prior to 1969. Recreational catches 1980-2004 from RecFIN and all prior years catch (#'s of fish) assumed to be 0.5% yelloweye weighing 2.41 k (Miller and Gottshall, 1965) for all CPFV rockfish catches (Kevin Hill, NMFS personal communication) in Northern California waters and 0.025% of Southern California rockfish catches.

[2/] 1983-2004 Trawl catches from PacFIN, 1978-1983 from Tagart and Kimura (1982). 1991-2004 hook-and-line from PacFIN and 1982-1990 catches based species composition estimates taken for Washington line gears applied. Trawl and Line gear catch grouped prior to 1977 and yelloweye assumed to 1.0 % of total rockfish catch as reported in variuos Fisheries and Statistics of Oregon publications.

[3/] 1983-2004 Trawl catch from PacFIN, 1976-1982 from Tagart and Kimura (1982) then assumed to decline to 1 mt by 1955. 1970-1999 commercial line catc applies species composition estimates taken 1986-1999 to "other rockfish" catch across all years, catch then assumed to decline to 1 mt by 1955. Recreational catches from various WDF reports back to 1975, catch then assumed to decline to 1 mt.

Table 2. Differences between catch estimates used in the 2006 and 2005 assessments. Bracketed () catch indicate a reduction in catch otherwise an increase in catch. Differences in Initial equilibrium catch on first line.

#_init_equil_catch_for_each_fishery 2006-2005 values

	California		Oregon		Washington			Total		Grand
	(4.0)	7.8	(4.0)	0.8	(1.0)	0.0	0.0	(9.0)	8.6	(0.4)
Year	Rec [1/]	Com [2/]	Rec [3/]	Com [2/]	Rec [4/]	Com [2/]	Line	Rec	Com	Total
1955	(5.8)	23.1	(13.8)	8.9	(4.0)	1.0	0.0	(23.6)	33.0	9.4
1956	(3.4)	27.8	(13.5)	9.1	(4.0)	1.0	0.0	(20.9)	37.9	17.0
1957	(7.6)	30.5	(13.3)	9.4	(4.0)	1.0	0.0	(24.9)	40.9	16.0
1958	(4.2)	34.5	(13.0)	9.6	(3.0)	1.0	0.0	(20.2)	45.1	24.9
1959	(7.6)	29.9	(12.8)	9.9	(3.0)	1.0	0.0	(23.4)	40.8	17.4
1960	(10.0)	27.1	(12.5)	10.1	(3.0)	1.0	0.0	(25.5)	38.2	12.7
1961	(11.7)	21.6	(12.3)	10.4	(3.0)	1.0	0.0	(27.0)	33.0	6.0
1962	(10.9)	19.8	(12.0)	10.6	(3.0)	1.0	0.0	(25.9)	31.4	5.5
1963	(10.6)	24.2	(11.8)	10.9	(2.0)	3.0	0.0	(24.4)	38.1	13.7
1964	(11.5)	16.7	(11.5)	11.1	(2.0)	3.0	0.0	(25.0)	30.8	5.8
1965	(7.5)	19.7	(11.3)	11.4	(2.0)	3.0	0.0	(20.8)	34.1	13.3
1966	(5.0)	21.5	(11.0)	11.6	(2.0)	3.0	0.0	(18.0)	36.1	18.1
1967	(3.9)	21.2	(10.8)	11.9	(2.0)	3.0	0.0	(16.7)	36.1	19.4
1968	(2.7)	20.7	(10.5)	12.1	(2.0)	3.0	0.0	(15.2)	35.8	20.6
1969	(3.2)	39.5	(10.3)	26.2	(2.0)	3.0	0.0	(15.5)	68.7	53.2
1970	(3.3)	45.9	(13.5)	18.7	(1.0)	4.1	0.0	(17.8)	68.7	50.9
1971	(12.1)	41.6	(13.9)	18.5	(1.0)	3.6	0.0	(27.0)	63.7	36.7
1972	(11.1)	61.4	(14.2)	20.5	(1.0)	3.8	0.0	(26.3)	85.7	59.4
1973	(10.7)	78.5	(14.5)	15.7	(1.0)	6.4	0.0	(26.2)	100.6	74.4
1974	(12.4)	67.1	(14.9)	8.7	(1.0)	7.5	0.0	(28.3)	83.3	55.0
1975	(18.5)	71.2	(15.2)	2.3	0.0	4.3	0.0	(33.7)	77.8	44.1
1976	(24.6)	78.5	(15.5)	10.4	0.0	7.0	0.0	(40.1)	95.9	55.8
1977	(33.2)	71.5	(15.9)	10.8	0.0	16.9	0.0	(49.1)	99.2	50.1
1978	(41.2)	66.1	(16.3)	7.0	0.0	22.7	0.0	(57.5)	95.8	38.3
1979	(40.9)	97.0	(16.6)	7.5	1.2	22.5	0.0	(56.3)	127.0	70.7
1980	0.0	126.9	(8.0)	8.0	0.0	4.3	0.0	(8.0)	139.2	131.2
1981	0.0	(158.0)	10.0	8.5	0.0	6.1	0.0	10.0	(143.4)	(133.4)
1982	0.0	(24.8)	9.6	94.5	0.0	7.3	0.0	9.6	77.0	86.6
1983	0.0	0.0	(3.4)	15.9	0.0	8.9	0.0	(3.4)	24.8	21.4
1984	0.0	0.0	9.8	10.0	0.0	8.4	0.0	9.8	18.4	28.2
1985	0.0	0.0	(3.6)	10.0	0.0	9.6	0.0	(3.6)	19.6	16.0
1986	0.0	0.0	9.1	5.1	0.0	5.6	0.0	9.1	10.7	19.8
1987	0.0	0.0	(6.3)	6.3	0.0	11.0	0.0	(6.3)	17.3	11.0
1988	0.0	0.0	1.7	(5.0)	0.0	5.5	0.0	1.7	0.5	2.2
1989	0.0	0.0	1.5	(9.4)	0.0	8.8	0.0	1.5	(0.6)	0.9
1990	0.0	0.0	(2.0)	(12.5)	0.0	5.8	0.0	(2.0)	(6.7)	(8.7)
1991	0.0	0.0	(3.9)	0.0	0.0	2.8	0.0	(3.9)	2.8	(1.1)
1992	0.0	0.0	(0.1)	0.0	0.0	5.4	0.0	(0.1)	5.4	5.3
1993	0.0	0.0	(1.9)	0.0	0.0	3.2	0.0	(1.9)	3.2	1.3
1994	0.0	0.0	1.5	0.0	0.0	9.6	0.0	1.5	9.6	11.1
1995	0.0	0.0	5.6	0.0	0.0	9.8	0.0	5.6	9.8	15.4
1996	0.0	0.0	(7.0)	0.0	0.0	8.3	0.0	(7.0)	8.3	1.3
1997	0.0	0.0	(4.4)	0.0	0.0	0.0	0.0	(4.4)	0.0	(4.4)
1998	0.0	0.0	1.6	0.0	0.0	0.0	0.0	1.6	0.0	1.6
1999	0.0	0.0	8.3	0.0	0.0	0.0	0.0	8.3	0.0	8.3
2000	0.0	0.0	4.4	0.0	0.0	0.0	(0.0)	4.4	(0.0)	4.4
2001	0.0	0.0	0.0	0.0	0.0	0.0	(0.1)	0.0	(0.1)	(0.1)
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	(313.6)	1000.7	(308.4)	424.7	(44.8)	248.2	(0.1)	(666.8)	1673.6	1006.8

Table 3. Historical rockfish landings in California waters from 1916 to 1955 (Heimann and Carlisle, 1970) and estimated catch of yelloweye. Catch estimates are not available for blank cells.

Historical Rockfish Landings in California

Year	Commercial Catch (mt) [1/]	CPFV Catch Catch (mt) [2/]
1916	2,231	
1917	3,526	
1918	3,739	
1919	2,449	
1920	2,555	
1921	2,160	
1922	1,956	
1923	2,312	
1924	2,151	
1925	2,490	
1926	3,421	
1927	2,899	
1928	2,912	
1929	2,738	
1930	3,277	
1931	3,301	
1932	2,557	
1933	2,172	
1934	2,088	
1935	2,191	
1936	2,088	139
1937	1,946	165
1938	1,650	163
1939	1,512	143
1940	1,620	205
1941	1,545	
1942	646	
1943	1,253	
1944	2,913	
1945	6,027	
1946	5,063	
1947	3,855	132
1948	2,952	279
1949	2,704	388
1950	3,681	462
1951	4,987	491
1952	4,866	480
1953	5,547	474
1954	5,734	782
1955	5,752	1182

1/ Commercial rockfish catch reported by Heimann and Carlisle (1970). 2/ Receational landings (#numbers offish) assumed to have an average weight of 1.5 kg.

Table 4. Historical observations of the yelloweye proportion in rockfish landings.

Source	Year of Estimate	Fishery	Proportion of Rockfish that are Yelloweye
Phillips, 1939.	1937-1938	Wholesale Monterey rockfish markets	0.6%
Nitsos and Reed, 1965.	1961-1962	Trawl caught animal food fishery in Calif.	0.1%
Heimann, 1963.	1960	Trawl caught rockfish in Monterey Bay	none reported
Miller and Gotshall, 1965 [1/]	1960	CPFV Cresent city to Avila	0.5%
Nitsos, R.J., 1965.	1962	Ca. Ottertrawl (Monterey Excluded)	0.2%
Don Pearson (NMFS personnel com.)	1978-1982	Ca. Trawl and Line fisheries (spp. Comps.)	1.00%

[1/] Miller and Gotshall reported 1,059 "Turkey Red" fish landed totaling 5,625 lbs (Ave. weight = 5.3 lbs or 2.41 k)

Table 5. Historical rockfish landings in Oregon waters between 1928 and 1953.

Historical rockfish landings in Oregon

	Total Rockfish [1/]	
Year	**Catch (lbs)**	**Catch (mt)**
1928	73,702	33
1929	128,265	58
1930	118,688	54
1931	90,833	41
1932	33,303	15
1933	48,709	22
1934	52,900	24
1935	48,800	22
1936	121,100	55
1937	153,800	70
1938	139,700	63
1939	163,800	74
1940	619,300	281
1941	1,301,400	590
1942	1,898,488	861
1943	6,923,325	3140
1944	11,367,169	5156
1945	17,458,309	7919
1946	10,867,187	4929
1947	6,799,941	3084
1948	4,658,388	2113
1949	4,737,478	2149
1950	4,163,795	1889
1951	3,670,157	1665
1952	3,760,818	1706
1953	1,986,794	901

[1/] 1928-1949 rockfish catch from: Fisheries Statistics ofOregon, F.C. Cleaver - Editor, Oregon Fish Commission, Portland, Oregon,Contribution No. 16, September, 1951. And 1950-1953 data from: Fisheries Statistics of Oregon, Harrison S., Fish Commission of Oregon, Portland, Oregon, Contribution No. 22,February 1956.

Table 6. Historical rockfish landings in Grays' Harbor and Willapa Harbor in1953.

Species	Month	Catch (lbs)	Gear	Area
Gen. Rockfish	Jan-July	250,304	Otter Trawl (GH)	Cape John-Cape Shoal
Black Rockfish	Apr-May	10,720	Otter Trawl (GH)	Cape Shoal
Red Rockfish	May-June	6,310	Otter Trawl (GH)	Cape Shoal
POP	Feb-Aug	160,473	Otter Trawl (GH)	Cape Flattery-Cape Tlmk
Red Snapper	April	17,595	Otter Trawl (GH)	Cape John-Cape Shoal
Gen. Rockfish	Feb-Nov	93,781	Troll (Grays Harbor)	Cape Flattery-Cape Tlmk
Red Snapper	May-Sept	364	Troll (Grays Harbor)	Cape Flattery-Cape Shoal
Gen. Rockfish	June&Oct	101	Troll (Willapa Harbor)	Cape shoal-Cape Tlmk
Red Rockfish	Sept	16	Troll (Willapa Harbor)	Cape shoal-Cape Tlmk
Gen & Red	Total	368,471		
Yelloweye %	1.0%	1.7		
From table belwo		0.4		
Total Yelloweye Catch (mt)		2.1		

Species	Month	Catch (lbs)	Gear	Area
Rockfish liver	March	342	Otter Trawl	Cape Shoal
Black Rockfish liver	May	126	Otter Trawl	Cape Shoal
Red Rockfihs liver	Jan-Oct	9841	Otter Trawl	Cape Flattery-Pt Lookout
POP liver	May-Sept	406	Otter Trawl	Cape Shoal

No data for Troll rockfish livers in GH & Willapa

Misc. data- All gears combined

Species	Month	Catch (lbs)	Gear	Area
Gen. Rockfish	Apr-May	344,056	all gears combined	Grays Harbor
Black Rockfish	Jan-Dec	10,720	all gears combined	Grays Harbor
Red Rockfish	May-June	6,310	all gears combined	Grays Harbor
POP	Feb-Aug	160,473	all gears combined	Grays Harbor
Red Snapper	Apr-Sept	17,959	all gears combined	Grays Harbor
Gen. Rockfish	Jun&Oct	101	all gears combined	Willapa Harbor
Red Rockfish	Sept	16	all gears combined	Willapa Harbor

Species	Month	Catch (lbs)	Gear	Area
Gen. Rockfish livers	March	342	all gears combined	Grays Harbor
Black Rockfish liver	May	126	all gears combined	Grays Harbor
Red Rockfish liver	Jan-Oct	12,898	all gears combined	Grays Harbor
POP liver	May&Sept	406	all gears combined	Grays Harbor

Table 7. Number of species composition estimates taken in Washington ports by Fishery since 1986.

Number of species compositions taken in Washington ports by Gear

YR	Bottomfish Troll	Hand-line-jig	Set Line	SN	Salmon Troll
86		33			6
87		1			
88	2	285	252		34
89	15	311	4	2	22
90	5	314	2	1	81
91		230			11
92		308	1		18
93		308			5
94		631	1		
95		197	350		
96		124	234		3
97			166		
98			146		
99			112		

Table 8. Summary of the estimated yelloweye rockfish von Bertalanffy growth function parameters by area and sex. Sizes are in cm fork length.

von Bertalanffy Growth Parameters

	Males						Females						Combined Sexes					
Area	**Linf**	**K**	**t 0**	**t 20**	**t 40**	**N**	**Linf**	**K**	**t 0**	**t 20**	**t 40**	**N**	**Linf**	**K**	**t 0**	**t 20**	**t 40**	**N**
California	67.3	0.054	-5.0	49.9	61.4	50	66.3	0.048	-7.8	49.0	59.7	79	65.4	0.052	-7.1	49.2	59.6	160
Oregon	67.3	0.054	-5.5	50.5	61.6	424	64.1	0.055	-6.0	48.6	58.9	531	65.4	0.055	-5.5	49.2	60.0	1060
Washington	68.5	0.050	-5.6	49.6	61.6	355	67.3	0.043	-9.3	48.1	59.1	286	67.5	0.047	-7.4	49.1	60.3	759
W-O-C	68.0	0.051	-6.0	50.0	61.5	779	64.9	0.051	-6.6	48.4	59.0	817	65.9	0.053	-5.9	49.2	60.1	1979
[1] **Vancouver Is.**	69.1	0.052	-3.7	49.2	62.1	684	66.4	0.052	-4.3	47.8	59.9	642	67.2	0.055	-3.5	48.6	60.9	1326
[2] **Queen Charlotte Islands**	68.3	0.053	-6.2	51.2	62.4	749	65.4	0.051	-6.6	48.7	59.4	997	65.8	0.056	-5.6	49.9	60.5	1746
[3] **Bowie Seamount**	79.3	0.043	-6.0	53.8	68.6	240	82.4	0.035	-7.8	50.9	66.6	228	81.0	0.038	-7.1	52.3	67.7	468
[4] **SE Alaska**	64.4	0.051	-5.4	46.9	58.1	1112	65.9	0.037	-11.6	45.6	56.3	1091	64.4	0.046	-7.6	46.2	57.1	2203

Table 9. Comparison of mean length estimates and standard deviations.

Source	L at Age 6	L at Age 60	K	CV @ Age 6	CV @ Age 60
External	30.8	63.9	0.053	0.180	0.098
SS1 Model estimates	26.9	65.7	0.049	0.128	0.095
SS2 (SS1 age error and catch)	23.1	64.1	0.059	0.141	0.134
SS2 Base Model (revised age error and catch)	22.6	64.6	0.063	0.082	0.051

Table 10. Length and age at 50% maturity for yelloweye rockfish by area and source.

		Male		Female	
Source	**Area**	A_{50}	L_{50}	A_{50}	L_{50}
O' Connell et.al. 2000	SE Alaska	23	50	21	45
Rosenthal et.al., 1982	SE Alaska	-	52-60	-	50-52
Kronlund and Yamanaka, 2000	Queen Charolotte Is.	-	-	18.9-20.3	48.5-49.1
Kronlund and Yamanaka, 2000	Vancouver Is.	-	-	16.5-17.2	42.1-42.4
Barss, 1989	Oregon	-	45	-	41
McClure, 1982 [1]	Oregon	12	56	11	45
Reilly et al. 1994 [2]	California		40		40
Watters, 1992 [1]	California	7	40	7	40

[1] Surface age reading of otoliths

[2] Sex unspecified

Table 11. Catch curve estimates of natural mortality.

Ricker Catch Curve Analyses

Area	Year	Age Range	Combined Sexes	Males	Females
Neah Bay, Washington	2000	16-34	0.076	0.060	0.083
		17-34	0.065	0.049	0.074
		18-34	0.048	0.036	0.056
		19-34	0.048	0.049	0.049
Bowie Seamount [1]	1999	19-46	0.025	0.021	0.033
		20-46	0.011	0.008	0.020
		21-46	-0.003	-0.007	0.009
Bowie Seamount-bright [2]	1999	>=20, 5yr Bins	-	0.086	0.043
SE Alaska [3]	1988	36-96,2yr Bins	0.02	-	-

[1] Data provide by Yamanaka, DFO Canada

[2] Yamanaka ,2000

[3] O'Connel et.al., 2000

Table 12. Natural mortality estimates derived from maximum age (Hoenig, 1983).

Empiracle use of longevity data to estimate natural mortality (Hoenig,1983)

			Sexes Combined				Males				Females			
Area	Year	Gear	Mean	Max	Mortality	N	Mean	Max	Mortality	N	Mean	Max	Mortality	N
California	77-85	Sport	25.8	122	0.038	163								
Neah Bay, Washington	98-00	Sport	25.8	87	0.053	296	25.2	79	0.058	152	26.6	87	0.053	144
N. Vancouver Island	97-98	Set Line	23.8	95	0.048	1129	23.8	109	0.042	577	24.9	94	0.049	552
Queen Charelotte	97-98	Set Line	24.3	115	0.040	1407	22.6	95	0.048	716	25.2	89	0.051	684
Bowie Seamount	99	Set Line	28.6	99	0.046	851	26.9	92	0.050	427	30.4	99	0.046	424
SE Alaska														

Note: Natural mortality was estimated using Hoenig's "all groups" a and b parameters.

Table 13a. Comparison of Fishery size and age composition sample size from California, Oregon and Washington Fisheries.

All Values are #'s of Fish

	California				**Oregon**				**Washington**				**IPHC**
Year	**Size**	**Age**	**Size**	**Age**	**Size**	**Age**	**Size**	**Age**	**Size**	**Age**	**Size**	**Age**	**Size**
Year	SPORT		COMMERCIAL		SPORT		COMMERCIAL		SPORT		COMMERCIAL		
1978	81		50		120	120							
1979	119		5		106	169							
1980	124	17	11	12	25				111				
1981	83	33	3		13				45				
1982	106	18	8	8	61				15				
1983	105		22	5	17				7				
1984	169		18	17	373				19				
1985	300		11	39	222	244			15				
1986	206		14	5	177	124			9				
1987	98		22		163	140			34				
1988	317		14		38	123			4				
1989	385		8		112								
1990	89		10										
1991	112		224										
1992	164		493				13						
1993	236		709		163	32							
1994	250		748		151								
1995	199		383		110		98		9				
1996	239		534		73		161		14		266	0	
1997	250		299		99		256				118	0	
1998	125		54		147		118		48	25	40	0	
1999	88		507		246		166	24	96	95	45	0	
2000	47		28		62		141		189	189	361	0	
2001	15		132		368	86	248	38	101	96	582	186	
2002	13				448	73					187	187	141
2003	15				490						19	10	314
2004	15										40	28	174
2005													155

Table 13b. Fishery size and age composition sample size from California Fisheries. X in the size@age column indicates the year to which mean size-at-age observation was assigned for data source and negative values indicate sample data not used due to small sample size.

Year	Size N	N [1/]	Age N	N [1/]	Size@Age	Catch (mt)	N/Catch
SPORT							
1978	81					66	1.2
1979	119					71	1.7
1980	124		17	23		76	1.9
1981	83		33	23	X	47	2.5
1982	106		18	22		104	1.2
1983	105					51	2.1
1984	169					81	2.1
1985	300					126	2.4
1986	206					65	3.1
1987	98					75	1.3
1988	317					58	5.5
1989	385					59	6.6
1990	89					46	1.9
1991	112					34	3.3
1992	164					21	7.8
1993	236					8	27.9
1994	250					14	17.4
1995	199					13	15.8
1996	239					12	19.2
1997	250					15	16.5
1998	125					6	21.5
1999	88	66				13	7.0
2000	47	67				8	6.2
2001	15	15				5	3.3
2002	13	13				2	6.3
2003	15	15				4	4.1
2004	15	15				3	4.3
COMMERCIAL							
1978	50	15				33	1.5
1979	5	15				37	0.1
1980	11	15	12	6		41	0.6
1981	3	15		6		368	0.0
1982	8	15	8	6		202	0.1
1983	22	15	5	7		58	0.5
1984	18	15	17	20		45	0.8
1985	11	15	39	20		9	5.7
1986	14	15	5	21	X	31	0.6
1987	22	15				54	0.4
1988	14	15				65	0.2
1989	8	15				50	0.2
1990	10	15				80	0.1
1991	224					141	1.6
1992	493					112	4.4
1993	709					53	13.4
1994	748					54	13.8
1995	383					49	7.9
1996	534					66	8.1
1997	299					62	4.8
1998	54					22	2.5
1999	507	268				22	22.8
2000	28	267				4	7.0
2001	**132**					5	29.3

Table 14. Fishery size and age composition sample size from Oregon Fisheries. X in the size@age column indicates the year to which mean size-at-age observation was assigned for data source and negative values indicate sample data not used due to small sample size.

Year	Size N	N [1/]	Age N	N [1/]	Size@Age	Catch (mt)	N/Catch
SPORT							
1978	120		120			52	4.7
1979	106		169			55	5.0
1980	25	29				36	0.7
1981	13	29				24	0.5
1982	61	29				39	1.6
1983	17	29				66	0.3
1984	373					34	11.0
1985	222		244			30	15.3
1986	177		124		X	18	16.6
1987	163		140			36	8.5
1988	38		123			8	20.3
1989	112					14	7.7
1993	163		32			22	9.0
1994	151					17	9.0
1995	110					8	13.5
1996	73					15	4.7
1997	99					19	5.3
1998	147					17	8.5
1999	246					10	25.8
2000	62					5	12.8
2001	368		86			3	144.6
2002	448		73			4	144.3
2003	490					4	128.6
2004						2	0.0
COMMERCIAL							
1992	-13					165.8	-0.1
1995	98					149.1	0.7
1996	161					97.7	1.6
1997	256					115.5	2.2
1998	118					41.4	2.9
1999	166		24			61.3	3.1
2000	141					3.6	39.2
2001	248		38			6.2	46.1

Table 15. Fishery size and age composition sample size from Washington Fisheries. X in the size@age column indicates the year to which mean size-at-age observation was assigned for data source and negative values indicate sample data not used due to small sample size.

Year	Size N	N [1/]	Age N	N [1/]	Size@Age	Catch (mt)	N/Catch
SPORT							
1980	111	29				2.4	45.7
1981	45	29				3.4	13.3
1982	15	29				3.4	4.5
1983	7	29				6.7	1.0
1984	19	29				12.2	1.6
1985	15	29				8.8	1.7
1986	9	29				9.0	1.0
1987	34	28				10.5	3.2
1988	4	28				8.3	0.5
1995	9	11				9.9	0.9
1996	14	12				10.8	1.3
1998	48		25	60		14.4	3.3
1999	96		95	60		10.6	9.0
2000	189		189		X	10.1	18.6
2001	101		96			12.5	8.1
COMMERCIAL							
1996	266					8.6	30.9
1997	118					18.7	6.3
1998	40	34				5.5	7.3
1999	45	34				32.9	1.4
2000	17	34				0.2	85.0
2001						0.8	0.0
2002	48	23	48	23		0.4	120.0
2003	5	23	2	23		0.2	25.0
2004	16	23	14	23		0.1	160.0
LINE							
2000	344				X	7.7	44.4
2001	582		186			21.2	27.4
2002	139		139			2.2	63.2
2003	14		8			0.3	46.7
2004	24		14			0.8	30.0
IPHC (Washington and Oregon)							
2002	141						
2003	314						
2004	174						
2005	155						

Table 16. CPUE indices of abundance used in base run.

	CPFV per angler hour	**CA_MRFSS** per angler hour	**OR_Sport** per angler hour	**OSP_BFO** per angler trip	**IHPC** per set
1979			11.67		
1980		4.48	15.69		
1981		2.78	13.92		
1982		11.27	18.09		
1983		4.64	23.27		
1984		8.46	16.52		
1985		13.57			
1986		6.25	13.03		
1987		11.70	15.14		
1988	26.19	2.96	10.17		
1989	25.52	3.94	6.58		
1990	32.16		12.21	6.90	
1991	31.59		14.69	16.03	
1992	20.88		11.91	15.29	
1993	23.63	7.72	10.81	13.19	
1994	21.67	1.87	8.98	7.15	
1995	16.33	3.06	7.24	5.70	
1996	17.90	2.08	5.63	5.72	
1997	13.31	4.23		8.75	
1998	10.13	3.12	9.53	11.06	
1999		2.14	10.79	6.88	5.71
2000		3.39		6.45	
2001		1.18		4.42	4.82
2002					3.36
2003					4.8
2004					3.37
2005					2.65

Table 17. Number of interviewed trips in MRFSS, CPFV, and OSP data sets.

	Oregon MRFSS		**N. California MRFSS**		**CPFV**		**OSP**	
	Angler_hour	Trip	Angler_hour	Trip	Angler_hour	Trip	Halibut trip	Bottomfish trip
1980	15,765	294	80,417	694				
1981	7,347	174	25,221	217				
1982	12,581	182	24,836	262				
1983	7,718	151	10,780	135				
1984	22,610	393	46,099	378				
1985	11,872	239	146,683	997				
1986	15,480	224	132,868	836				
1987	16,950	189	39,321	363	3,658	148		
1988	25,463	286	84,401	550	10,423	351		
1989	30,389	254	68,479	371	9,796	384		
1990					2,706	120	4,470	20,678
1991					3,165	131	4,372	20,437
1992					7,041	376	3,386	19,797
1993	32,720	1,520	6,479	178	7,407	459	5,046	18,843
1994	42,252	1,446	16,043	500	6,323	458	5,576	25,821
1995	29,653	873	62,141	627	5,755	513	6,760	23,890
1996	36,014	1,463	245,694	2,061	5,978	557	7,760	26,046
1997	80,943	1,475	115,810	2,475	6,684	628	8,368	21,355
1998	47,331	1,343	89,658	1,160	4,243	431	9,500	21,889
1999	58,203	1,586	298,606	1,741			6,728	15,919
2000	31,795	916	106,164	680			6,641	16,719
2001	21,690	567	101,973	732			5,773	14,733

Table 18. Numbers of stations and yelloweye caught during the IPHC surveys. Note that values for the 1999 and 2001 yelloweye catch were expanded from the first 20 hooks of each skate. There are 100 hooks per skate.

Year	Yelloweye catch	no. of stations
1999	336	71
2000		
2001	203	84
2002	141	85
2003	317	85
2004	172	85
2005	156	85

Table 19. Summary of Northern California partyboat (CPFV) trips sampled, number retained for CPUE analysis and number positive for yelloweye rockfish.

		WAVE						Year Total
YEAR	Trips	1	2	3	4	5	6	
1980	Positive	3	2	9	4	6	2	26
	Retained	7	5	14	9	14	7	56
	Total Trips	13	21	37	37	31	46	185
1981	Positive	0	2	4	2	3	1	12
	Retained	2	5	8	8	9	2	34
	Total Trips	10	13	18	30	18	11	100
1982	Positive	1	1	3	2	4	2	13
	Retained	5	4	11	9	10	3	42
	Total Trips	10	15	26	24	18	5	98
1983	Positive	0	1	6	4	3	0	14
	Retained	1	5	19	13	6	3	47
	Total Trips	5	14	32	31	14	9	105
1984	Positive	5	2	7	6	7	3	30
	Retained	9	5	10	13	15	7	59
	Total Trips	22	19	30	30	32	24	157
1985	Positive	6	4	7	10	20	6	53
	Retained	14	14	16	24	31	11	110
	Total Trips	21	31	47	52	48	21	220
1986	Positive		7	12	7	11	3	40
	Retained		18	20	19	24	10	91
	Total Trips	21	25	35	43	35	23	182
1987	Positive	3	0	3	2	1	4	13
	Retained	5	4	6	4	5	8	32
	Total Trips	15	18	16	25	31	19	124
1988	Positive	5	2	1	3	3	2	16
	Retained	7	6	2	7	8	4	34
	Total Trips	12	24	8	30	16	16	106
1989	Positive			5	6	2	5	18
	Retained			6	13	9	7	35
	Total Trips	1		12	20	10	8	51
1993	Positive							
(not used)	Retained							
	Total Trips	1			5	60	56	122
1994	Positive	2	1			1		4
	Retained	9	7			9		25
	Total Trips	33	108	110	227	111	5	594
1995	Positive		0	7	8		0	15
	Retained		2	15	25		2	44
	Total Trips		13	35	89	1	4	142
1996	Positive	7	3	7	6	6	3	32
	Retained	17	18	21	32	25	11	124
	Total Trips	40	87	191	226	105	26	675
1997	Positive	1	1	3	11	5	5	26
	Retained	1	11	13	47	26	34	132
	Total Trips	2	70	105	245	139	94	655
1998	Positive	1	4	1	6	8	8	28
	Retained	2	6	6	30	34	22	100
	Total Trips	10	43	71	164	141	68	497
1999	Positive	8	8	3	4	6	2	31
	Retained	30	29	8	15	21	7	110
	Total Trips	63	79	82	76	52	21	373
2000	Positive	4		2	0	2	4	12
	Retained	8		6	4	12	17	47
	Total Trips	16	16	30	46	32	28	168
2001	Positive	3		0	2	2	0	7
	Retained	10		1	15	13	1	40
	Total Trips	16	12	50	82	50	12	222
2002	Positive	3			0	1		4
	Retained	16			6	6		28
	Total Trips	28	38	57	103	47	8	281
2003	Positive	1			1	1	1	4
	Retained	1			13	11	6	31
	Total Trips	18	37	65	129	78	27	354
Total Positive		53	38	80	84	92	51	398
Total Retained		144	139	182	306	288	162	1221
Total Trips		357	683	1057	1714	1069	531	5411

Table 20. Estimated year effects from delta-GLM of yelloweye rockfish CPUE (catch per hour) on northern California RecFIN trips.

Year	CPUE Index	CV
1980	0.0081	0.19
1981	0.0064	0.30
1982	0.0094	0.36
1983	0.0057	0.34
1984	0.0144	0.25
1985	0.0120	0.20
1986	0.0106	0.20
1987	0.0100	0.30
1988	0.0125	0.30
1989	0.0109	0.28
1994	0.0071	0.51
1995	0.0052	0.27
1996	0.0043	0.22
1997	0.0096	0.24
1998	0.0167	0.28
1999	0.0038	0.25
2000	0.0061	0.38
2001	0.0030	0.42
2002	0.0017	0.58
2003	0.0017	0.52

Table 21. Yelloweye rockfish biomass as estimated from area-swept densities observed in bottom trawl surveys.

	California			Oregon			Washington			Canada		
YEAR	Biomass	CV	Tows	Biomass	CV	Tows	Biomass	CV	Tows	Biomass	CV	Tows
Depth Zone 55-183m												
1977	0		0	68	0.78	2	232	0.29	14	0		0
1980	59	0.72	2	234	0.65	11	82	0.72	8	7	0.44	7
1983	4	1.00	1	180	0.43	11	510	0.58	14	4	0.50	4
1986	299	0.70	2	136	0.47	6	181	0.31	29	0		0
1989	83	0.54	8	187	0.52	11	463	0.36	8	17	0.62	17
1992	11	0.65	4	213	0.58	11	108	0.30	11	12	0.41	12
1995	18	1.00	1	44	0.96	3	22	0.60	3	6	0.58	6
1998	4	1.00	1	24	0.75	3	61	0.36	5	10	0.49	10
2001	0		1	172	0.52	8	111	0.49	9	3	0.75	3
Depth Zone 184-366m												
1977[a]	0		0	0		0	23	0.61	3	0		0
1980	34	1.00	1	0		0	6	1.00	1	2	0.67	2
1983	4	1.00	1	126	0.58	4	49	0.75	5	0		0
1986	0		0	0		0	27	1.00	1	0		0
1989	1	1.00	1	12	1.00	1	2	0.79	1	1	1.00	1
1992	0		0	0		0	10	0.72	1	1	0.96	1
1995	0		0	0		0	0		0	0		0
1998	4	1.00	1	0		0	1	1.00	0	1	1.00	1
2001	0		1	0		0	8	0.53	3	1		1
Depth zone 367-475												
1977[a]							52	0.60	3			

Table 22. Yelloweye submersible study area statistics.

Area Description	Area (ha)
Vancouver (U.S. only) shallow strata 55-183 meters	351,800
Study Area	55,680
Total Sampled Area	28
Study Area/U.S. Vancouver Area Ratio	15.8%

[1/] *Vancouver US includes U.S. territorial coastal waters from 47 30' - U.S. Canadian Border.*

Table 23. Results from the 2002 yelloweye submersible survey in untrawlable habitat found in the US Vancouver INPFC area.

Study results for yelloweye rockfish

	All Fish	Age 3+ Fish [1/]
Mean Length (cm)	50.0	51.7
Length Estimates (#'s of Fish)	38	36
Weight (kg) [2/]	2.73	2.69
Number of Fish Observed	59	57
Mean Density (#'s per ha)	2.02	1.95
Estimated Numbers of Fish in Stu	112,586	108,746
Biomass in Study Area (mt)	307	292

[1/] *Fish greater than 30 cm*

[2/] *Weighted biomass*

Table 24. Adjusted NMFS trawl survey area swept estimates in the US Vancouver INPFC area.

	Washington State			U.S. Vancouver 55-183 meter			[2/] Adjusted Biomass (mt)	
Year	Total	CV	[1/] Tows	Total	CV	[1/] Tows	U.S. Vancouver	Total Washington
1977	232	0.29	14	56	0.50	4	47	223.6
1980	82	0.72	8	57	1.00	2	48	73.0
1983	510	0.58	14	140	0.48	7	118	487.9
1986	181	0.31	29	120	0.44	18	101	162.1
1989	463	0.36	8	422	0.38	4	355	396.0
1992	108	0.30	11	82	0.33	8	69	95.2
1995	22	0.60	3	8	0.55	1	7	21.1
1998	61	0.36	5	52	0.39	4	44	53.0
2001	111	0.49	9	64	0.61	7	54	101.2
Mean	197	0.45	11	111	1	6	94	179
Median	111	0.36	9	64	0	4	54	101

[1/] *Tows with yelloweye rockfish.*

[2/] *WDFW adjustment to NMFS trawl survey biomass reflecting trawlable habitat in US Vancouver Area onl*

Table 25. Comparison of biomass estimates from the current assessment and the 2002 submersible survey in the US Vancouver INPFC area.

Comparison of biomass estimates

Area Model	Biomass (mt) [1/]	Ratio W-O-C
Current Yelloweye Stock Assessment		
W-O-C [2/]	1,593	
California [3/]	484	30.4%
Oregon [3/]	581	36.5%
Washington [3/]	312	19.6%
Survey Biomass Estimates		
Adjusted 2001 NMFS Trawl Survey for	101	
Study Survey	292	
Total Survey Based Biomass	393	

[1/] *Age 3+ Biomass in 2005*

[2/] *2006 Base Model Results*

[3/] *2006 Base Model Results*

[4/] *WDFW adjusted NMFS trawl survey biomass*

Table 26a. Comparison between 2005 and 2006 model configurations, parameter estimates and results.

Parameters Estimated (Bold) in Final Base Model

Area	Coastwide	Coastwide	California	Oregon	Washington
Assessment Year	2005	2006	2006	2006	2006
Start Year	1955	1925	1925	1925	1925
End Year	2004	2006	2006	2006	2006
Composition	Through 2004	Appended New	Appended New	Appended New	Appended New
Catch (Years Revised)	1980-2004	1955-1980	1955-1980	1955-1980	1955-1980
Number of Parameters	112	58	38	42	18
Estimated Recruitement Years	1955-2004	1968-1999	1968-1999	1968-1999	1984-1999
Objective function value	1171	1494	452	533	585
Selectivity	**Double Logistic**				
	Time varying	**Logistic**	**Logistic**	**Logistic**	**Logistic**
Peak	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Initial	0.001	0.001	0.001	0.001	0.001
Ascending inflection	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Ascending slope	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Final	7 Fisheries	7 Fisheries	2 Fisheries	2 Fisheries	3 Fisheries
Descending inflection	7 Fisheries	na	na	na	na
Descending slope	7 Fisheries	na	na	na	na
Width of top	7 Fisheries	na	na	na	na
Mirror related sport fisheries	4 Surveys	4 Surveys	2 Surveys	2 Surveys	2 Surveys
Estimated		1 Survey	1 Survey	1 Survey	1 Survey
Age Error	Revised Age Error	Same as 2005	Same as 2005	Same as 2005	Same as 2005
Discard	Included in catch	Included in catch	Included in catch	Included in catch	Included in catch
M-G Parameters					
Natural Mortality (Young)	0.045	**0.036**	Fixed to CSTWide	Fixed to CSTWide	Fixed to CSTWide
Old Offset	0	0	0	0	0
age_for_growth_Lmin	6	6	6	6	6
age_for_growth_Lmax	60	60	60	60	60
Body length @Agemin	**22.6**	**23.9**	**29.3**	**21.0**	Fixed to Oregon
Body length @Agemax	**64.6**	**61.4**	**59.0**	**61.1**	Fixed to Oregon
VonBert	**0.063**	**0.066**	**0.077**	**0.079**	Fixed to Oregon
CV@Age 6	**0.082**	**0.107**	**0.079**	**0.099**	Fixed to Oregon
CV@Age 60	**0.577**	**0.057**	**0.408**	**0.171**	Fixed to Oregon
Biology					
W-length-1	2.9696	2.9696	2.9696	2.9696	2.9696
W-length-2	0.0000	0.0000	0.0000	0.0000	0.0000
Mat-length-1	42.1	42.1	42.1	42.1	42.1
Mat-length-2	-0.415	-0.415	-0.415	-0.415	-0.415
S-R Parameters					
Ln(R0) (Lambda 0.5)	**5.269**	**4.846**	**4.185**	**3.853**	**3.003**
S-R Steepness (assumed, est ir	0.437	0.450	0.450	0.450	0.450
SD Recruitments (assumed, est	0.4	0.5	0.5	0.5	0.5
Enviro Link	0	0	0	0	0
Initial Equil	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**
Final Results					
B $_{2005}$	2,008	1,593	375	657	254
SPB 0	3,808	3,322	1,715	1,258	453
SPB2005	798	573	141	265	94
Depletion	21.0%	17.3%	8.2%	21.1%	20.8%

Table 26b. Comparison between alternative model configurations employing double logistic selectivity, parameter estimates and results.

Parameters Estimated (Bold) in Final Base Model

Area	Coastwide	California	Oregon	Washington	Washington
Model Name	**CST-1b**	**CA-1b**	**OR-1b**	**WA-1b**	**WA-1c**
					Fit to Wa Sub Survey
Assessment Year	2006	2006	2006	2006	2006
Start Year	1955	1955	1955	1955	1955
End Year	2005	2005	2005	2005	2005
Composition	Appended New	Appended New	Appended New	Appended New	Appended New
Catch (Years Revised)	1955-1980	1955-1980	1955-1980	1955-1980	1955-1980
Number of Parameters	64	41	45	21	67
Estimated Recruitement Year	1968-1999	1968-1999	1968-1999	1984-1999	1984-1999
Objective function value	1469	433	527	590	589
Selectivity Type	**Dbl Logistic Rec**	**Dbl Logistic Rec**	**Dbl Logistic Rec**	**Dbl Logistic Rec**	**Logistic**
Age Error	Same as 2005	Same as 2005	Same as 2005	Same as 2005	Same as 2005
Discard	Included in catch	Included in catch	Included in catch	Included in catch	Included in catch
M-G Parameters					
Natural Mortality (Young)	0.045	0.045	0.045	0.045	0.045
Old Offset	0	0	0	0	0
age_for_growth_Lmin	6	6	6	6	6
age_for_growth_Lmax	60	60	60	60	60
Body length @Agemin	**23.6**	**27.4**	**21.2**	Fixed to Oregon	Fixed to Oregon
Body length @Agemax	**61.4**	**57.9**	**61.0**	Fixed to Oregon	Fixed to Oregon
VonBert	**0.068**	**0.110**	**0.082**	Fixed to Oregon	Fixed to Oregon
CV@Age 6	**0.105**	**0.055**	**0.071**	Fixed to Oregon	Fixed to Oregon
CV@Age 60	**0.158**	**0.904**	**0.600**	Fixed to Oregon	Fixed to Oregon
Biology					
W-length-1	2.9696	2.9696	2.9696	2.9696	2.9696
W-length-2	0.0000	0.0000	0.0000	0.0000	0.0000
Mat-length-1	42.1	42.1	42.1	42.1	42.1
Mat-length-2	-0.415	-0.415	-0.415	-0.415	-0.415
S-R Parameters					
Ln(R0) (Lambda 0.5)	**5.242**	**4.482**	**4.256**	**3.230**	**3.231**
S-R Steepness (assumed, est	0.437	0.437	0.437	0.437	0.437
SD Recruitments (assumed, e	0.4	0.4	0.5	0.5	0.5
Enviro Link	0	0	0	0	0
Initial Equil	**0.04**	**0.00**	**0.00**	**0.00**	**0.00**
Final Results					
B_{2006}	1619	475	580	313	314
SPB 0	6566	1677	1273	456	456
SPB2006	1271	176	235	113	113
Depletion	19.4%	10.5%	18.5%	24.8%	24.8%

Table 27. Convergence test for the base models.

Convergence test of base models using SS2 V1.21

Run	Obj. Func. Value	Max. Gradient	Hession	Depletion
	Coast-Wide Model			
1	1480.05	0.000199822	184.398	18.9%
2	2.01939E+12	1.04506E+15	184.398	100.0%
3	1480.05	0.00131074	184.398	18.9%
4	5.72071E+12	2.85438E+15	184.398	100.0%
5	1480.05	6.75684E-05	184.398	18.9%
6	1480.05	0.000218353	184.398	18.9%
7	1480.05	0.000362469	184.398	18.9%
8	2.48702E+12	1.74875E+15	184.398	100.0%
9	1480.05	0.000152958	184.398	18.9%
10	1480.05	0.000316715	184.398	18.9%
11	5.64667E+13	3.0276E+16	184.398	100.0%
12	4.38991E+17	3.55971E+20	184.398	100.0%
13	1480.05	0.000734386	184.398	18.9%
14	1480.05	0.000094615	184.398	18.9%
15	2.4039E+16	2.11462E+19	184.398	100.0%
16	1480.05	0.00172253	184.398	18.9%
17	1480.05	0.00224036	184.398	18.9%
18	1480.05	5.33006E-05	184.398	18.9%
19	1480.05	0.000508299	184.398	18.9%
20	2.35306E+13	1.13591E+16	184.398	100.0%
21	1480.05	0.000260828	184.398	18.9%
22	1480.05	0.000103058	184.398	18.9%
23	1480.05	0.00625271	184.398	18.9%
24	8.67482E+13	5.30047E+16	184.398	100.0%
25	1480.05	0.00058619	184.398	18.9%
	California Model			
1	432.881	0.000155719	115.072	10.1%
2	432.881	2.15347E-05	115.072	10.1%
3	432.881	4.93922E-05	115.072	10.1%
4	432.881	9.62336E-05	115.072	10.1%
5	432.881	5.83771E-05	115.072	10.1%
6	432.881	1.79366E-05	115.072	10.1%
7	432.881	7.55239E-05	115.072	10.1%
8	432.881	3.17318E-05	115.072	10.1%
9	432.881	9.46131E-05	115.072	10.1%
10	479.586	8545.02		38.3%
11	432.881	0.000291002	115.072	10.1%
12	432.881	8.76344E-05	115.072	10.1%
13	432.881	1.40817E-05	115.072	10.1%
14	432.881	0.00006416	115.072	10.1%
15	432.881	2.16804E-05	115.072	10.1%
16	432.881	7.42887E-05	115.072	10.1%
17	432.881	0.000101997	115.072	10.1%
18	432.881	5.57475E-05	115.072	10.1%
19	432.881	9.79033E-05	115.072	10.1%
20	432.881	1.28848E-05	115.072	10.1%
21	432.881	3.35142E-05	115.072	10.1%
22	432.881	0.000591106	115.072	10.1%
23	432.881	0.000011705	115.072	10.1%
24	432.881	4.11385E-05	115.072	10.1%
25	432.881	5.73436E-05	115.072	10.1%

Run	Obj. Func. Value	Max. Gradient	Hession	Depletion
	Oregon Model			
1	528.527	0.00027718	115.135	18.2%
2	528.527	0.000195903	115.135	18.2%
3	528.527	0.000406173	115.135	18.2%
4	528.527	0.000189687	115.135	18.2%
5	528.527	0.00026801	115.135	18.2%
6	528.527	0.000287327	115.135	18.2%
7	528.527	0.00006825	115.135	18.2%
8	528.527	0.000290843	115.135	18.2%
9	528.527	0.000023134	115.135	18.2%
10	528.527	3.73447E-05	115.135	18.2%
11	528.527	7.31964E-05	115.135	18.2%
12	528.527	4.68811E-05	115.135	18.2%
13	528.527	6.58172E-05	115.135	18.2%
14	528.527	9.56227E-05	115.135	18.2%
15	528.527	7.02865E-05	115.135	18.2%
16	528.527	0.000741329	115.135	18.2%
17	528.527	1.43859E-05	115.135	18.2%
18	528.527	0.00008854	115.135	18.2%
19	528.527	0.000062811	115.135	18.2%
20	528.527	9.45772E-05	115.135	18.2%
21	528.527	3.37473E-05	115.135	18.2%
22	528.527	0.000092456	115.135	18.2%
23	528.527	2.59858E-05	115.135	18.2%
24	528.527	2.59858E-05	115.135	18.2%
25	528.527	2.63323E-05	115.135	18.2%
	Washington Model			
1	589.384	3.54E-05	68.99	24.5%
2	589.384	8.53E-05	68.99	24.5%
3	589.384	6.12E-05	68.99	24.5%
4	589.384	5.79E-05	68.99	24.5%
5	589.384	8.75E-06	68.99	24.5%
6	589.384	8.75E-06	68.99	24.5%
7	589.384	7.84E-07	68.99	24.5%
8	589.384	2.30E-05	68.99	24.5%
9	589.384	5.17E-06	68.99	24.5%
10	589.384	4.95E-04	68.99	24.5%
11	589.384	5.61E-05	68.99	24.5%
12	589.384	1.07E-04	68.99	24.5%
13	589.384	3.02E-06	68.99	24.5%
14	589.384	2.44E-06	68.99	24.5%
15	589.384	8.65E-05	68.99	24.5%
16	589.384	3.75E-05	68.99	24.5%
17	589.384	3.87E-05	68.99	24.5%
18	589.384	2.17E-05	68.99	24.5%
19	589.384	1.18E-05	68.99	24.5%
20	589.384	6.23E-05	68.99	24.5%
21	589.384	5.16E-05	68.99	24.5%
22	589.384	8.71E-06	68.99	24.5%
23	589.384	1.36E-06	68.99	24.5%
24	589.384	2.90E-05	68.99	24.5%
25	589.384	1.01E-04	68.99	24.5%

Note: Blank cells indicate non-convergence and depletion=100% results have unreasonable estimates for Fpenalty.

Table 28. Biomass results from base models.

		Coastwide Model				California Model				Oregon Model				Washington Model		
	Year	bio-all	bio-smry	Recruit	SpawnBio	bio-all	bio-smry	Recruit	SpawnBio	bio-all	bio-smry	Recruit	SpawnBio	bio-all	bio-smry	Recruit
1923	**1923**	7496	7448.08	127	3322	3902.43	3877.05	65.704	1715	2807	2789	47	1258	1025	1017	20
1924	**1924**	7496	7448.08	127	3322	3884.67	3859.4	65.4049	1707	2796	2779	47	1253			
1925	**1925**	7496	7448.08	127	3322	3884.7	3859.4	65.6123	1707	2796	2779	47	1253			
1926	**1926**	7486	7437.3	127	3317	3876.79	3851.47	65.5696	1703	2795	2778	47	1252			
1927	**1927**	7475	7426.63	127	3312	3868.96	3843.62	65.5269	1699	2795	2777	47	1252			
1928	**1928**	7464	7416.08	127	3307	3861.22	3835.9	65.4843	1696	2794	2776	47	1251			
1929	**1929**	7454	7405.66	127	3302	3853.59	3828.28	65.4417	1692	2793	2775	47	1251			
1930	**1930**	7444	7395.38	127	3297	3846.06	3820.78	65.3993	1689	2792	2774	47	1251			
1931	**1931**	7433	7385.25	127	3292	3838.66	3813.39	65.3571	1685	2791	2773	47	1250			
1932	**1932**	7423	7375.26	127	3287	3831.37	3806.12	65.3152	1682	2790	2772	47	1250			
1933	**1933**	7414	7365.43	127	3283	3824.21	3798.98	65.2737	1678	2789	2771	47	1249			
1934	**1934**	7404	7355.76	127	3278	3817.18	3791.96	65.2328	1675	2788	2770	47	1249			
1935	**1935**	7394	7346.25	127	3273	3810.27	3785.07	65.1924	1672	2787	2770	47	1248			
1936	**1936**	7385	7336.9	127	3269	3803.5	3778.31	65.1528	1668	2787	2769	47	1248			
1937	**1937**	7376	7327.71	127	3264	3796.85	3771.68	65.1139	1665	2786	2768	47	1248			
1938	**1938**	7367	7318.68	127	3260	3790.33	3765.17	65.0757	1662	2785	2767	47	1247			
1939	**1939**	7358	7309.81	126	3256	3783.93	3758.79	65.0383	1659	2784	2767	47	1247			
1940	**1940**	7349	7301.09	126	3252	3777.66	3752.53	65.0015	1656	2784	2766	47	1247			
1941	**1941**	7340	7292.54	126	3247	3771.51	3746.4	64.9656	1653	2783	2765	47	1246			
1942	**1942**	7332	7284.15	126	3243	3765.49	3740.38	64.9302	1650	2782	2765	47	1246			
1943	**1943**	7324	7275.9	126	3239	3759.58	3734.49	64.8956	1647	2782	2764	47	1246			
1944	**1944**	7316	7267.81	126	3236	3753.78	3728.71	64.8616	1645	2781	2763	47	1245			
1945	**1945**	7308	7259.87	126	3232	3748.1	3723.04	64.8283	1642	2781	2763	47	1245			
1946	**1946**	7300	7252.08	126	3228	3742.53	3717.48	64.7955	1639	2780	2762	47	1245			
1947	**1947**	7292	7244.43	126	3224	3737.07	3712.03	64.7633	1637	2780	2762	47	1244			
1948	**1948**	7285	7236.92	126	3221	3731.72	3706.69	64.7317	1634	2779	2761	47	1244			
1949	**1949**	7277	7229.56	126	3217	3726.46	3701.45	64.7007	1632	2779	2761	47	1244			
1950	**1950**	7270	7222.33	126	3214	3721.31	3696.32	64.6703	1629	2778	2760	47	1244			
1951	**1951**	7263	7215.23	126	3211	3716.26	3691.28	64.6403	1627	2778	2760	47	1244			
1952	**1952**	7256	7208.27	126	3207	3711.31	3686.33	64.6109	1625	2777	2759	47	1243			
1953	**1953**	7249	7201.43	126	3204	3706.45	3681.49	64.582	1622	2777	2759	47	1243			
1954	**1954**	7242	7194.72	126	3201	3701.69	3676.73	64.5536	1620	2776	2758	47	1243	960	952	20
1955	**1955**	7236	7188.14	126	3198	3697.01	3672.07	64.5257	1618	2776	2758	47	1243	960	952	20
1956	**1956**	7184	7136.02	125	3173	3662.43	3637.52	64.3242	1602	2760	2743	47	1236	959	951	20
1957	**1957**	7124	7076.83	125	3146	3621.1	3596.25	64.0789	1583	2745	2727	47	1228	958	950	20
1958	**1958**	7067	7019.35	125	3119	3581.68	3556.92	63.8396	1565	2729	2711	47	1221	957	949	20
1959	**1959**	7001	6953.78	124	3088	3535.42	3510.76	63.5532	1544	2712	2695	47	1213	955	947	20
1960	**1960**	6944	6896.46	124	3061	3497.63	3473.07	63.3128	1526	2696	2678	47	1205	953	945	20
1961	**1961**	6891	6844.48	124	3036	3465.45	3440.99	63.103	1511	2679	2661	46	1197	951	943	20
1962	**1962**	6847	6799.97	123	3015	3440.93	3416.54	62.9388	1499	2662	2644	46	1189	949	941	20
1963	**1963**	6803	6756.63	123	2994	3417.81	3393.49	62.7821	1488	2644	2627	46	1180	947	940	20
1964	**1964**	6753	6706.14	123	2970	3390.43	3366.18	62.5966	1475	2627	2609	46	1172	942	935	20
1965	**1965**	6711	6664.22	123	2949	3371.81	3347.62	62.467	1466	2609	2592	46	1163	937	930	20

Table 28 (Continued). Biomass results from base models.

	Year	Coastwide Model bio-all	bio-smry	Recruit	SpawnBio	California Model bio-all	bio-smry	Recruit	SpawnBio	Oregon Model bio-all	bio-smry	Recruit	SpawnBio	Washington Model bio-all	bio-smry	Recruit
1966	**1966**	6662	6615.62	122	2926	3346.56	3322.44	62.2935	1454	2591	2574	46	1155	932	925	20
1967	**1967**	6609	6563.06	122	2901	3317.5	3293.44	62.0932	1440	2573	2555	46	1146	927	920	19
1968	**1968**	6546	6510.04	45	2876	3283.89	3264.03	30.3249	1427	2555	2537	46	1137	923	915	19
1969	**1969**	6484	6456.66	55	2850	3251.03	3234.41	36.4519	1413	2533	2519	19	1128	918	910	19
1970	**1970**	6488	6371.86	794	2810	3200.97	3187.04	41.3152	1391	2537	2486	327	1113	913	906	19
1971	**1971**	6388	6273.29	57	2768	3161.76	3123.25	218.362	1364	2509	2462	26	1101	906	899	19
1972	**1972**	6289	6178.16	53	2727	3100.88	3063.11	37.0963	1339	2479	2432	26	1088	900	893	19
1973	**1973**	6151	6129.99	53	2669	3010.67	2973.03	36.3038	1301	2441	2431	25	1072	893	886	19
1974	**1974**	6065	5968.45	637	2598	2901.63	2886.87	41.1095	1251	2439	2392	308	1055	885	877	19
1975	**1975**	5928	5830.39	84	2529	2800.62	2784.53	47.435	1204	2400	2355	21	1039	875	868	19
1976	**1976**	5797	5697.83	87	2459	2693.8	2675.69	52.0892	1153	2371	2328	19	1023	867	860	19
1977	**1977**	5639	5609.44	64	2376	2577.7	2557.69	55.7812	1097	2335	2327	19	1001	855	848	19
1978	**1978**	5475	5449.27	57	2290	2481.39	2447.67	152.371	1045	2294	2287	19	976	832	825	19
1979	**1979**	5382	5307.27	459	2206	2374.19	2343.33	33.7009	995	2280	2246	222	951	808	801	18
1980	**1980**	5166	5093.06	61	2090	2228.66	2200.36	33.3917	930	2212	2178	27	911	780	773	18
1981	**1981**	4911	4802.93	339	1946	2027.2	1996.01	172.841	831	2156	2123	22	877	747	740	18
1982	**1982**	4590	4529.64	79	1797	1795.82	1766.25	26.2746	728	2060	2052	20	829	739	732	18
1983	**1983**	4225	4157.22	128	1633	1543.11	1513.38	31.6742	615	2004	1930	523	772	728	721	18
1984	**1984**	3932	3897.83	60	1503	1470.01	1455.92	51.1318	577	1786	1715	20	679	710	703	18
1985	**1985**	3827	3736.39	514	1432	1379.77	1365.25	30.4267	533	1716	1647	25	651	690	684	17
1986	**1986**	3630	3552.76	42	1350	1280.88	1266.6	29.4327	486	1632	1623	25	618	661	655	17
1987	**1987**	3515	3442.17	40	1302	1221.59	1208.58	40.9978	457	1577	1568	23	598	644	637	18
1988	**1988**	3346	3330.27	41	1233	1131.64	1115.31	56.2407	417	1520	1501	99	573	615	609	11
1989	**1989**	3169	3152.3	54	1158	1041.86	1026.87	19.9289	380	1448	1431	19	539	587	582	9
1990	**1990**	2937	2913.24	90	1055	963.774	952.168	14.0639	351	1321	1305	16	475	540	536	8
1991	**1991**	2802	2778.37	42	997	868.313	862.076	14.4547	316	1299	1292	15	457	511	508	9
1992	**1992**	2552	2532.06	25	896	723.387	716.899	21.7774	260	1217	1211	11	415	480	477	11
1993	**1993**	2290	2272.98	64	791	616.488	609.079	21.3551	220	1094	1087	27	359	440	435	18
1994	**1994**	2082	2062.75	60	711	578.308	570.141	20.3219	206	958	950	24	304	404	396	36
1995	**1995**	1957	1934.18	58	669	531.281	523.476	18.9849	189	897	888	23	286	383	374	13
1996	**1996**	1793	1771.68	54	614	490.435	483.087	17.801	175	790	781	21	254	363	355	12
1997	**1997**	1660	1639.37	52	574	431.002	424.218	15.9558	153	731	723	21	241	343	338	12
1998	**1998**	1495	1475.4	48	522	370.855	364.717	13.9752	131	643	635	19	217	320	316	11
1999	**1999**	1450	1431.65	48	517	359.137	353.527	13.6365	127	617	610	19	215	308	304	11
2000	**2000**	1355	1337.05	46	488	339.542	334.317	12.9935	120	570	563	18	203	274	270	10
2001	**2001**	1368	1350.35	47	502	342.587	337.464	13.1585	122	585	578	19	215	266	262	10
2002	**2002**	1371	1352.88	47	509	347.822	342.728	13.4058	125	603	596	20	228	242	239	9
2003	**2003**	1409	1391.31	49	531	359.647	354.434	13.9023	130	624	617	21	241	246	242	9
2004	**2004**	1448	1429.66	50	553	369.951	364.584	14.3602	135	645	637	21	253	253	249	9
2005	**2005**	1485	1466.4	52	573	380.272	374.722	14.8329	140	665	657	22	265	258	254	9
2006	**2006**	1510	1490.82	53	588	388.606	382.883	15.2434	145	679	671	22	274	259	255	9
	depletion				17.7%				8.5%				21.1%			
	Area % in 2006				114.5%				28.2%				53.3%			

Table 29. Estimates of average fishing mortality from each base model.

	Average Fishing Mortaily Rates			
Year	**Coastwide**	**California**	**Oregon**	**Washington**
1955	0.009	0.012	0.006	0.003
1956	0.010	0.014	0.006	0.003
1957	0.009	0.012	0.007	0.004
1958	0.009	0.011	0.007	0.004
1959	0.008	0.009	0.007	0.004
1960	0.008	0.009	0.007	0.004
1961	0.009	0.010	0.008	0.004
1962	0.008	0.008	0.008	0.007
1963	0.009	0.010	0.008	0.007
1964	0.010	0.011	0.008	0.007
1965	0.010	0.012	0.009	0.008
1966	0.010	0.012	0.009	0.008
1967	0.016	0.018	0.015	0.008
1968	0.017	0.022	0.012	0.008
1969	0.017	0.021	0.013	0.010
1970	0.023	0.031	0.016	0.009
1971	0.028	0.040	0.017	0.011
1972	0.028	0.040	0.017	0.013
1973	0.030	0.044	0.017	0.014
1974	0.035	0.050	0.023	0.013
1975	0.038	0.050	0.026	0.017
1976	0.039	0.050	0.028	0.031
1977	0.055	0.069	0.044	0.034
1978	0.073	0.109	0.043	0.040
1979	0.083	0.127	0.063	0.048
1980	0.100	0.156	0.079	0.018
1981	0.092	0.070	0.128	0.022
1982	0.067	0.086	0.062	0.032
1983	0.078	0.098	0.075	0.036
1984	0.060	0.075	0.060	0.051
1985	0.078	0.106	0.070	0.036
1986	0.085	0.108	0.085	0.055
1987	0.113	0.104	0.135	0.055
1988	0.086	0.131	0.069	0.092
1989	0.130	0.201	0.116	0.067
1990	0.147	0.184	0.158	0.075
1991	0.136	0.100	0.185	0.104
1992	0.105	0.119	0.126	0.109
1993	0.129	0.115	0.182	0.074
1994	0.118	0.160	0.134	0.073
1995	0.143	0.179	0.178	0.076
1996	0.072	0.074	0.094	0.088
1997	0.109	0.097	0.128	0.062
1998	0.031	0.034	0.022	0.142
1999	0.039	0.027	0.016	0.066
2000	0.009	0.007	0.007	0.130
2001	0.008	0.010	0.008	0.026
2002	0.008	0.009	0.005	0.013
2003	0.016	0.014	0.013	0.021
2004	0.007	0.007	0.005	0.036
2005	0.014	0.011	0.014	0.029

Table 30. Profile of likelihood and other model outcomes over a range of fixed values for the initial recruitment level (virgin recruitment) for the Coast-Wide model.

Bold = Estimated — **R_0 Profile**

Model Initial R_0	**145**	**152**	**159**	**166**	**173**	**180**	**187**	**194**	**201**	**208**	**215**	**222**	**229**	**236**	**243**
RUN FILE	SS2-15	SS2-16	SS2-17	SS2-18	SS2-19	SS2-20	SS2-21	SS2-22	SS2-23	SS2-24	SS2-25	SS2-26	SS2-27	SS2-28	SS2-29
S-R Parameters															
Ln(R0)	**4.977**	**5.024**	**5.069**	**5.112**	**5.153**	**5.193**	**5.233**	**5.268**	**5.303**	**5.338**	**5.371**	**5.403**	5.434	**5.464**	**5.493**
S-R Steepness (model est)	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	0.437	**0.437**	**0.437**
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Equil	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349
SPB 0					6007	6252	6508	6739	6979	7228	7471	7713	7956	8199	8440
SPB2005					907	1052	1251	1467	1736	2087	2484	2915	3366	3824	4300
Depletion					15.1%	16.8%	19.2%	21.8%	24.9%	28.9%	33.2%	37.8%	42.3%	46.6%	51.0%
LIKELIHOOD	**No Convergence or crash**				**1494.8**	**1483.1**	**1479.7**	**1481.6**	**1486.5**	**1493.2**	**1500.5**	**1507.7**	**1514.5**	**1521.6**	**1526.8**
indices					27	27	28	28	30	32	35	38	41	44	47
discard					0	0	0	0	0	0	0	0	0	0	0
length_comps					967	965	966	969	972	976	979	983	986	990	990
age_comps					406	399	395	394	394	393	392	391	390	390	389
size-at-age					76	76	76	77	78	78	78	78	78	77	78
mean_body_wt					0	0	0	0	0	0	0	0	0	0	0
Equil_catch					0	0	0	0	0	0	0	0	0	0	0
Recruitment					19	16	14	13	14	15	16	18	19	21	24
Parm_priors					0	0	0	0	0	0	0	0	0	0	0
Parm_devs					0	0	0	0	0	0	0	0	0	0	0
penalties					0	0	0	0	0	0	0	0	0	0	0
Forecast_Recruitment					0	0	0	0	0	0	0	0	0	0	0
CaCPFV Index					3.7	4.0	4.6	5.2	6.1	7.3	8.6	10.0	11.2	12.3	13.5
Ca MRFSS Index					19.3	19.1	19.3	19.7	20.4	21.5	22.9	24.4	25.9	27.3	28.8
OrRec Index					3.1	2.9	2.6	2.5	2.4	2.3	2.4	2.5	2.7	2.8	3.1
Wa Rec Index					1.1	1.0	1.0	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1
IPHC					0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1

Table 31. Profile of likelihood and other model outcomes over a range of fixed values for steepness for the Coast-wide Model.

Bold = Estimated — **Profile on Steepness**

Model	**0.05**	**0.1**	**0.15**	**0.2**	**0.25**	**0.3**	**0.35**	**0.4**	**0.45**	**0.5**	**0.55**	**0.6**	**0.65**	**0.7**	**0.75**
RUN FILE	SS2-30	SS2-31	SS2-32	SS2-33	SS2-34	SS2-35	SS2-36	SS2-37	SS2-38	SS2-39	SS2-40	SS2-41	SS2-42	SS2-43	SS2-44
S-R Parameters															
Ln(R0)	**5.273**	**5.242**	**5.234**	**5.230**	**5.230**	**5.228**	**5.229**	**5.231**	**5.234**	**5.229**	**5.242**	5.24585	**5.25039**	**5.25505**	**5.25967**
S-R Steepness (model est)	**0.05**	**0.1**	**0.15**	**0.2**	**0.2**	**0.3**	**0.35**	**0.4**	**0.45**	**0.35**	**0.55**	0.6	**0.65**	**0.7**	**0.75**
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Initial Equil	**0.0349**	**0.0349**	**0.0349**	**3.49E-02**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	0.0349	**0.0349**	**0.0349**	**0.0349**
SPB 0	6776	6567	6512	6485	6485	6476	6483	6496	6515	6483	6563	6592	6622	6653	6683
SPB2005	532	610	695	787	787	971	1072	1177	1280	1072	1477	1570.14	1658	1741	1819
Depletion	0.08	0.09	0.11	0.12	0.12	0.15	0.17	0.18	0.20	0.17	0.23	0.24	0.25	0.26	0.27
LIKELIHOOD	1543	1502	1488	1481	1481	1477	1478	1479	1480	1478	1483	1484	1486	1487	1488
indices	**35**	**32**	**30**	**29**	**29**	**27**	**27**	**27**	**28**	**27**	**29**	29.5308	**30**	**31**	**31**
discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
length_comps	984.0	975.6	971.8	969.7	969.7	967.0	966.5	966.3	966.2	966.5	966.1	966.1	966.0	965.9	965.8
age_comps	374.6	381.9	385.3	388.4	388.4	392.1	393.5	394.7	395.6	393.5	397.1	397.6	398.1	398.5	398.9
size-at-age	75.0	71.6	72.3	72.5	72.5	74.5	75.3	75.9	76.5	75.3	77.4	77.8	78.1	78.4	78.7
mean_body_wt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equil_catch	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recruitment	73.7	40.3	27.7	21.6	21.6	16.4	15.1	14.4	13.9	15.1	13.4	13.3	13.2	13.1	13.1
Parm_priors	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Parm_devs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
penalties	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forecast_Recruitment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CaCPFV Index	4.4	4.0	3.7	3.5	3.5	3.7	4.0	4.3	4.7	4.0	5.5	5.9	6.3	6.6	6.9
Ca MRFSS Index	23.4	22.1	21.0	20.1	20.1	19.3	19.2	19.2	19.4	19.2	19.9	20.2	20.5	20.8	21.1
OrRec Index	5.0	4.6	4.1	3.7	3.7	3.1	2.9	2.7	2.6	2.9	2.4	2.4	2.3	2.3	2.3
Wa Rec Index	2.0	1.7	1.5	1.3	1.3	1.1	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0
IPHC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2

Table 32. Profile of likelihood and other model outcomes over a range of Lambda values on the SR curve.

Bold = Estimated	Rec from SR	Rec from SR	SR Lamda Profile				
Model	Emp 0 for comps Force SR	for comps Force SR	10	1	0.5	0.01	0.001
RUN FILE	SS2-1	SS2-2	SS2-3	SS2-4	SS2-5	SS2-6	SS2-7
S-R Parameters							
Ln(R0)	5.190	5.242	5.296	5.242	5.229	5.229	5.229
S-R Steepness (model est)	0.437	0.437	0.437	0.437	**0.437**	**0.437**	**0.437**
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0
Initial Equil	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349	0.0349
SPB 0	6234	6564	6933	6564	6480	6480	6481
SPB2005	710	1181	1150	1181	1462	1462	1470
Depletion	0.11	0.18	0.17	0.18	0.23	0.23	0.23
LIKELIHOOD	**29**	**1492.19**	**1582**	**1492.19**	**1464**	**1464**	**1463**
indices	26.9	27.4	27.8	27.4	28.8	28.8	28.9
discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0
length_comps	0.0	967.9	1000.6	967.9	964.8	964.8	964.8
age_comps	0.0	397.1	418.0	397.1	393.9	393.9	393.8
size-at-age	0.0	77.3	81.6	77.3	75.5	75.5	75.5
mean_body_wt	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equil_catch	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recruitment	1.9	22.4	54.1	22.4	0.4	0.4	0.0
Parm_priors	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Parm_devs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
penalties	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forecast_Recruitment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CaCPFV Index	4.3	4.3	4.5	4.3	5.5	5.5	5.5
Ca MRFSS Index	18.6	19.2	19.4	19.2	19.8	19.8	19.9
OrRec Index	2.9	2.7	2.8	2.7	2.4	2.4	2.4
Wa Rec Index	0.967	0.983	0.992	0.983	0.951	0.951	0.951
IPHC	0.098	0.154	0.164	0.154	0.161	0.161	0.161

Table 33. Profile of likelihood and other model outcomes over a range of Lambda values on the size, age and mean-size-at-age compostion.

Bold = Estimated	Length, Age and Size Profile						
Model Lamda	100	10	1	0.5	0.1	0.01	0.001
RUN FILE	SS2-8	SS2-9	SS2-10	SS2-11	SS2-12	SS2-13	SS2-14
S-R Parameters							
Ln(R0)	**5.324**	**5.271**	**5.234**	**5.234**	**5.265**	**5.304**	5.30518
S-R Steepness (model est)	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	**0.437**	0.437
SD Recruitments	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Enviro Link	0	0	0	0	0	0	0
Initial Equil	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	**0.0349**	0.0349
SPB 0	7128	6761	6513	6515	6718	6987	6995
SPB2005	3,342	2,236	1,361	1,222	1,117	1,114	1,038
Depletion	0.469	0.331	0.209	0.188	0.166	0.159	0.148
LIKELIHOOD	238526	23922.7	2437.55	1239.95	277.119	55.1195	31.8194
indices	47.5	36.2	28.2	27.5	27.3	27.8	27.7
discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0
length_comps	161329.0	16109.1	1609.8	805.4	162.4	17.0	1.9
age_comps	64659.2	6503.5	657.1	329.9	67.3	7.1	0.7
size-at-age	12438.5	1242.8	126.2	63.9	13.4	1.4	0.1
mean_body_wt	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equil_catch	1.5	0.0	0.0	0.0	0.0	0.0	0.0
Recruitment	50.3	31.1	16.1	13.3	6.6	1.7	1.3
Parm_priors	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Parm_devs	0.0	0.0	0.0	0.0	0.0	0.0	0.0
penalties	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Forecast_Recruitment	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CaCPFV Index	14.2	9.3	5.0	4.4	4.1	4.5	4.6
Ca MRFSS Index	28.9	23.3	19.5	19.3	19.2	19.3	19.2
OrRec Index	3.0	2.4	2.5	2.6	2.8	2.9	2.8
Wa Rec Index	1.2	1.0	1.0	1.0	1.0	1.0	1.0
IPHC	0.178	0.171	0.158	0.155	0.153	0.166	0.173

Table 34: Summary of the estimated parameters in fitting both Models I and II.

Age (year) [>= age]	No. of yelloweye rockfish used	Estimates					
		Model I				Model II	
		$\hat{L}_{\infty}$ (cm)	$\hat{K}$ (per year)	$\hat{t}_0$ (year)	$\hat{L}_0$ (cm)	$\hat{L}_{\infty}$ (cm)	$\hat{K}$ (per year)
5	730	63.38	0.04614	-11.16	25.50	**59.94**	**0.08314**
10	723	64.64	0.03764	-16.86	30.37	60.05	0.08268
15	697	65.46	0.03318	-21.01	32.86	60.37	0.08042
20	559	65.42	0.03341	-20.70	32.66	61.37	0.07290
25	364	67.43	0.02403	-36.08	29.09	62.31	0.06583
30	268	68.62	0.02041	-45.10	41.29	62.92	0.06095

Table 35: Summary of the number of yelloweye used in modeling the growth of yelloweye rock fish.

	No. of yelloweye collected	
Year	Columbia	Vancouver Island, US
1999	24	0
2001	19	125
2002	0	135
2003	208	10
2004	154	55

Table 36: Summary of estimated unknown parameters and their standard errors in the final sub-optimal model in Model III.

Parameters	Estimates (Model III)	Estimated standard error
$\hat{L}_{\infty}$ (cm)	64.44	0.5160
$\hat{K}$ (per year)	0.07779	0.001944
$\hat{r}_L$ (female) (cm)	-7.444	0.6678
$\hat{s}_K$ (Columbia) (per year)	-0.0009158	0.001531
$\hat{r}_K$	0.02224	0.0035
$\hat{y}_{K,2003}$	-0.008632	0.002408

Table 37. Summary of estimated yelloweye rockfish total mortality coefficients from years 1984 to 2002 in Washington, Oregon and California states. Bold value means the estimated coefficient was not significant (P>0.05).

Years	**Estimated total mortality coefficient [M+F] (standard error)**		
	Washington	**Oregon**	**California**
1984		0.17 (0.006)	
1985		0.09 (0.022)	
1986		0.13 (0.030)	
1987		0.14 (0.006)	
1989		0.18 (0.023)	0.08 (0.031)
1990			**0.09 (0.12)**
1991			0.10 (0.023)
1992			0.13 (0.014)
1993		0.09 (0.026)	0.14 (0.08)
1994			0.17 (0.013)
1995			0.15 (0.004)
1996	0.15 (0.031)		0.18 (0.006)
1997	0.20 (0.026)		0.14 (0.012)
1998	0.12 (0.017)		0.15 (0.016)
1999	0.08 (0.019)	0.07 (0.049)	0.15 (0.069)
2000	**0.07 (0.037)**		
2001	**0.02 (0.059)**	0.24 (0.063)	0.17 (0.076)
2002	0.08 (0.031)	0.21 (0.040)	

Table 38. Table 2. Ten-year OY projections and depletion levels under different PMAX for the coastwide model.

P_{MAX}	0.5		0.6		0.7		0.8		0.9		Yr=Tmid		F=0	
T_{MAX}	2096		2092		2087		2083		2078		2073		2048	
2007	14.8	18%	14.1	18%	13.4	18%	12.6	18%	11.4	18%	10.2	18%	0.0	18%
2008	15.1	18%	14.5	18%	13.7	19%	12.9	19%	11.7	19%	10.5	19%	0.0	19%
2009	15.4	19%	14.8	19%	14.0	19%	13.2	19%	12.0	19%	10.7	19%	0.0	19%
2010	15.7	19%	15.1	19%	14.3	19%	13.5	19%	12.3	20%	11.0	20%	0.0	20%
2011	16.0	20%	15.4	20%	14.6	20%	13.8	20%	12.6	20%	11.2	20%	0.0	21%
2012	16.3	20%	15.6	20%	14.9	20%	14.1	20%	12.8	20%	11.4	20%	0.0	21%
2013	16.6	21%	15.9	21%	15.1	21%	14.3	21%	13.0	21%	11.7	21%	0.0	22%
2014	16.8	21%	16.1	21%	15.4	21%	14.5	21%	13.2	21%	11.9	21%	0.0	22%
2015	17.0	21%	16.4	21%	15.6	21%	14.7	21%	13.5	22%	12.1	22%	0.0	23%
2016	17.3	21%	16.6	22%	15.8	22%	15.0	22%	13.7	22%	12.2	22%	0.0	23%

Table 39. Benchmark fishing mortality rates for each area model and the coastwide model based on the SSC default rebuilding analysis simulation software..

Reference Point	Area (models) for consideration Coastwide	California	Oregon	Washington	W-O-C
[1/] Unfished Spawning Stock Biomass (SSB_0)	3,322	1,715	1,258	453	3,425
Unfished Exploitable Biomass (B_0)	7,448	3,877	2,789	1,017	7,683
Unfished Recruitment (R_0)	4.85	4.19	3.85	3.00	
SSB_{2006}	588	145	274	95	514
Depletion Level (2006)	17.7%	8.5%	21.8%	21.0%	15.0%
Depletion -95CI	14.2%	5.7%	16.5%	17.3%	
Depletion +95CI	21.1%	11.2%	27.0%	24.6%	
Target Spawning Biomass ($B_{0.40}$)	1,329	684	502	181	
$F_{MSY\ Proxy\ (SPR=0.50)}$	0.024	0.021	0.021	0.027	
Exploitable Biomass	1491	383	671	255	
[2/] ABC_{2006}	36.2	8.1	14.2	7.0	
OY_{2006}	36.2				

[1/] This value is expressed in female biomass (one-half of the model SSB_0 estimate of 6,644 m for both sexes).

[2/] Assumes F_{MSY} Proxy (SPR=0.50)

Table 40. Fishing benchmarks based on SS2 V1.21 forcast.ss2 output.

Forecast based SS2 v1.21 output for Coastwide Model

Element	perRecr	*Recr
Recr_unfished	1.0	127.4
SPB_unfished	51.8	6603.1
BIO_Smry_unfished	58.2	7414.5
Steepness_for_MSYcalc	0.450	
SPR_at_msy	0.573	
Exploit_at_MSY_(=Y/Bsmry)	0.016	
Recruits_at_msy	0.671	85.5
SPB_at_msy	29.7	2539.4
SPBmsy/SPBzero(using_S0)	0.384	
SPBmsy/SPBzero(using_endyear_LifeHistory)	0.385	
MSY_Yield	0.558	47.7
BIO-Smry_at_MSY	35.5	3038.5
SPR_for_target_F	0.500	
Exploit_at_target_F_(=Y/Bsmry)	0.020	
SPB_at_target	25.9	
YIELD_at_Target_F	0.636	
Biomass_Smry_at_Target_F	31.6	
Depletion(endyr&endyr+1)	0.160	0.163
Summary_age:	3	

Table 41. Yield (with 40:10 adjustment) based on SS2 V1.21 forcast.ss2 output.

year	bio-all	bio-Smry	SpawnBio	Depletion	recruit-0	Catch
2006	1,345	1,329	1,078	0.163	43.8	26.6
2007	1,355	1,338	1,095	0.166	50.2	26.8
2008	1,362	1,344	1,109	0.168	50.6	27.0
2009	1,369	1,350	1,119	0.169	50.9	27.1
2010	1,374	1,354	1,125	0.170	51.2	27.2
2011	1,378	1,358	1,130	0.171	51.3	27.3
2012	1,381	1,362	1,132	0.171	51.4	27.4
2013	1,385	1,365	1,132	0.171	51.4	27.4
2014	1,388	1,369	1,132	0.171	51.4	27.4
2015	1,392	1,372	1,131	0.171	51.3	27.5
2016	1,396	1,376	1,129	0.171	51.3	27.5
2017	1,399	1,380	1,128	0.171	51.2	27.6

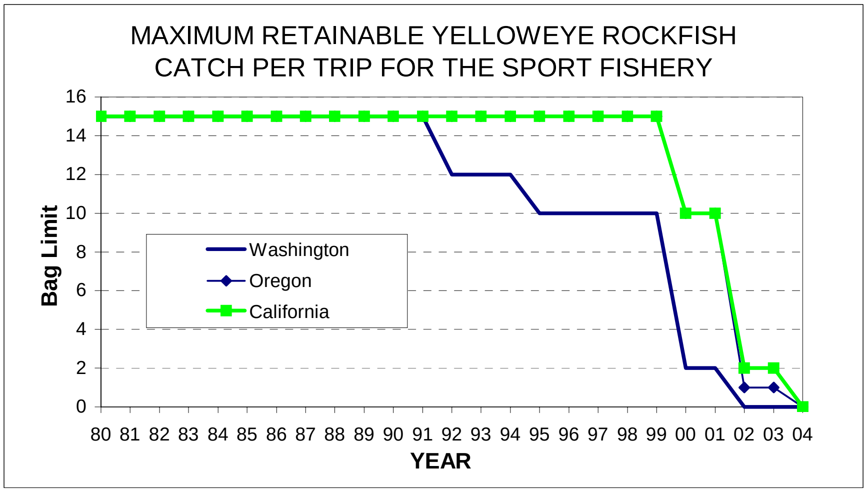
Table 42. Comparison of yelloweye ABC, OY and catch since single species management began in 2002.

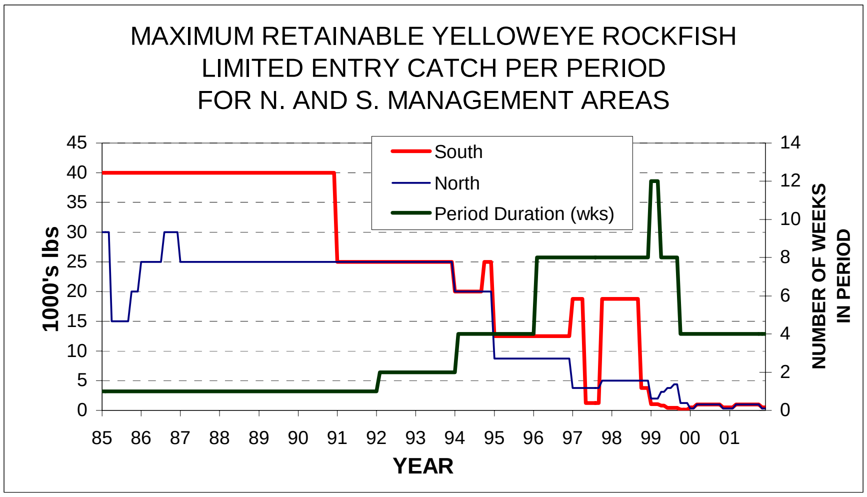
Coastal Washington, Oregon and California Yelloweye Rockfish Landings

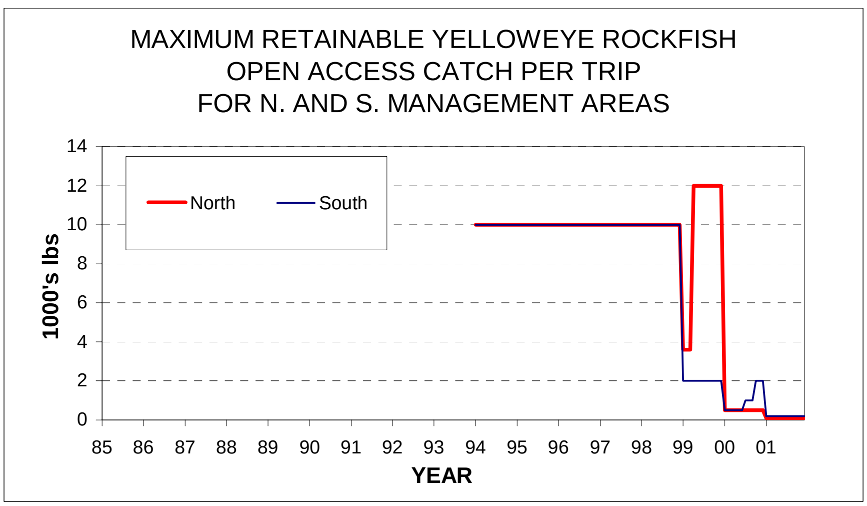
Source	PacFIN and MRFSS				Tagart, PacFIN, and ODFW				Tagart, PacFIN and WDFW										
	California [1/]				Oregon [2/]				Washington [3/]				Totals				Coastwide		
Year	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Trawl	Line	Other	Sport	Total	ABC	OY (Tmid)
2002	0.2	0.0	0.0	2.1	0.4	0.3	0.0	3.6	0.4	2.2	0	3.7	1.0	2.5	0.0	9.4	12.9	52.0	22.0
2003	0.0	0.0	0.0	3.7	0.8	0.2	0.0	3.8	0.2	0.3	0	2.6	1.0	0.5	0.0	10.1	11.6	52.0	22.0
2004	0.0	0.0	0.0	3.5	0.2	0.5	0.0	2.4	0.1	0.8	0	4.5	0.3	1.3	0.0	10.4	12.0	54.0	22.0
2005	1.6	0.0	0.0	3.7	0.2	4.1	0.2	4.3	0.1	4.2	0.1	5.1	1.9	8.3	0.3	13.1	23.6	54.0	26.0

Note: GMT "Scorecard" from Nov. 2005 used for all 2005 catch estimates and prior catches from a varity of sources including PacFIN, RecFIN, CDFG, ODFW and WDFW.

Figure 1. Yelloweye management history by fishery and area 1985-2004.

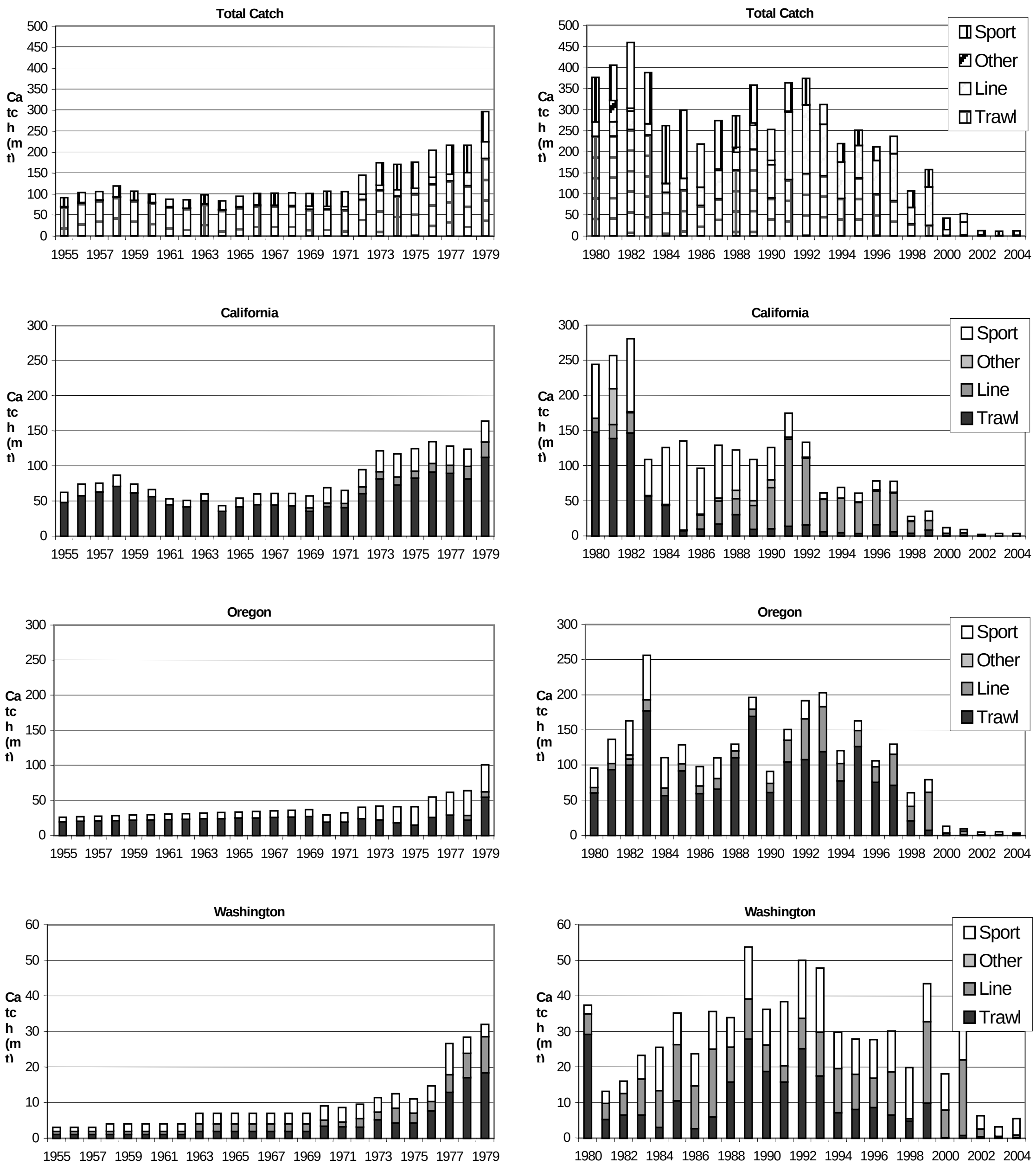






Note: The PFMC N/S Management border shifted North from Cape Mendencio to 40° 10' in 2000. Between Cape Mendocino and N of 36' N, recreational rockfish fishing is closed 3/1 - 4/30; S of 36' N, recreational rockfish fishing is closed 1/1 - 2/29

Figure 2. Estimated yelloweye rockfish catch by State and year since 1955.



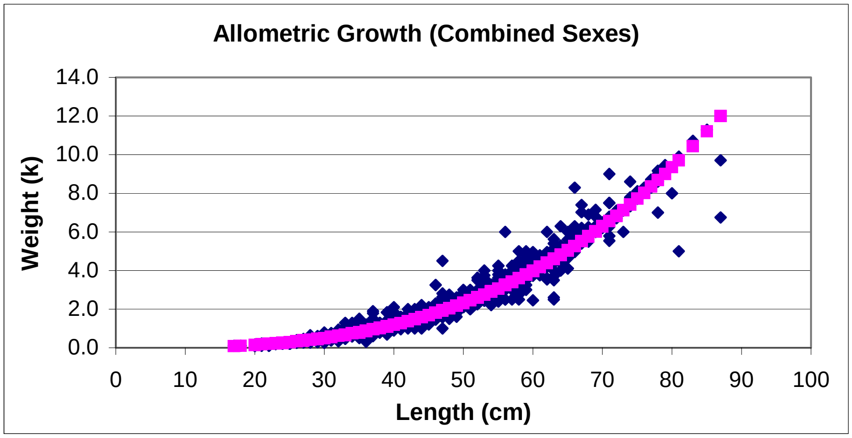


Figure 3. Yelloweye allometric growth for combined sexes (weight= 0.000021*length$^{2.9659}$)

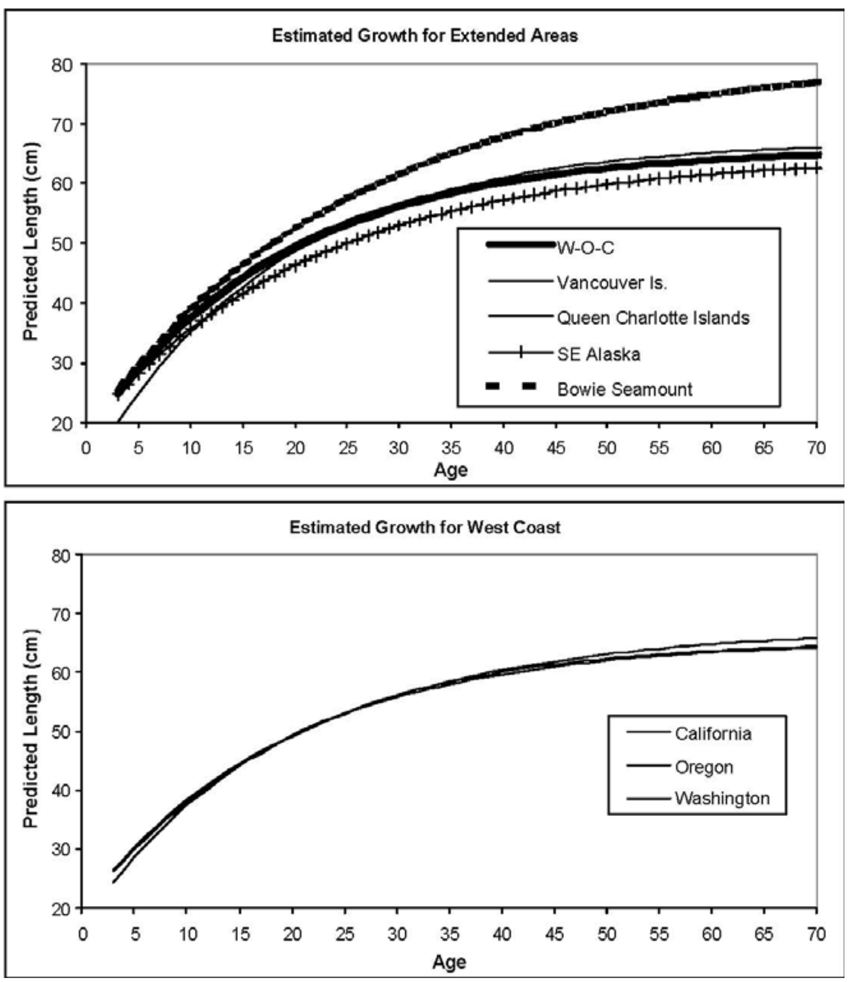


Figure 4. Predicted yelloweye rockfish size-at-age by locale. Need to update for the final model.

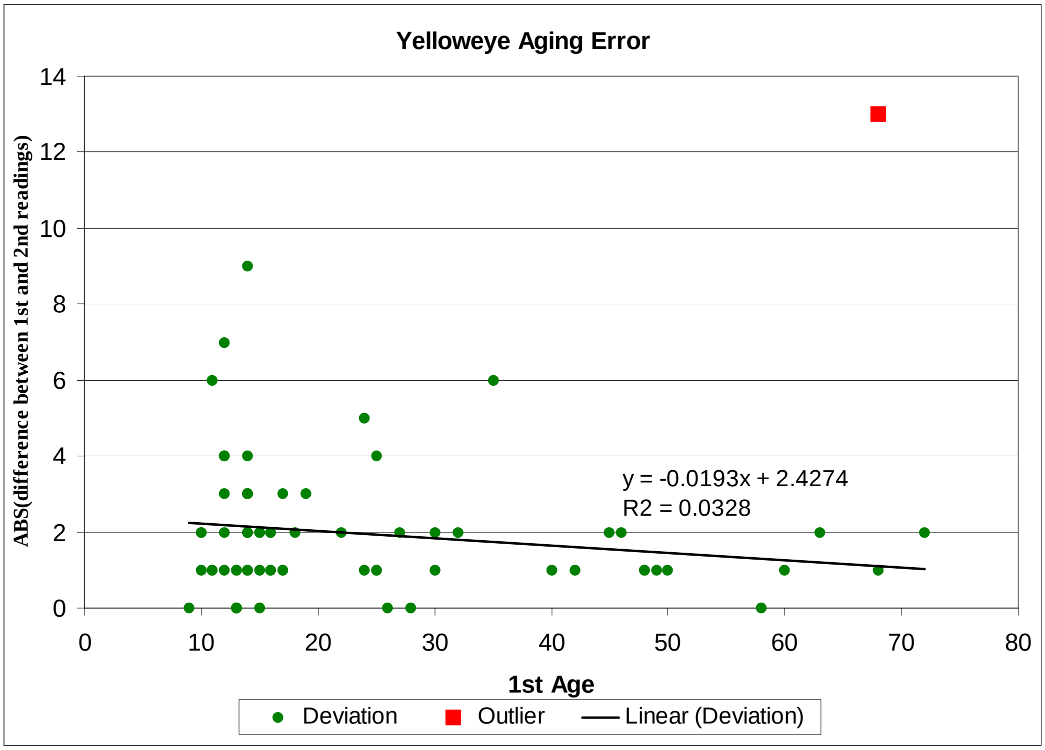


Figure 5. Observed and predicted age error for yelloweye rockfish when omitting the outlier from the dataset.

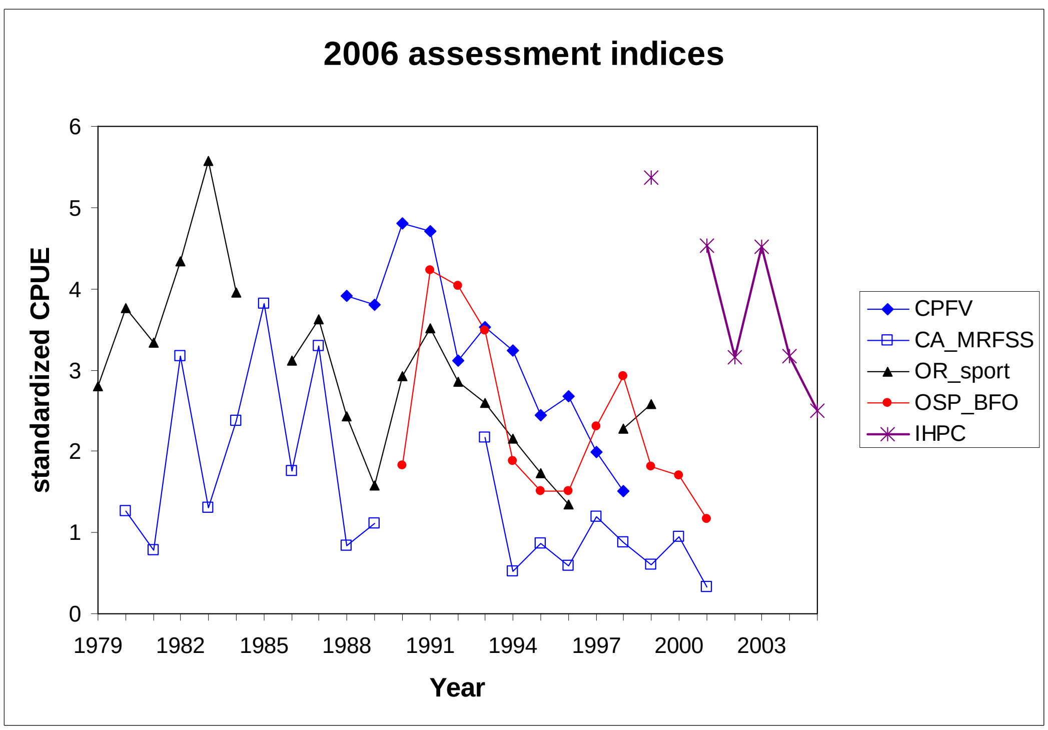


Figure 6. Comparison of standardized CPUE indices used in the base run.

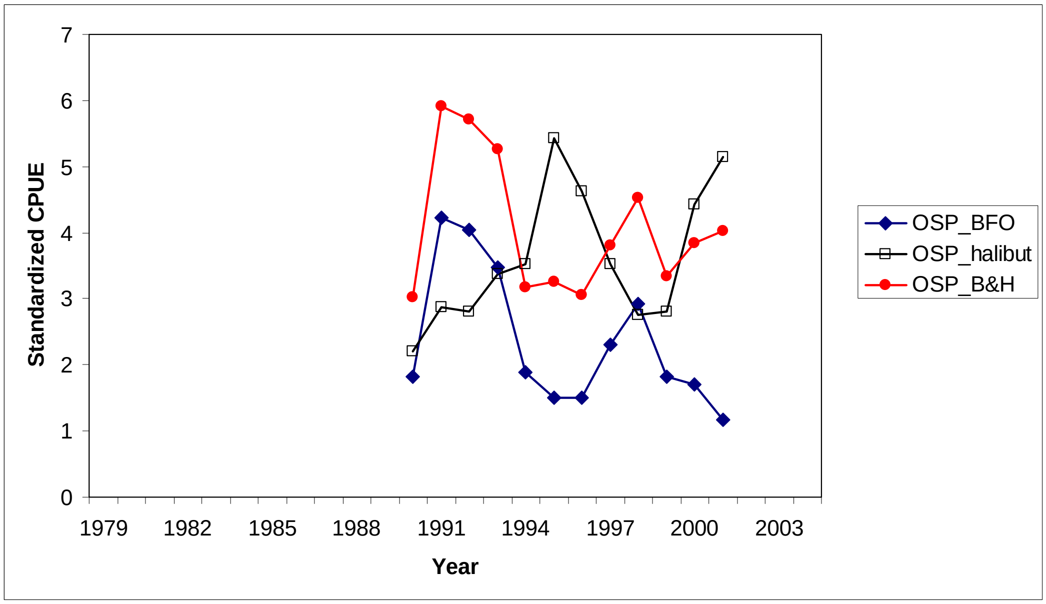


Figure 7. Abundance indices calculated from Washington recreational sampling – bottomfish only trips (OSP_BFO), halibut directed trips (OSP_halibut), and combined (OSP_B&H).

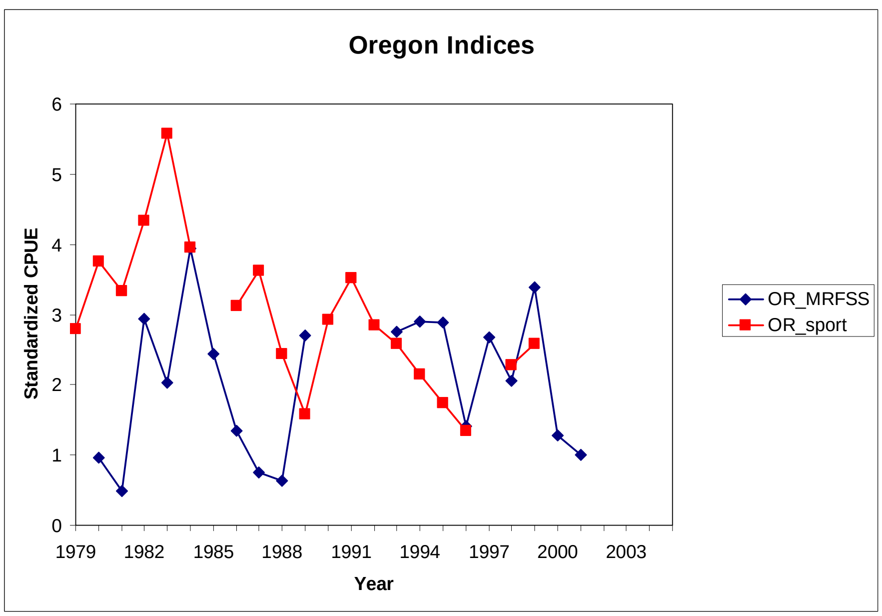


Figure 8. Comparison of Oregon sport CPUE and MRFSS CPUE.

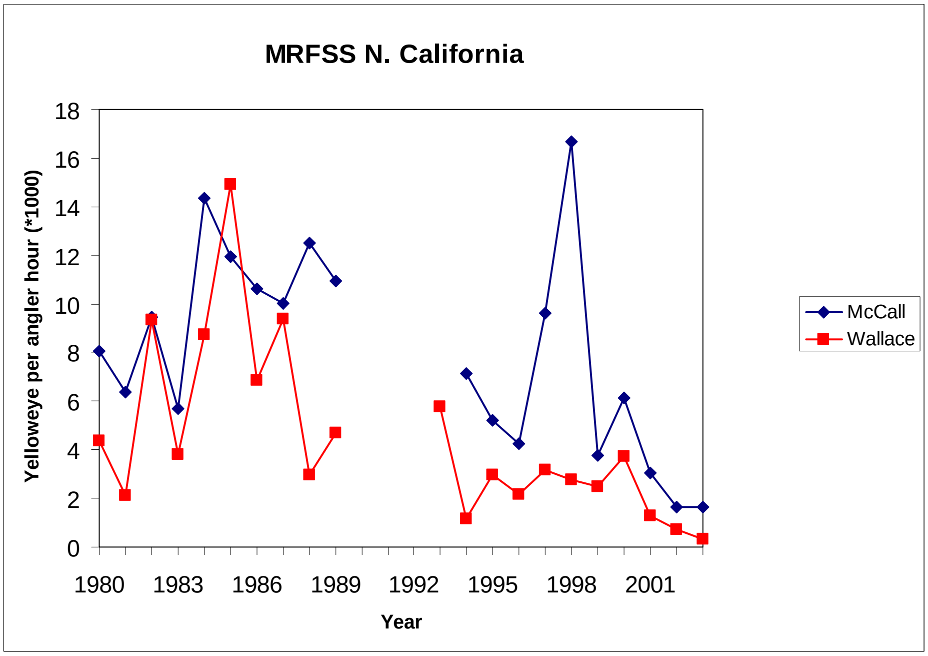


Figure 9. Comparison of Northern California MRFSS CPUE trends generated by using targeted speicies information (Wallace) and by using a binomial filtering mechanism (McCall).

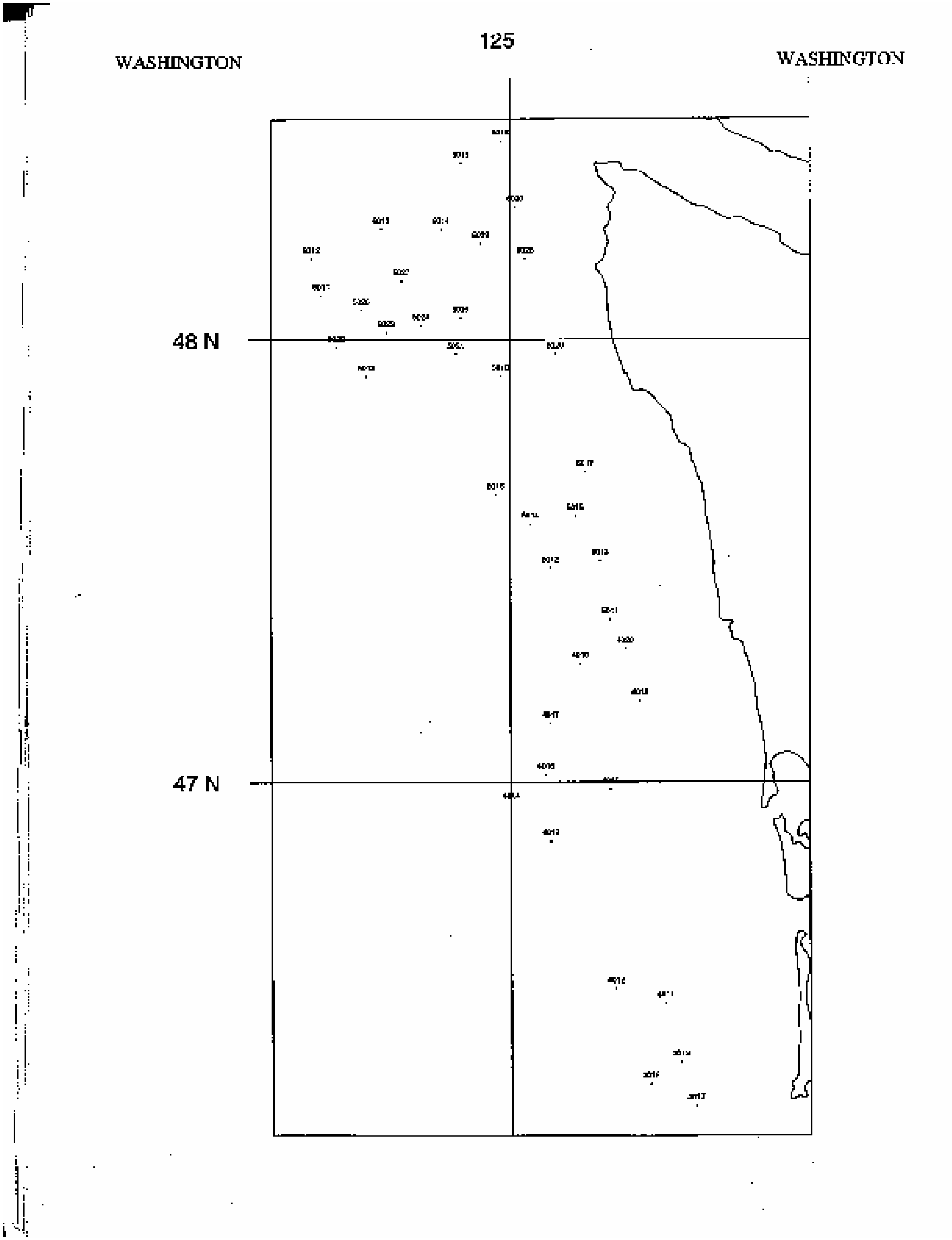


Figure 10. IPHC 1997 stations off Washington coast.

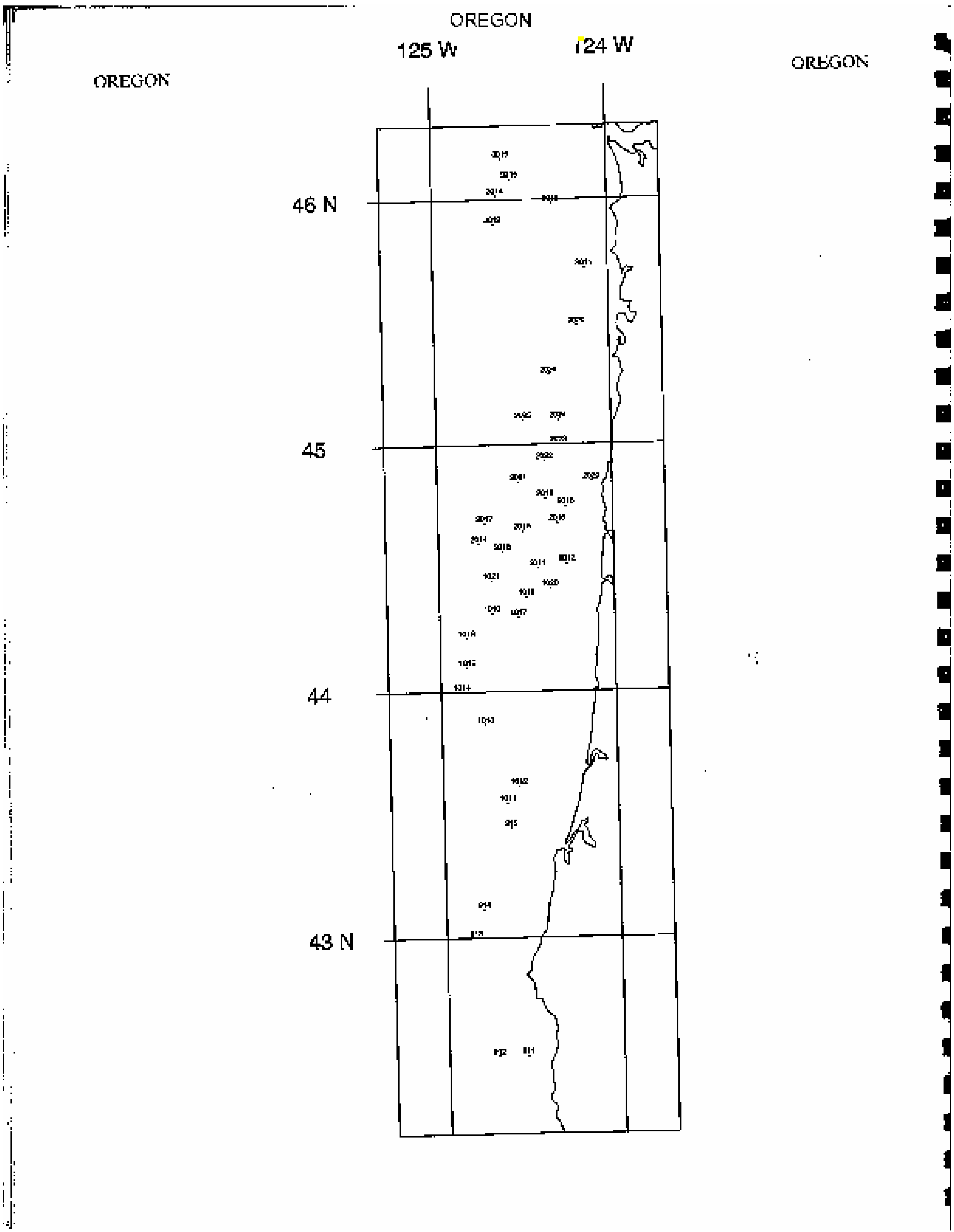


Figure 11. 1997 IPHC survey stations off Oregon coast.

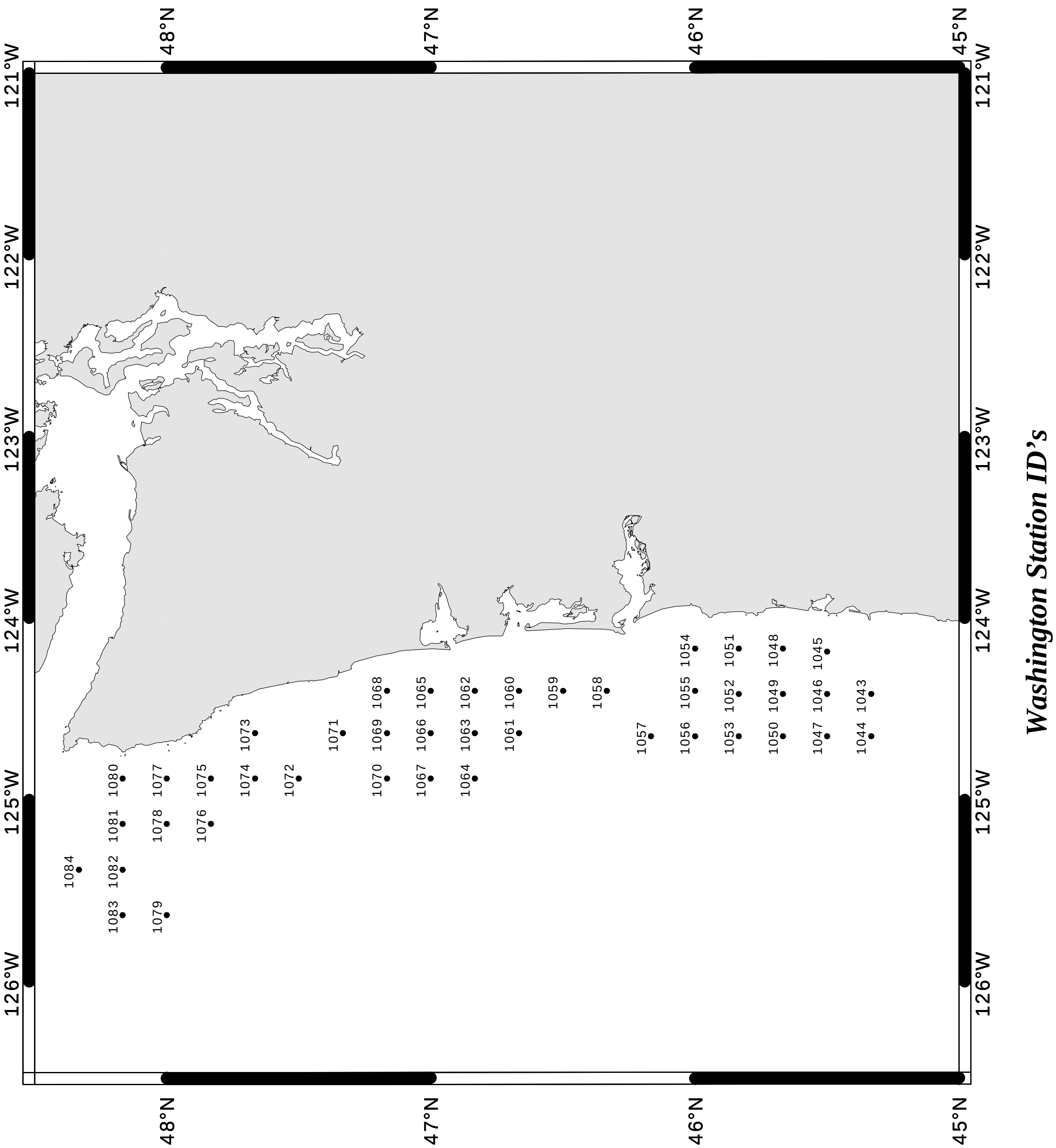


Figure 12. IPHC survey stations off Washington coast during 1999 and 2001.

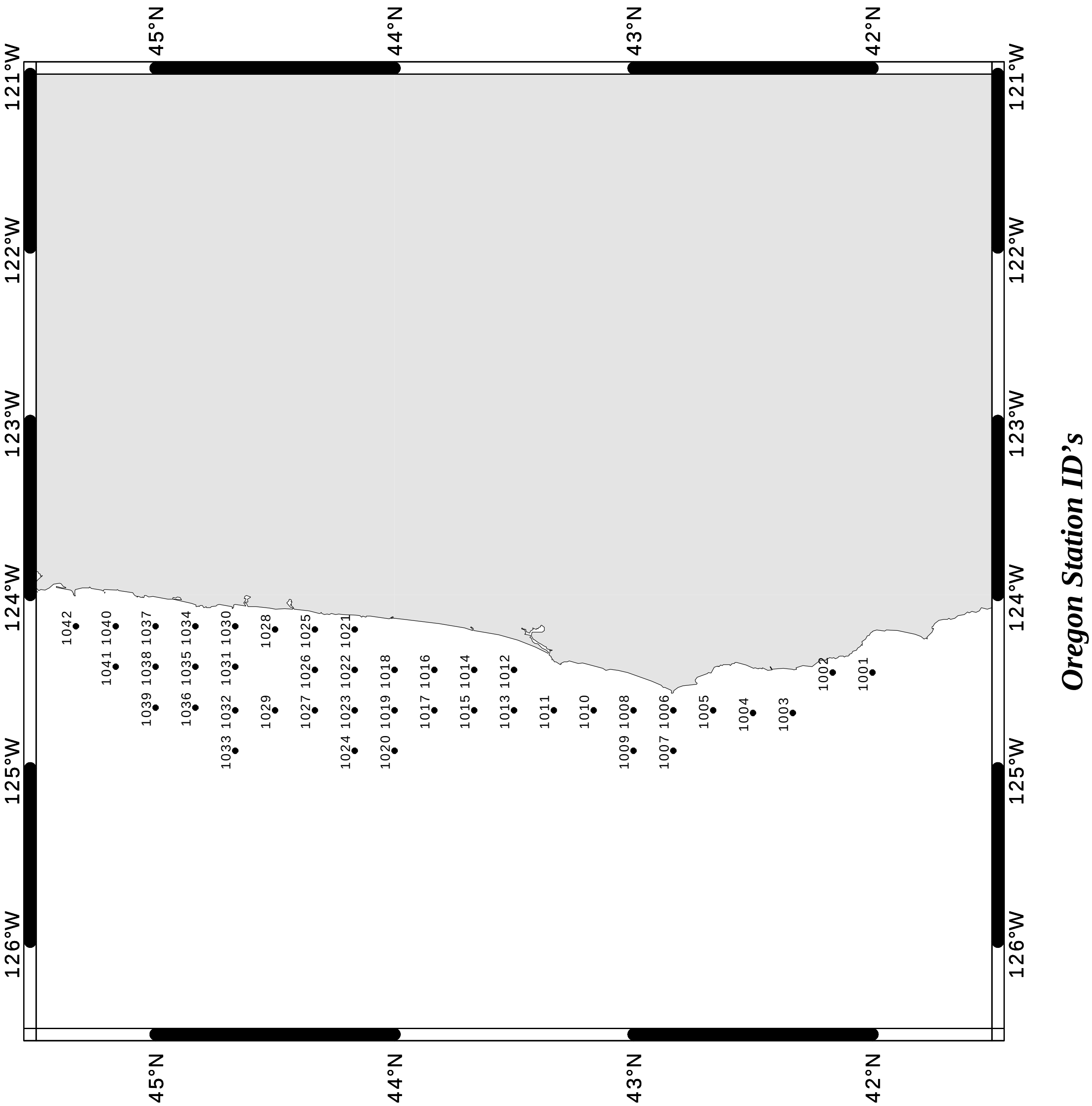


Figure 13. IPHC survey stations off Oregon coast during 1999 and 2001.

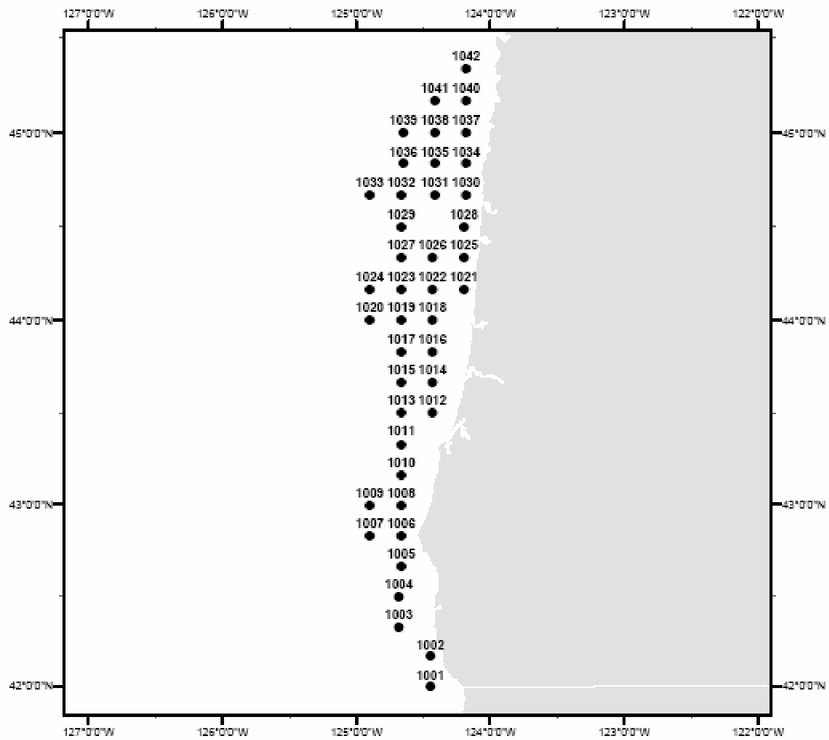


Figure 14. IPHC survey stations off Oregon coast during 2002 - 2005.

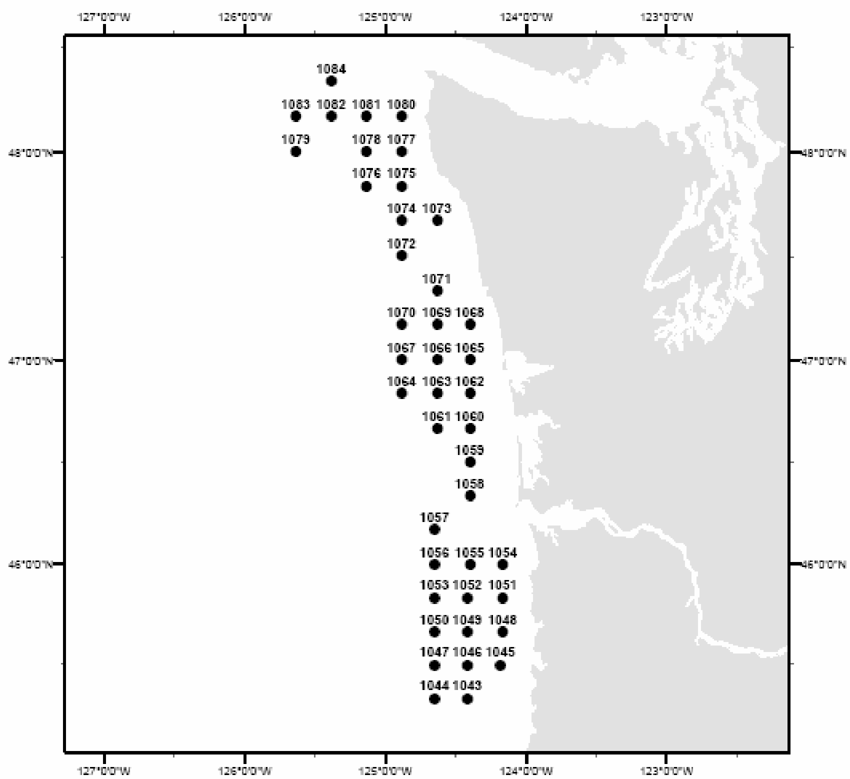


Figure 15. IPHC survey stations off Washington coast during 2002 - 2005.

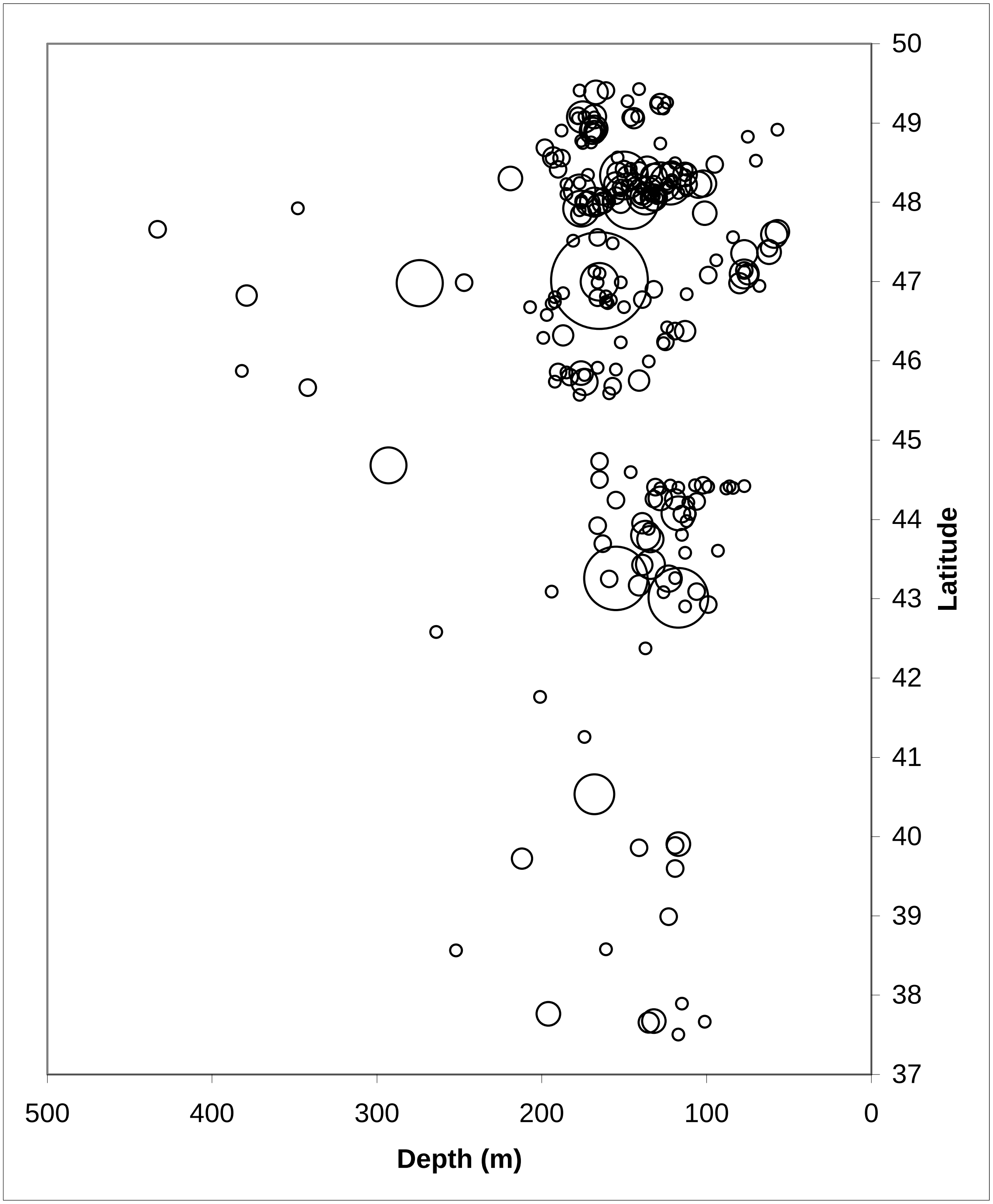


Figure 16. Spatial pattern of yelloweye rockfish occurrence in the NMFS bottom trawl survey; 1977-2001. Size of circle is proportional to yelloweye rockfish density at that location.

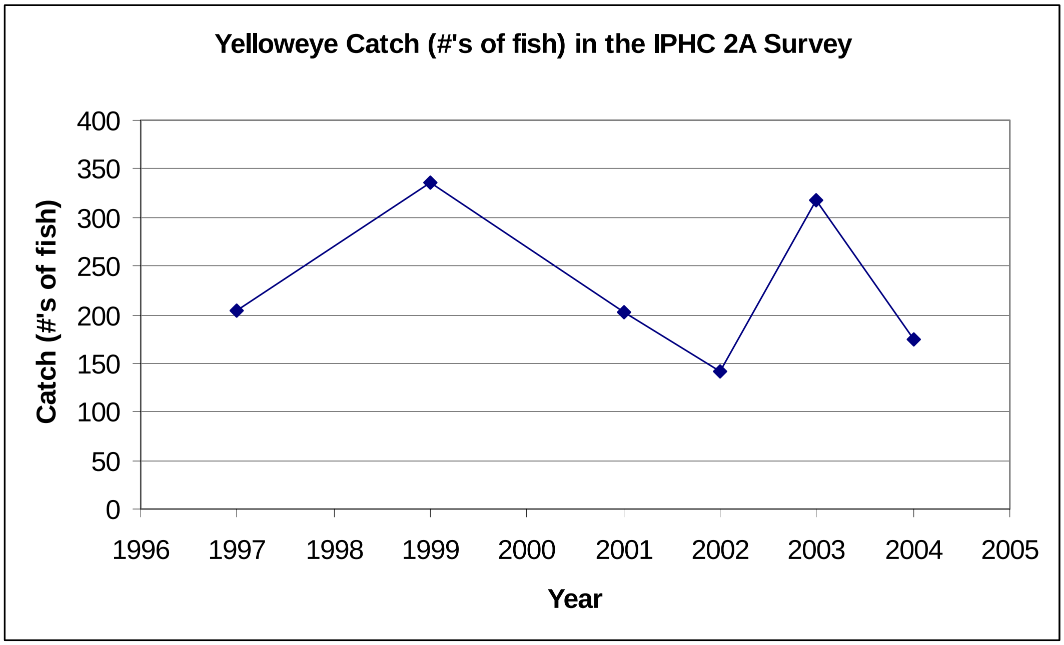


Figure 17. IPHC US water 2A yelloweye catch since 1997. Expanded estimates through 2001.

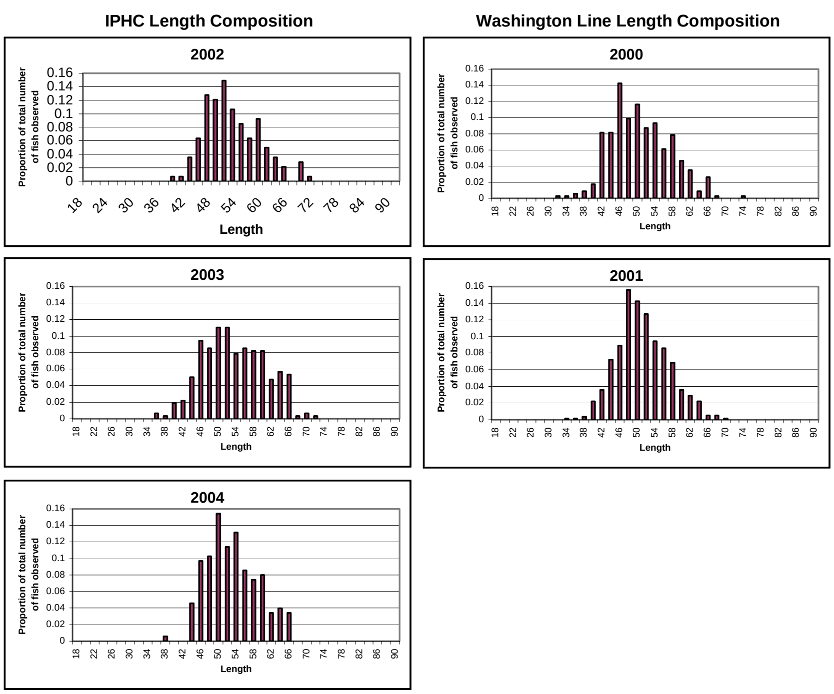


Figure 18. Comparison of length composition between the Washington yelloweye line fishery and the IPHC line survey by year.

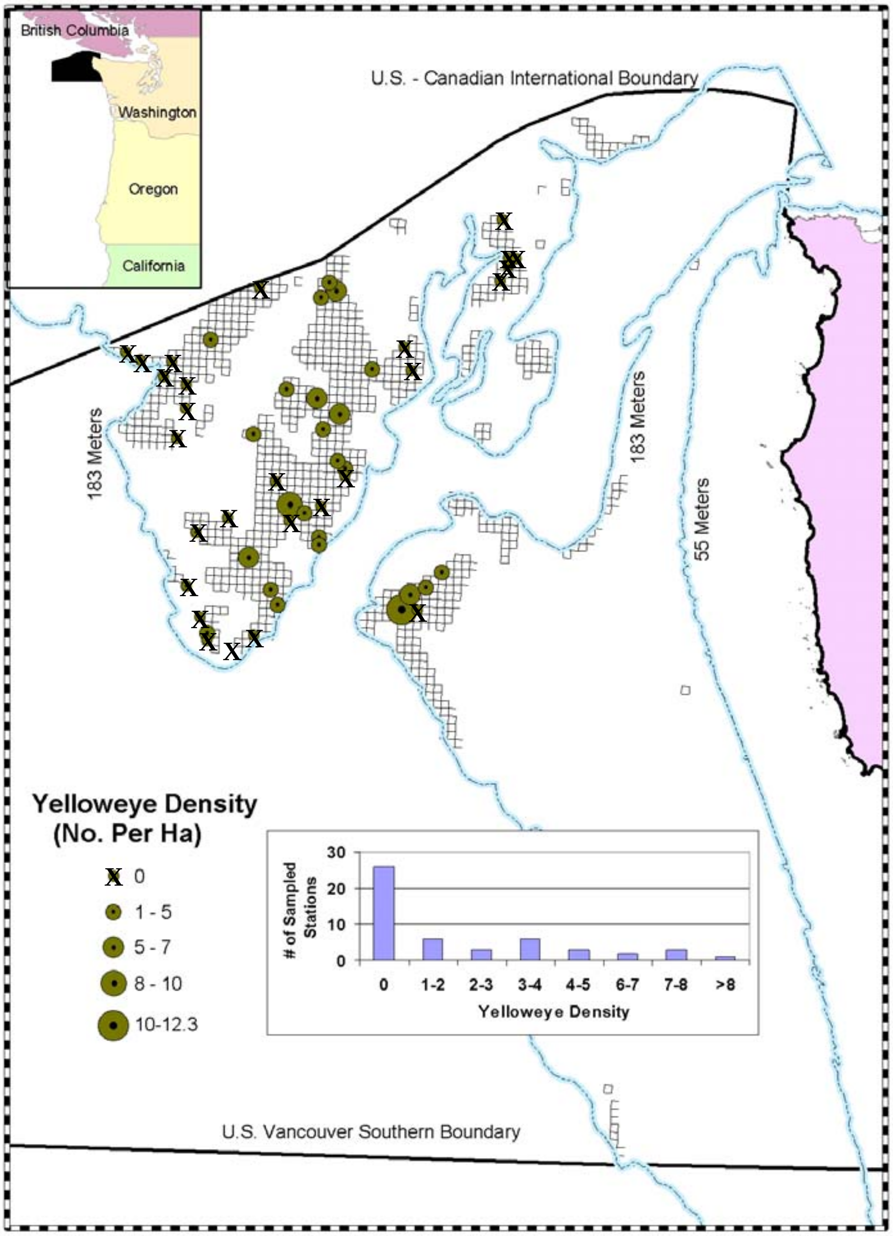


Figure 19a. Yelloweye density in the untrawlable habitat surveyed in 2002.

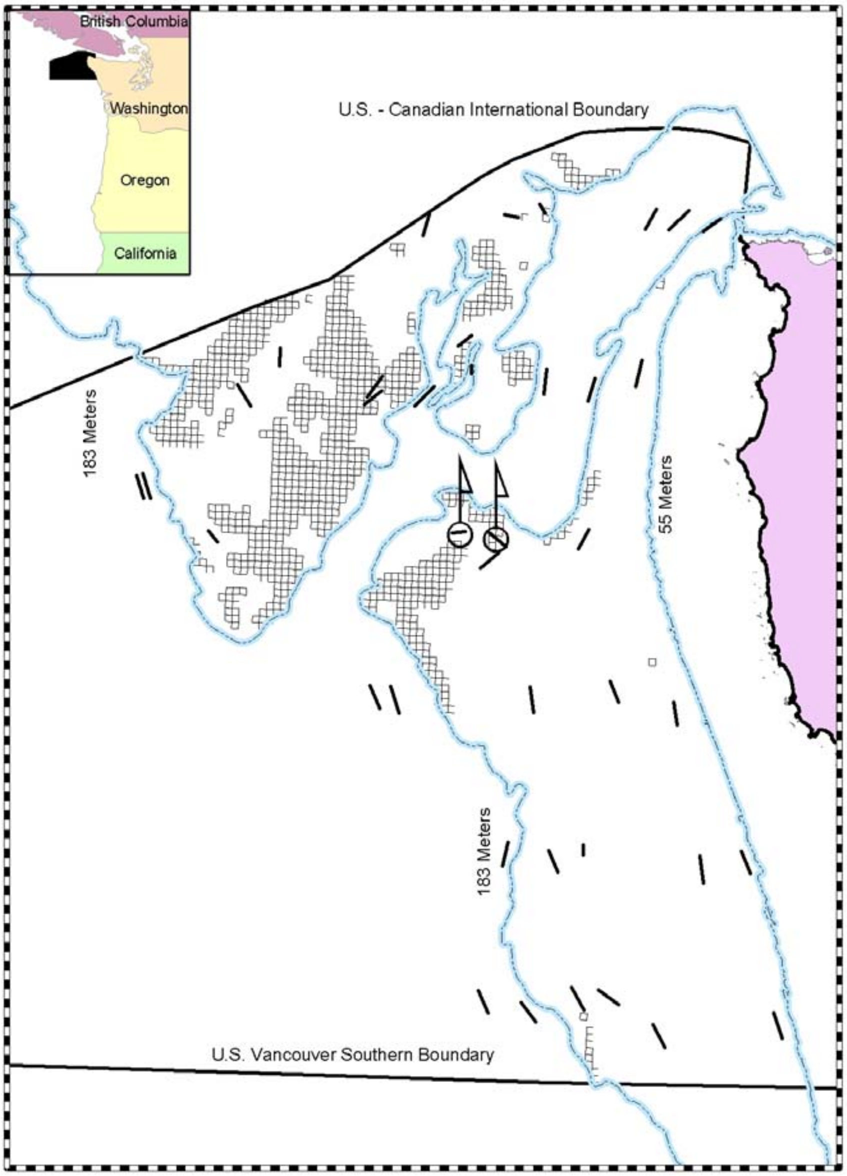


Figure 19b. NMFS trawl survey haul location for all successful tows in the U.S. Vancouver Area in 2001. Symbols mark tows with yelloweye rockfish and grey grid represents the untrawlable habitat surveyed in 2002.

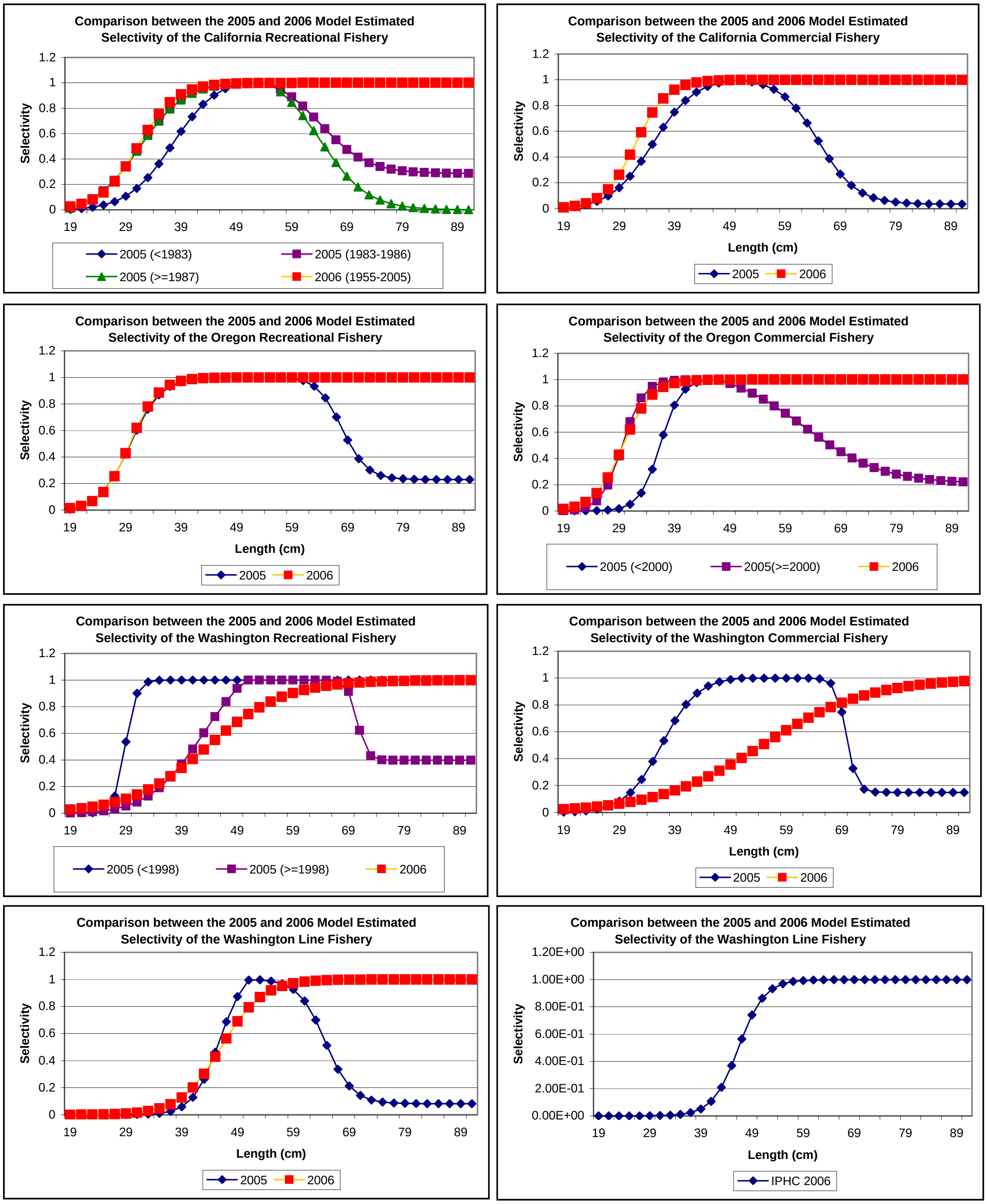
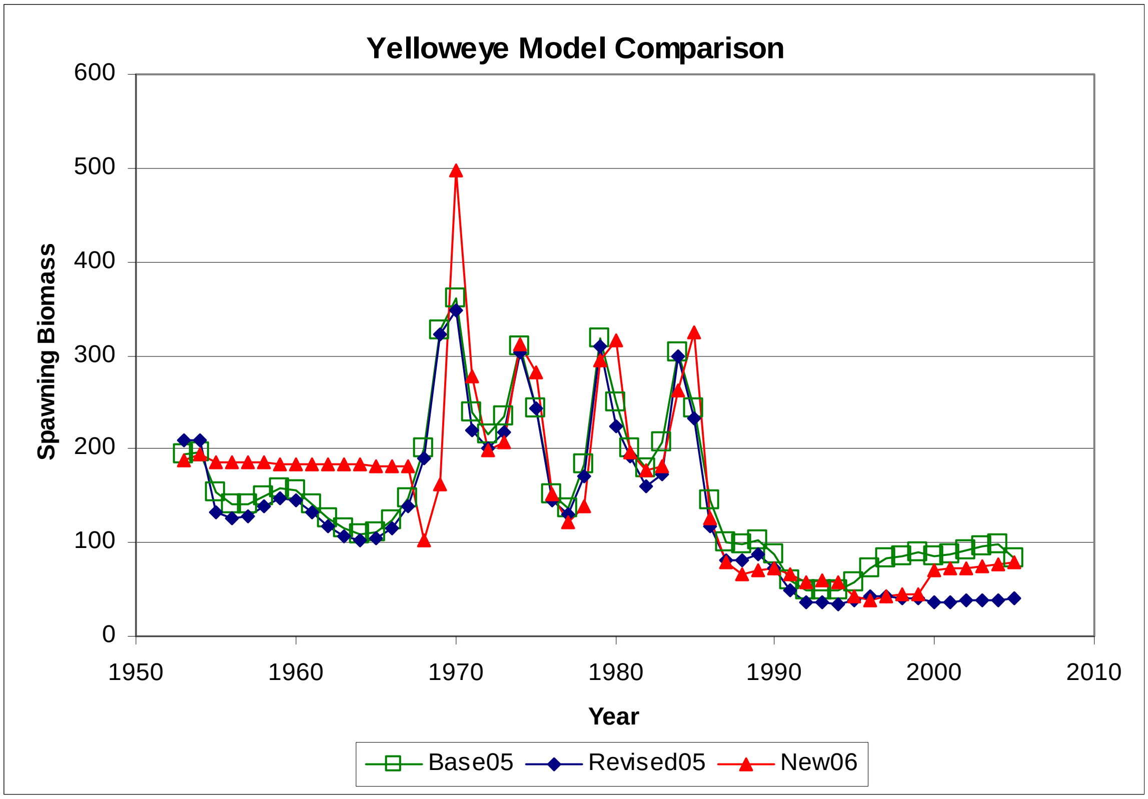


Figure 20. Comparison of estimated selectivity's between 2005 and 2006 models.



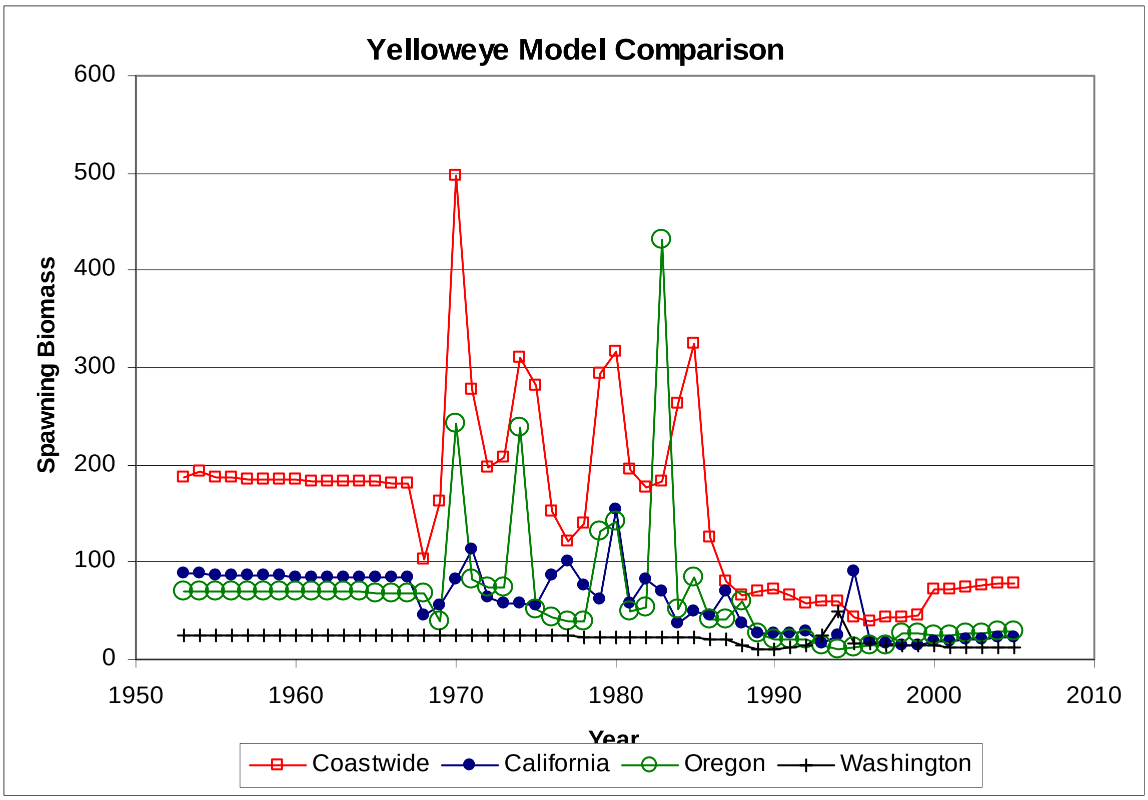
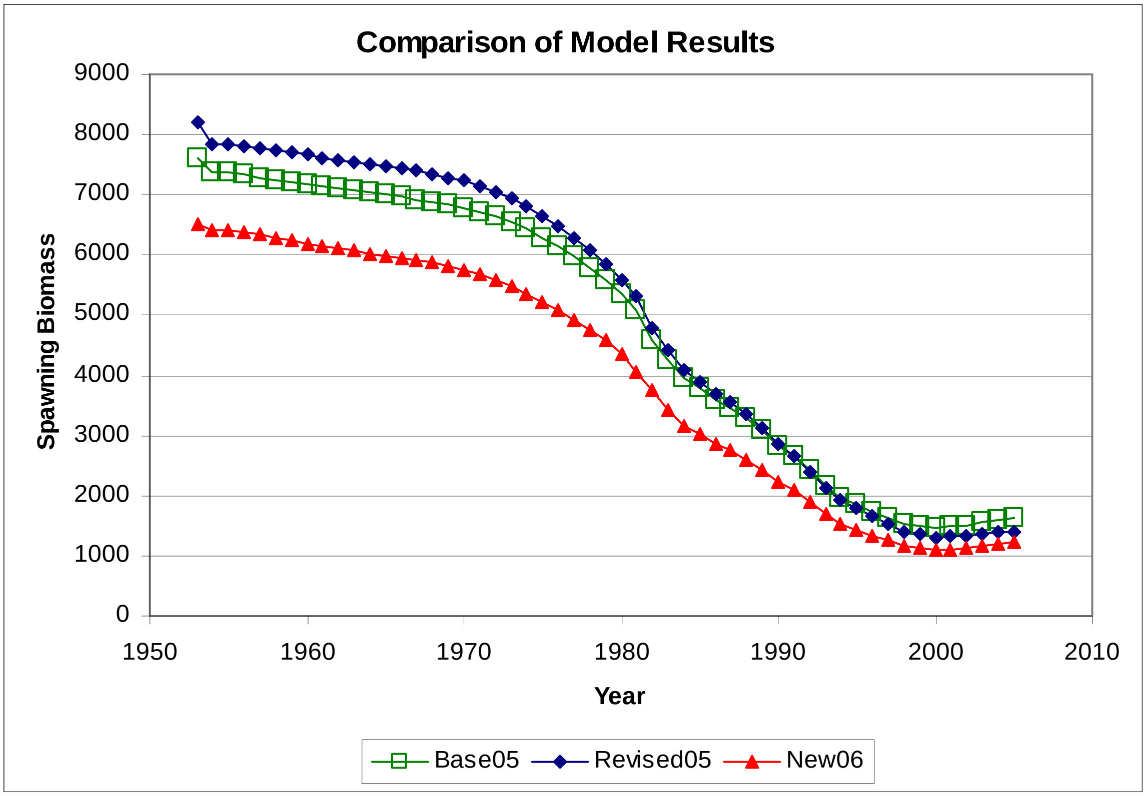


Figure 21. Comparison of the estimated recruitment time series between 2005 and 2006 base models (top panel) and between 2006 area specific models.



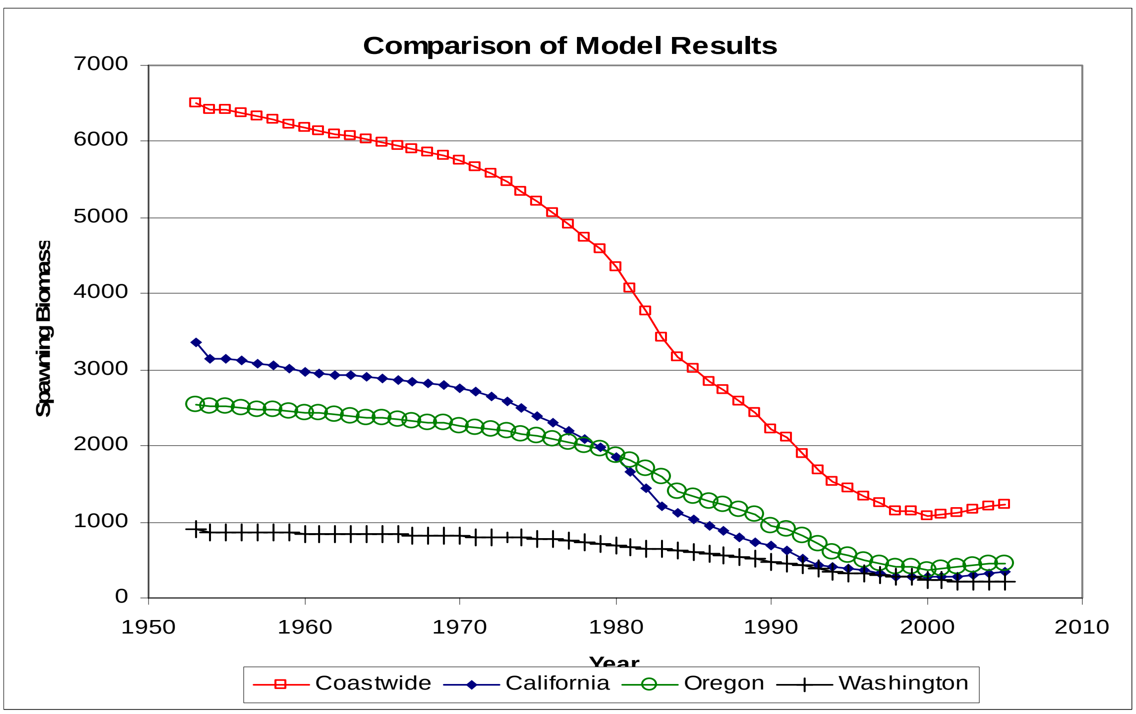


Figure 22. Comparison of the spawning biomass time series between 2005 and 2006 base models (top panel) and between 2006 area specific models.

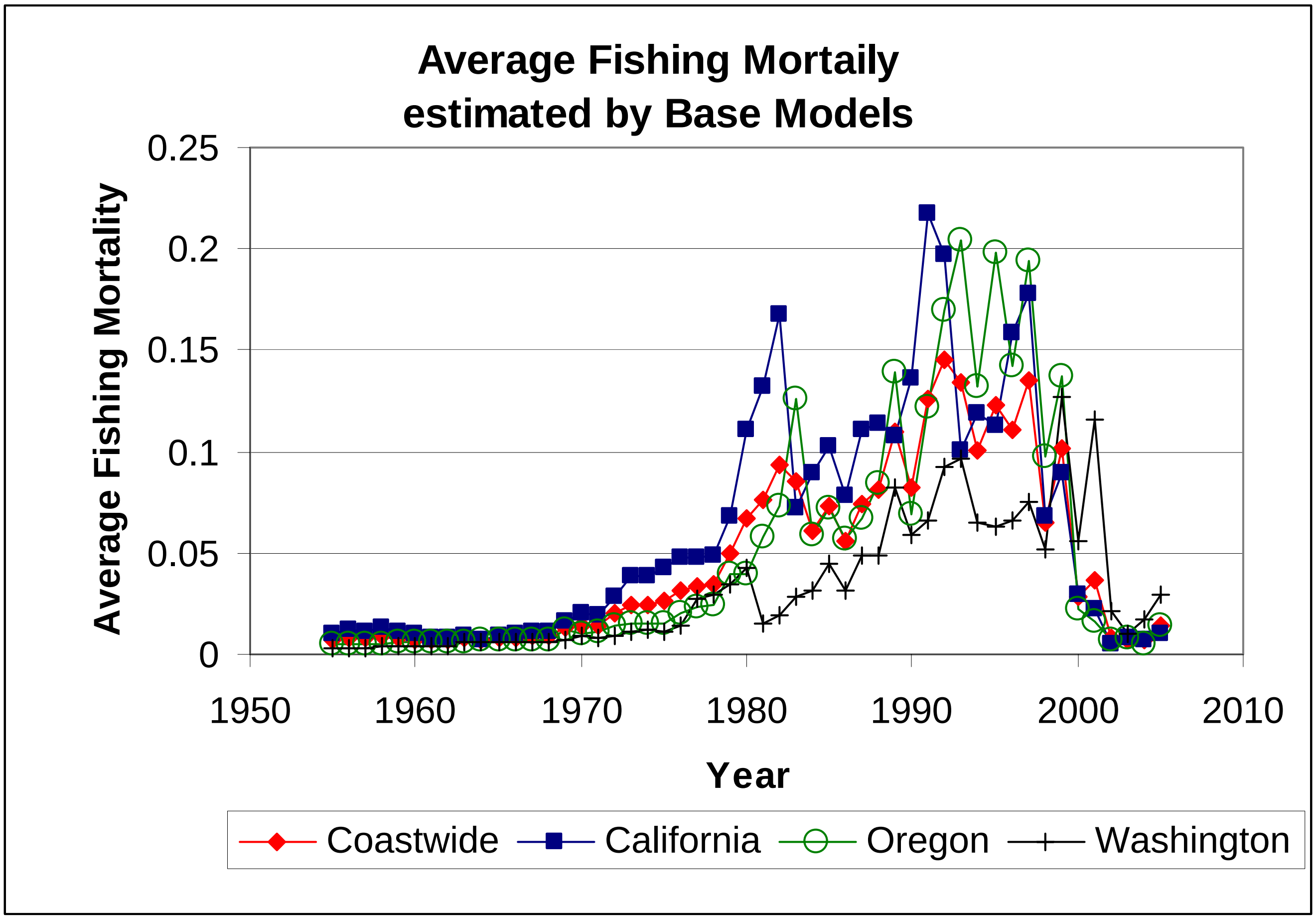
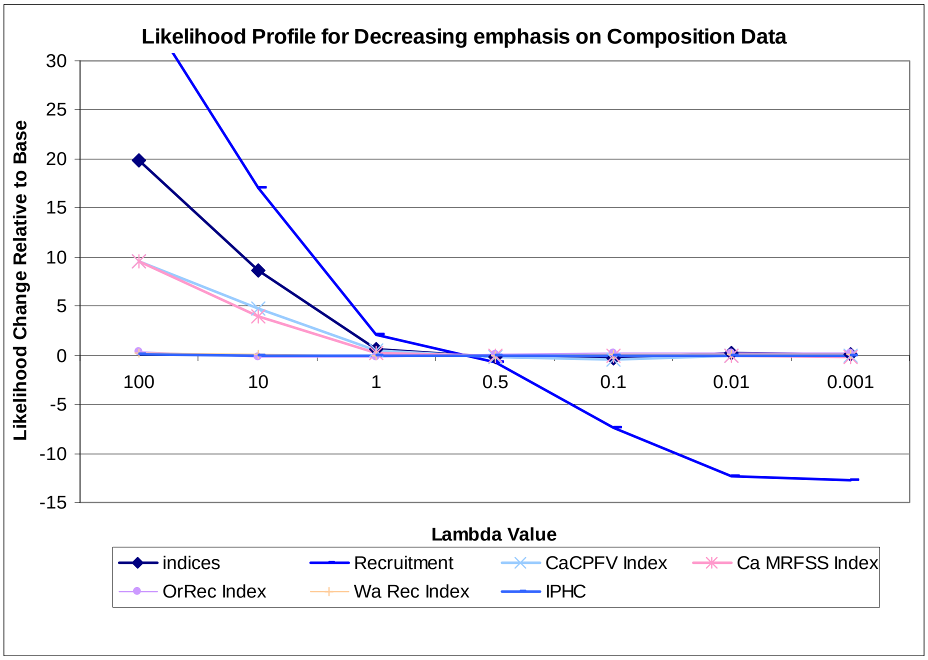


Figure 23. Comparison of average fishing mortality between all 2006 area specific base models.



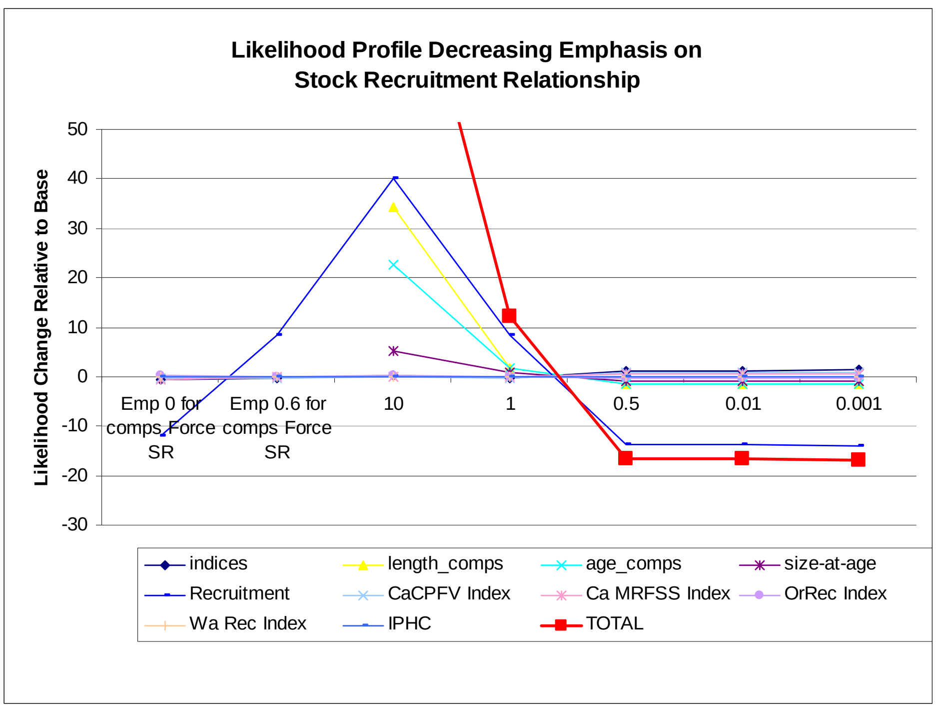
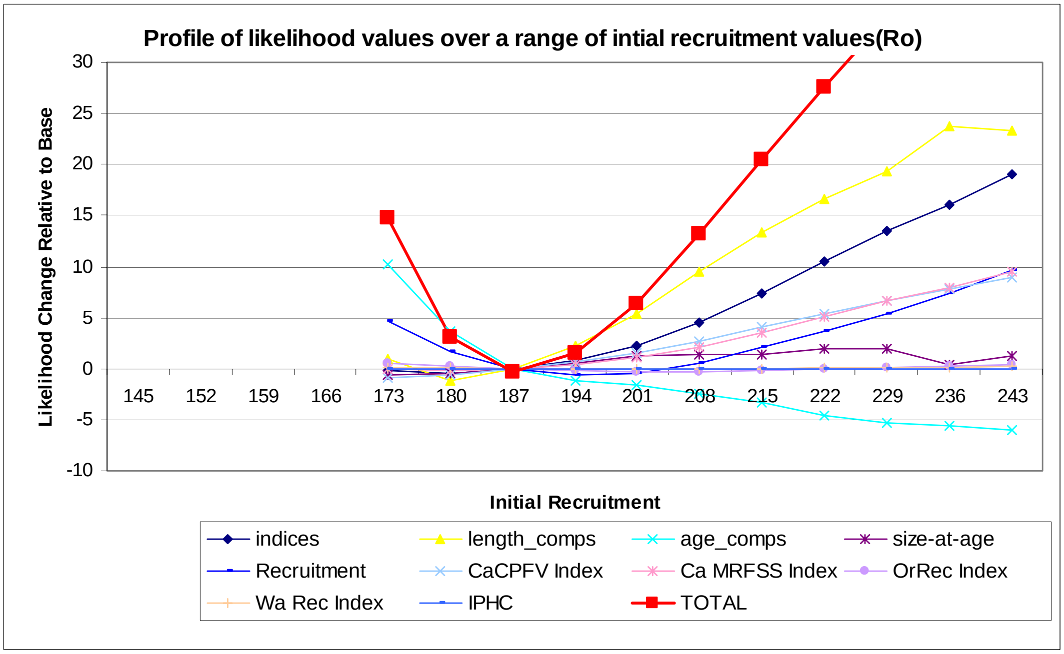


Figure 24. Profile of likelihood over a range of emphasis values (lambda) on length, age and size composition data (top panel) and over a range of emphasis values on the stock recruitment curve.



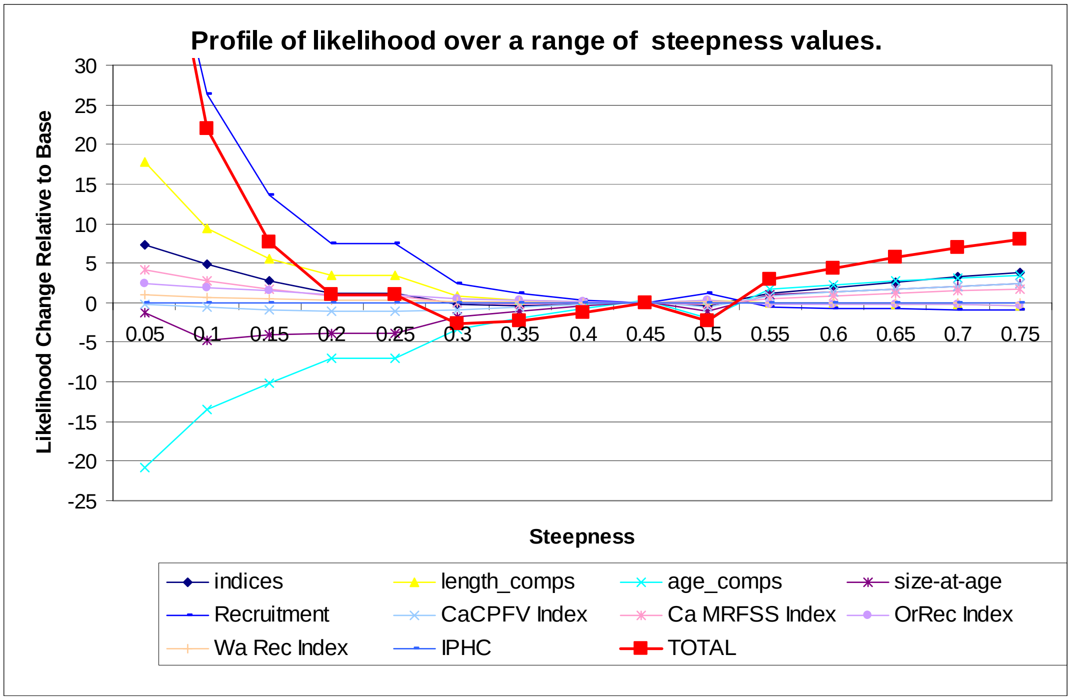


Figure 25. Profile of likelihood over a range of initial recruitment (Ro) values (top Panel) and over a range of steepness values presumed in the stock recruitment curve.

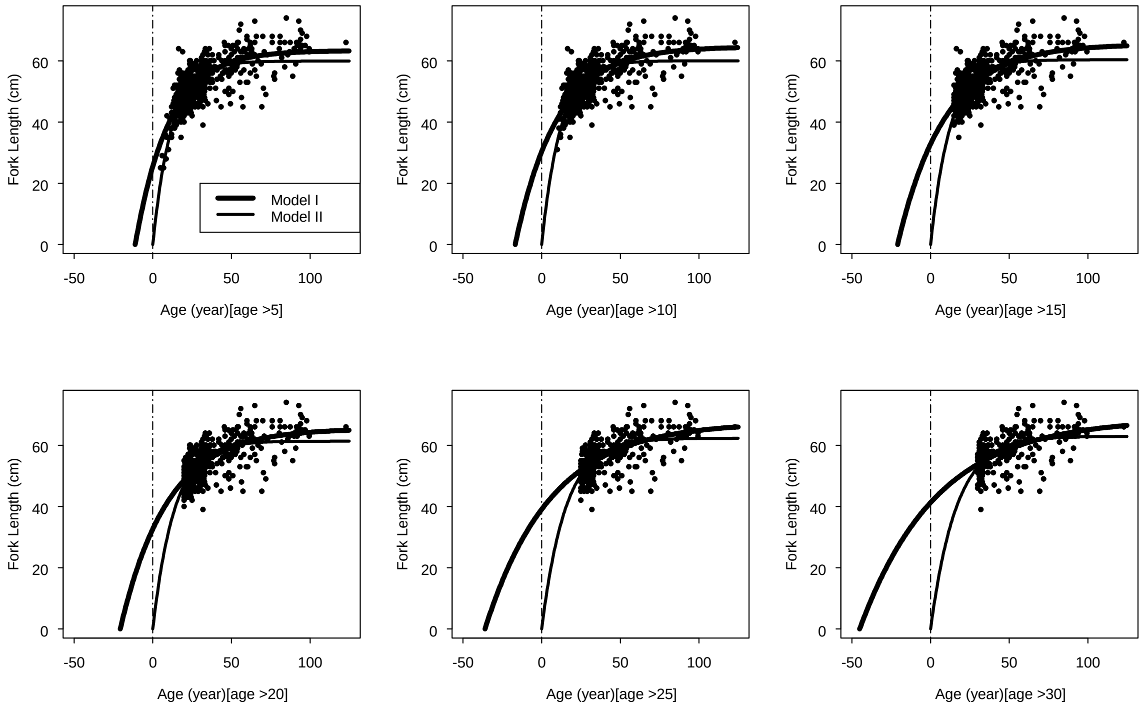


Figure 26. Plots of expected yelloweye rockfish growth curves fitted by Models I and II with different age groups.

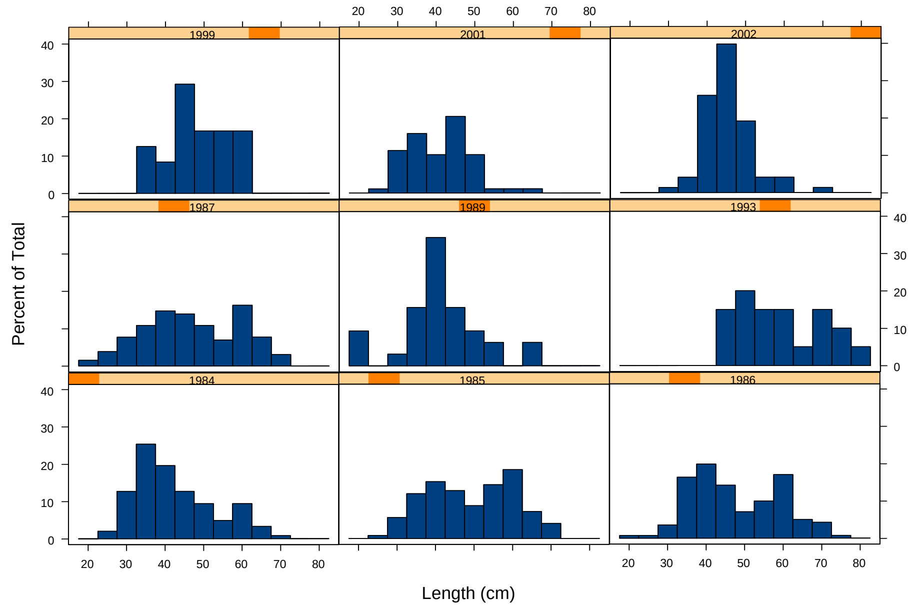


Figure 27. Plot of the yelloweye rockfish length frequency data collected from years 1984 to 2002 in Oregon State coastal sampling.

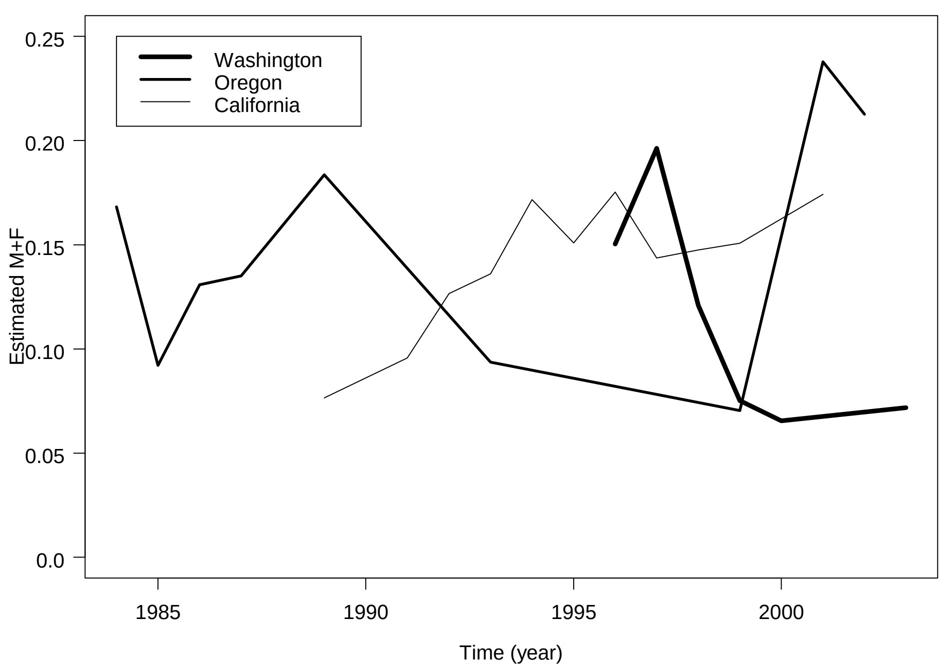
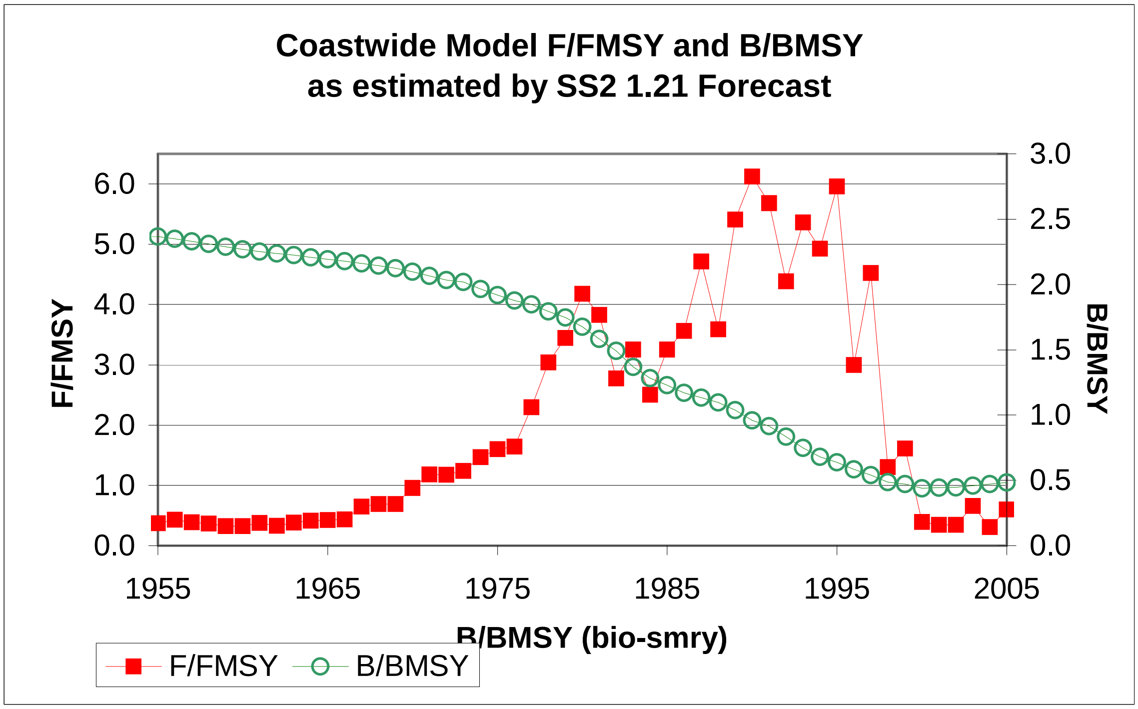


Figure 28. Plot of the estimated total mortality coefficients from yelloweye rockfish length frequency data collected between years 1984 to 2002 in Washington, Oregon and California states coastal sampling.



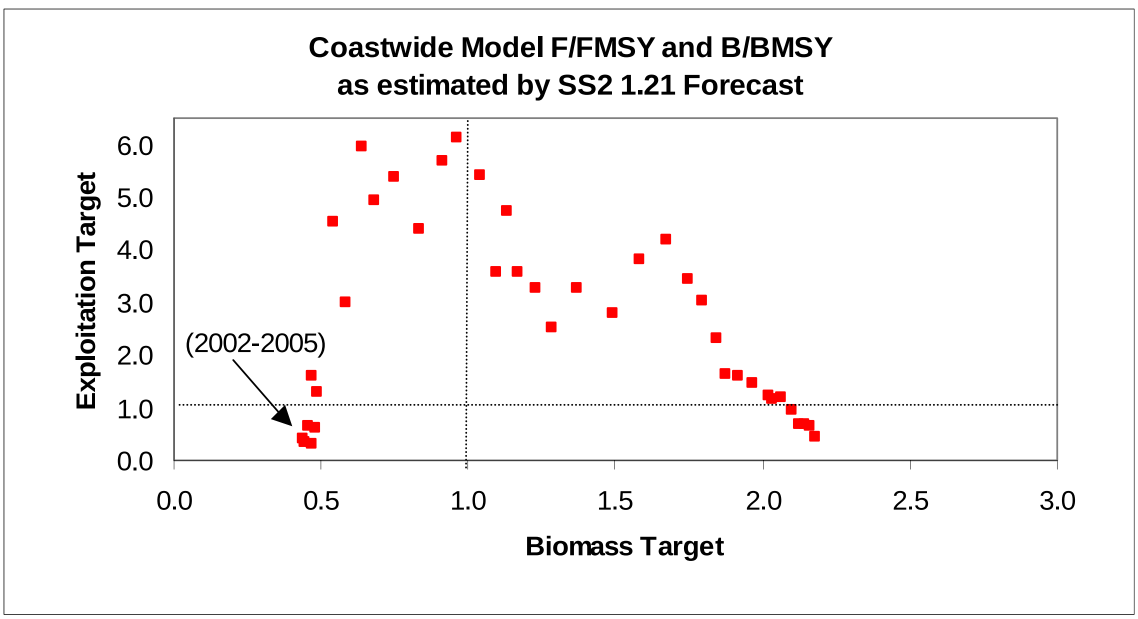
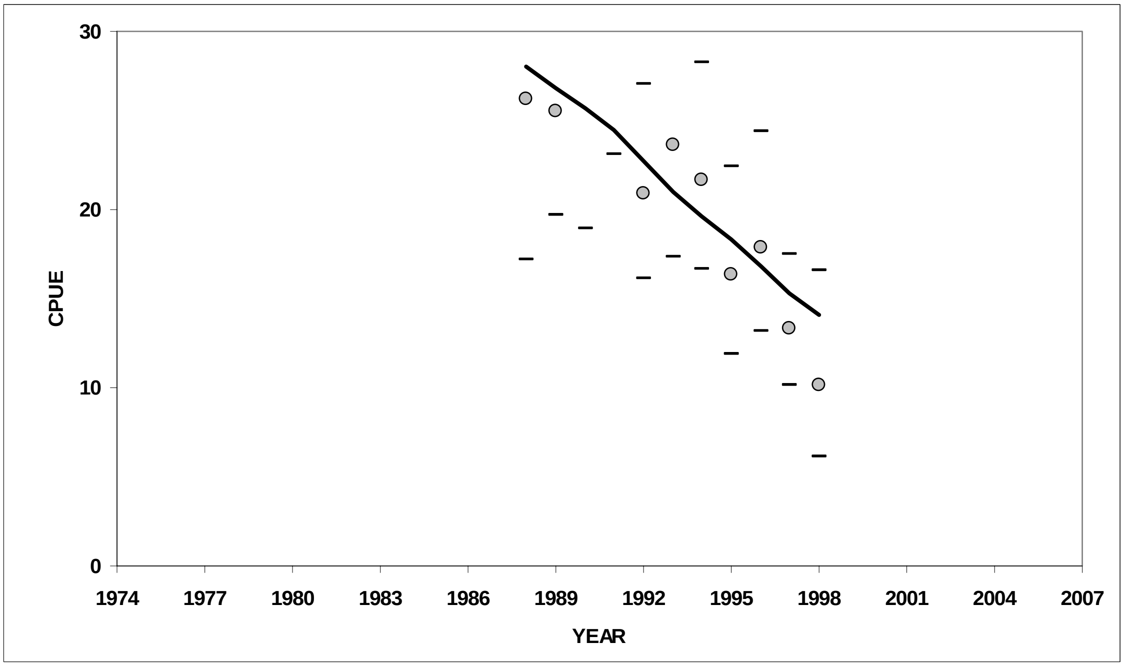


Figure 29. Estimated (SS2 V2.21 forecast) F/F_{MSY} and B/B_{MSY} (SPB at B_{MSY}) time series from the coastwide model.



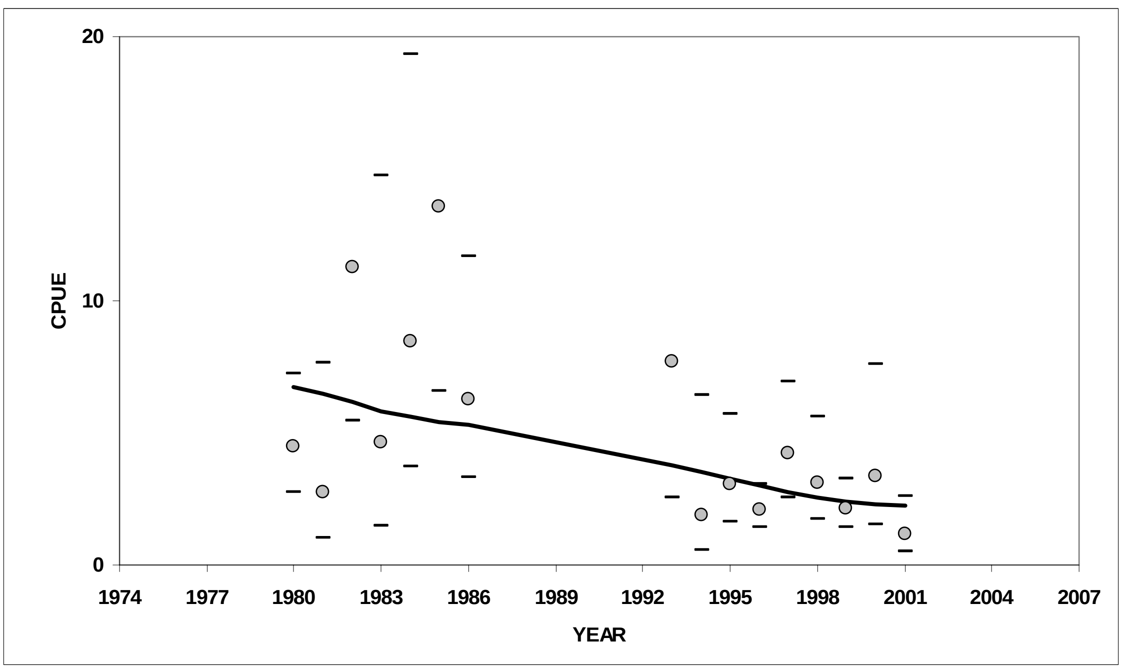


Figure 30. Coastwide Model fit to California CPFV (top panel) and California MRFSS (bottom panel) indices.

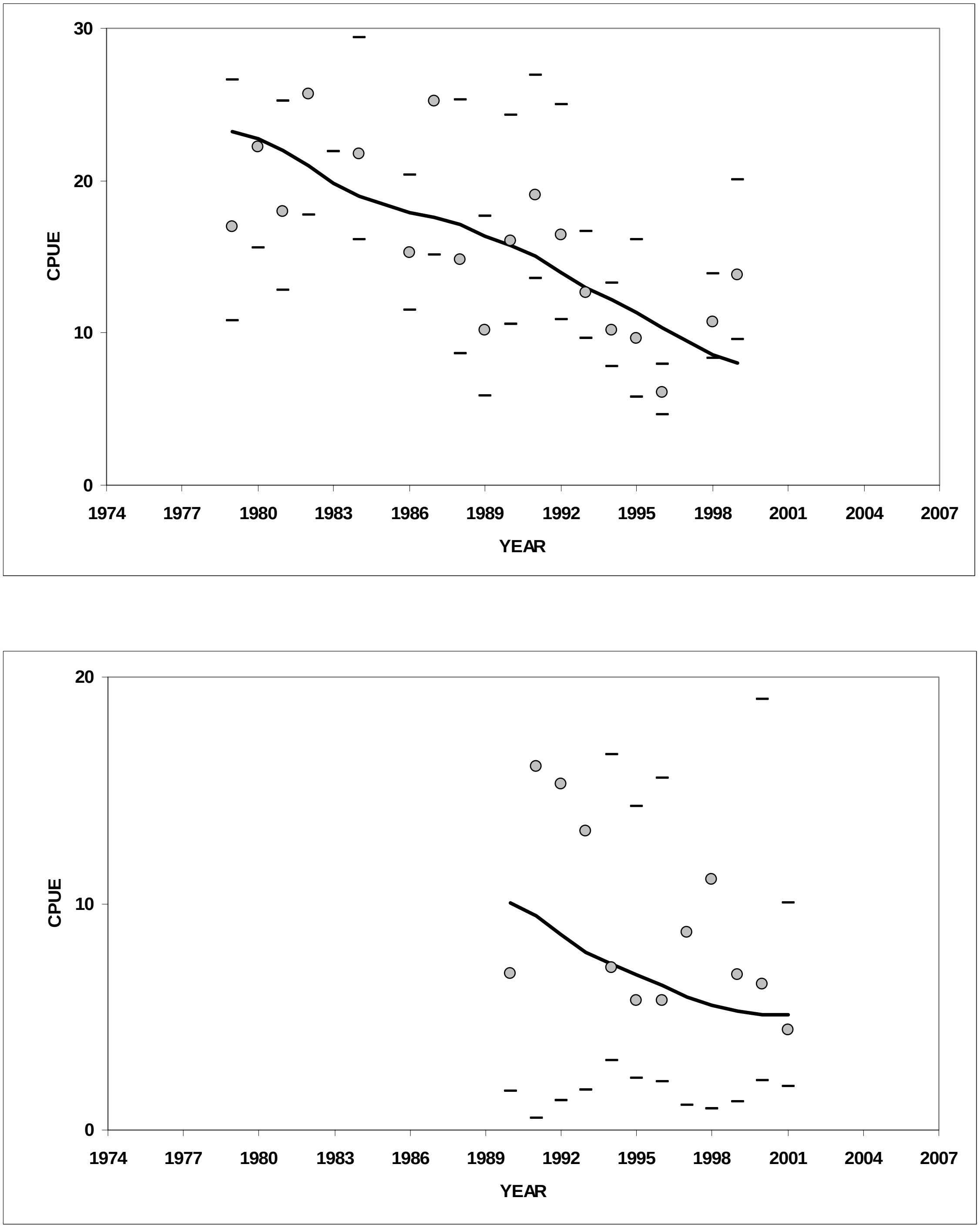


Figure 31. Coastwide Model fit toOregon sport (top panel) and Washington OSP (bottom panel) indices.

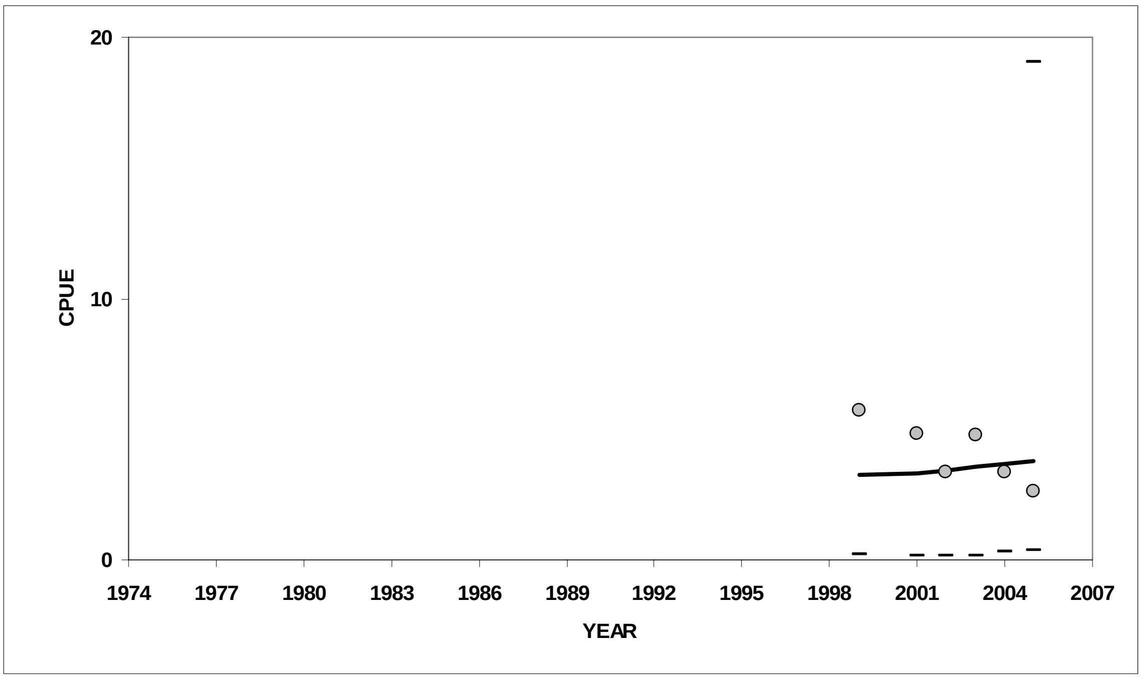
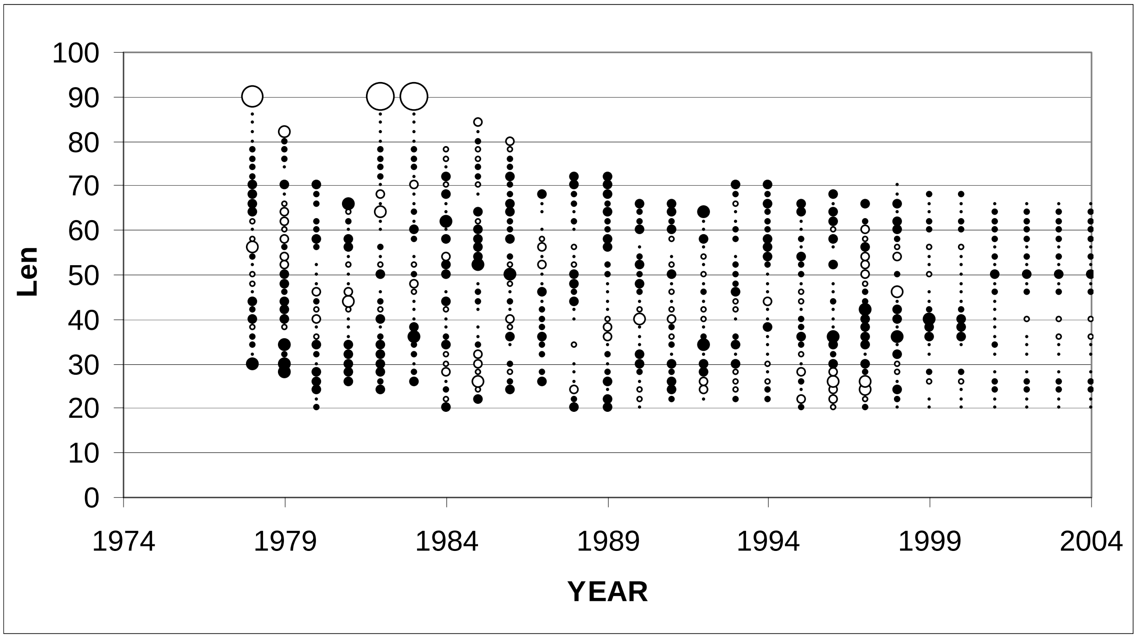


Figure 32. Coastwide Model fit to the Washington and Oregon IPHC halibut set line survey index.



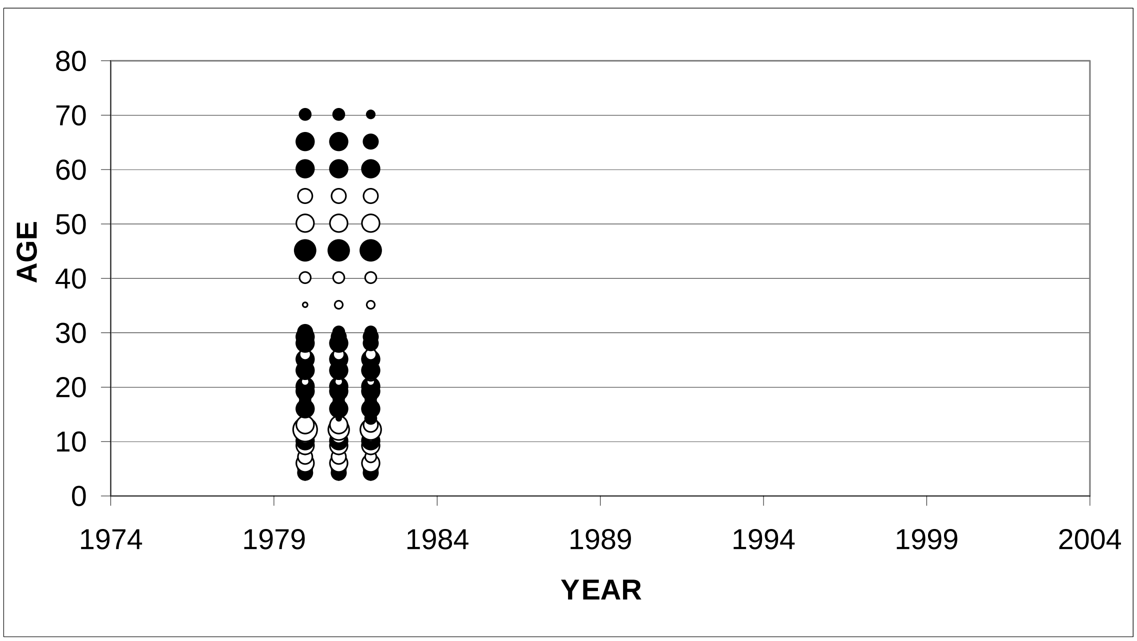
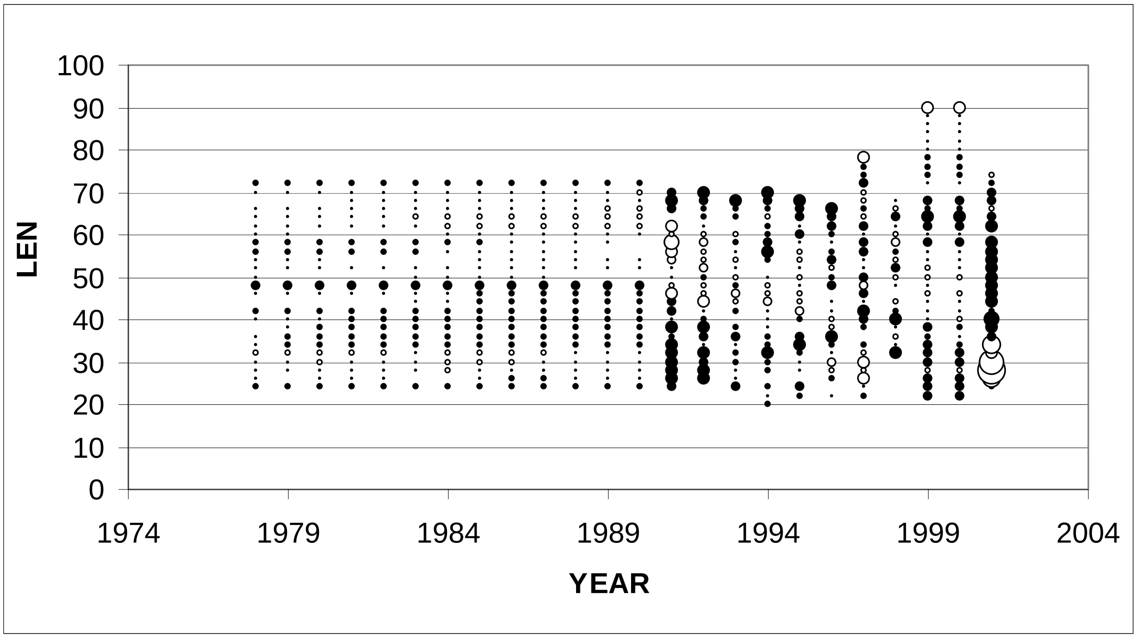


Figure 33. Coastwide model fit to California sport length and age compositions by year (solids = Observed <Expected).



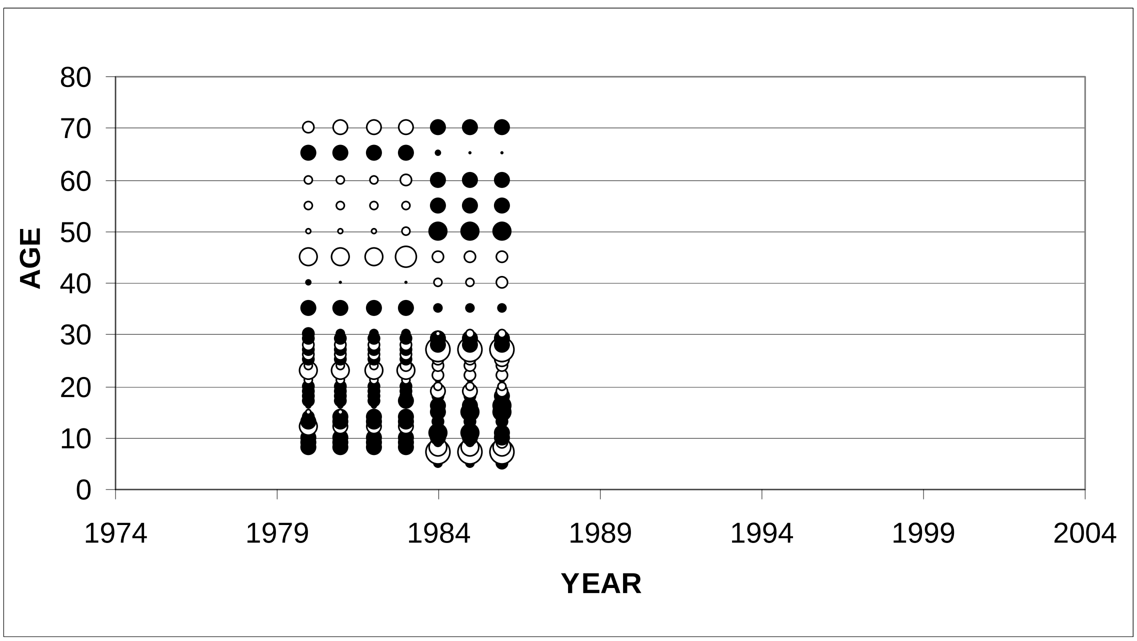
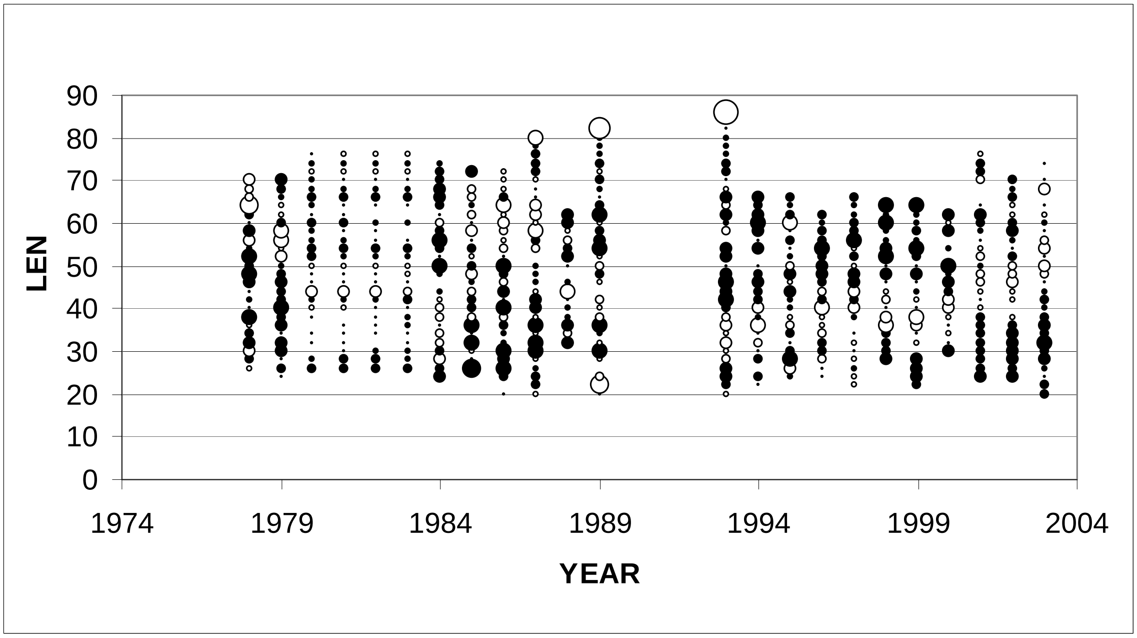


Figure 34. Coastwide model fit to California commercial length and age compositions by year (solids = Observed <Expected).



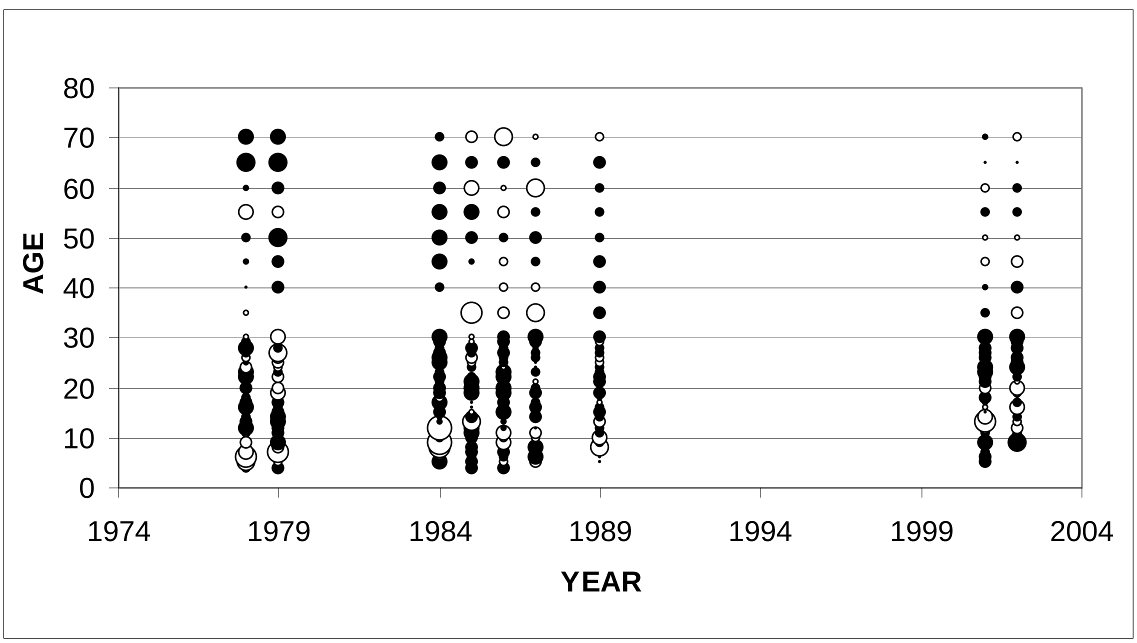
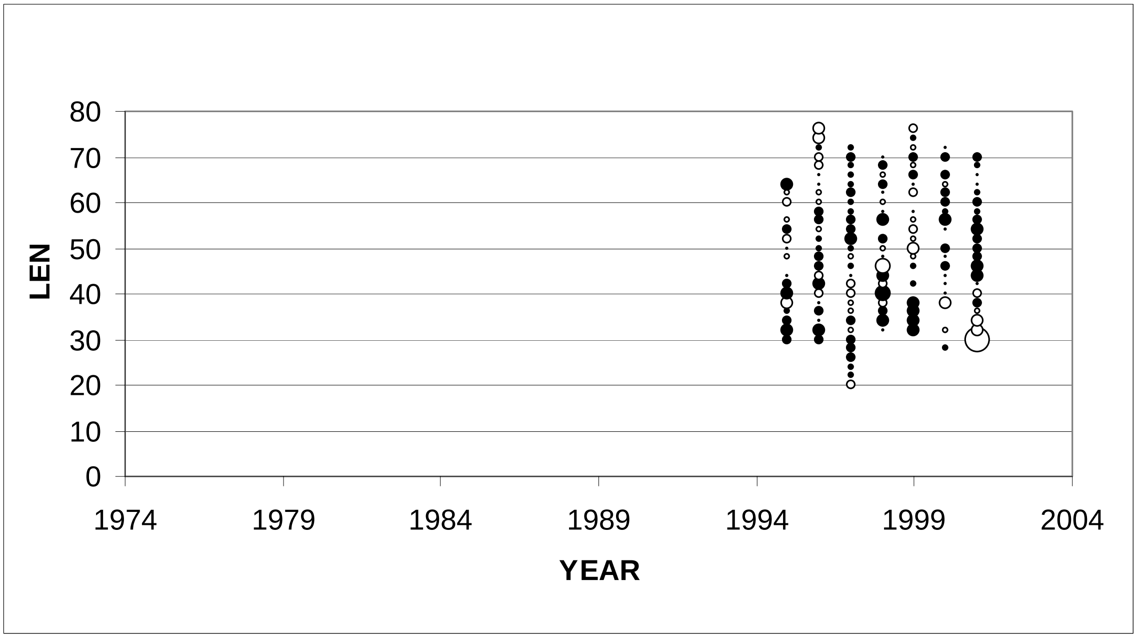
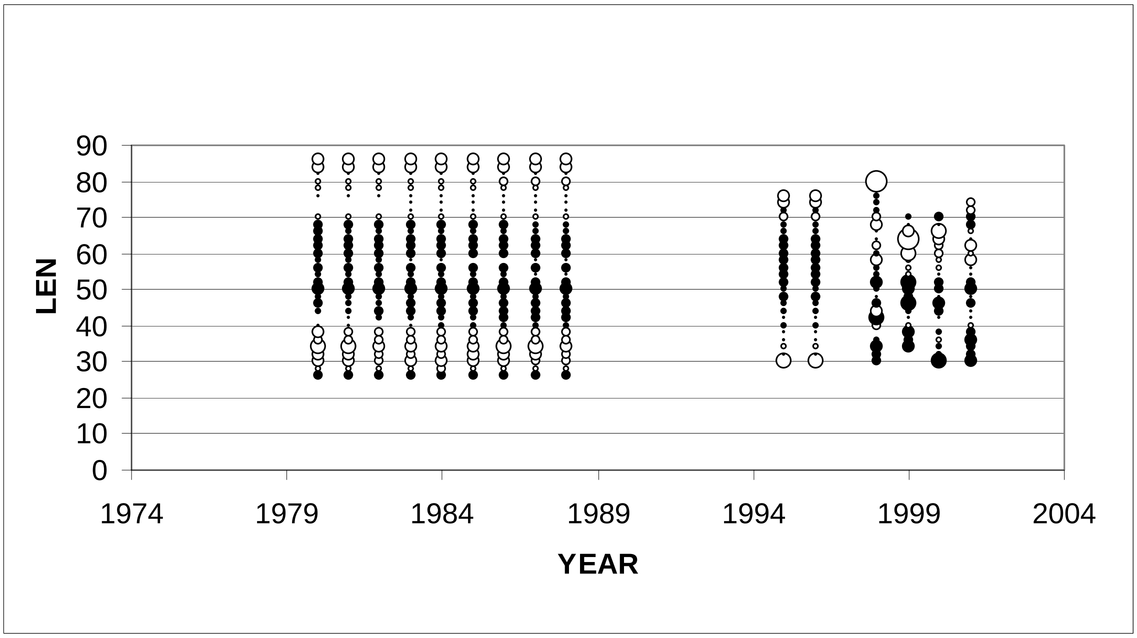


Figure 35. Coastwide model fit to Oregon sport length and age compositions by year (solids = Observed <Expected).



NO AGE DATA

Figure 36. Coastwide model fit to Oregon commercial length and age compositions by year (solids = Observed <Expected).



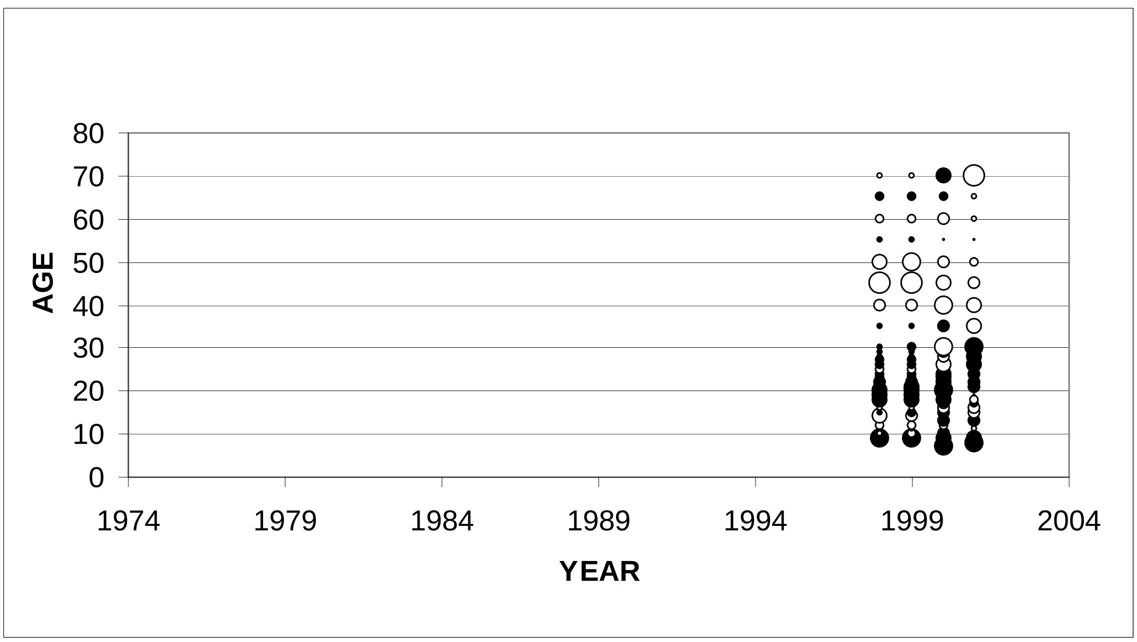
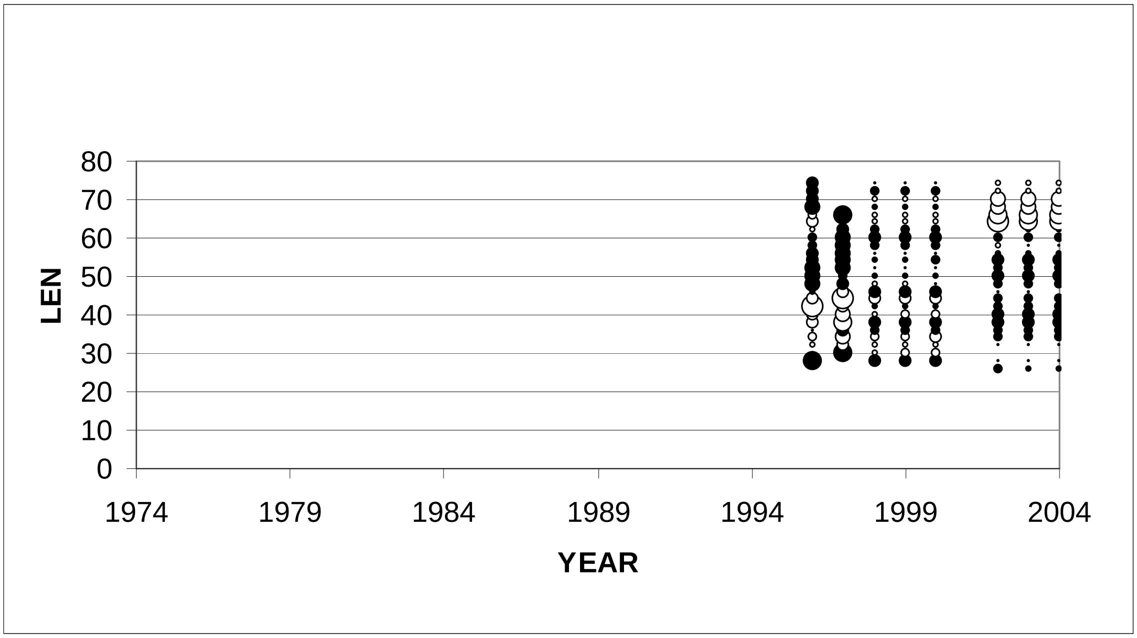


Figure 37. Coastwide model fit to Washington sport length and age compositions by year (solids = Observed <Expected).



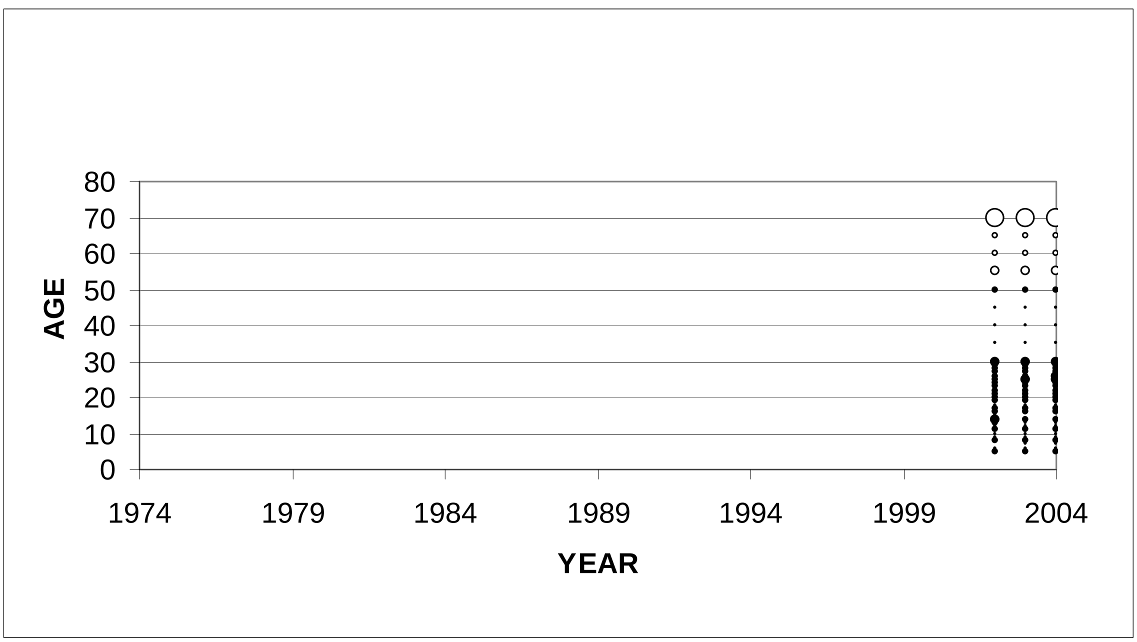
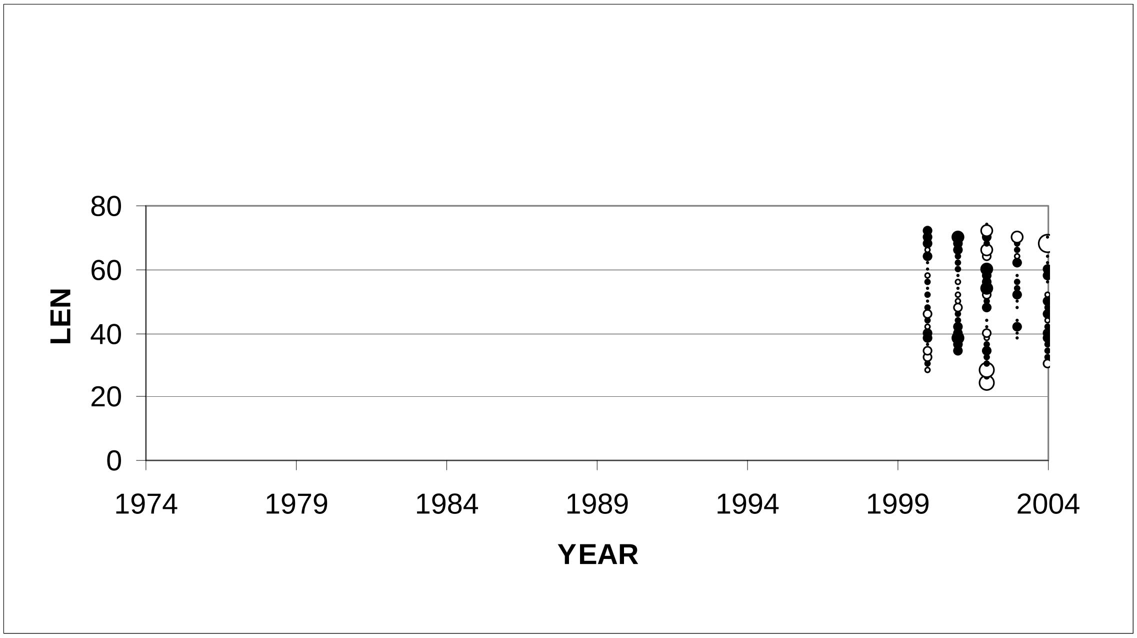


Figure 38. Coastwide model fit to Washington commercial length and age compositions by year (solids = Observed <Expected).



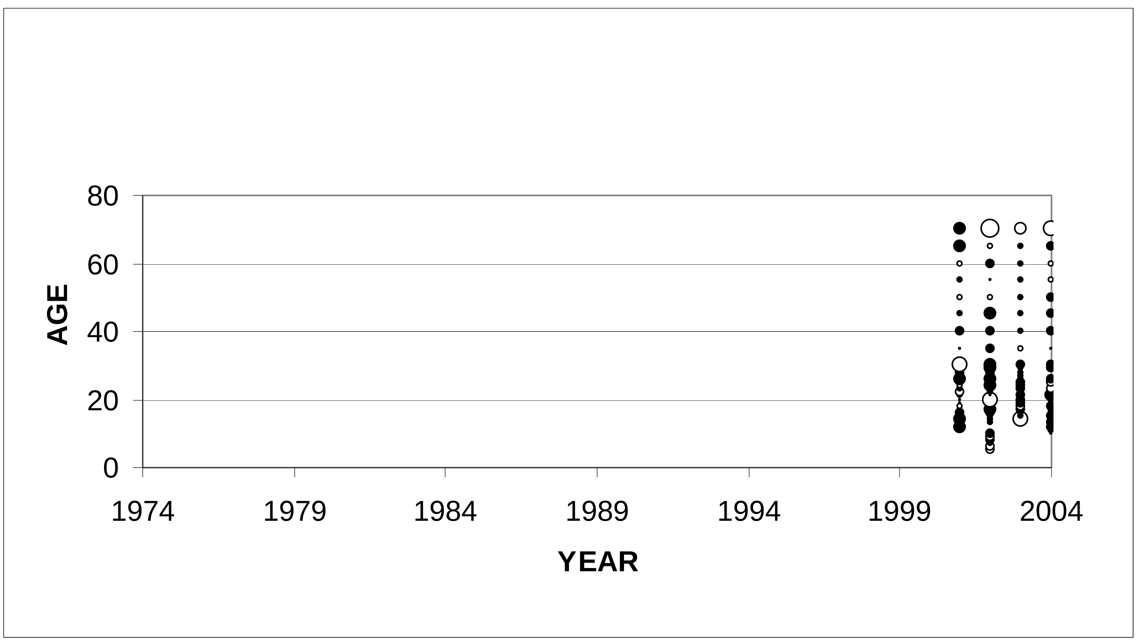


Figure 39. Coastwide model fit to Washington target line length and age compositions by year (solids = Observed <Expected).

Appendix A: Data Input and Control Files for Coastwide Yelloweye Model

Control File for Coastwide Model

```
#     V1.21 version
#     Yeye06-C.ctl      selex pattern     1;    Logistic
#     datafile:Yeye05.dat
1     #_N_growthmorphs
#_assign_sex_to   each_morph_(1=female;_2=male)
1

1     #_N_Areas_(populations)

#_each_fleet/survey_operates_in_just_one_area

#_but_different_fleets/surveys_can  be    assigned_to_share_same_selex(FUTURE_coding)

1     1     1     1     1     1     1     1     1     1     1     1     #area_for_each_fleet/survey

0     #do_migration_(0/1)

0     #_N_Time_Block_Definitions
#1    1     1     1     1     1     #_N_  of    time  blocks      in    each  definition
#1983 2004
#1987 2004
#2000 2004
#1998 2004
#1998 2004
#1998 2004

#Natural_mortality_and_growth_parameters_for_each_morph

4     #_Last_age_for_natmort_young
10    #_First_age_for_natmort_old
6     #_age_for_growth_Lmin
60    #_age_for_growth_Lmax
```

```
-4    #_MGparm_dev_phase


#LO   HI    INIT  PRIOR PR_type     SD    PHASE env-variable      use_dev     dev_minyr   dev_maxyr
      dev_stddev
0.01  0.1   0.036 0.1   0     0.8   -3    0     0     0     0     0.5   0     0     #M1_natM_young

-3    3     0     0     0     0.8   -3    0     0     0     0     0.5   0     0
      #M1_natM_old_as_exponential_offset(rel_young)
10    35    22.618      30    0     10    2     0     0     0     0     0.5   0     0     #M1_Lmin

40    120   64.6346     66    0     10    2     0     0     0     0     0.5   0     0     #M1_Lmax

0.01  0.2   0.0626      0.05  0     0.8   3     0     0     0     0     0.5   0     0     #M1_VBK

0.05  0.2   0.0819      0.14  0     0.8   3     0     0     0     0     0.5   0     0     #M1_CV-
young_3.440821/26.913709=0.127846
-1    1     0.5773      0.4   0     0.8   3     0     0     0     0     0.5   0     0     #M1_CV-
old_as_exponential_offset(rel_young)      6.21/65.7=  0.095 so    offset      =     ln(0.095/0.127846)=-
3.06

#Add  2+2*gender  lines to    read  the   wt-Len      and   mat-Len     parameters

-3    3     0.000020873 0.000020873 0     0.8   -2    0     0     0     0     0.5   0     0     #Female
      wt-len-1
-3    3     2.96956     2.96956     0     0.8   -2    0     0     0     0     0.5   0     0     #Female
      wt-len-2

-3    3     42.1  42.1  0     0.8   -2    0     0     0     0     0.5   0     0     #Female     mat-len-1

-3    3     -0.415      -0.415      0     0.8   -2    0     0     0     0     0.5   0     0     #Female
      mat-len-2

-3    3     1     1     0     0.8   -2    0     0     0     0     0.5   0     0     #Female     eggs/gm
      intercept
-3    3     0     0     0     0.8   -2    0     0     0     0     0.5   0     0     #Female     eggs/gm
      slope
```

```
#pop*gmorph lines For   the   proportion  of    each  morph in    each  area

0     1     1     1     0     1     -2    0     0     0     0     0.5   0     0     #frac to    morph 1
      in    area  1

#pop  lines For   the   proportion  assigned    to    each  area

0     1     1     1     0     1     -2    0     0     0     0     0.5   0     0     #frac to    area  1


#_custom-env_read

0     #_    0=read_one_setup_and_apply_to_all_env_fxns;     1=read_a_setup_line_for_each_MGparm_with_Env-
var>0

#_custom-block_read

0     #_    0=read_one_setup_and_apply_to_all_MG-blocks;    1=read_a_setup_line_for_each_block  x
      MGparm_with_block>0


#     LO    HI    INIT  PRIOR Pr_type     SD    PHASE

#_Spawner-Recruitment_parameters
1     #     SR_fxn:     1=Beverton-Holt

#LO   HI    INIT  PRIOR Pr_type     SD    PHASE
3     31    5.172 5     0     50    1     #Ln(R0)
0.2   1     0.45  1     0     50    -6    #steepness
0     5     0.5   1     0     0.8   -3    #SD_recruitments
-5    5     0     0     0     1     -3    #Env_link
-5    5     0     0     0     1     -3    #init_eq

0     #env-var_for_link

#     recruitment_residuals
#     start end_rec_year      Lower_limit Upper_limit phase
1968  1992  -10   10    1
```

```
#init_F_setupforeachfleet
#      LO     HI     INIT   PRIOR PR_type     SD     PHASE
0      1      0.001 0.01   0      99     1      #      need  init  value>0
0      1      0.001 0.01   0      99     1
0      1      0.001 0.01   0      99     1
0      1      0.001 0.01   0      99     1
0      1      0.001 0.01   0      99     1
0      1      0.001 0.01   0      99     1
0      1      0.001 0.01   0      99     1

#_Qsetup
#_add_parm_row_for_each_positive_entry_below(row_then_column)

#-Float(0/1)      #Do-power(0/1)     #Do-env(0/1)      #Do-dev(0/1)      #env-Var     #Num/Bio(0/1)      for
       each   fleet and   survey
0      0      0      0      0      1      #CaRec_1
0      0      0      0      0      1      #CaCom_2
0      0      0      0      0      1      #OrRec_3
0      0      0      0      0      1      #OrCom_4
0      0      0      0      0      1      #WaRec_5
0      0      0      0      0      1      #WaCom_6
0      0      0      0      0      1      #WaLine_7
0      0      0      0      0      0      #CPFV_8
0      0      0      0      0      0      #CaMRFSS_9
0      0      0      0      0      0      #OrRec_10
0      0      0      0      0      0      #WaRec_11
0      0      0      0      0      0      #IPHC_12

#      LO     HI     INIT   PRIOR PR_type     SD     PHASE env-variable

#_SELEX_&_RETENTION_PARAMETERS
#Selex_type Do_retention(0/1) Do_male     Mirrored_selex_number(or      Special)

1      0      0      0      #CaRec_1
1      0      0      0      #CaCom_2
1      0      0      0      #OrRec_3
1      0      0      0      #OrCom_4
```

```
1     0     0     0     #WaRec_5
1     0     0     0     #WaCom_6
1     0     0     0     #WaLine_7
5     0     0     1     #CaCPFV_8
5     0     0     1     #CaMRFSS_9
5     0     0     3     #OrRecSur_10
5     0     0     5     #WaRec_11
1     0     0     0     #IPHC_12

#_Age selex
10    0     0     0     #CaRec_1
10    0     0     0     #CaCom_2
10    0     0     0     #OrRec_3
10    0     0     0     #OrCom_4
10    0     0     0     #WaRec_5
10    0     0     0     #WaCom_6
10    0     0     0     #WaLine_7
15    0     0     1     #CaCPFV_8
15    0     0     1     #CaMRFSS_9
15    0     0     3     #OrRecSur_10
15    0     0     5     #WaRec_11
10    0     0     0     #IPHC_12

#LO   HI    INIT  PRIOR PR_type     SD    PHASE env-variable      use_dev     dev_minyr   dev_maxyr
      dev_stddev  Block_Pattern
#cARec_1
#40   70    50    50    0     10    -3    0     0     0     0     0     0     0     #peakCARec_1
#0.0001     0.1   0.001 0     0     99    -4    0     0     0     0     0     0     0     #init
#-10  9     0.4107      0.5   0     3     3     0     0     0     0     0     0     0     #infl1
#-5.00      5     0.24215     0.3   0     99    3     0     0     0     0     0     0     0     #slope1

#-9   10    -0.9115     5     0     99    3     0     0     0     0     0     0     0     #final
#-10  9     -0.9597     0.3   0     3     3     0     0     0     0     0     0     0     #infl2
#-5.00      5     0.24284     0.3   0     99    -4    0     0     0     0     0     0     0     #slope2

#0.1  10    3     3     0     99    -4    0     0     0     0     0     0     0     #width      of    top

#CaRec_1
```

```
10    70    31.29 30    0     99    3     0     0     0     0     0.5   0     0     #infl_for_logistic

0.001 60    9.54  15    0     99    4     0     0     0     0     0.5   0     0     #95%width_for_logistic


#Cal_Com2
#40   70    50    50    0     10    -3    0     0     0     0     0.5   0     0     #peakCaCom_2
#0.0001     0.1   0.001 0     0     99    -4    0     0     0     0     0.5   0     0     #init
#-10  9     0.11186     0.5   0     3     3     0     0     0     0     0.5   0     0     #infl1
#-5.00      9     0.26276     0.3   0     99    3     0     0     0     0     0.5   0     0     #slope1

#-10  10    -3.3152     5     0     99    3     0     0     0     0     0.5   0     0     #final
#-10  9     -0.5608     0.3   0     3     4     0     0     0     0     0.5   0     0     #infl2
#-5.00      9     0.29184     0.3   0     99    -4    0     0     0     0     0.5   0     0     #slope2

#0.1  10    3     3     0     99    -4    0     0     0     0     0.5   0     0     #width      of    top

#CaCom_2
10    70    33.24 30    0     99    3     0     0     0     0     0.5   0     0     #infl_for_logistic

0.001 60    8.93  15    0     99    4     0     0     0     0     0.5   0     0     #95%width_for_logistic


#OrREc_3
#40   70    48    50    0     10    -3    0     0     0     0     0.5   0     0     #peakOrRec_3
#0.0001     0.1   0.001 0     0     99    -2    0     0     0     0     0.5   0     0     #init
#-10  9     -0.4227     0.5   0     3     3     0     0     0     0     0.5   0     0     #infl1
#-5.00      9     0.36466     0.3   0     99    3     0     0     0     0     0.5   0     0     #slope1

#-9   10    -1.2055     5     0     99    3     0     0     0     0     0.5   0     0     #final
#-10  9     -0.8301     0.3   0     3     4     0     0     0     0     0.5   0     0     #infl2
#-5.00      9     0.45459     0.3   0     99    -4    0     0     0     0     0.5   0     0     #slope2

#0.1  10    3     3     0     99    -4    0     0     0     0     0.5   0     0     #width      of    top

#OR_Rec_3
10    70    28.61 30    0     99    4     0     0     0     0     0.5   0     0     #infl_for_logistic
```

```
0.001 60    6.69  15    0     99    5     0     0     0     0     0.5   0     0     #95%width_for_logistic


#OR_Com_4
10    70    34.71 30    0     99    4     0     0     0     0     0.5   0     0     #infl_for_logistic

0.001 60    8.23  15    0     99    5     0     0     0     0     0.5   0     0     #95%width_for_logistic


#WA_Rec_5
10    70    29.7191     30    0     99    4     0     0     0     0     0.5   0     0
      #infl_for_logistic
0.001 60    7.66227     15    0     99    5     0     0     0     0     0.5   0     0
      #95%width_for_logistic

#WA_Com_6
10    70    34.167      30    0     99    4     0     0     0     0     0.5   0     0
      #infl_for_logistic
0.001 60    7.36903     15    0     99    5     0     0     0     0     0.5   0     0
      #95%width_for_logistic

#WA_Com_7
10    70    41.96 30    0     99    4     0     0     0     0     0.5   0     0     #infl_for_logistic
0.001 60    13.63 15    0     99    5     0     0     0     0     0.5   0     0     #95%width_for_logistic

#CaCPFV_8
1     37    1     5     0     99    -1    0     0     0     0     0.5   0     0     #minsizeBinCaCPFV_8
1     37    37    6     0     99    -1    0     0     0     0     0.5   0     0     #maxsizeBinCaCPFV_8

#CaMRFSS_9
1     37    1     5     0     99    -1    0     0     0     0     0.5   0     0     #minsizeBinCaMRFSS_9
1     37    37    6     0     99    -1    0     0     0     0     0.5   0     0     #maxsizeBinCaMRFSS_9

#OrRecSur_10
1     37    1     5     0     99    -1    0     0     0     0     0.5   0     0     #minsizeBinOrRecSur_10
1     37    37    6     0     99    -1    0     0     0     0     0.5   0     0     #maxsizeBinOrRecSur_10

#WaRecSur
```

```
1     37    1     5     0     99    -1    0     0     0     0     0.5   0     0     #minSizeBinWaRecSur_11
1     37    37    6     0     99    -1    0     0     0     0     0.5   0     0     #maxSizeBinWaRecSur_11

#IPHC_12
10    70    41.96 30    0     99    4     0     0     0     0     0.5   0     0     #infl_for_logistic
0.001 60    13.63 15    0     99    5     0     0     0     0     0.5   0     0     #95%width_for_logistic

#_custom-env_read
0     #_    0=read_one_setup_and_apply_to_all;_1=Custom_so_read_1_each;


#_custom-block_read
1     #_
      0=read_one_setup_and_apply_to_all;_1=Custom_so_see_detailed_instructions_for_N_rows_in_Custom_setup

#_LO  HI    INIT  PRIOR PR_type     SD    PHASE

#Now  estimate    these
#-10  5     -0.293376   0.5   0     3     -5    #CaRec_asc_infl_83-01
#-19  10    -9.35824    0.3   0     99    -5    #CARec_final_87-01
#-5   5     -0.32666    0.5   0     3     -5    #OrCom_asc_infl_00-01
#-5   5     0.930662    0.5   0     3     -5    #WaRec_asc_infl_98-01
#-5   5     0.175635    0.3   0     3     -5    #WaRec_asc_slope_98-01
#-10  10    -0.414428   0.5   0     99    -5    #WaRec_final_98-01

#     LO    HI    INIT  PRIOR PR_type     SD    PHASE

-4    #_phase_for_selex_parm_devs

0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0
0     0     0     0     0     0     0     0     0     0     0     0
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

#Max_lambda_phase:      read  this  number      of    lambda      values      for   each  element
      below.
```

```
#The  last  lambda      value is    used  for   all   higher      numbered    phases
1     #_max_lambda_phases:_read_this_Number_of_values_for_each_componentxtype_below

1     #SDoffset

#_survey_lambda
1     1     1     1     1     1     1     1     1     1     1     1
#_discard_lambdas
0     0     0     0     0     0     0     0     0     0     0     0
#_meanbodywt
0
#_lenfreq_lambdas
0.6   0.6   0.6   0.6   0.6   0.6   0.6   0     0     0     0     0.6
#_age_freq_lambdas
0.6   0.6   0.6   0.6   0.6   0.6   0.6   0     0     0     0     0.6
#_size@age_lambdas
#1    1     1     1     1     1     1     0     0     0     0     0.6
0.6   0.6   0.6   0.6   0.6   0.6   0.6   0     0     0     0     0
#_initial_equil_catch(f)
1
#_recruitment_lambda
0.5
#_parm_prior_lambda
1
#_parm_dev_timeseries_lambda
0.00001

#SS1  Lambdas
#33   STOCK-RECR
#3    "1=B-H,"    "2=RICKER," 3=new B-H

#0    0=USE S-R   "CURVE,"    1=SCALE     CURVE

#0.5  -0.4  '     SPAWN-RECRUIT     indiv'      !     #     =     33    VALUE:      15.72058

#0.00001    -0.3  '     SPAWN-RECRUIT     mean  '     !     #     =     34    VALUE:      -31.29407
```

```
#1.557006   0.001 9     'VIRGIN     RECR  MULT' 2     1     0     0     0     !     108   OK    0     -1927
      -1
#0.436856   0.2   0.9   'B/H  S/R   PARAM '     2     1     0     0     0     !     109   OK    0     -84
      -1
#0    -0.2  0.2   'BACKG.     RECRUIT     '     0     1     0     0     0     !     110   NO    PICK  0
      -1    0
#0.4  0.1   1.5   'S/R  STD.DEV.    '     0     1     0     0     0     !     111   NO    PICK  0     -1
      0
#0    -0.2  0.2   'RECR TREND '     0     1     0     0     0     !     112   NO    PICK  0     -1    0
#1    0.5   3     'RECR.      MULT. '     0     1     0     0     0     !     113   NO    PICK  0     -1
      0


#     crashpen    lambda

100
#max  F
0.9

999   #_end-of-file
```

Forecast File for Coastwide Model

```
3     # summary age for biomass reporting
0     # 0=skip forecast; 1=normal; 2=force without sdreport required
0     # Do_MSY:  0=skip; 1=calculate; 2=set to Fspr; 3=set to endyear(only useful if set relative F from
endyr)
0.5    # target SPR
12    # number of forecast years
12    # number of forecast years with stddev
1     # emphasis for the forecast recruitment devs that occur prior to endyyr+1
1     # fraction of bias adjustment to use with forecast_recruitment_devs before endyr+1
0     # fraction of bias adjustment to use with forecast_recruitment_devs after endyr
0.40  # topend of 40:10 option; set to 0.0 for no 40:10
0.10  # bottomend of 40:10 option
1.00  # OY scalar relative to ABC
2     # for forecast:  1=set relative F from endyr; 2=use relative F read below
# relative Fs used for forecast; rows are seasons; columns are fleets
 # Fleet 1  Fleet 2
0.30  0.02  0.30  0.05  0.30  0.02  0.01

# starwars battlefront

 # verify end of input harvest rates
 999

 # specified actual catches into the future
 # (negative values are not used, but there must be a sufficient number of values)
 # fleet1 fleet2
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  1     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  2     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  3     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  4     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  5     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  6     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  7     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  8     season      1
7.8   0.52  7.8   1.3   7.8   0.52  0.26 #year  9     season      1
```

7.8	0.52	7.8	1.3	7.8	0.52	0.26	#year	10	season	1
7.8	0.52	7.8	1.3	7.8	0.52	0.26	#year	11	season	1
7.8	0.52	7.8	1.3	7.8	0.52	0.26	#year	12	season	1

Data File for Coastwide Model

```
1925  #     start year
2005  #     end   year
1     #     N     seasons     per   year
12    #     vector      with  N     months      in    each  season
1     #     spawning    season
7     #     N     fishing     fleets
5     #     N     surveys;    data  type  ID    below is    sequential  with  the   fisheries
CaRec1%CaCom2%OrRec3%OrCom4%WaRec5%WaCom6%WaLine7%CPFV_8%CaMRFSS_9%OrRec_10%WaRec_11%IPHC_12

0.5   0.5   0.5   0.5   0.5   0.5   0.5   0.5   0.5   0.5   0.5   0.5   #_surveytiming_in_season

1     #     number      of    genders     (1/2);      females     are   gender      1
70    #Accumulator      age
#4    0.2   4     0.2   1     0.2   0.1   #_init_equil_catch_for_each_fishery
0     0     0     0     0     0     0     #_init_equil_catch_for_each_fishery

#_catch_biomass(mtons):_columns_are_fisheries   _rows_are_year*season

0     8     0     2     0     1     0     #1925
0     8     0     2     0     1     0     #1926
0     8     0     2     0     1     0     #1927
0     8     0     2     0     1     0     #1928
0     8     0     2     0     1     0     #1929
0     8     0     2     0     1     0     #1930
0     8     0     2     0     1     0     #1931
0     8     0     2     0     1     0     #1932
0     8     0     2     0     1     0     #1933
0     8     0     2     0     1     0     #1934
0     8     0     2     0     1     0     #1935
0     8     0     2     0     1     0     #1936
0     8     0     2     0     1     0     #1937
0     8     0     2     0     1     0     #1938
0     8     0     2     0     1     0     #1939
0     8     0     2     0     1     0     #1940
0     8     0     2     0     1     0     #1941
```

0	8	0	2	0	1	0	#1942						
0	8	0	2	0	1	0	#1943						
0	8	0	2	0	1	0	#1944						
0	8	0	2	0	1	0	#1945						
0	8	0	2	0	1	0	#1946						
0	8	0	2	0	1	0	#1947						
0	8	0	2	0	1	0	#1948						
0	8	0	2	0	1	0	#1949						
0	8	0	2	0	1	0	#1950						
0	8	0	2	0	1	0	#1951						
0	8	0	2	0	1	0	#1952						
0	8	0	2	0	1	0	#1953						
0	8	0	2	0	1	0	#1954	CaCOM.005		CaCOM.01		OrCOM.005%	OrCOM.01
14.2	24.05	6.2	9.85	1	2	0	#1955	24.05	48.1	9.85	19.7		
16.6	28.8	6.5	10.1	1	2	0	#	28.8	57.6	10.1	20.2		
12.4	31.5	6.7	10.35	1	2	0	#	31.5	63	10.35	20.7		
15.8	35.45	7	10.6	2	2	0	#	35.45	70.9	10.6	21.2		
12.4	30.85	7.2	10.85	2	2	0	#	30.85	61.7	10.85	21.7		
10	28.1	7.5	11.1	2	2	0	#	28.1	56.2	11.1	22.2		
8.3	22.55	7.7	11.35	2	2	0	#	22.55	45.1	11.35	22.7		
9.1	20.75	8	11.6	2	2	0	#	20.75	41.5	11.6	23.2		
9.4	25.15	8.2	11.85	3	4	0	#	25.15	50.3	11.85	23.7		
8.5	17.65	8.5	12.1	3	4	0	#	17.65	35.3	12.1	24.2		
12.5	20.7	8.7	12.35	3	4	0	#	20.7	41.4	12.35	24.7		
15	22.45	9	12.6	3	4	0	#	22.45	44.9	12.6	25.2		
16.1	22.2	9.2	12.85	3	4	0	#	22.2	44.4	12.85	25.7		
17.3	21.65	9.5	13.1	3	4	0	#	21.65	43.3	13.1	26.2		
16.8	40.5	9.7	27.2	3	4	0	#1969						
21.8	47.1	10	19.2	4	5.1	0							
18.1	46.8	13.1	19	4	4.6	0							
24.2	70.6	16.3	24	4	5.5	0							
29.6	91.7	19.5	22.2	4	7.4	0							
33	84.3	22.6	18.2	4	8.5	0							
32	92.4	25.8	14.8	4	7.1	0							
31	103.7	29	25.9	4.3	10.3	0							
27.5	100.7	32.1	29.3	8.8	17.8	0							
24.5	99.3	35.3	28.5	4.5	23.9	0							
29.9	134.2	38.5	62.2	3.5	28.5	0							

```
75.9  168.1 27.5  68.2  2.4   35    0
46.9  209.8 34.2  102.2 3.4   9.7   0
103.8 177   48.7  114.5 3.4   12.6  0
51    57.6  62.9  193.2 6.7   16.6  0
80.8  44.9  43.6  67.1  12.2  13.4  0
125.8 8.8   26.8  101.9 8.8   26.4  0
65.5  31    27.2  70.6  9     14.7  0
75.2  53.7  29.4  80.7  10.5  25.1  0
57.5  64.9  9.6   120.1 8.3   25.6  0
58.7  50.1  16    180   14.6  39.2  0
46.1  79.8  16.6  74.3  9.9   26.3  0
33.6  141.1 14.9  135.9 18    20.4  0
21    112.2 25.9  165.8 16.2  33.8  0
8.5   52.9  19.7  183.2 18    29.8  0
14.4  54.4  18.3  102.2 10.3  19.6  0
12.6  48.5  13.8  149.1 9.9   18    0
12.5  65.8  8.4   97.7  10.8  16.9  0
15.1  62.2  14.4  115.5 11.4  18.7  0
5.8   21.6  18.9  41.4  14.4  5.5   0
12.6  22.2  17.8  61.3  10.6  10    23
7.5   4     9.2   3.6   10.1  0.2   7.7
4.6   4.5   3.1   6.2   12.5  1     21
2.1   0.2   3.6   0.7   3.7   0.4   2.2
3.7   0     3.8   1     2.6   0.2   0.3
3.5   0     2.4   0.7   4.5   0.1   0.8
3.7   1.6   4.3   4.5   5.1   4.3   0

64    #_N_cpue_and_surveyabundance_observations
#Note all   values      for   indexes     are   the   same  as    SS1   ye-dat09.dat
#Year seas  index obs   selog
#     CA    CPFV  CPUE; using Henrys      delta lognormal   and   est._CV's
1988  1     8     26.19 0.2112
1989  1     8     25.52 0.1298
1990  1     8     32.16 0.2652
1991  1     8     31.59 0.1565
1992  1     8     20.88 0.1297
1993  1     8     23.63 0.1555
1994  1     8     21.67 0.1321
```

```
1995  1     8     16.33 0.1592
1996  1     8     17.9  0.1541
1997  1     8     13.31 0.1371
1998  1     8     10.13 0.2478
#     CA    MRFSS CPUE  Henrys      DeltaLogNormaland CV's
1980  1     9     4.48  0.2396
1981  1     9     2.78  0.5057
1982  1     9     11.27 0.3608
1983  1     9     4.64  0.5789
1984  1     9     8.46  0.4129
1985  1     9     13.57 0.3634
1986  1     9     6.25  0.3138
#1987 1     9     11.7  0.3697
#1988 1     9     2.96  0.3046
#1989 1     9     3.94  0.3245
1993  1     9     7.72  0.5523
1994  1     9     1.87  0.6164
1995  1     9     3.06  0.3144
1996  1     9     2.08  0.1932
1997  1     9     4.23  0.2492
1998  1     9     3.12  0.2951
1999  1     9     2.14  0.2106
2000  1     9     3.39  0.4028
2001  1     9     1.18  0.3972
#     Oregon      Sport CPUE  Henry 2/14/2006   MRFSSversion
1979  1     10    16.988      0.224886142
1980  1     10    22.237      0.178339382
1981  1     10    17.9801333  0.168786567
1982  1     10    25.7039667  0.185204629
1983  1     10    31.94824    0.188876127
1984  1     10    21.7533333  0.150233401
1986  1     10    15.2668148  0.143419913
1987  1     10    25.2302857  0.257165588
1988  1     10    14.80976    0.267684898
1989  1     10    10.1664     0.275531766
1990  1     10    16.0214138  0.208205411
1991  1     10    19.0812857  0.171424481
1992  1     10    16.4627     0.20899499
```

```
1993  1     10    12.6602333  0.136904372
1994  1     10    10.1659667  0.13175002
1995  1     10    9.6534667   0.257078825
1996  1     10    6.0977241   0.134448599
1998  1     10    10.7553     0.126699316
1999  1     10    13.8429655  0.185692573
#     WA    sport CPUE  Henrys_Delta_Lognormal
1990  1     11    6.9   0.7
1991  1     11    16.03 1.7
1992  1     11    15.29 1.24
1993  1     11    13.19 1.01
1994  1     11    7.15  0.42
1995  1     11    5.7   0.46
1996  1     11    5.72  0.5
1997  1     11    8.75  1.05
1998  1     11    11.06 1.24
1999  1     11    6.88  0.85
2000  1     11    6.45  0.54
2001  1     11    4.42  0.41
#     IPHC  Oregon      and   Wash  TSOU_CPUE
1999  1     12    5.71  1.69021569
2001  1     12    4.82  1.69021569
2002  1     12    3.36  1.45524749
2003  1     12    4.8   1.69164656
2004  1     12    3.37  1.2269225
2005  1     12    2.65  0.98577383

2     #     Discard     in    fraction    of    total catch
0     #     Number      of    Discard     observaions (-    value causes      program     to    ignore)

0     #_N_meanbodywt_obs



0.0001      #     compress    tails of    composition until observed#   proportion  is    greater     than
      this  value
```

```
0.0001      #     constant    added to    observed    and   expected    proportions at    length      and
      age   tail  compression occurs      first

#_LengthComp

37    #     N     length      bins  and   Described   Below

18    20    22    24    26    28    30    32    34    36    38    40    42    44    46    48    50    52
      54    56    58    60    62    64    66    68    70    72    74    76    78    80    82    84    86
      88    90

113   #N    Length      comp  observations

#Year Seas  Type  Gender      Partition(market) Nsamp Detail

1978  1     1     0     0     81    0     0     0     0     0     0     0.01235     0.06173     0.02469
      0.02469     0.06173     0.01235     0.03704     0.02469     0.04938     0.09877     0.09877
      0.07407     0.04938     0.16049     0.08642     0.04938     0.06173     0     0     0     0     0
      0     0     0     0     0     0     0     0     0.01235     #     52.65 81
1979  1     1     0     0     119   0     0     0     0     0     0.0084      0     0.04202     0.0084
      0.05042     0.05882     0.01681     0.01681     0.02521     0.03361     0.01681     0.03361
      0.10924     0.12605     0.05042     0.10084     0.07563     0.07563     0.06723     0.04202
      0.01681     0     0.0084      0.0084      0     0     0     0.0084      0     0     0     0     #
      77.35 119
1980  1     1     0     0     124   0     0.00806     0.00806     0     0.00806     0.00806     0.03226
      0.03226     0.03226     0.08065     0.06452     0.08871     0.06452     0.04032     0.08871
      0.05645     0.04839     0.06452     0.05645     0.04839     0.03226     0.03226     0.03226
      0.03226     0.01613     0.00806     0     0.01613     0     0     0     0     0     0     0     0
      0     #     80.6  124
1981  1     1     0     0     83    0     0     0     0.0241      0     0     0     0.01205     0.0241
      0.06024     0.07229     0.04819     0.08434     0.13253     0.09639     0.06024     0.04819
      0.09639     0.07229     0.0241      0.01205     0.04819     0.0241      0.04819     0.01205     0
      0     0     0     0     0     0     0     0     0     0     0     #     53.95 83
```

```
1982 1 1 0 0 106 0 0 0 0.00943 0.00943 0 0.00943 0.0283
     0.0283 0.04717 0.0566 0.03774 0.08491 0.03774 0.0566 0.04717
     0.0283 0.08491 0.06604 0.03774 0.04717 0.0566 0.04717 0.08491
     0.01887 0.04717 0.00943 0 0 0 0 0 0 0 0 0 0.01887
     # 68.9 106
1983 1 1 0 0 105 0 0 0 0 0.00952 0.01905 0.04762 0.0381
     0.04762 0.00952 0.0381 0.05714 0.06667 0.05714 0.07619 0.10476
     0.0381 0.07619 0.05714 0.04762 0.0381 0.01905 0.0381 0.01905
     0.01905 0.01905 0.02857 0.00952 0 0 0 0 0 0 0 0
     0.01905 # 68.25 105
1984 1 1 0 0 169 0 0.00592 0.01775 0.00592 0.01183 0.04142
     0.05325 0.07101 0.04142 0.05325 0.06509 0.07692 0.07692 0.0355
     0.04734 0.04734 0.02367 0.02959 0.07692 0.04734 0.02367 0.04734
     0.00592 0.02959 0.02367 0.00592 0.01775 0 0.00592 0.00592 0.00592
     0 0 0 0 0 0 # 109.85 169
1985 1 1 0 0 200 0 0 0.00333 0.02333 0.05 0.04 0.05667 0.07667
     0.04667 0.07667 0.07667 0.07 0.07667 0.04667 0.04 0.04667 0.04667
     0.01667 0.01667 0.02 0.02333 0.02333 0.04667 0.01 0.02 0.01333 0.01667
     0.00333 0 0.00667 0.00333 0 0 0.00333 0 0 0 # 195 300
1986 1 1 0 0 200 0 0 0 0.01942 0.01456 0.04369 0.02913
     0.04369 0.06311 0.04854 0.10194 0.1165 0.07767 0.0534 0.05825
     0.07282 0.01456 0.05825 0.03883 0.04369 0.01942 0.02913 0.01942
     0.00485 0.00485 0.00971 0.00485 0 0 0 0.00485 0.00485 0 0
     0 0 0 # 133.9 206
1987 1 1 0 0 98 0 0 0 0 0.03061 0.02041 0.04082 0.04082
     0.04082 0.02041 0.05102 0.05102 0.05102 0.08163 0.03061 0.05102
     0.06122 0.09184 0.05102 0.09184 0.07143 0.03061 0.03061 0.02041
     0.02041 0 0.02041 0 0 0 0 0 0 0 0 0 0 # 63.7
     98
1988 1 1 0 0 200 0 0.00315 0.00315 0.02839 0.02208 0.04101
     0.05363 0.05363 0.07886 0.06309 0.06625 0.07571 0.06625 0.0347
     0.05363 0.03155 0.03155 0.06309 0.05047 0.05047 0.0347 0.02839
     0.01893 0.02524 0.01262 0.00631 0 0.00315 0 0 0 0 0 0
     0 0 0 # 206.05 317
1989 1 1 0 0 200 0 0.0026 0 0.00779 0.00779 0.02597 0.05195
     0.05455 0.07792 0.1013 0.0987 0.08571 0.06494 0.07273 0.05974
     0.06234 0.04416 0.03896 0.04156 0.01818 0.01558 0.02597 0.01818
```

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     0.00779   0.01039   0.0026    0    0.0026    0    0    0    0    0    0    0    0
     0    #    250.25    385
1990 1    1    0    0    89   0    0.01124   0.02247   0.03371   0.02247   0.02247
     0.02247   0.02247   0.08989   0.06742   0.07865   0.16854   0.11236   0.07865
     0.04494   0.02247   0.03371   0.01124   0.03371   0.03371   0.03371   0    0.01124
     0.01124   0.01124   0    0    0    0    0    0    0    0    0    0    0    0    #
     57.85 89
1991 1    1    0    0    112  0    0    0.00893   0    0.00893   0.01786   0.01786
     0.07143   0.05357   0.10714   0.05357   0.11607   0.08929   0.07143   0.08036
     0.05357   0.01786   0.0625    0.05357   0.03571   0.04464   0    0.01786   0
     0.01786   0    0    0    0    0    0    0    0    0    0    0    0    #    72.8 112
1992 1    1    0    0    164  0    0.0061    0.0061    0.03049   0.04878   0.0122
     0.02439   0.06098   0.02439   0.06707   0.07317   0.09756   0.08537   0.07317
     0.04268   0.06098   0.07927   0.04878   0.05488   0.03659   0.0061    0.03049
     0.02439   0.0061    0    0    0    0    0    0    0    0    0    0    0    0    0
     #    106.6 164
1993 1    1    0    0    200  0    0    0.00424   0.01695   0.0339    0.05932   0.04237
     0.07203   0.05085   0.0678    0.07627   0.07203   0.08898   0.08051   0.0339
     0.04237   0.03814   0.0339    0.04237   0.0339    0.02119   0.01695   0.02542
     0.02119   0.01695   0.00424   0.00424   0    0    0    0    0    0    0    0    0
     0    #    153.4 236
1994 1    1    0    0    200  0    0    0.004 0.004 0.02 0.036 0.064 0.076 0.088 0.092 0.06 0.08
     0.08 0.104 0.056 0.056 0.056 0.032 0.02 0.016 0.012 0.016 0.012 0.008 0    0.004 0.004 0    0
     0    0    0    0    0    0    0    0    #    162.5 250
1995 1    1    0    0    199  0    0.00503   0.01508   0.01005   0.00503   0.0402
     0.04523   0.0804    0.07538   0.06533   0.07035   0.07035   0.08543   0.09548
     0.07538   0.06533   0.0402    0.03518   0.0201    0.03015   0.0201    0.0201
     0.0201    0    0.01005   0    0    0    0    0    0    0    0    0    0    0    0
     #    129.35    199
1996 1    1    0    0    200  0    0.01255   0.01674   0.02092   0.03766   0.05021
     0.02092   0.04603   0.05858   0.04603   0.1046    0.10042   0.08368   0.05858
     0.06695   0.06695   0.05021   0.02092   0.03766   0.02929   0.01255   0.02929
     0.00837   0.00418   0.01255   0.00418   0    0    0    0    0    0    0    0    0
     0    0    #    155.35    239
1997 1    1    0    0    200  0    0.004 0.008 0.032 0.04 0.016 0.012 0.044 0.048 0.052 0.076 0.068
     0.04 0.06 0.056 0.084 0.092 0.076 0.064 0.02 0.04 0.04 0.012 0.012 0.004 0    0    0    0
     0    0    0    0    0    0    0    0    #    162.5 250
```

```
1998  1     1     0     0     125   0     0.008 0     0     0.016 0.032 0.056 0.024 0.064 0.024 0.088 0.056
      0.064 0.08  0.152 0.064 0.04  0.048 0.072 0.056 0.016 0.008 0     0.016 0     0.008 0.008 0     0
      0     0     0     0     0     0     0     0     #     81.25 125
1999  1     1     0     0     67    0     0.01481     0.00741     0.00741     0.02963     0.00741
      0.02963     0.03704     0.06667     0.02963     0.03704     0.02222     0.08148     0.11111
      0.1037      0.06667     0.08148     0.06667     0.05926     0.05926     0.02963     0.01481
      0.00741     0.01481     0.00741     0.00741     0     0     0     0     0     0     0     0     0
      0     0     #     Super Years 1999-2000
2000  1     1     0     0     66    0     0.01481     0.00741     0.00741     0.02963     0.00741
      0.02963     0.03704     0.06667     0.02963     0.03704     0.02222     0.08148     0.11111
      0.1037      0.06667     0.08148     0.06667     0.05926     0.05926     0.02963     0.01481
      0.00741     0.01481     0.00741     0.00741     0     0     0     0     0     0     0     0     0
      0     0     #     Super Years 1999-2000
2001  1     1     0     0     15    0     0.01724     0.01724     0     0     0.03448     0.03448
      0.06897     0.03448     0.10345     0.06897     0.13793     0.08621     0.08621     0.05172
      0.10345     0     0.05172     0.01724     0.03448     0.01724     0     0     0     0.01724
      0.01724     0     0     0     0     0     0     0     0     0     0     0     #     Super Years 2001-
2004
2002  1     1     0     0     13    0     0.01724     0.01724     0     0     0.03448     0.03448
      0.06897     0.03448     0.10345     0.06897     0.13793     0.08621     0.08621     0.05172
      0.10345     0     0.05172     0.01724     0.03448     0.01724     0     0     0     0.01724
      0.01724     0     0     0     0     0     0     0     0     0     0     0     #     Super Years 2001-
2004
2003  1     1     0     0     15    0     0.01724     0.01724     0     0     0.03448     0.03448
      0.06897     0.03448     0.10345     0.06897     0.13793     0.08621     0.08621     0.05172
      0.10345     0     0.05172     0.01724     0.03448     0.01724     0     0     0     0.01724
      0.01724     0     0     0     0     0     0     0     0     0     0     0     #     Super Years 2001-
2004
2004  1     1     0     0     15    0     0.01724     0.01724     0     0     0.03448     0.03448
      0.06897     0.03448     0.10345     0.06897     0.13793     0.08621     0.08621     0.05172
      0.10345     0     0.05172     0.01724     0.03448     0.01724     0     0     0     0.01724
      0.01724     0     0     0     0     0     0     0     0     0     0     0     #     Super Years 2001-
2004
1978  1     2     0     0     15    0     0     0     0.00634     0.00951     0.03487     0.06022
      0.08399     0.03803     0.03803     0.04437     0.03962     0.03803     0.05071     0.04596
      0.01585     0.05705     0.07132     0.05388     0.03803     0.03328     0.04754     0.06022
      0.05388     0.03487     0.02219     0.01902     0.00317     0     0     0     0     0     0     0
      0     0     #     combine     78-90
```

```
1979  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
      0.05388  0.03487  0.02219  0.01902  0.00317  0  0  0  0  0  0  0
      0  0  #  combine  78-90
1980  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
      0.05388  0.03487  0.02219  0.01902  0.00317  0  0  0  0  0  0  0
      0  0  #  combine  78-90
1981  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
      0.05388  0.03487  0.02219  0.01902  0.00317  0  0  0  0  0  0  0
      0  0  #  combine  78-90
1982  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
      0.05388  0.03487  0.02219  0.01902  0.00317  0  0  0  0  0  0  0
      0  0  #  combine  78-90
1983  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
      0.05388  0.03487  0.02219  0.01902  0.00317  0  0  0  0  0  0  0
      0  0  #  combine  78-90
1984  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
      0.05388  0.03487  0.02219  0.01902  0.00317  0  0  0  0  0  0  0
      0  0  #  combine  78-90
1985  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
      0.05388  0.03487  0.02219  0.01902  0.00317  0  0  0  0  0  0  0
      0  0  #  combine  78-90
1986  1        2        0        0        15       0        0        0        0.00634  0.00951  0.03487  0.06022
      0.08399  0.03803  0.03803  0.04437  0.03962  0.03803  0.05071  0.04596
      0.01585  0.05705  0.07132  0.05388  0.03803  0.03328  0.04754  0.06022
```

```
        0.05388     0.03487     0.02219     0.01902     0.00317     0     0     0     0     0     0     0
        0     0     #     combine     78-90
1987    1     2     0     0     15    0     0     0     0.00634     0.00951     0.03487     0.06022
        0.08399     0.03803     0.03803     0.04437     0.03962     0.03803     0.05071     0.04596
        0.01585     0.05705     0.07132     0.05388     0.03803     0.03328     0.04754     0.06022
        0.05388     0.03487     0.02219     0.01902     0.00317     0     0     0     0     0     0     0
        0     0     #     combine     78-90
1988    1     2     0     0     15    0     0     0     0.00634     0.00951     0.03487     0.06022
        0.08399     0.03803     0.03803     0.04437     0.03962     0.03803     0.05071     0.04596
        0.01585     0.05705     0.07132     0.05388     0.03803     0.03328     0.04754     0.06022
        0.05388     0.03487     0.02219     0.01902     0.00317     0     0     0     0     0     0     0
        0     0     #     combine     78-90
1989    1     2     0     0     15    0     0     0     0.00634     0.00951     0.03487     0.06022
        0.08399     0.03803     0.03803     0.04437     0.03962     0.03803     0.05071     0.04596
        0.01585     0.05705     0.07132     0.05388     0.03803     0.03328     0.04754     0.06022
        0.05388     0.03487     0.02219     0.01902     0.00317     0     0     0     0     0     0     0
        0     0     #     combine     78-90
1990    1     2     0     0     16    0     0     0     0.00634     0.00951     0.03487     0.06022
        0.08399     0.03803     0.03803     0.04437     0.03962     0.03803     0.05071     0.04596
        0.01585     0.05705     0.07132     0.05388     0.03803     0.03328     0.04754     0.06022
        0.05388     0.03487     0.02219     0.01902     0.00317     0     0     0     0     0     0     0
        0     0     #     combine     78-90
1991    1     2     0     0     200   0     0     0     0.00446     0     0     0.01786     0.01786
        0.03571     0.07143     0.04911     0.08036     0.05357     0.04911     0.11161     0.07143
        0.05804     0.04911     0.06696     0.07143     0.07589     0.03571     0.04911     0.01786
        0.00446     0     0.00893     0     0     0     0     0     0     0     0     0     0     #     145.6
        224
1992    1     2     0     0     200   0     0     0     0     0.00609     0.01217     0.02637     0.03043
        0.06694     0.05477     0.05477     0.06897     0.07911     0.12576     0.07099     0.06694
        0.0426      0.07099     0.04868     0.04665     0.04462     0.03245     0.02231     0.01217
        0.01014     0.00406     0.00203     0     0     0     0     0     0     0     0     0     0     #
        320.45      493
1993    1     2     0     0     200   0     0     0     0.00423     0.0141      0.03385     0.04372
        0.06065     0.07193     0.05501     0.07475     0.07898     0.06347     0.07616     0.08463
        0.04654     0.06629     0.04513     0.04937     0.03103     0.02116     0.03667     0.01975
        0.00987     0.00846     0.00423     0     0     0     0     0     0     0     0     0     0     0
        #     460.85      709
```

```
1994	1	2	0	0	200	0	0.00134	0.00267	0.00134	0.00936	0.01872
	0.04011	0.04545	0.07487	0.07487	0.08155	0.08824	0.08422	0.09492
	0.08021	0.07219	0.05348	0.04412	0.03342	0.01471	0.01738	0.01872
	0.01604	0.02139	0.00668	0.00267	0.00134	0	0	0	0	0	0	0
	0	0	0	#	486.2	748
1995	1	2	0	0	200	0	0	0.00261	0	0.00783	0.01828	0.04178
	0.05483	0.05222	0.06789	0.09138	0.07572	0.10444	0.08616	0.08355
	0.05483	0.05744	0.047	0.047	0.03916	0.02872	0.01044	0.01567	0.00522
	0.00522	0.00261	0	0	0	0	0	0	0	0	0	0	0	#
	248.95	383
1996	1	2	0	0	200	0	0	0.00375	0.00375	0.00562	0.02434	0.05243
	0.05993	0.06929	0.06554	0.11049	0.11236	0.09176	0.07865	0.06554
	0.04682	0.04307	0.05805	0.02622	0.02434	0.02434	0.01685	0.00749
	0.00749	0.00187	0	0	0	0	0	0	0	0	0	0	0	0	#
	347.1	534
1997	1	2	0	0	200	0	0	0.00334	0.00334	0.02341	0.02341	0.0602
	0.0602	0.05686	0.08696	0.0903	0.07692	0.05351	0.08027	0.05017
	0.08696	0.03679	0.04682	0.04348	0.02007	0.01672	0.02007	0.01003
	0.02007	0.00669	0.01003	0.00669	0	0	0	0.00669	0	0	0	0
	0	0	#	194.35	299
1998	1	2	0	0	54	0	0	0	0	0	0	0	0.01852	0.05556
	0.11111	0.11111	0.03704	0.07407	0.11111	0.07407	0.07407	0.09259
	0.01852	0.05556	0.01852	0.05556	0.03704	0.01852	0	0.01852	0.01852
	0	0	0	0	0	0	0	0	0	0	0	#	35.1	54
1999	1	2	0	0	200	0	0	0.00187	0	0.00374	0.02056	0.01121
	0.02617	0.04486	0.06355	0.07103	0.10093	0.1028	0.09907	0.10093
	0.0729	0.0729	0.05794	0.04673	0.03738	0.01869	0.0243	0.00561
	0.00187	0.00561	0.00187	0.00374	0.00187	0	0	0	0	0	0	0
	0	0.00187	#	combines	99-100
2000	1	2	0	0	200	0	0	0.00187	0	0.00374	0.02056	0.01121
	0.02617	0.04486	0.06355	0.07103	0.10093	0.1028	0.09907	0.10093
	0.0729	0.0729	0.05794	0.04673	0.03738	0.01869	0.0243	0.00561
	0.00187	0.00561	0.00187	0.00374	0.00187	0	0	0	0	0	0	0
	0	0.00187	#	combines	99-100
2001	1	2	0	0	132	0	0	0	0.00758	0.05303	0.14394	0.15909
	0.08333	0.15152	0.04545	0.02273	0.02273	0.07576	0.04545	0.03788
	0.0303	0.02273	0.02273	0.01515	0.00758	0.00758	0.02273	0	0
```

```
     0.01515  0   0   0   0.00758  0   0   0   0   0   0   0   0   #   New
     2006  Ca  com  sample
1978 1   3   0   0   120  0   0   0   0   0.04167   0.025 0.08333   0.025 0.03333
     0.05  0.00833   0.05  0.04167   0.05  0.025 0.01667   0.04167   0.00833   0.05  0.1
     0.03333   0.05  0.03333   0.10833   0.04167   0.03333   0.03333   0.01667   0   0
     0   0   0   0   0   0   0   #   120
1979 1   3   0   0   106  0   0   0   0.01887   0.00943   0.0283   0.01887
     0.03774   0.06604   0.0283   0.0283   0.00943   0.0283   0.0283   0.01887
     0.03774   0.04717   0.10377   0.06604   0.13208   0.12264   0.03774   0.04717
     0.04717   0.01887   0.00943   0.00943   0   0   0   0   0   0   0   0   0
     0   #   106
1980 1   3   0   0   29   0   0   0   0   0.00862   0.01724   0.0431   0.06034
     0.07759   0.06034   0.06034   0.06897   0.03448   0.11207   0.0431   0.06034
     0.07759   0.03448   0.01724   0.0431   0.0431   0.02586   0.03448   0.02586
     0.00862   0.00862   0.00862   0.01724   0   0.00862   0   0   0   0   0   0
     0   #   combine   80-83
1981 1   3   0   0   29   0   0   0   0   0.00862   0.01724   0.0431   0.06034
     0.07759   0.06034   0.06034   0.06897   0.03448   0.11207   0.0431   0.06034
     0.07759   0.03448   0.01724   0.0431   0.0431   0.02586   0.03448   0.02586
     0.00862   0.00862   0.00862   0.01724   0   0.00862   0   0   0   0   0   0
     0   #   combine   80-83
1982 1   3   0   0   29   0   0   0   0   0.00862   0.01724   0.0431   0.06034
     0.07759   0.06034   0.06034   0.06897   0.03448   0.11207   0.0431   0.06034
     0.07759   0.03448   0.01724   0.0431   0.0431   0.02586   0.03448   0.02586
     0.00862   0.00862   0.00862   0.01724   0   0.00862   0   0   0   0   0   0
     0   #   combine   80-83
1983 1   3   0   0   29   0   0   0   0   0.00862   0.01724   0.0431   0.06034
     0.07759   0.06034   0.06034   0.06897   0.03448   0.11207   0.0431   0.06034
     0.07759   0.03448   0.01724   0.0431   0.0431   0.02586   0.03448   0.02586
     0.00862   0.00862   0.00862   0.01724   0   0.00862   0   0   0   0   0   0
     0   #   combine   80-83
1984 1   3   0   0   200  0   0   0   0.00804   0.00804   0.04021   0.03217
     0.08043   0.09115   0.08043   0.09651   0.08847   0.07239   0.05094   0.04826
     0.04021   0.01609   0.0429   0.03217   0.00804   0.03217   0.05362   0.03485
     0.01877   0.00536   0.00536   0.00536   0.00268   0.00536   0   0   0   0   0
     0   0   0   #   161  373
1985 1   3   0   0   200  0   0   0   0   0.0045   0.02703   0.04054   0.02252
     0.07207   0.03153   0.1036   0.05405   0.04955   0.08108   0.04505   0.07207
```

```
     0.03153  0.05405  0.03153  0.04505  0.07207  0.03604  0.04054  0.02252
     0.02703  0.02252  0.00901  0.0045  0  0  0  0  0  0  0  0  0
     #  98  222
1986 1  3  0  0  177  0  0.0113  0.00565  0.00565  0  0.01695  0.0113
     0.0452  0.0565  0.0565  0.10169  0.03955  0.0678  0.03955  0.07345
     0.03955  0.01695  0.0452  0.06215  0.0452  0.0565  0.0565  0.0339
     0.0565  0.0113  0.01695  0.0113  0.01695  0  0  0  0  0  0  0
     0  0  #  37  177
1987 1  3  0  0  163  0  0.01227  0  0.00613  0.0184  0.04908  0.01227
     0.02454  0.07362  0.03067  0.07975  0.04908  0.04294  0.07362  0.04908
     0.04294  0.04294  0.04294  0.06135  0.02454  0.07975  0.03681  0.05521
     0.04294  0.0184  0.01227  0.01227  0  0  0  0  0.00613  0  0  0
     0  0  #  40  163
1988 1  3  0  0  38  0  0  0  0  0  0  0.13158  0.02632  0.10526
     0.02632  0.05263  0.05263  0.07895  0.18421  0.05263  0.05263  0.05263  0
     0.02632  0.07895  0.05263  0  0.02632  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  #  38  38
1989 1  3  0  0  112  0  0.00893  0.03571  0.01786  0.01786  0.04464
     0.01786  0.08036  0.0625  0.02679  0.08929  0.08036  0.08929  0.0625
     0.07143  0.03571  0.07143  0.05357  0.00893  0.01786  0.01786  0.03571  0
     0.00893  0.01786  0.00893  0  0.00893  0  0  0  0  0.00893  0  0
     0  0  #  80  112
1993 1  3  0  0  163  0  0.00613  0  0  0.00613  0.06135  0.07975
     0.11656  0.09202  0.12883  0.10429  0.06135  0.02454  0.04294  0.02454
     0.02454  0.04294  0.0184  0.0184  0.03067  0.04294  0.0184  0.00613
     0.02454  0  0.01227  0.00613  0  0  0  0  0  0  0  0.00613  0
     0  #  163  163
1994 1  3  0  0  151  0  0  0.00662  0  0.01325  0.01987  0.06623
     0.10596  0.09272  0.15232  0.07285  0.12583  0.0596  0.04636  0.03311
     0.03974  0.04636  0.03974  0.01325  0.03311  0.00662  0  0.00662  0.00662
     0.01325  0  0  0  0  0  0  0  0  0  0  0  0  #  151  151
1995 1  3  0  0  110  0  0  0  0.00909  0.02727  0  0.03636  0.08182
     0.07273  0.13636  0.1  0.07273  0.06364  0.02727  0.07273  0.02727  0.06364
     0.03636  0.03636  0.01818  0.02727  0.05455  0.00909  0.00909  0.01818  0
     0  0  0  0  0  0  0  0  0  0  0  #  110  110
1996 1  3  0  0  73  0  0  0  0.0137  0.0137  0.0411  0.0274
     0.0411  0.12329  0.10959  0.12329  0.17808  0.05479  0.09589  0.0411
```

```
     0.0274  0.0137  0.0274  0  0.0137  0.0137  0.0137  0.0274  0  0
     0  0  0  0  0  0  0  0  0  0  0  0  #  73  73
1997 1  3  0  0  99  0  0  0.0101  0.0101  0.0101  0.0303  0.0404
     0.07071  0.07071  0.09091  0.09091  0.14141  0.06061  0.12121  0.0404
     0.0202  0.06061  0.0303  0.05051  0  0.0101  0.0101  0.0101  0.0101
     0.0101  0  0  0  0  0  0  0  0  0  0  0  0  #  99  99
1998 1  3  0  0  147  0  0  0  0  0  0.02041  0.02721  0.04082
     0.04762  0.14286  0.13605  0.10204  0.12245  0.09524  0.07483  0.03401
     0.05442  0.01361  0.02041  0.02721  0.02041  0  0.01361  0.0068  0  0
     0  0  0  0  0  0  0  0  0  0  0  #  147  147
1999 1  3  0  0  200  0  0  0.00407  0  0.00407  0.00813  0.03252
     0.05285  0.06504  0.10976  0.15041  0.09756  0.10569  0.07724  0.07724
     0.04065  0.05691  0.03252  0.00813  0.02846  0.01626  0.01626  0.0122
     0.00407  0  0  0  0  0  0  0  0  0  0  0  0  0  #  246
     246
2000 1  3  0  0  62  0  0  0  0  0  0  0.04839  0.04839  0.08065
     0.06452  0.09677  0.16129  0.17742  0.06452  0.03226  0.06452  0  0.04839
     0.03226  0.03226  0  0.03226  0.01613  0  0  0  0  0  0  0  0
     0  0  0  0  0  0  #  62  62
2001 1  3  0  0  200  0  0  0  0.00272  0.00815  0.01359  0.02174
     0.02989  0.04076  0.05163  0.05707  0.09511  0.08424  0.10326  0.10054
     0.09783  0.05707  0.07337  0.04891  0.03533  0.02446  0.0163  0.00272
     0.01087  0.00815  0.00543  0.00815  0  0  0.00272  0  0  0  0  0
     0  0  #
2002 1  3  0  0  200  0  0  0  0.00446  0.00893  0.00893  0.01786
     0.02679  0.03348  0.05134  0.08036  0.07589  0.09152  0.09598  0.11607
     0.10045  0.09152  0.04464  0.04464  0.03125  0.01563  0.01339  0.02009
     0.01563  0.00446  0.00446  0.00223  0  0  0  0  0  0  0  0  0
     0  #
2003 1  3  0  0  200  0  0.00204  0  0.00612  0.0102  0.0102  0.02449
     0.0102  0.04082  0.03061  0.0551  0.06531  0.06735  0.07755  0.08571
     0.09592  0.10816  0.06327  0.08367  0.05102  0.02857  0.01837  0.02041
     0.01429  0.00816  0.01429  0.00408  0.00204  0.00204  0  0  0  0  0
     0  0  0  #

1995 1  4  0  0  98  0  0  0  0  0  0  0.0102  0.0102  0.04082
     0.08163  0.17347  0.03061  0.06122  0.09184  0.07143  0.08163  0.06122
```

0.08163 0.02041 0.06122 0.03061 0.05102 0.03061 0.0102 0 0 0
0 0 0 0 0 0 0 0 0 0 # 98 98
1996 1 4 0 0 161 0 0 0 0 0 0 0.01242 0 0.07453
0.07453 0.09938 0.15528 0.04969 0.13043 0.04348 0.03727 0.04348
0.03727 0.0559 0.01863 0.01863 0.03727 0.03106 0.01242 0.01242
0.01863 0.01242 0 0.01242 0.01242 0 0 0 0 0 0 0 #
161 161
1997 1 4 0 0 200 0 0.00391 0 0 0 0 0.00781 0.03906
0.03516 0.10156 0.12109 0.14453 0.13281 0.08203 0.0625 0.07813
0.04688 0.02344 0.03125 0.01953 0.02344 0.01563 0.00781 0.00781
0.00781 0.00391 0 0.00391 0 0 0 0 0 0 0 0 0 #
256 256
1998 1 4 0 0 118 0 0 0 0 0 0 0.02542 0.02542 0.00847
0.04237 0.13559 0.02542 0.15254 0.05085 0.18644 0.0678 0.08475
0.0339 0.04237 0.00847 0.0339 0.0339 0.01695 0 0.01695 0
0.00847 0 0 0 0 0 0 0 0 0 0 # 118 118
1999 1 4 0 0 166 0 0 0 0 0 0 0 0.00602 0.01205
0.0241 0.04217 0.10241 0.09639 0.09639 0.07831 0.09639 0.11446
0.07229 0.07229 0.05422 0.03614 0.0241 0.03614 0.01205 0 0.01205
0 0.00602 0 0.00602 0 0 0 0 0 0 0 # 166 166
2000 1 4 0 0 141 0 0 0 0 0 0.00709 0.01418 0.03546
0.04255 0.06383 0.14184 0.09929 0.11348 0.10638 0.06383 0.07801
0.04965 0.05674 0.04965 0.00709 0.02128 0.00709 0.00709 0.02128 0
0.00709 0 0.00709 0 0 0 0 0 0 0 0 0 # 141 141
111
2001 1 4 0 0 200 0 0 0 0 0 0.02823 0.10081 0.05645
0.07661 0.06855 0.05645 0.125 0.09274 0.06452 0.05242 0.06855 0.04435
0.04032 0.02419 0.02419 0.02419 0.0121 0.0121 0.0121 0.00806
0.00403 0.00403 0 0 0 0 0 0 0 0 0 0 # 248 248

1980 1 5 0 0 29 0 0 0 0 0.01138 0.02987 0.06543 0.07539
0.11522 0.0825 0.09388 0.0441 0.03841 0.02703 0.03129 0.04694
0.0128 0.02418 0.05405 0.02987 0.05974 0.01991 0.01991 0.01422
0.01849 0.00711 0.03129 0.01138 0.00711 0.00569 0.00569 0.00569 0
0.00569 0.00569 0 0 # combine 80-88 111
1981 1 5 0 0 29 0 0 0 0 0.01138 0.02987 0.06543 0.07539
0.11522 0.0825 0.09388 0.0441 0.03841 0.02703 0.03129 0.04694
0.0128 0.02418 0.05405 0.02987 0.05974 0.01991 0.01991 0.01422

```
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
1982 1  5  0  0  29  0  0  0  0  0.01138  0.02987  0.06543  0.07539
     0.11522  0.0825   0.09388  0.0441   0.03841  0.02703  0.03129  0.04694
     0.0128   0.02418  0.05405  0.02987  0.05974  0.01991  0.01991  0.01422
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
1983 1  5  0  0  29  0  0  0  0  0.01138  0.02987  0.06543  0.07539
     0.11522  0.0825   0.09388  0.0441   0.03841  0.02703  0.03129  0.04694
     0.0128   0.02418  0.05405  0.02987  0.05974  0.01991  0.01991  0.01422
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
1984 1  5  0  0  29  0  0  0  0  0.01138  0.02987  0.06543  0.07539
     0.11522  0.0825   0.09388  0.0441   0.03841  0.02703  0.03129  0.04694
     0.0128   0.02418  0.05405  0.02987  0.05974  0.01991  0.01991  0.01422
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
1985 1  5  0  0  29  0  0  0  0  0.01138  0.02987  0.06543  0.07539
     0.11522  0.0825   0.09388  0.0441   0.03841  0.02703  0.03129  0.04694
     0.0128   0.02418  0.05405  0.02987  0.05974  0.01991  0.01991  0.01422
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
1986 1  5  0  0  29  0  0  0  0  0.01138  0.02987  0.06543  0.07539
     0.11522  0.0825   0.09388  0.0441   0.03841  0.02703  0.03129  0.04694
     0.0128   0.02418  0.05405  0.02987  0.05974  0.01991  0.01991  0.01422
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
1987 1  5  0  0  28  0  0  0  0  0.01138  0.02987  0.06543  0.07539
     0.11522  0.0825   0.09388  0.0441   0.03841  0.02703  0.03129  0.04694
     0.0128   0.02418  0.05405  0.02987  0.05974  0.01991  0.01991  0.01422
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
1988 1  5  0  0  28  0  0  0  0  0.01138  0.02987  0.06543  0.07539
     0.11522  0.0825   0.09388  0.0441   0.03841  0.02703  0.03129  0.04694
     0.0128   0.02418  0.05405  0.02987  0.05974  0.01991  0.01991  0.01422
     0.01849  0.00711  0.03129  0.01138  0.00711  0.00569  0.00569  0.00569  0
     0.00569  0.00569  0  0  #  combine  80-88
```

```
1995  1   5   0   0   11  0   0   0   0   0   0   0.30435 0.04348 0.08696
      0.08696 0.08696 0.04348 0.08696 0.04348 0.04348 0   0.04348 0   0
      0   0   0   0   0   0   0   0.04348 0   0.04348 0.04348 0   0   0
      0   0   0   0   #   combine 95-96
1996  1   5   0   0   12  0   0   0   0   0   0   0.30435 0.04348 0.08696
      0.08696 0.08696 0.04348 0.08696 0.04348 0.04348 0   0.04348 0   0
      0   0   0   0   0   0   0   0.04348 0   0.04348 0.04348 0   0   0
      0   0   0   0   #   combine 95-96
1998  1   5   0   0   48  0   0   0   0   0   0   0.02083 0   0   0.04167
      0.0625  0.125 0 0.16667 0.04167 0.08333 0.0625  0   0.04167 0.04167
      0.10417 0.02083 0.0625  0.02083 0.02083 0.04167 0.02083 0   0   0
      0   0.02083 0   0   0   0   0   #   48  48
1999  1   5   0   0   96  0   0   0   0   0   0   0   0   0.05208 0.02083
      0.03125 0.09375 0.08333 0.08333 0.03125 0.0625  0.04167 0.01042
      0.07292 0.0625  0.05208 0.10417 0.03125 0.10417 0.04167 0.01042
      0.01042 0   0   0   0   0   0   0   0   0   0   #   96  96
2000  1   5   0   0   189 0   0   0   0   0   0   0.00529 0.01587 0.02116
      0.04762 0.04762 0.06878 0.08995 0.07407 0.06349 0.09524 0.06349
      0.0582  0.06349 0.06349 0.04762 0.04762 0.03704 0.03704 0.03704
      0.01058 0.00529 0   0   0   0   0   0   0   0   0   0   #   189 189
2001  1   5   0   0   101 0   0   0   0   0   0   0.0099  0.0099  0.0099
      0.0099  0.0297  0.07921 0.08911 0.09901 0.07921 0.09901 0.0495
      0.05941 0.06931 0.05941 0.07921 0.0495  0.05941 0.0198  0.0198  0
      0   0.0099  0.0099  0   0   0   0   0   0   0   0   #   101 101
1996  1   6   0   0   200 0   0   0   0   0   0.00752 0.0188  0.03008
      0.05263 0.04511 0.08271 0.09023 0.12782 0.09023 0.05639 0.02632
      0.03759 0.03008 0.04135 0.03759 0.04135 0.03759 0.04511 0.05263
      0.03759 0.00376 0.00376 0   0.00376 0   0   0   0   0   0   0   0
      #   266 266
1997  1   6   0   0   118 0   0   0   0   0   0   0.00847 0.04237 0.0678
      0.02542 0.13559 0.11017 0.10169 0.16102 0.11017 0.04237 0.05085
      0.02542 0.02542 0.01695 0.01695 0.00847 0.01695 0.02542 0.00847 0
      0   0   0   0   0   0   0   0   0   0   0   #   118 118
1998  1   6   0   0   34  0   0   0   0   0   0.01961 0.02941 0.02941
      0.05882 0.01961 0   0.08824 0.05882 0.14706 0.02941 0.08824 0.05882
      0.07843 0.04902 0.06863 0.02941 0.0098  0.01961 0.03922 0.03922
      0.0098  0.01961 0   0.0098  0   0   0   0   0   0   0   0   #
      combine 98-100
```

1999 1 6 0 0 34 0 0 0 0 0 0.01961 0.02941 0.02941
0.05882 0.01961 0 0.08824 0.05882 0.14706 0.02941 0.08824 0.05882
0.07843 0.04902 0.06863 0.02941 0.0098 0.01961 0.03922 0.03922
0.0098 0.01961 0 0.0098 0 0 0 0 0 0 0 0 #
combine 98-100
2000 1 6 0 0 34 0 0 0 0 0 0.01961 0.02941 0.02941
0.05882 0.01961 0 0.08824 0.05882 0.14706 0.02941 0.08824 0.05882
0.07843 0.04902 0.06863 0.02941 0.0098 0.01961 0.03922 0.03922
0.0098 0.01961 0 0.0098 0 0 0 0 0 0 0 0 #
combine 98-100
2002 1 6 0 0 23 0 0 0 0 0.02899 0.01449 0.01449 0.01449
0 0 0 0 0.02899 0.02899 0.07246 0.04348 0.01449 0.04348
0.02899 0.05797 0.07246 0.01449 0.02899 0.17391 0.14493 0.08696
0.05797 0.01449 0.01449 0 0 0 0 0 0 0 0 # combine
4-Feb
2003 1 6 0 0 23 0 0 0 0 0.02899 0.01449 0.01449 0.01449
0 0 0 0 0.02899 0.02899 0.07246 0.04348 0.01449 0.04348
0.02899 0.05797 0.07246 0.01449 0.02899 0.17391 0.14493 0.08696
0.05797 0.01449 0.01449 0 0 0 0 0 0 0 0 # combine
4-Feb
2004 1 6 0 0 23 0 0 0 0 0.02899 0.01449 0.01449 0.01449
0 0 0 0 0.02899 0.02899 0.07246 0.04348 0.01449 0.04348
0.02899 0.05797 0.07246 0.01449 0.02899 0.17391 0.14493 0.08696
0.05797 0.01449 0.01449 0 0 0 0 0 0 0 0 # combine
4-Feb
2000 1 7 0 0 200 0 0 0 0 0 0.00554 0 0.01108 0.01662
0.01108 0.00831 0.02216 0.08033 0.07756 0.1385 0.09418 0.1108
0.0831 0.08864 0.05817 0.07479 0.04432 0.03324 0.00831 0.02493
0.00277 0 0 0.00554 0 0 0 0 0 0 0 0 # 344 344
2001 1 7 0 0 200 0 0 0 0 0 0 0 0 0.00172 0.00172
0.00343 0.0223 0.03431 0.07204 0.08919 0.15609 0.14237 0.12693
0.09605 0.08576 0.06861 0.03602 0.02916 0.0223 0.00515 0.00515
0.00172 0 0 0 0 0 0 0 0 0 0 # 583 583
2002 1 7 0 0 139 0 0 0 0.01439 0 0.01439 0 0 0
0.00719 0.02878 0.05755 0.05755 0.08633 0.10072 0.07914 0.09353
0.15827 0.02158 0.04317 0.03597 0.01439 0.03597 0.05036 0.06475
0.00719 0 0.02158 0.00719 0 0 0 0 0 0 0 0 #

```
2003  1     7     0     0     19    0     0     0     0     0     0     0     0     0     0     0.05263
      0.05263     0     0.10526     0.10526     0.15789     0.10526     0.05263     0.05263     0.05263
      0.05263     0.05263     0     0.05263     0     0     0.10526     0     0     0     0     0     0
      0     0     0     0     #
2004  1     7     0     0     40    0     0     0     0     0     0     0.025 0     0     0     0     0
      0.025 0.1   0.05  0.1   0.075 0.175 0.1   0.075 0.025 0     0.05  0.025 0.025 0.125 0.025 0     0
      0     0     0     0     0     0     0     0     #

#IPHC


2002  1     12    0     0     141   0     0     0     0     0     0     0     0     0     0.00709
      0.00709     0.02128     0.06383     0.06383     0.14184     0.13475     0.12766     0.09929
      0.07092     0.07092     0.07092     0.04965     0.02837     0.00709     0.00709     0.02837     0
      0     0     0     0     0     0     0     0     0     0     #     2002  IPHC
2003  1     12    0     0     200   0     0     0     0     0     0     0     0     0.00631     0
      0.01262     0.01577     0.03785     0.07256     0.09464     0.09779     0.11672     0.07886
      0.08517     0.08202     0.07571     0.0694      0.05994     0.05994     0.02524     0     0.00946
      0     0     0     0     0     0     0     0     0     0     #     2003  IPHC
2004  1     12    0     0     174   0     0     0     0     0     0     0     0     0     0     0.00571
      0     0.01143     0.08  0.11429     0.12  0.13143     0.12  0.10286     0.10857     0.05714
      0.05714     0.03429     0.02857     0.02857     0     0     0     0     0     0     0     0     0
      0     0     0     #     2004  IPHC
2005  1     12    0     0     155   0     0     0     0     0     0     0     0     0     0     0.00641
      0.00641     0.04487     0.03846     0.07051     0.11538     0.10897     0.07051     0.12821
      0.05769     0.12179     0.07051     0.0641      0.05769     0.01282     0.01282     0.01282     0
      0     0     0     0     0     0     0     0     0     #     2005  IPHC



36    #     N     age'  bins
```

```
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	35	40	45	50	55	60	65
	70

1	#	number		of	unique		ageing		error	matrices	to	generate

0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5
	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5	28.5	29.5	30.5	31.5	32.5	33.5	34.5
	35.5	36.5	37.5	38.5	39.5	40.5	41.5	42.5	43.5	44.5	45.5	46.5	47.5	48.5	49.5	50.5	51.5
	52.5	53.5	54.5	55.5	56.5	57.5	58.5	59.5	60.5	61.5	62.5	63.5	64.5	65.5	66.5	67.5	68.5
	69.5	70.5	#71.5	72.5	73.5	74.5	75.5	76.5	77.5	78.5	79.5	80.5	81.5	82.5	83.5	84.5	85.5
	86.5	87.5	88.5	89.5	90.5
#SS1	Age	Error	Vector1.5	1.53	1.57	1.6	1.64	1.67	1.71	1.74	1.78	1.81	1.85	1.88	1.92	1.95
	1.99	2.02	2.06	2.09	2.13	2.16	2.2	2.23	2.27	2.3	2.33	2.37	2.4	2.44	2.47	2.51	2.54
	2.58	2.61	2.65	2.68	2.72	2.75	2.79	2.82	2.86	2.89	2.93	2.96	3	3.03	3.07	3.1	3.13
	3.17	3.2	3.24	3.27	3.31	3.34	3.38	3.41	3.45	3.48	3.52	3.55	3.59	3.62	3.66	3.69	3.73
	3.76	3.8	3.83	3.87	3.9	3.93	#3.97	4	4.04	4.07	4.11	4.14	4.18	4.21	4.25	4.28	4.32
	4.35	4.39	4.42	4.46	4.49	4.53	4.56	4.6	4.63
#1.01	1.06	1.1	1.14	1.19	1.23	1.27	1.31	1.36	1.4	1.44	1.49	1.53	1.57	1.62	1.66	1.7	1.75
	1.79	1.83	1.87	1.92	1.96	2	2.05	2.09	2.13	2.18	2.22	2.26	2.31	2.35	2.39	2.44	2.48
	2.52	2.56	2.61	2.65	2.69	2.74	2.78	2.82	2.87	2.91	2.95	3	3.04	3.08	3.12	3.17	3.21
	3.25	3.3	3.34	3.38	3.43	3.47	3.51	3.56	3.6	3.64	3.69	3.73	3.77	3.81	3.86	3.9	3.94
	4	3.93	#3.97	4	4.04	4.07	4.11	4.14	4.18	4.21	4.25	4.28	4.32	4.35	4.39	4.42	4.46
	4.49	4.53	4.56	4.6	4.63
2.41775	2.39845	2.37915	2.35985	2.34055	2.32125	2.30195	2.28265	2.26335
	2.24405	2.22475	2.20545	2.18615	2.16685	2.14755	2.12825	2.10895
	2.08965	2.07035	2.05105	2.03175	2.01245	1.99315	1.97385	1.95455
	1.93525	1.91595	1.89665	1.87735	1.85805	1.83875	1.81945	1.80015
	1.78085	1.76155	1.74225	1.72295	1.70365	1.68435	1.66505	1.64575
	1.62645	1.60715	1.58785	1.56855	1.54925	1.52995	1.51065	1.49135
	1.47205	1.45275	1.43345	1.41415	1.39485	1.37555	1.35625	1.33695
	1.31765	1.29835	1.27905	1.25975	1.24045	1.22115	1.20185	1.18255
```

```
      1.16325     1.14395     1.12465     1.10535     1.08605     1.06675     #1.04745    1.02815
      1.00885     0.98955     0.97025     0.95095     0.93165     0.91235     0.89305     0.87375
      0.85445     0.83515     0.81585     0.79655     0.77725     0.75795     0.73865     0.71935
      0.70005     0.68075

#SS1

#3    "1=%CORRECT,"     "2=C.V.,"   "3=%AGREE," 4=READ      %AGREE      @AGE

#0.31 0.1   0.95  '%AGREE     @     1     (MIN)'      0     70    0     0     0     !     82    NO    PICK
      0     -1    0

#0.11 0.1   0.9   '%AGREE     @70   (MAX)'      0     70    0     0     0     !     83    NO    PICK  0
      -1    0

#1    0.001 4     'POWER      '     0     70    0     0     0     !     84    NO    PICK  0     -1    0

#0.04 0.01  0.3   'OLD  DISCOUNT    '     0     70    0     0     0     !     85    NO    PICK  0     -1
      0
```

```
#0    0.001 0.1   '%MIS-SEXED '     0     70    0     0     0     !     86    NO    PICK  0     -1    0

30    #     N     age   observations      (need to    count and   enter value here)

#Year Seas  Type  Gender      Partition   ageerr      LbinLo      LbinHi      Nsamp

1980  1     1     0     0     1     1     -1    23    0.01471     0     0     0.04412     0.04412
      0.02941     0.07353     0.01471     0.07353     0.10294     0.07353     0.02941     0.02941     0
      0.01471     0.01471     0     0     0.02941     0.02941     0     0.01471     0     0.02941
      0.01471     0     0     0.04412     0.05882     0.05882     0     0.05882     0.04412     0
      0.01471     0.04412     #     combines    80-82 Super Years
1981  1     1     0     0     1     1     -1    23    0.01471     0     0     0.04412     0.04412
      0.02941     0.07353     0.01471     0.07353     0.10294     0.07353     0.02941     0.02941     0
      0.01471     0.01471     0     0     0.02941     0.02941     0     0.01471     0     0.02941
      0.01471     0     0     0.04412     0.05882     0.05882     0     0.05882     0.04412     0
      0.01471     0.04412     #     combines    80-82 Super Years
1982  1     1     0     0     1     1     -1    22    0.01471     0     0     0.04412     0.04412
      0.02941     0.07353     0.01471     0.07353     0.10294     0.07353     0.02941     0.02941     0
      0.01471     0.01471     0     0     0.02941     0.02941     0     0.01471     0     0.02941
      0.01471     0     0     0.04412     0.05882     0.05882     0     0.05882     0.04412     0
      0.01471     0.04412     #     combines    80-82 Super Years
1980  1     2     0     0     1     1     -1    6     0     0     0     0     0     0.04  0     0     0.04
      0.12  0     0     0.04  0.04  0     0     0     0     0.04  0.04  0.08  0.04  0     0.04  0     0.04
      0     0.04  0     0.04  0.12  0.04  0.04  0.04  0     0.12  #     combine     80-82-83    Super Years
1981  1     2     0     0     1     1     -1    6     0     0     0     0     0     0.04  0     0     0.04
      0.12  0     0     0.04  0.04  0     0     0     0     0.04  0.04  0.08  0.04  0     0.04  0     0.04
      0     0.04  0     0.04  0.12  0.04  0.04  0.04  0     0.12  #     combine     80-82-83
```

```
1982 1 2 0 0 1 1 -1 6 0 0 0 0 0 0.04 0 0 0.04
     0.12 0 0 0.04 0.04 0 0 0 0 0.04 0.04 0.08 0.04 0 0.04 0 0.04
     0 0.04 0 0.04 0.12 0.04 0.04 0.04 0 0.12 # combine 80-82-83 Super Years
1983 1 2 0 0 1 1 -1 7 0 0 0 0 0 0.04 0 0 0.04
     0.12 0 0 0.04 0.04 0 0 0 0 0.04 0.04 0.08 0.04 0 0.04 0 0.04
     0 0.04 0 0.04 0.12 0.04 0.04 0.04 0 0.12 # combine 80-82-83 Super Years
1984 1 2 0 0 1 1 -1 20 0 0 0.01639 0.01639 0.08197
     0.06557 0.04918 0.01639 0.01639 0.04918 0.03279 0.04918 0.01639
     0.01639 0.03279 0.01639 0.04918 0.03279 0.01639 0.03279 0.01639
     0.03279 0.03279 0 0.06557 0 0 0.06557 0.03279 0.04918 0.04918
     0 0 0 0.03279 0.01639 # combine 84-86 Super Years
1985 1 2 0 0 1 1 -1 20 0 0 0.01639 0.01639 0.08197
     0.06557 0.04918 0.01639 0.01639 0.04918 0.03279 0.04918 0.01639
     0.01639 0.03279 0.01639 0.04918 0.03279 0.01639 0.03279 0.01639
     0.03279 0.03279 0 0.06557 0 0 0.06557 0.03279 0.04918 0.04918
     0 0 0 0.03279 0.01639 # combine 84-86 Super Years
1986 1 2 0 0 1 1 -1 21 0 0 0.01639 0.01639 0.08197
     0.06557 0.04918 0.01639 0.01639 0.04918 0.03279 0.04918 0.01639
     0.01639 0.03279 0.01639 0.04918 0.03279 0.01639 0.03279 0.01639
     0.03279 0.03279 0 0.06557 0 0 0.06557 0.03279 0.04918 0.04918
     0 0 0 0.03279 0.01639 # combine 84-86 Super Years
1978 1 3 0 0 1 1 -1 120 0 0.00833 0.05 0.08333 0.075 0.03333
     0.06667 0.03333 0.05 0.00833 0.00833 0.01667 0.025 0 0.00833 0.01667
     0.025 0.00833 0.01667 0 0 0.04167 0.01667 0.03333 0.00833 0
     0.00833 0.08333 0.06667 0.05 0.03333 0.025 0.06667 0.01667 0 0.01667
     # 120 120
1979 1 3 0 0 1 1 -1 169 0 0.00592 0.02367 0.01183 0.08284
     0.06509 0.01775 0.04734 0.01775 0.01775 0.01183 0.00592 0.01183
     0.01775 0.01183 0.01775 0.05325 0.04142 0.02367 0.0355 0.01183
     0.02959 0.0355 0.0355 0.04734 0.01183 0.01775 0.10651 0.05325
     0.02367 0.02367 0 0.04734 0.00592 0.00592 0.02367 # 169 169

1984 1 3 0 0 1 1 -1 200 0 0 0.0082 0.0123 0.04918
     0.09836 0.13525 0.04098 0.06148 0.14344 0.04918 0.04918 0.03279
     0.03279 0.0123 0.03279 0.0123 0.0082 0.0123 0.0082 0.0123
     0.0123 0 0 0.0041 0.0082 0.0041 0.02459 0.04098 0.02459
     0.0082 0.0041 0.0041 0.0041 0.0123 0.03689 # 244 244
```

```
1985  1     3     0     0     1     1     -1    124   0     0.00806     0     0.00806     0.00806
      0.01613     0.04839     0.02419     0.02419     0.02419     0.12903     0.03226     0.06452
      0.04839     0.04032     0.02419     0     0     0     0.00806     0.01613     0.00806     0.02419
      0.03226     0.00806     0     0.01613     0.06452     0.12097     0.03226     0.02419     0.00806
      0     0.04032     0.01613     0.08065     #     124   124
1986  1     3     0     0     1     1     -1    140   0     0.00714     0.02857     0.01429     0.01429
      0.03571     0.07143     0.06429     0.09286     0.05  0.05  0.05714     0.01429     0.03571
      0.02143     0.02143     0.00714     0     0.01429     0     0     0.02143     0.00714     0.00714
      0     0.00714     0     0.02857     0.07143     0.04286     0.03571     0.01429     0.03571
      0.02143     0.01429     0.09286     #     140   140
1987  1     3     0     0     1     1     -1    123   0     0.02439     0.03252     0     0.04065     0
      0.04065     0.06504     0.07317     0.04878     0.05691     0.03252     0.04065     0.02439
      0.03252     0.04065     0.01626     0.01626     0.02439     0.01626     0.00813     0.01626
      0.01626     0.00813     0.00813     0.00813     0     0.01626     0.09756     0.04878     0.01626
      0.00813     0.00813     0.04878     0.01626     0.04878     #     123   123
1989  1     3     0     0     1     1     -1    32    0     0     0.03125     0.03125     0.0625
      0.15625     0.03125     0.15625     0.03125     0.03125     0.125 0.03125     0     0.03125
      0.0625      0.03125     0     0.03125     0     0     0     0     0.03125     0.03125     0     0
      0.03125     0     0     0     0     0     0     0     0     0.0625      #     32    32
2001  1     3     0     0     1     1     -1    86    0     0     0.01163     0     0.01163     0.02326
      0     0.03488     0.02326     0.06977     0.15116     0.11628     0.06977     0.0814      0.0814
      0.03488     0.05814     0.0814      0.01163     0.01163     0     0     0.01163     0     0     0
      0.01163     0.01163     0.01163     0.01163     0.02326     0.01163     0     0.01163     0.01163
      0.01163     #     86    86
2002  1     3     0     0     1     1     -1    73    0     0     0     0     0     0     0.0137
      0.0137      0.0274      0.08219     0.06849     0.0274      0.06849     0.13699     0.0411
      0.06849     0.08219     0.10959     0.05479     0.0274      0.0274      0     0     0     0.0137
      0     0     0.0137      0.0411      0     0.0274      0.0137      0     0     0.0137      0.0274
      #     73    fish
1998  1     5     0     0     1     1     -1    60    0     0     0     0     0     0     0.00833
      0.03333     0.04167     0.06667     0.05  0.10833     0.05  0.06667     0.06667     0.01667
      0.00833     0.00833     0.00833     0.00833     0.01667     0.01667     0.04167     0.01667
      0.01667     0.01667     0.01667     0.04167     0.025 0.05  0.08333     0.05  0.00833     0.01667
      0.00833     0.03333     #     combine     98-99 Super Years
1999  1     5     0     0     1     1     -1    60    0     0     0     0     0     0     0.00833
      0.03333     0.04167     0.06667     0.05  0.10833     0.05  0.06667     0.06667     0.01667
      0.00833     0.00833     0.00833     0.00833     0.01667     0.01667     0.04167     0.01667
```

```
     0.01667  0.01667  0.01667  0.04167  0.025 0.05  0.08333  0.05  0.00833  0.01667
     0.00833  0.03333  #  combine  98-99 Super Years
2000 1  5  0  0  1  1  -1  189  0  0  0  0  0.00529  0.00529  0
     0.01058  0.02646  0.04233  0.02646  0.04233  0.04233  0.08466  0.08466
     0.03175  0.06349  0.01587  0.03704  0.01587  0.01058  0.01058  0.02646
     0.04762  0.02646  0.03704  0.03175  0.11111  0.01587  0.05291  0.03175
     0.02116  0.01058  0.01587  0.01058  0.00529  #  189  189
2001 1  5  0  0  1  1  -1  96  0  0  0  0  0  0.01042  0
     0.02083  0.03125  0.03125  0.02083  0.04167  0.08333  0.09375  0.05208
     0.07292  0.05208  0.05208  0.03125  0.02083  0.03125  0.01042  0.02083  0
     0.02083  0  0.01042  0.01042  0.0625  0.05208  0.03125  0.02083  0.01042
     0.01042  0.02083  0.07292  #  was  101  in  last  assessment
2002 1  6  0  0  1  1  -1  23  0  0  0.015625  0.015625  0.015625  0
     0.03125  0.015625  0  0.015625  0.015625  0  0.03125  0.015625  0.015625
     0.078125  0.03125  0.03125  0.015625  0.03125  0.015625  0.015625  0  0  0
     0  0  0  0.0625  0.03125  0.015625  0  0.0625  0.03125  0.046875
     0.34375  #Super  year  2002  -2004
2003 1  6  0  0  1  1  -1  23  0  0  0.015625  0.015625  0.015625  0
     0.03125  0.015625  0  0.015625  0.015625  0  0.03125  0.015625  0.015625
     0.078125  0.03125  0.03125  0.015625  0.03125  0.015625  0.015625  0  0  0
     0  0  0  0.0625  0.03125  0.015625  0  0.0625  0.03125  0.046875
     0.34375  #Super  year  2002  -2004
2004 1  6  0  0  1  1  -1  23  0  0  0.015625  0.015625  0.015625  0
     0.03125  0.015625  0  0.015625  0.015625  0  0.03125  0.015625  0.015625
     0.078125  0.03125  0.03125  0.015625  0.03125  0.015625  0.015625  0  0  0
     0  0  0  0.0625  0.03125  0.015625  0  0.0625  0.03125  0.046875
     0.34375  #Super  year  2002  -2004
2001 1  7  0  0  1  1  -1  200  0  0  0  0  0  0  0  0  0
     0.01145  0.01145  0.01145  0.03817  0.04198  0.05725  0.07252  0.06107
     0.05344  0.06489  0.07634  0.03435  0.0458  0.02672  0.01145  0.03053
     0.01908  0.03435  0.17176  0.03435  0.01145  0.01527  0.02672  0.01145
     0.01527  0.00382  0.00763  #  was  262  in  last  assessment


2002 1  7  0  0  1  1  -1  139  0  0  0.00719  0.00719  0.00719  0
     0.01439  0  0.01439  0.01439  0.01439  0.02158  0.05036  0.03597  0.02878
     0.08633  0.09353  0.1295  0.06475  0.04317  0.04317  0.00719  0.02158  0
     0.02158  0.01439  0  0.05036  0.02158  0.00719  0  0.02158  0.01439  0
```

```
     0.02878     0.11511     #     Revised     new

2003 1     7     0     0     1     1     -1    10    0     0     0     0     0     0     0     0     0
     0     0.1   0.2   0     0.1   0     0.2   0     0     0     0.1   0     0     0     0     0     0
     0     0     0.1   0     0     0     0     0     0     0.2   #     Revised     new

2004 1     7     0     0     1     1     -1    38    0     0     0     0     0     0     0     0.02632
     0     0     0     0.02632     0     0.02632     0.02632     0.02632     0.07895     0.05263     0
     0.07895     0.13158     0.05263     0.10526     0     0.02632     0.02632     0     0.05263
     0.05263     0     0     0     0.02632     0.02632     0     0.15789     #     Revised     new

#2002 1     12    0     0     1     1     -1    141   0     0     0     0     0     0     0     0     0
     0     0     0     0.00709     0.01418     0.03546     0.02837     0.04255     0.06383     0.04965
     0.05674     0.04255     0.02837     0.02128     0.04965     0.04965     0.02128     0.05674
     0.02128     0.14184     0.04255     0.01418     0.04255     0.05674     0.03546     0.00709
     0.07092     #     IPHC

#2003 1     12    0     0     1     1     -1    200   0     0     0     0     0     0     0.00318     0
     0     0.00318     0     0.00637     0.00637     0.00955     0.03185     0.0414      0.03503
     0.05414     0.03822     0.05414     0.03185     0.03185     0.02548     0.01274     0.04777
     0.03822     0.0414      0.03503     0.13057     0.04777     0.02548     0.05732     0.03822
     0.02229     0.02229     0.10828     #     IPHC

#2004 1     12    0     0     1     1     -1    175   0     0     0     0     0     0     0     0     0
     0     0.00575     0.01149     0.00575     0     0.03448     0.04598     0.04598     0.03448
     0.08046     0.06322     0.07471     0.04023     0.03448     0.02299     0.01724     0.01149
     0.02299     0.00575     0.14368     0.03448     0.02874     0.05747     0.04023     0.05747
     0.01149     0.06897     #     IPHC

#2005 1     12    0     0     1     1     -1    175   0     0     0     0     0     0     0     0     0
     0     0.00575     0.01149     0.00575     0     0.03448     0.04598     0.04598     0.03448
     0.08046     0.06322     0.07471     0.04023     0.03448     0.02299     0.01724     0.01149
     0.02299     0.00575     0.14368     0.03448     0.02874     0.05747     0.04023     0.05747
```

```
      0.01149     0.06897     #     IPHC

5     #_N_MeanSize-at-Age_obs

#Yr   Seas  Flt/Svy     Gender      Part  Ageerr      Ignore      datavector(female-male)

#     samplesize(female-male)

#Below      were  what  was   used  in    SS1   data  file

#2000 1     1     0     0     1     2     30    30    30    35.2  32.4  34.8  37.1  37.3  37.4  41.2  41
      43.4  43.6  44.8  43.5  43.9  46.7  48.6  48    51.8  53    53.8  52.9  53.2  54.8  56.7  56.5  57
      56.6  62.2  61.7  64.2  64.1  64.4  63.8  65.7  1     1     1     5     10    9     11    15    29
      29    21    30    21    29    29    14    15    6     13    9     8     9     12    15    13    10
      7     30    15    23    22    16    7     5     6     14
#2000 1     2     0     0     1     2     30    30    30    35.2  32.4  34.8  37.1  37.3  37.4  41.2  41
      43.4  43.6  44.8  43.5  43.9  46.7  48.6  48    51.8  53    53.8  52.9  53.2  54.8  56.7  56.5  57
      56.6  62.2  61.7  64.2  64.1  64.4  63.8  65.7  1     1     1     5     10    9     11    15    29
      29    21    30    21    29    29    14    15    6     13    9     8     9     12    15    13    10
      7     30    15    23    22    16    7     5     6     14
#2000 1     3     0     0     1     2     30    30    30    35.2  32.4  34.8  37.1  37.3  37.4  41.2  41
      43.4  43.6  44.8  43.5  43.9  46.7  48.6  48    51.8  53    53.8  52.9  53.2  54.8  56.7  56.5  57
      56.6  62.2  61.7  64.2  64.1  64.4  63.8  65.7  1     1     1     5     10    9     11    15    29
```

	29	21	30	21	29	29	14	15	6	13	9	8	9	12	15	13	10
	7	30	15	23	22	16	7	5	6	14							
#2000	1	5	0	0	1	2	30	30	30	35.2	32.4	34.8	37.1	37.3	37.4	41.2	41
	43.4	43.6	44.8	43.5	43.9	46.7	48.6	48	51.8	53	53.8	52.9	53.2	54.8	56.7	56.5	57
	56.6	62.2	61.7	64.2	64.1	64.4	63.8	65.7	1	1	1	5	10	9	11	15	29
	29	21	30	21	29	29	14	15	6	13	9	8	9	12	15	13	10
	7	30	15	23	22	16	7	5	6	14							
#2000	1	7	0	0	1	2	30	30	30	35.2	32.4	34.8	37.1	37.3	37.4	41.2	41
	43.4	43.6	44.8	43.5	43.9	46.7	48.6	48	51.8	53	53.8	52.9	53.2	54.8	56.7	56.5	57
	56.6	62.2	61.7	64.2	64.1	64.4	63.8	65.7	1	1	1	5	10	9	11	15	29
	29	21	30	21	29	29	14	15	6	13	9	8	9	12	15	13	10
	7	30	15	23	22	16	7	5	6	14							
#Year	Season		Fleet	Gender		Partition		ageerr		Nsamp							
1981	1	1	0	0	1	74	24	24.8	26	35.3	36.3	33.5	40.2	40	38.6	38.7	43.6
	41.5	45	44	42	44	45	48	50	53	53	53	53	53	64	59	60	61.3
	53.6	61.5	62	62.6	64	63	62	65.3	1	0	0	3	3	2	5	1	5
	7	5	2	2	0	1	1	0	0	3	2	0	1	0	2	1	1
	0	3	7	4	0	5	3	0	1	3	#80-82		California		Sport		
1986	1	2	0	0	1	86	24	24.8	26	30	29.8	35.4	32.7	38	38	46.7	40
	43	45.5	52	48	45	45	48	47.5	54.7	53.3	56.7	50.5	53	53.8	60	58	56.2
	57.5	62.3	61.2	66	61	65	64.5	64	0	0	1	1	5	5	3	1	2
	6	2	3	2	2	2	1	3	2	2	3	3	3	2	1	4	1
	0	5	2	4	6	1	1	1	2	4	#80-86		California		Com		
1986	1	3	0	0	1	200	24	24.8	30.2	23.6	27.9	27.7	30.9	37.2	36.7	36.4	39.1
	40.1	40.9	44.4	45.9	45.6	46	38.8	44.5	49.6	52.5	54.1	51.6	53.9	54	51.5	39.8	57.4
	57.9	56.5	59.8	62.4	58.7	60.4	63.2	62.8	0	5	11	7	22	36	55	35	41
	52	46	29	23	23	17	20	6	5	8	5	6	9	7	7	3	4
	4	20	47	22	12	5	7	15	9	40	#84-87		Oregon		Sport		
2000	1	5	0	0	1	200	24	24.8	26	28	30	35	36	38.8	37.9	40.5	40.8
	43.7	43.7	44.6	44.6	46.3	47.8	51	47.7	49.5	52.3	54.2	53.9	54	55.1	55.2	56.7	56.3
	59.8	62	62.2	64.9	65.3	64.4	63	65.9	0	0	0	0	1	2	1	8	13
	19	13	26	23	34	30	15	18	9	12	6	7	5	12	12	9	9
	9	32	11	20	18	12	3	8	5	10	#98	-	4	Washington		Sport	

```
2000  1     7     0     0     1     200   24    24.8  26    28    30    33    36    38    39.5  42    46.3
      43.4  46.3  47    47.5  48.4  48.6  48.7  50.9  51.1  50.4  52.3  51    54.3  53.4  56    54.1  56.2
      56    64    62.5  62.7  65    65    67    71    0     0     0     0     0     0     0     0     2
      4     4     9     12    13    14    22    25    30    20    22    18    9     13    3     8     6
      8     36    10    1     4     6     3     3     0     3     #00   -     4     Washington  Line
#2002 1     12    0     0     1     141   24    24.8  26    28    30    33    36    38    39.5  42    46.3
      40.1  46    46.5  41.4  45.3  46.8  45    46.1  48.5  45.8  47    48.7  50.7  49.9  50    51    53.1
      53.4  60.5  56.5  58.5  58    58    65.7  62.9  0     0     0     0     0     0     0     0     0
      0     0     0     1     2     5     4     6     9     7     8     6     4     3     7     7     3
      8     20    9     2     4     8     7     1     3     7     #     2002  IPHC
#2003 1     12    0     0     1     200   24    24.8  30.2  23.6  27.9  27.7  35    37.2  36.7  39    39.1
      42    45    41.3  46.6  44.8  46.3  47.1  47.1  48.4  48.2  50.5  50.1  52.5  53.2  53.2  51.7  53.9
      55.8  57.4  60.2  59.8  61.9  62.7  59.6  62.6  0     0     0     0     0     0     1     0     0
      1     0     2     2     3     10    13    11    17    12    17    10    10    8     4     15    12
      13    48    16    11    12    16    9     6     5     30    #     2003  IPHC
#2004 1     12    0     0     1     174   24    24.8  26    28    30    33    36    38    39.5  42    46.3
      55.5  56    44.4  50.5  52.3  50.1  48.2  49.1  50.2  51.2  49.1  49.2  53    55.7  53.5  51.8  52.7
      55.8  47    55.3  57.2  55.6  61    54.7  59.5  0     0     0     0     0     0     0     0     0
      0     1     2     1     0     6     8     8     6     14    11    13    7     6     4     3     2
      4     23    9     1     12    6     9     5     3     10    #     2004  IPHC
#2005 1     12    0     0     1     134   24    24.8  30.2  23.6  27.9  27.7  30.9  37.2  36.7  36.4  42
      40.1  40.9  44.4  47    49    44.5  49.5  46.6  47.8  50.7  50.3  50.8  54.2  53    54.3  53    54.9
      57.1  55.7  60.8  61.5  61.4  58.8  65    63.8  0     0     0     0     0     0     0     0     0
      0     1     0     0     0     2     1     2     4     5     11    6     12    9     5     3     3
      3     15    15    3     4     6     5     6     2     11    #     2005  IPHC
0     #N    environmental     variables
```

```
0     #_N_environ_obs

999

#ENDDATA
```