Status of the Darkblotched Rockfish **(*Sebastes crameri*)** Resource in 2005

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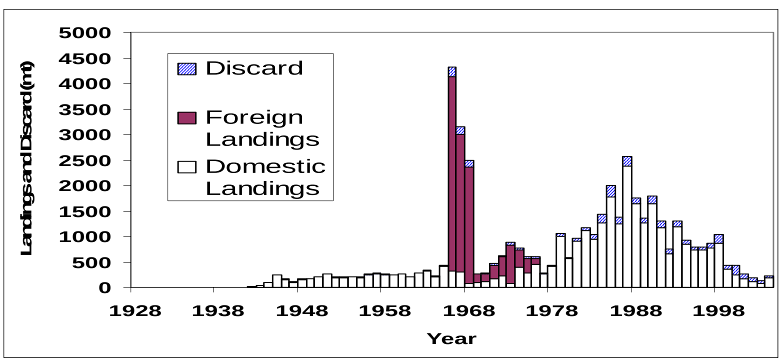
EXECUTIVE SUMMARY

Stock: This assessment pertains to the population of darkblotched rockfish (*Sebastes crameri*) found off the coasts of California, Oregon, and Washington (WOC). Although the stock may cross the Canadian border, an international assessment was not planned at this time. Recent analyses indicate genetic changes in the stock along the WOC coast, but no distinct stock breaks (Gomez-Uchida and Banks in press).

Catches: Darkblotched rockfish has always been caught primarily with bottom trawl gear, so catches were treated as coming from one fishery. Domestic landings of rockfish prior to 1962 and foreign landings prior to 1975 were not sampled for species composition. Darkblotched rockfish landings for those periods were estimated based on market category, knowledge of fishing strategy, survey data, and information from the earliest port sampling (Rogers 2003). Landings and port sampling species compositions from 1963-1977 were available in the literature, but some estimation was required to fill in gaps. Landings estimates from 1978 to the present exist in various databases. Estimated landings peaked in the mid-1960 for the foreign fleet and in the late 1980's for the domestic fleet. Discard rates and retention-at-length were estimated within the model, based on data from 1986 and 2000-2004. Discard prior to 2000 was assumed to be size-based, with only smaller, unmarketable fish discarded. Discarding by the foreign fleet was probably minimal (Rogers 2003) and prior to 2000, domestic-fleet managers limited landings only for the entire Sebastes complex, which included darkblotched rockfish along with many other less-marketable species. Recent landings and discard estimates from the model are reported in the table at the end of the summary.



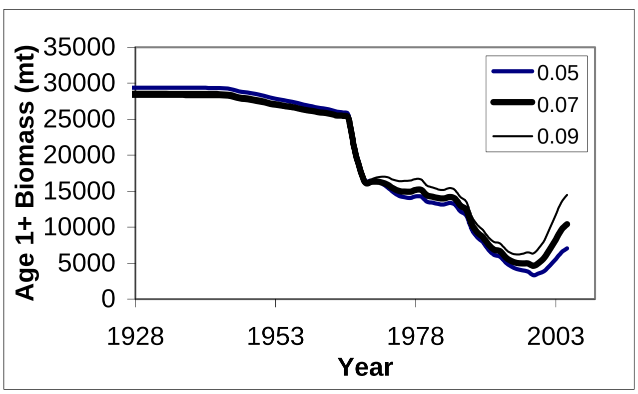
Data and Assessment: This assessment follows a full assessment in 2000 (Rogers et al. 2000), which was updated in 2003 (Rogers 2003). Data used in this assessment included: (1) WOC rockfish landings from CDFG Fish Bulletins, Fisheries Statistics of Oregon (1951,1956), Pacific Fisherman Yearbook (1950), and Lynde (1950), (2) WOC species compositions and darkblotched rockfish landings from Fraidenburg et al. (1977), Nitsos (1965), Barss and Niska (1978), Tagart (1985), and J. Tagart WDFW (pers.comm.). (3) California darkblotched rockfish landings and size composition data from CalComm data base as of 4/4/05, (4) WOC darkblotched rockfish landings and size composition data from the PacFIN data base as of 4/4/05, (5) foreign fleet catch estimates from Rogers (2003), (6) discard rates, mean size discarded, and length frequency of discarded fish (Rogers et al. 2000 and J. Hastie, NWFSC, pers.comm.), (7) four indices of relative abundance and length compositions derived from Alaska Fisheries Science Center (AFSC) shelf, Pacific Ocean perch, and slope survey data, and from Northwest Fishery Science Center (NWFSC) slope survey data, and (8) age composition derived from 2004 AFSC shelf survey data. These data from multiple sources were combined in a maximum likelihood statistical framework using the Stock Synthesis 2 Model, version 1.19 (Methot 2005 b)

Unresolved Problems and Major Uncertainties: The major sources of uncertainty in this stock assessment include: (1) the assumed natural mortality rate (M), (2) the age-length relationship, (3) noisy survey indices and length compositions due to a few large survey catches which tend to have larger than average fish, (4) steepness of the spawner-recruit curve, and (5) the amount of historical landings prior to 1978. Uncertainty in the model results was explored primarily through examination of alternative M values. Based on maximum age of 60-105 years, Hoenig's (1983) method estimates M is 0.025- 0.05. Based on average size of mature females at 42.7 cm, a linear relationship with reproductive effort as measured by GSI (ovary weight/somatic body weight) produces an estimated M of 0.107 (Gunderson et al. 2003). In our modeling, log-likelihood profiles across M ranging from 0.05 to 0.10 indicated conflicting fits to the various types of data. The primary source of this conflict was the AFSC slope survey, where the abundance index was fit best when M equaled 0.05, but the lengths fit best when M equaled 0.10. The fishery lengths, shelf and NWFSC slope survey indices and length compositions all were fit best for values of M in the 0.07-0.08 range. The total log-likelihood was, however, relatively flat as M increased from 0.07 to 0.10. The STAR panel determined that the confidence intervals produced within the models underestimated uncertainty. They determined uncertainty could be bracketed by assuming that an M value of 0.07 is likely (base model), while 0.05 and 0.09 are the unlikely extremes.

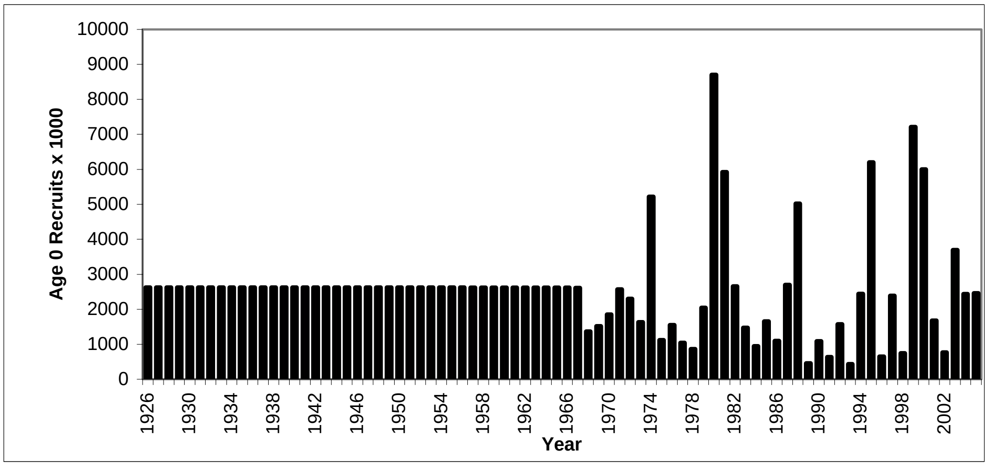
Reference Points: Darkblotched rockfish has been declared overfished (i.e. spawning stock has been below 25% of the unfished level and is not yet above 40%) and is currently under a rebuilding plan (Rogers 2003). Since 2004, the Optimum Yield (OY) has been equivalent to the Allowable Biological Catch (ABC). This rebuilding harvest rate policy adopted by the Council was estimated to have a slightly greater than 90% probability of rebuilding the spawning stock by the maximum year allowed (2028). Rebuilding occurs when the spawning stock (S) reaches the target level, which is 40% of the unfished level (S40%). This is the default Pacific Fishery Management Council's proxy for S at which the maximum sustained yield (MSY) is obtained. The ABC is based on the default harvest rate policy for Sebastes (F50%). The spawning stock ratio (SPR) is ratio of fished to unfished spawning stock, assuming recruitment is equal to virgin recruitment and growth and maturity schedules are at the current state. Higher values therefore indicate a lower rate of fishing mortality. In this assessment, spawning stock (S) is in terms of egg production, or spawning stock output. Reference points estimated using the base model are presented in the table below. MSY yield is affected by slower estimated growth in 1998.

	M=0.07 (base)
Unfished Spawning Output (10^7 eggs)	26650
Unfished Age 1+ Biomass (mt) (B age 1+)	28286
Unfished Recruitment (numbers age 0 fish x 1000)	2622
Spawning Stock Output at MSY (S_{msy}) (10^7 eggs)	10660
Basis for S_{msy}	S40% proxy
Spawning Potential Ratio$(SPR)_{msy}$	0.50
Basis for SPR_{msy} or Fmsy	F50% proxy
Exploitation Rate at MSY(=Yield/B age 1+)	0.038
MSY_Yield (mt) based on F50% proxy	650

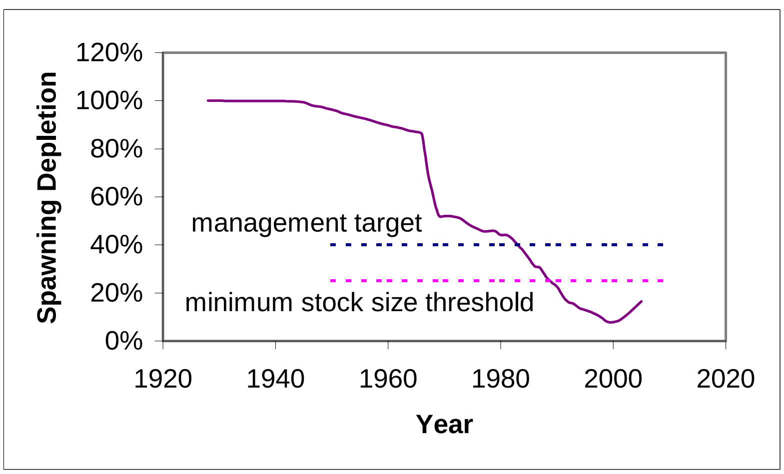
Stock Biomass: The biomass of age 1+ darkblotched rockfish declined by 84% from 1928 to 1999 in the base model (M equals 0.07). Most of that decline occurred during the periods of large foreign-fleet catches in the mid 1960's and increased domestic-fleet catches during the 1980's and 1990's. Since 1999, the age 1+ biomass has more than doubled. If M is assumed to be 0.05, the decline from 1928 to 1999 is greater and the increase since 1999 is less. The opposite is true if M is assumed to be 0.09. Recent estimates for age 1+ biomass for alternative values of M are presented in the table at the end of this summary.

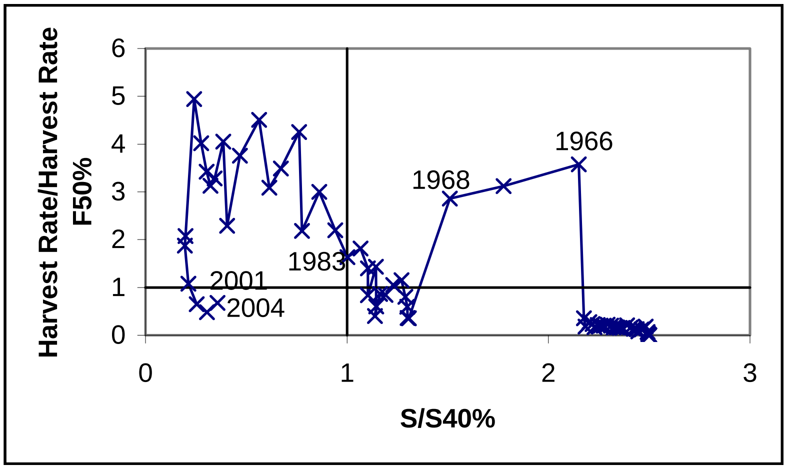


Recruitment: In the assessment, recruits were treated deterministically during 1928-1967 and in 2004 and stochastically during 1968-2003. The Beverton-Holt steepness parameter (*h*) was fixed at a value of 0.95. Fitting steepness within the model resulted in a value greater than 0.95, but it was viewed as more reasonable to assume some effect of stock size on the amount of recruitment. The standard deviation of the log recruitment, which is used to define offset of the stock-recruitment curve when recruitment is stochastic, was iteratively fit within the model, and then fixed at the resulting level (0.80). There were several strong recruitments in recent years, even though spawning stock has been at a low level. The 1999 year class is the strongest since the 1980 year class. Recent estimates with uncertainty expressed through both alternative values for M and standard deviations within the base model are presented in the table at the end of this summary.



Exploitation Status: The darkblotched rockfish spawning output off the coasts of California, Oregon, and Washington has been beneath the current management target (S40%) since 1984 and below the minimum threshold (S25%) since 1989. Harvest rates were substantially above the MSY proxy during peak years for the foreign fishery (1966-1968) and the domestic fishery (1980’s through 1990’s) (second figure below). Since 2001, the harvest rate has been below the MSY proxy, and the spawning output has begun to increase. Recent estimates of spawning output and spawning depletion are presented in the table at the end of this summary. That table also includes estimates of spawning output and spawning depletion uncertainty within the base model and due to varying assumptions of natural mortality.





Management Performance: Management goals (ABC or OY) specific to darkblotched rockfish were exceeded from 1997 through 2002. Although the 1996 assessment produced an ABC calculation for darkblotched, from 1997 through 2000 that amount was combined with yields for other species for purposes of managing a complex of species to combined ABC and OY amounts. Separate ABCs and OYs for darkblotched have been specified since 2001, however the species continues to be managed as part of a slope rockfish trip limit. Based on discard estimates now available from observer and logbook data for 2000-2003, the species-specific ABC was exceeded during 1997-2000 and the OY was exceeded in 2001 and 2002. Final estimates of the amount of trawl discard are not yet available for 2004. However, the proportion of darkblotched rockfish that was discarded on observed trips in January-August 2004 was substantially lower than during 2003.

Year	Goals/Assumptions					Actual		
	Catch		Discard		Landings	Landings	Discard	Catch
	ABC	OY	%	mt	OY		%	
1997	256					747		
1998	256					842		
1999	256					359		
2000	256					226	32%	369
2001	302-349	130	16%		109	161	41%	271
2002	187	168	20%		135	103	46%	202
2003	205	172		20		80	45%	146
2004	240	240				204		

Forecasts: A forecast of stock abundance and yields, using the base model (M=0.07) is presented below. Landings in 2005 and 2006 were assumed equal to the OYs already adopted for those years (269 mt and 294 mt, respectively), assuming a discard rate of 35.3%. A constant harvest rate (total catch/available biomass) of 0.032 was assumed for the years 2007-2016. This rate is an approximation of the fishing mortality rate used to determine the 2004 OY (John DeVore, PFMC, pers.comm.). Actual OYs beginning in 2007 will be based on forecasts from updated rebuilding analyses, to be reviewed in September 2005. Forecasts based on the 0.032 harvest rate are shown in the following table:

	Beginning of Year					
Year	Age 1+ Biomass (mt)	Spawning Output (10^7 eggs)	Depletion	Age 0 recruits x 1000	Catch (mt)	Harvest Rate
Constant Harvest Rate 0.032						
2005	10717	4447	0.16	1785	271	0.033
2006	11676	5393	0.20	1809	291	0.031
2007	12241	6596	0.24	1830	319	0.032
2008	12824	7669	0.28	2538	342	0.032
2009	13381	8797	0.33	2553	364	0.032
2010	13770	9621	0.36	2561	377	0.032
2011	14000	10061	0.37	2565	381	0.032
2012	14353	10613	0.39	2570	388	0.032
2013	14665	10965	0.41	2573	395	0.032
2014	14974	11241	0.42	2575	403	0.032
2015	15282	11497	0.43	2576	411	0.032
2016	15560	11711	0.43	2578	419	0.032

Decision Table: Decision table with uncertainty bounded by assuming natural mortality (M) is equal to a value of 0.05 or 0.09. For 2005 and 2006, catch was estimated within the model to approximate the previously set OYs (269 and 294 mt, respectively). Landings were assumed to be 174 mt in 2005 and 179 mt in 2006, with a discard rate of 35.3% in both years (M. Burden, pers.comm.). Actual catches for those years varied slightly among models. OY catches in 2007-2016 were forecasted using the constant harvest rate of 0.032. Those OY forecasts were then harvested under alternative true values of M. If M actually is 0.07, the M=0.07 OY will rebuild the stock by 2013. At the extremes, if M actually is 0.05 and the OY is based on M=0.09, depletion would be at the overfished level (0.25) at the end of the time period. Likewise, if M actually is 0.09 and the OY is based on M=0.05, the stock will be rebuilt by 2008.

			Spawning Output (10^7 eggs)			Depletion		
			True State of Nature			True State of Nature		
			M=0.05	M=0.07	M=0.09	M=0.05	M=0.07	M=0.09
			UNLIKELY	LIKELY	UNLIKELY	UNLIKELY	LIKELY	UNLIKELY
Assumed State of Nature								
	Year	**Catch(MT)**						
M=0.05	2005	269	3004	4447	6182	0.10	0.16	0.25
	2006	294	3637	5393	7456	0.12	0.20	0.30
	2007	221	4441	6596	9061	0.15	0.24	0.36
	2008	239	5237	7813	10629	0.18	0.29	0.42
	2009	258	6086	8889	11969	0.21	0.33	0.48
	2010	271	6744	9820	13084	0.23	0.36	0.52
	2011	279	7166	10592	13953	0.25	0.39	0.56
	2012	288	7662	11203	14578	0.26	0.42	0.58
	2013	298	8038	11670	14991	0.28	0.43	0.60
	2014	308	8368	12019	15238	0.29	0.45	0.61
	2015	319	8689	12274	15357	0.30	0.46	0.61
	2016	329	8982	12454	15382	0.31	0.46	0.61
M=0.07	2005	269	3004	4447	6182	0.10	0.16	0.25
	2006	294	3637	5393	7456	0.12	0.20	0.30
	2007	319	4441	6596	9061	0.15	0.24	0.36
	2008	342	5208	7669	10553	0.18	0.28	0.42
	2009	364	5871	8797	11800	0.20	0.33	0.47
	2010	377	6432	9621	12810	0.22	0.36	0.51
	2011	381	6890	10061	13571	0.24	0.37	0.54
	2012	388	7253	10613	14091	0.25	0.39	0.56
	2013	395	7532	10965	14405	0.26	0.41	0.57
	2014	403	7745	11241	14562	0.27	0.42	0.58
	2015	411	7906	11497	14601	0.27	0.43	0.58
	2016	419	8024	11711	14555	0.28	0.43	0.58
M=0.09	2005	269	3004	4447	6182	0.10	0.16	0.25
	2006	294	3637	5393	7456	0.12	0.20	0.30
	2007	425	4441	6596	9061	0.15	0.24	0.36
	2008	449	5132	7664	10371	0.18	0.28	0.41
	2009	471	5702	8557	11720	0.20	0.32	0.47
	2010	481	6159	9284	12629	0.21	0.34	0.50
	2011	478	6510	9844	12984	0.22	0.36	0.52
	2012	480	6769	10250	13493	0.23	0.38	0.54
	2013	481	6950	10524	13712	0.24	0.39	0.55
	2014	483	7073	10696	13831	0.24	0.40	0.55
	2015	487	7153	10793	13926	0.25	0.40	0.55
	2016	490	7200	10833	13974	0.25	0.40	0.56

Research and Data Needs: The stock assessment of darkblotched rockfish could be improved if 1) fish ageing was further validated to allow for proper corrections due to ager and aging-time-period biases, 2) the model allowed more flexibility in fitting growth, 3) survey length compositions and indices were based on stratification designed to reduce noise or bias due to the infrequent large catches, 4) comparing genetics and life history of fish found in the Washington areas with consistently large survey catches versus those in Northern California could lead to better understanding of latitudinal changes in the stock, 5) if those issues are resolved and there still does not appear to be a split in the coast wide stock, separate north-south fisheries and growth should be explored in the model.

Regional Management: There are currently sufficient data to compare at least some of the life history characteristics of fish in areas with consistently large catches of darkblotched rockfish**.** Available genetics data may come from some of those areas, but this needs to be investigated further. Analysis of the available data would help determine future data needs. Management of the stock may be improved by this further exploration. Since the large catches tended to contain larger than average fish, closure of those areas might allow for relaxation of the broad depth-based closures currently in place.

Summary Table: Recent data and estimates referred to in this summary are in the following table. The 95% confidence intervals assume a normal distribution (biomass +/- 2 std):

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Catch (mt)	918	790	790	862	1041	434	436	272	192	127	227	
Discards (model predicted)	68	58	60	91	182	84	184	111	83	47	35	
Landings	850	732	730	771	859	350	252	161	109	80	192	
ABC	none	none	none	256	256	256	256	302-349	187	203	240	
OY * (if different from ABC)	none	none	none	group	group	group	group	130	168	172		
Target F									0.029	0.029	0.032	
Exploitation Rate (Y/available B)	0.164	0.156	0.171	0.201	0.247	0.1038	0.094	0.054	0.032	0.024	0.034	
Base Model (M=0.07)												
Age 1+ Biomass (mt)	5828	5308	5027	4961	4951	4606	5067	5799	6964	8279	9595	10403
Spawning Output (10^7 eggs)	3696	3485	3280	2985	2598	2136	2103	2304	2739	3282	3848	4453
95% Confidence Intervals	3185-4207	2973-3996	2756-3804	2444-3526	2036-3159	1547-2726	1477-2729	1586-3021	1874-3605	2242-4322	2628-5068	3024-5882
Recruitment (# age 0 fishx1,000)	2439	6198	650	2385	740	7212	5995	1672	769	3695	2430	2459
95% Confidence Intervals	1801-3077	4740-7655	343-956	1681-3090	65-1414	4806-9617	3972-8017	903-2440	358-1180	1870-5521	2199-2662	2229-2689
Depletion level	0.14	0.13	0.12	0.11	0.10	0.08	0.08	0.09	0.10	0.12	0.14	0.17
95% Confidence Intervals											0.10-0.18	0.12-0.21
Uncertainty due to M (0.05-0.09)												
Age 1+ Biomass (mt)	5078-6918	4544-6410	4203-6203	4012-6300	3832-6510	3337-6351	3562-7103	3950-8249	4681-9922	5553-11728	6468-13455	7026-14467
Spawning Output (10^7 eggs)	3309-4293	3053-4132	2810-3968	2486-3700	2073-3336	1582-2903	1514-2902	1604-3231	1872-3862	2227-4617	2607-5378	3009-6190
Recruitment (# age 0 fishx1,000)	1776-3386	4303-8975	398-1014	1490-3698	376-1258	4506-11041	3639-9266	961-2636	452-1194	2158-5773	1534-3519	1561-3547
Depletion level	0.11--0.17	0.11--0.16	0.10--0.16	0.09--0.15	0.07--0.13	0.05--0.12	0.05--0.12	0.06--0.13	0.06--0.15	0.08--0.18	0.09--0.21	0.10--0.25

INTRODUCTION

General

Darkblotched rockfish (*Sebastes crameri*) are found from the Bering Sea to near Santa Catalina I., California at depths of 29-549 m (16-300 fm; Eschmeyer et al.1983). Commercially important concentrations are found from Northern CA through the Canadian border, on or near the bottom, in depths of approximately 183-366 m (100-200 fm) (Figure 1). This species co-occurs with an assemblage of slope rockfish, including Pacific ocean perch (*Sebastes alutus*), splitnose rockfish (*Sebastes diploproa*), yellowmouth rockfish (*Sebastes reedi*), and sharpchin rockfish (*Sebastes zacentrus*). Pacific ocean perch and darkblotched rockfish are the most abundant members of that assemblage off the coasts of Oregon and Washington, but splitnose rockfish and darkblotched rockfish dominate off the coast of California. In the early years of the fishery, darkblotched rockfish were designated as "Pacific ocean perch" in the landings. That landings classification was actually a market category for red-colored northern slope rockfish, rather than a species designation. The fishery targeting the slope rockfish assemblage has always used bottom trawl gear. Although Eschmeyer et al. (1983) indicated darkblotched rockfish are found on soft bottoms, ssubmersible observations indicate darkblotched rockfish is associated with rocks or other bottom structures (Waldo Wakefield, NMFS, Newport, OR 97365, pers.comm.).

Stock Delineation

Like many west coast groundfish species, there are no clear stock delineations for darkblotched rockfish in U.S. waters. There are no distinct breaks in the fishery landings and catch distributions (Figure 2). Survey catches imply a continuous distribution over most of the range, but certain areas with very high abundance (Figure 1).

Recent analyses indicated genetic changes in the stock along the coast, but no distinct stock breaks. Genetic and geographic distance was correlated, with mean average dispersal distances of 1-100 km (Gomez-Uchida and Banks in press). Genetic structure between northern California and Washington samples was significantly different, but overall the level of genetic differentiation was small.

For the purpose of this assessment, the species is treated as a unit stock from the Mexican border to the U.S.-Canadian border. Although darkblotched rockfish occur on both sides of the Canadian border, an international assessment is not planned at this time.

Life History Features

Darkblotched rockfish, like many Sebastes species show sexually dimorphic growth. Females grow faster than and reach larger sizes than males (Nichol 1990, Rogers et al 2000, Rogers 2003). Eighty percent of fish over 40 cm fl were females in the National Marine Fisheries Service (NMFS) survey data.

Darkblotched rockfish migrate to deeper waters with increasing size and age (Lenarz 1993, Nichol 1990, Rogers 2003). Fish measured in NMFS surveys tows averaged 21 cm fork length (fl) in less than 100 fm, 29 cm in 100-200 fm, and 35 cm in 200-300 fm. Although aging is uncertain, analysis of 2003-2004 NWFSC shelf-slope survey data indicates depth migration is either more dependent upon length than age, or that the rate of growth changes with depth. I found that depth was a significant predictor ($p<0.0001$) of size-at-age in a GLM model which also had age and sex as categorical variable predictors ($r2 = 0.94$).

Diurnal migration is also possible. Hannah et al. (2005) determined darkblotched rockfish catch was reduced at night using a conventional bottom trawl. This could mean the species raises off-bottom at night and is not available to the gear.

In general, darkblotched rockfish mate from August to December, eggs are fertilized from October through March, and larvae are released from November through April (Love et al. 2002). Fecundity increases with fish size and can reach 610,000 eggs, with all larvae released in one batch. Late-stage larvae and pelagic juvenile darkblotched rockfish are found closer to the surface than many other rockfishes.

Life history characteristics may change with latitude, but that is uncertain. Maturity estimates using fish collected off California (Echeverria 1987, Phillips 1964) indicated smaller size at 50% maturity than estimates based on fish collected off Oregon (Nichol 1990, Barss 1989). Nichol (1990), however, attributed this to a difference in the criteria used to rate maturity. He developed maturity criteria specific to darkblotched rockfish, and believed females remain in a “maturing” stage for up to 3 years. Westrheim (1975) determined that the size at 50% maturity for darkblotched rockfish decreased, rather than increased, as latitude increased from Oregon to Alaska. Size-at-age estimates also vary widely in the literature. Shaw and Archibald (1981) estimated much smaller size-at-age for darkblotched rockfish off British Columbia, Canada, than did Nichol (1990) for fish off Oregon. Fisheries ages were available from all three U.S. west coast states for the first time in 2003. The same ager also aged them during 2004. Fish landed in California generally had smaller size-at-age than fish landed in the two northern states (Oregon-Washington). Size-at-age in the 2003-2004 survey data did not, however, change significantly with latitude.

History of Fishery and Management

Darkblotched rockfish has always been caught primarily with commercial trawl gear, as part of a complex of slope rockfish, including Pacific ocean perch (*Sebastes alutus*), splitnose rockfish (*Sebastes diploproa*), yellowmouth rockfish (*Sebastes reedi*), and sharpchin rockfish (*Sebastes zacentrus*) (Rogers and Pikitch 1992, Rogers 1994, Rogers 2003).

Catch of darkblotched rockfish very likely first became significant in the mid-to-late 1940’s. Rockfish catch in general increased dramatically in the mid 1940’s due to increases in gear efficiency and demand (Scofield 1948, Harry and Morgan 1963). Balloon otter trawls were introduced and the army requested large quantities of rockfish to feed the World War II troops. This increased demand caused the fishery to shift to previously unexploited areas, areas preferred by darkblotched rockfish (Figure 1). The California fishery moved north to the Eureka INPFC around 1943. The Oregon fishery first targeted slope rockfish in 1945 (Oregon Fish Comm. 1951). By the late 1940's, California and Oregon fisheries had moved deeper into the slope area (greater than 100 fm) (Scofield 1948, Harry and Morgan 1963). Domestic demand for rockfish declined after the end of WWII.

During the mid 1960's to mid 1970's darkblotched rockfish were caught by both domestic and foreign fleets (Rogers 2003). Foreign catch was significant during 1966-1968 (Figure 2). The foreign fishery apparently used small cod end mesh (5-8 cm, 2-3 in), fished mainly in greater than 100 fm, and was not known to discard fish. Regulations increasingly reduced foreign slope rockfish catch until finally on-bottom trawling was prohibited in 1976 (Table 1). During this same period, the domestic fleet used a larger mesh size (11-13 cm, 4.5-5 in) (PFMC 1992) and was free to target rockfish in shallower waters.

Domestic landings rose from late 1970's until the late 1980's. Limits on rockfish catch were first instituted in 1983, with darkblotched rockfish managed as part of a group of around 50 species (designated as the Sebastes complex) (Rogers et al. 2000). Observer data collected off Oregon in 1986-1987 indicated slope rockfish were caught primarily in 134 - 282 fm (Rogers 1994). The fishery targeting those rockfish used bottom trawl gear utilizing rollers (roller gear) with 3.5 inch cod end mesh, reduced from the mesh size used in the mid 1970's. About five percent of the catch was discarded due to small size. Nichol (1990) stated that fishermen were not harvesting the largest darkblotched rockfish in 1986-1987 because they were mainly fishing in less than 200 fm.

Several changes occurred in the 1990's. Cod end mesh size was increased from 3 to 4.5 inches through regulations in 1992 and 1995. An assessment of the major species in the Sebastes complex (Rogers et al. 1996) led to a species-specific Allowable Biological Catch in 1997.

During the 2000's, managers have progressively tried to reduce the catch of darkblotched rockfish (Table 2). The species was fully assessed in 2000 (Rogers et al 2000) and as a result of that assessment was declared overfished. Since that time, it has been managed as part of a group of eight other slope rockfish, including Pacific ocean perch for the areas south of $40^0$10' and splitnose rockfish for the area north of that boundary. In 2001, darkblotched rockfish was given an individual Optimum Yield (OY) (Methot and Rogers 2001). Since September 2002, managers have used Rockfish Conservation Areas (RCA's) in addition to landings limits. RCA's are large closed 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. Reductions in landings limits for shelf rockfish species have also reduced incentives to fish in rocky areas shoreward of the RCA.

Management Performance

Management targets for darkblotched rockfish were exceeded until 2003 (Table 3). Landings goals were not met in 1997-2001 and the assumed discard rate was underestimated in 2002. Estimates of the amount of trawl discard are not yet available for 2004. However, the proportion of darkblotched that was discarded on observed trips in January-August 2004 was substantially lower than during 2003. This was most likely due to the higher trip limits that were in place for northern slope rockfish throughout the first eight months of 2004. The RCA areas in 2003 appeared to effectively change the distribution of the catch. In 2002, distribution of the catch was similar to that in the survey catches (Figures 1,2). In 2003, most of the landings and catch were from outside those areas (Figure 2). In 2004, observers noted two very large catches (8,000-15,000 lbs), which were partially discarded. They were both from an area that also had large survey catches, approximately 40.5 N latitude in 200 fm (Figures 1,2).

DATA

Landings

For this assessment, I estimated landings back to 1928. In the last assessment, the first year of catch was 1963, with the 1962 population assumed to be at equilibrium with an historical catch of 200 mt per year.

For the period 1928-1962, darkblotched landings (Table 4) were estimated by apportioning combined rockfish landings using the earliest available species proportions in a given area. When necessary, I first allocated state rockfish estimates to PFMC or INPFC area. Since the fleet fished shallower than 100 fm in years before 1945-1948, I reduced the available darkblotched proportions for those years.

Landings from 1963-1977 were mainly available in the literature, but some estimation was required (Table 4). I revised our method of estimation to allow for trends in the landings, but the estimates were similar to those used previously. Landings for 1978-2004 are available in various databases (Table 5). Darkblotched rockfish has been sorted since 2000. Previous estimates were based on applying port-sampling species ratios to mixed rockfish landings.

Discards

The discarding rate in 1986 was estimated using 1985-1987 observed darkblotched rockfish catch and discard in the Oregon and Washington bottom trawl fisheries (Rogers 1993). Fishermen attributed those discards to small sizes rather than management limits or other market considerations (Rogers 1994). Both the shrimp and groundfish trawl fisheries were observed, but most of the catch came from groundfish trawl tows. The percent of the 1985-1987 observed catch that was discarded in all trawls was 5%, while in groundfish trawls only it was 4%. I used a discard estimate of 5%, but utilized only the groundfish trawl length compositions for retained and discarded fish. Given the smaller mesh of the shrimp gear, the fish discarded with that gear reached a smaller size than those caught with groundfish trawl.

Data from another set of fishery observations conducted during 1995-1998 off Oregon and Washington was not used in this assessment. Due to time constraints, the observers only recorded discarded catch for darkblotched rockfish. At that time, darkblotched rockfish landings were recorded in the logbooks and landings tickets as part of a mixed group of rockfish. All the discarded darkblotched rockfish measured in that observer study were from shrimp gear catches.

Annual discard rates for 2000-03 were computed using a combination of fish ticket, species composition, logbook, and observer data from that period. Fish ticket landed catch, as adjusted by species composition sampling of rockfish market categories, was used as the measure of landed tonnage in each area. Area discards of darkblotched rockfish were estimated by multiplying area- and depth-specific observed ratios of discarded darkblotched rockfish per metric ton of target species by retained amounts of target species (derived from logbooks and expanded to match area fish ticket amounts). For the 2002 and 2003 estimates, only observer data from those specific years were used. Discard estimates for 2000 and 2001 were computed using pooled observer data from September 2001 through August 2004. Discard rates for each year were calculated by dividing the estimated discard by the sum of discard plus landed catch (Table 6). The annual average weight (lb) of discarded darkblotched rockfish was estimated for 2002 and 2003 by weighting area- and depth-specific observed discard average sizes by corresponding discard amounts. The discard rate for 2004 was calculated using only the amounts of retained and discarded darkblotched rockfish reported by the observer program for January-August, 2004. An estimate of the 2004 fleet discard rate, based on the approach described for previous years, could not be developed in time for the assessment, due to missing depths for a substantial portion of the Oregon logbook data provided to PacFIN. This period should be representative of observed discard for the entire year, since the trawl fishery north of 38^{o} N. Lat. was closed from the shoreline to 250 fm from October through December.

Life History Parameters

Estimates from Literature

Maturity-at-length for females and fecundity-at-weight were based on the work of Nichol (1990). Fecundity-at-weight was derived by converting Nichol's (1990) fecundity-at-length equation using his length-weight relationship. In the previous assessment, I used Nichol's (1990) fecundity-at-gonad-free-weight equation.

Proportion Mature Females = 1/1-exp(-0.6449 Length(fl cm)+22.2)
(50% mat.=34.5 cm)
Spawn Index (100,000 eggs/kg) = 0.1458 + 1.325 Weight(kg).

I considered a range of natural mortalities, between 0.05 and 0.10. In the last assessment, 0.05 was selected based on fit to the data (Rogers et al. 2000). Lenarz (1993) suggested a range of natural morality estimates (0.025-0.05) based on a maximum age range of 60-105 years. A recent publication provided indirect estimates of M for darkblotched rockfish (Gunderson et al. 2003). Their estimated M was based on a linear relationship with reproductive effort as measured by GSI (ovary weight/somatic body weight). Average size of mature females was estimated at 42.7 cm, resulting in M = 0.107 with a 95% confidence interval of 0.07-0.144.

Estimates derived from Data

The length-weight relationship was estimated using available survey data. The equation was fit to mean weight at length from 6374 fish measured in west coast surveys. Sexes were combined because means did not differ substantially (Figure 4 A). The equation differed slightly from Nichol's (1990) equation used previously (Table 7).

$$\text{Weight(kg)} = 0.000021\ \text{Length(fl cm)}^{2.96142}$$

Changes in the weight-length and fecundity-length equations resulted in minimal changes to the resultant weight and fecundity at age estimated in the models.

Life history relationships involving ages required a thorough investigation. Nichol (1990) aged by sectioning otoliths collected from the Oregon fishery in 1986-1987. There was good agreement between his ages and ages from break-and-burn readings at the Pacific Biological Station, Canada on the same otoliths. Edge analysis also confirmed his aging through 10 year-old fish. For the 2000 assessment, ages read in 1996-2000 by three agers (ager1-3) at the Newport, Oregon aging laboratory were added to those from Nichol (1990) (Table 8). The von-Bertanlaffy growth curve fit to the combined data estimated smaller size-at-age than estimated by Nichol (1990), particularly for females. Subsequent ages read in 2002 by agers 1,2 and 4 at Newport, Oregon had greater size-at-age for the younger ages than predicted by the 2000 growth curves (Rogers 2003). The relationship between aging error and age also changed. Although yearly growth changes may have had some effect, the otoliths aged in each time period were collected in a wide range of years (Table 8). Because the 2003 assessment was an update and growth and aging error were fixed in the 2000 model, the new ages were not utilized in the 2003 model.

To try to determine the reason for this change, I subsequently calculated the mean size divided by age (adjusted for month of capture) for age 5 plus fish. I did this separately by ager, source of sample, year collected, and year aged (Table 9). The range was 4.5 to 5.7 cm. All the means below 5 cm (indicating slower growth or ages read older) were from fish aged in 2000 and 2001. Both agers 1 and 2 produced those low means. The data sources included landings from two states and two different surveys. Although means from those different sources may be affected by differences in selectivity, the means were larger for all sources in the 2002 aging period than in the 2000 period.

In 2003, one of the agers (Ager 1) was then asked to re-age shelf survey otoliths, which were initially aged in three years (1996, 2000, and 2002), by both Ager 1 and Ager 2. Ager 2 had trained this ager in 2000. For the 1996 and 2002 initial aging time periods, there were only slight differences with re-aging. The early period slightly increased, while the latest period slightly decreased (Table 9). Both those time periods had mean length/age consistent with the 2000 growth curve. The 1998 shelf survey otoliths were initially aged in 2000, the time period with low mean size/age. Comparing the readings of Ager 1 and Ager 2 in 2000 indicated Ager 1 read smaller size at age than Ager 2 (older fish). Re-aging of those otoliths by Ager 1 in 2003, however, led to an average size/age larger (younger ages) than the previous maximum value (Table 8, Figure 5).

To explore this problem further, I tested several categorical variables as predictors of size/age adjusted for month of capture using all available ages (read in1990-2004). They were: age, ager, year otolith was aged, sex of fish, source of data, and year sample collected. All variables were significant ($p<0.0001$), listed in order of importance: age, ager, agency, year aged, sex, and year sample collected ($r2 = .92$). Using only ages read after 2001, the significant variables in order of importance were age, agency, ager, sex, and year aged ($r2 = .90$). These results indicate the agers had different criteria, and an ager's criteria changed over time.

Agers were then interviewed regarding possible changes in criteria. Variation in criteria used to count annuli and growth at the edge of an otolith (edge type) may have contributed to differences in size at age between agers and aging period. The variation can result in differences of one year. Since differences were often more than one year, this may only be one factor in the change in aging criteria.

Examination of the otolith readings that were done in 2004 indicated there were still uncertainties in the amount and type of aging error. The age readings included 4686 fish taken from surveys (2003-2004), California groundfish trawl (1983,1994,2003), Oregon groundfish trawl (2002-2004), Oregon shrimp trawler (2004), and Washington groundfish trawl (2003). During the 2004 to 2005 aging period, Ager 1 and Ager 2 re-aged some of the otoliths initially aged by Ager 1. The results indicated Ager 1 was becoming increasingly consistent, but Ager 2 now read the ages as younger than Ager 1 (Figure 6). Only Ager 1 production-read otoliths in 2004-2005.

For the first time, fisheries ages were available from all three states in the same year (2003). Fish landed in California generally had smaller size-at-age than fish landed in the two northern states (Oregon-Washington) (Figure 7). Since the fish were all aged by the same ager in the same time period and collected in the same year, it would appear that the difference is based on data source. If fish landed in California generally have slower growth, the substantial number of those fish aged in 2000 (Table 8) could have biased the curve downward. The age five California fish aged in 1997, however, had one of the highest size/age (Table 8). In addition, if growth was different, it was likely not due to change in growth with latitude. I found that latitude was not a significant predictor ($P<0.10$) of either size-at-age or weight-at-length in the 2003-2004 NWFSC survey data. It is possible that the California fishery has different selectivity than do the northern fisheries.

To reduce variation from ager and time period aged, I estimated an age-length relationship and aging error using only ages read in 2004, which were all aged by ager1. To reduce bias from gear selectivity, only fish taken with the smaller mesh in surveys and the shrimp fishery were used in fitting a growth curve. This did, however, remove the California fishery data. Unsexed fish, which were less than age five, were used in calculating curves for both sexes. Size-at-age in 2004 was similar to that from Nichol (1990) (Figure 7C,D,E). As noted by Nichol (1990), the von-Bertanlaffy curve poorly fits the growth of darkblotched rockfish. I therefore fit the curve with a limited range of ages (ages 1-40:1,505 males and 1,263 females) to best fit the majority of the data in the model. The resulting curves estimated smaller size at age 1.7 and larger size at age 40 than estimated using the 2000 curves (Table 7):

Female Length at age = 42.94* (1 – exp ((-0.2010 (Age - 0.1036))
Male Length at age = 37.88 *(1 – exp ((-0.2546 (Age - 0.2311))

Aging error was derived using the 2005 double readings of otoliths by ager 1. The standard deviation in age given the initial age (first reading) for ages 1-75 was estimated using a linear relationship. Actual values were used for the younger ages because they were based on a large number of fish and varied slightly from the values predicted by the relationship:.

Std_{age} =0.138+.07 * initial age (actual std used for ages less than 10)

Estimates of coefficient of variation (CV) in length-at-age were derived differently for the young and old ages. Variation in length for the fast-growing younger ages can be confounded with aging error and variations in growth between years based on environmental conditions. I therefore estimated the CV at age 1 using samples collected on the same date, which were easy to read (two agers had 100% agreement on the ages). The CV for both age 0.83 and 1.83 was 6%. Plotting of CV's at age using all data aged in 2004 indicated variation at older ages due to limited data, but a constant CV of 6% for both sexes appeared adequate (Figure 4F).

To help verify the ages and explore further the significance of year of capture in size-at-age in the GLM model using all the data, I examined the length compositions from the Alaska Fisheries Science Center (AFSC) shelf survey. There are usually distinct modes in the compositions for the smaller fish. From 1980-2004, the first peak varied from 12-14 cm and the second peak from 17-20 cm (Table 10). In 1977, small fish may not have been proportionally measured. The two modes in a year had a correlation of 0.87, while the modes and their age (adjusted for date of capture) were only correlated at 0.6 and 0.3 (Table 10). This indicates yearly growth-rate changes. The modes in 1986 and 2004 were similar and consistent with lengths expected based on aging (Figure 4E). The smallest size for both modes was in 1998 (Figure 8). It is possible that this unusual growth in 1998 made aging those otoliths more difficult to read than usual, as demonstrated by the variation in size-at-age with multiple readings (Figure 5). The agers noted otoliths collected in 1998 had an unusually small amount of growth after the last annuli (J. Menkel, pers. comm.). Although 1998 is considered an El Nino year, there was no obvious relationship between water temperature at gear depth and size of the modes (Table 10).

Indices

I used four NMFS surveys to derive indices of relative abundance (Table 11). Three of those were conducted by the AFSC and were used in the 2000-2003 assessments: the triennial shelf survey (Zimmerman et al. 1994), the slope survey (Lauth et al. 1997) and the pop survey

(Wilkins and Golden 1983). The NWFSC slope survey (Ramsey et al 2002) began in 1999 and was not used in previous assessments. The NMFS surveys were conducted with different gear, over different time periods, and covered different depth ranges (Table 11). The shelf survey and NWFSC survey covered a wider depth range and latitudinal range in more recent years. Considering all surveys combined, the depth range covered was 13-781 fm and the latitude range covered was $32^0$34' to $49^0$40' (Table 11).

In order to utilize as many years as possible, I generally used only comparable depth and latitudes in our indices (Figure 9, Table 12). In spite of that, little information was lost. Fewer than two percent of the 2796 survey catches of darkblotched rockfish were in less than 50 fm or in greater than 250 fm and all of those were small (average 0.2 kg/ha). Only one catch was in greater than 300 fm. Fewer than three percent of the catches occurred north of 48^0 30' N latitude, and those catches averaged 2 kg/ha). One percent of the catches occurred below 37^0 N latitude, averaging 1 kg/ha.

Until 1997, the AFSC slope survey was conducted in different latitudinal ranges in each year (Table 11, Figure 9). To utilize an index incorporating the early years, I created what I refer to as "super years" covering the Eureka to US Vancouver INPFC areas. In the prior assessments, I used two "super years". The first super year ("1991") was based on survey data for 1988 to 1993, except that the northern Monterey area surveyed during 1991 was not included. For the first super year, I averaged biomass, variance, and length composition data from the central Columbia area for 1988 and 1993. The averages were then added to estimates from Eureka (1990), S. and C. Columbia (1993), and N. Columbia to U.S. Vancouver (1992). The second super year ("1995") was based on adding data from the 1995 (Eureka) and 1996 surveys (Columbia and U.S. Vancouver). The 1997 and 1999 surveys information from the Eureka to US-Vancouver INPFC areas completed the index.

The AFSC shelf and slope survey indices and length compositions were revised for this assessment (Figure 10, Table 12). Tows which may not have tended bottom (water tows) in the 1977-1995 shelf survey were removed (Zimmerman 2001). The AFSC slope survey index was re-estimated using a GLM Model (Helser et al. 2005 draft). In doing so, the AFSC super years were re-defined and the index coverage was extended to include the Monterey INPFC area. The first super year was "1992", which combined survey estimates from 1990,1991,1992, and 1993. The second super year was "1996", which combined 1995 and 1996. The earliest data from 1988 were no longer utilized (Figure 9). There were four large post-stratified areas in the model: two latitudinal strata (U.S. Vancouver-Columbia INPFC versus Eureka-Monterey INPFC) and two depth strata (183-299 m versus 300-567 m). For the super years, which did not cover the entire Monterey INPFC (Figure 9), the available data were expanded to the entire southern area. The index estimates in Table 12 were the median values from the marginal posterior distributions for the combined strata. The positive catches were fit using a lognormal error model. The GLM estimates were generally lower that the previous estimates, and the variances around those estimates were reduced (Figure 10).

Large survey catches occurred in specific areas, which were consistent across surveys and time periods. Those large catches occurred most often in 100-150 fm at about 47^0 N latitude

(Figure 1, Table 13). Although all surveys had some catches greater than 100 kg/ha, the AFSC shelf and slope surveys had much smaller percentages of those large catches (<0.05%). Those two surveys contributed 75% of the total catches, but only 33% of the larger catches. The P.o.p. survey, which was designed to sample areas with high density of Pacific ocean perch (*Sebastes alutus*), a slope rockfish often caught with darkblotched rockfish, had the highest percentage of large catches (4%). The NWFSC surveys were conducted using vessels and crew who also commercially fished groundfish in the area. In addition, the tows were one-half as long as those in the AFSC surveys. This combination of crew expertise and shorter length of tow may have allowed access to more areas with high density of darkblotched rockfish, particularly if they occur in rocky areas which may tear the net. In the 2002 NWFSC survey a very large catch of darkblotched rockfish occurred during a tow when the belly of the net tore, indicating a very rocky area. Submersible observations also indicate darkblotched rockfish is associated with rocks or other bottom structures (Waldo Wakefield, NMFS, Newport, OR 97365, pers.comm.).

The patchy distribution of survey catches has led to erratic indices. When average catch per unit effort is applied to a large stratum area (swept area estimates), an unusually large tow can greatly increase both the survey index estimate and it's variance. In addition, the length composition of the tow can have a substantial impact on the overall size composition. Capture of a large tow tends to increase the size composition. Only in the Pacific ocean perch survey was the average size in the large hauls ever smaller than the overall average for all fish measured that year (Table 9).

The new GLM estimates for the slope surveys were derived using four large stratum areas, while the previous swept area estimates were based on many smaller strata (compare stratum sizes in Table 13). To be consistent, length compositions were derived for the same four strata (Hamel 2005 draft). This had varying effects, but generally the large tows had more influence on the overall length composition. In the NWFSC 2000 slope survey, the influence of the tow with large fish was reduced because another large tow with smaller fish was in the same strata (Table 13).

Length and Ages

Lengths and ages were not available for all years from any data source (Figure 11, Tables 14-16). Although the P.O.P. and AFSC shelf survey had some lengths in all years, in the early years not all darkblotched catches had length samples. As mentioned, 2003 was the only year with ages available from all three states, and differences by data sources were noted (Figure 7).

In deriving yearly length and age frequencies, individual area frequencies were weighted by numbers of fish they represented. For the fishery, they were weighted by state using numbers estimated by dividing the landings by the average weight of fish in landings. For the surveys, they were weighted by strata, using numbers estimated by dividing the estimated biomass for the strata by the average weight of fish caught in that stratum.

The length frequencies size bins were the same as in the 2000-2003 assessments. The first bin was all fish less than 6 sm. There were then 1 cm length bins up to 32 cm, and then 2 cm bins up to the maximum bin, which was all fish greater than 51 cm.

Since the new modeling program allowed more age bins, I increased the range of single age bins from 1 to 40+ to 0-45+. The plus refers to an accumulator bin, all fish aged greater than 40 or 45 years.

Effective sample sizes were calculated using the number of fish up to a maximum number of either 100 or 200 fish (Tables 14-16). Those maximums were down-weighted if they were taken from only a few samples: effective sample size = number of fish * sqrt(#samples)/sqrt(20)) or the maximum, whichever is less. Previously, the fishery maximum number was 200, regardless of whether or not the samples came from more than one state. In this assessment, I limited the maximum size for samples from only one state to 100. That affected the California samples in the early years. I down-weighted those compositions because California length compositions tend to have a higher proportion of larger fish than in coast wide length compositions (Lenarz 1993), perhaps due to the greater slope area. Another change in this assessment is that the length compositions for the 1977 shelf survey, 1979 P.o.p. survey, and the two slope “super-years” were assigned an effective sample size of 0 (not used in fitting the model). Those compositions were based on samples that may not have represented the depth and/or latitude range of the survey in those years. Previously, those compositions were included in the model fitting, but the Pop and slope survey frequencies had a maximum sample size of 100.

Age frequencies from data aged in 2004 varied among data sources (Figure 12, Table 16). The coast wide fishery age composition available for 2003 contained more older fish than did the slope survey in the same year. The 2003 age modes were quite different for the fishery and the slope survey, yet the length modes were very similar. The opposite was true for the 2004 shelf and slope survey. There the age compositions were similar but the size compositions varied. The 2003 survey ages suggested strong 1998 and 1996 year classes, while the 1995 year class was strong in the fishery. The age modes for both surveys in 2004 indicated a strong 1999 year class (age 5 fish). I ultimately decided to use only the 2004 shelf survey age composition in the model. That composition covered the depth and latitude of the species, gave some supporting information on the growth signal in the shelf survey length composition, and was not biased by any latitudinal variation in gear selectivity.

ASSESSMENT

History of Modeling Approaches

There have been five previous assessments of the U.S. darkblotched rockfish resource (Lenarz 1993, Rogers et al. 1996, Rogers et al. 2000, Methot and Rogers 2001, and Rogers 2003). These assessments began with life-history based analyses of sustainable catch rates and have progressed to statistical age-based modeling. The first full assessment of the darkblotched rockfish stock was done in 2000. This assessment has been updated twice since then, in 2001 and 2003 but the current assessment represents only the second full assessment for this species.

1993 Assessment

The first darkblotched rockfish assessment (Lenarz 1993) reviewed the available life-history and fishery information on the species. Based on Hoenig's (1983) method, and a maximum age of 60-105 years, the rate of natural mortality was estimated to be between 0.025 and 0.05. From these values, the target fishing mortality rate at that time ($F_{35\%}$) was estimated to be between 0.04 and 0.06 and the overfishing level at that time ($F_{20\%}$) was estimated to be between 0.07 and 0.11. There was no calculation of allowable biological catch (ABC), however the author did express concern about the relatively low $F_{35\%}$ and $F_{20\%}$ estimates. All of the length frequency data available at that time indicated that average size had decreased from 1983 to 1993. Although it was recognized that this could be attributed to other causes, it was consistent with impacts from fishing.

1996 Assessment

The second darkblotched rockfish assessment included both a modified F=M approach and a simple age structured model. The darkblotched rockfish model was, however, only developed to confirm the F=M approach. That F=M methodology was then used to assess an additional 12 commercially-important rockfish including eight species without an ABC and an additional five species whose stock assessments did not cover the entire coast wide area.

An F=M approach (assuming stocks can be managed by setting fishing mortality equal to natural mortality) was modified to attempt to derive ABC's given the target fishing mortality of F35% at that time. First, the AFSC shelf survey index biomass was averaged over 1980-1995. Then a proxy adjustment factor was estimated based on the ABC's from available stock assessments for WOC rockfish. It was determined that for most rockfish, if the average shelf survey biomass was multiplied by 0.5 and then by M, the resulting catch was approximately the ABC based on $F_{35\%}$ using the full stock assessment models. That proxy of 0.5 was then individually adjusted for each species included in the analyses. For darkblotched rockfish, the proxy was adjusted to 0.8 based on the fact that the survey covered most of the depth range of the species, caught smaller fish than did the fishery, showed a downtrend in biomass estimates over time, and the estimated size at 50% maturity was greater than the estimated size at 50% selectivity. The ABC was then determined by assuming natural mortality was 0.05 for darkblotched rockfish.

Darkblotched rockfish was the only species that was assessed using a simple stock synthesis model (Methot 1990). That two-sex model covered the period from 1980-1995, and included two indices: the AFSC shelf survey and a Pacific ocean perch bycatch effort index which was derived by the assessment authors. The AFSC shelf survey also included age and length composition data. The model was structured to have two fisheries, one in the north (Columbia and US Vancouver INPFC areas) and one in the southern INPFC areas. Length compositions were included from the commercial fishery in California from 1980-1994, and

Oregon and Washington in 1986. Fishery age composition data were available from Oregon and Washington in 1986 only. The population was assumed to be in equilibrium in 1979, with an historical catch of 300 mt. The model produced estimates of age-one recruitment from1980-1993, dome-shaped selectivity for the shelf survey and southern fishery (selectivity of the largest fish was allowed to be less than for the medium sized fish), asymptotic selectivity for the northern fishery and bycatch index (selectivity of the largest fish was assumed equal to that for medium sized fish), with catchability for the shelf survey fixed at 1.0. The $F_{35\%}$ fishing mortality rate was estimated to be 0.04 for the northern fishery and 0.02 for the southern fishery.

2000 Assessment

In 2000, the 1996 model was expanded to provide the first full assessment of the darkblotched rockfish stock. That model covered the period from 1963-1999, with the population assumed to be at equilibrium in 1962, given an historical catch of 200 mt. Five indices of relative abundance were included in the model: the AFSC slope survey, P.o.p. survey (Wilkins and Golden 1983) and a commercial trawl fishery logbook cpue index (Ralston 1999) were added to the AFSC shelf and P.o.p. bycatch indices used in the 1996 assessment. Length composition data included all years of the slope, shelf, and P.o.p. surveys. Survey age composition data were available only for the shelf survey, and that survey did not have ages in 1989. Fishery length compositions were available from California landings in 1977-1998, from Oregon landings in 1982, 1984, 1985, 1990, 1991, and 1994-1999, and from Washington landings in 1996-1999. Fishery age compositions were from California landings in 1977-1978, 1987-1988, 1990, 1993, and 1995-1997 and from Oregon landings in 1999. Discard information from 1985-1987 and 1996-1998 indicated that discarding was primarily size-related and totaled approximately five percent of the landed catch. In the model structure, the two fisheries in the 1996 model were combined into one fishery. Discard was included only in a sensitivity run, because it complicated the model without substantially changing the results. Fishery selectivity was assumed to be asymptotic, but survey selectivity was allowed to be dome-shaped. Age-one recruitments were estimated from 1963-1998, with the 1999 recruitment fixed at an assumed value.

Two models were fully presented in the 2000 assessment: a STAT team model and a STAR panel model. Both models had similar results, but their assumptions were quite different. The STAT model included subjective weights on the log-likelihood components, informative prior distributions on some of the fitted parameters, and assumed a Beverton-Holt type stock-recruitment relationship. The STAR panel model assumed all weights on the likelihood components were either 1 or 0 (data were either included in the model or not), assumed no prior knowledge about the fitted parameters, and placed no bounds on the estimated recruitments.

Both the STAT and STAR models rated the logbook and bycatch indices as less reliable than the other indices, but the STAT model also rated the shelf survey higher than the slope or P.o.p. surveys. The STAT model weights (low weight = low reliability) on the indices likelihood components were: shelf survey =10, slope and P.o.p. surveys = 1, and logbook and bycatch indices = 0.5. The slope survey was rated lower than the shelf survey because adjacent years sometimes had to be combined in order to achieve close to coast-wide coverage. The P.o.p.

survey was given less weight because in one of its two years, different boats were used in the north and the south of the surveyed area. The logbook and bycatch indices were given the lowest weights because they required many assumptions and were considered exploratory. The STAR model assigned those indices zero weight (they were left out of the model entirely) and the remaining three indices (shelf, slope, and P.o.p.) were each assigned a weight of one.

The STAT model placed informative prior distributions on survey catchabilities, the descending limbs of the survey selectivities, and the Beverton-Holt steepness parameter (h). The catchability (Q) priors were assumed to be log-normally distributed: shelf survey mean =0.5, with a CV of 0.15, slope survey mean = 0.3 with a CV of 0.25, and P.o.p. survey mean =0.6 with a CV of 0.15. The estimated values were 0.80, 0.39, and 0.71, respectively. Priors on the descending slope of the survey selectivity curves had a mean of 0.5 and final selectivity mean = 1.0; all selectivity priors had CV's of 2. In spite of the high prior for the slope survey final selectivity, the model estimated similarly dome-shaped selectivites for all three surveys. The steepness parameter prior had a mean = 0.8, with CV of 0.1, and the estimated value was 0.83.

Uncertainty in the 2000 assessment was expressed both through choice of the two models and through assumptions regarding the amount of foreign catch of darkblotched rockfish relative to that estimated for Pacific ocean perch. In the Pacific ocean perch assessment (Ianelli and Zimmerman 1998), all foreign catch off WOC in 1965-1976 which was reported as "POP" or undesignated rockfish was attributed to that species. It was, however, acknowledged in the assessment that the catch included unknown amounts of other rockfish species. In the 2000 darkblotched assessment, 10% of the catch attributed to Pacific ocean perch was reassigned to darkblotched rockfish, based on ratios of the two species in the domestic fleet landings during 1965-1976, and the proportion of darkblotched rockfish observed in slope rockfish domestic catches in 1986. Uncertainty was bracketed by assuming no foreign catch of darkblotched rockfish versus assuming 20% of the catch assigned to Pacific ocean perch was actually darkblotched rockfish. $F_{50\%}$, the target fishing mortality (raised from $F_{35\%}$), was about 0.032, regardless of model or foreign catch assumption. Given the range of foreign catch, spawning depletion in 1999 was estimated to be between 0.17 and 0.28 in the STAT model, and 0.13 and 0.26 in the STAR model. The projected ABC yields averaged over the years 2000-2002 ranged from 272 mt to 330 mt, given uncertainty in both the model and the amount of foreign catch.

2001 Assessment

Following the 2000 assessment, darkblotched rockfish was declared overfished and a rebuilding plan was required in mid-year 2001. Because new data were available, that rebuilding plan also included a partial update of the 2000 STAR model. That update added the 2000 AFSC slope survey biomass estimate, along with slope survey length and age composition data. It also added length data from the 2000 Oregon and Washington commercial fishery landings. Selectivities and survey catchabilities were fixed at the values estimated in the 2000 assessment. Only the age-one recruitments were re-estimated, with 2000 and 2001 recruitments fixed at an assumed level. It should be noted that although there was no stock-recruitment relationship in the 2000 model, recruitments were bounded by a minimum of 10,000 fish. In the 2000 assessment, this was not limiting, but in this update that bound limited recruitments in 1964-1966 and 1971.

The fishing mortality rate at $F_{50\%}$ was estimated to be 0.032, the spawning depletion at the beginning of 2002 was 14%, and the 2002 ABC was 187 mt

2003 Assessment

The 2003 assessment was a comprehensive update of the 2000 assessment, meaning that the data were extended though 2002 and all the fitted parameters were estimated, but the model structure and values assumed for fixed parameters were not changed. This update added 2001 AFSC slope and shelf survey biomass estimates and length compositions. It also added fishery length data from California in 1999, 2001, and 2002, from Washington in 2000-2002, and from Oregon in 2001-2002. Newly available age compositions (Table 8) were not included in the model because they were not compatible with the growth curve and the aging error parameters that were fixed in the 2000 model. (See the data section in this document for more information). Management-induced (not size-related) discard was added to the 2001 and 2002 landings, using rates assumed by the Pacific Fishery Management Council (16% in 2001 and 20% in 2002). Several changes were also made to data included in the 2000 assessment. Revised foreign catch estimates for 1966-1976 were taken from Rogers (2003). In that document, WOC foreign rockfish catch in those years was allocated to all species using a consistent methodology. Total foreign catch for darkblotched rockfish during that period was increased by 1,579 mt over the estimates used in the 2000 assessment base model. Domestic landings also changed due to revisions in the PacFIN data base. The new fishery length data indicated differences among states; so all the yearly state length compositions were weighted by state landings before combining then into a single composition. Previously, the length samples had been combined without weighting by landings. The STAR panel model was again used for this update. Annual age-one recruitments were estimated for 1963-2001, with the 2002 recruitment fixed at an assumed level. As in the 2001 update, the lower bound on recruitments (10,000 fish) was reached in 1964-1966 and 1971. The estimated fishing mortality rate at $F_{50\%}$ was 0.032, the spawning depletion was 11% in 2004, and the 2004 ABC was 240 mt.

2005 Assessment

There were nine major changes from the 2003 analysis to the model structure and data used in this assessment:

1) The model program was Stock Synthesis 2 (Methot 2005 a,b) versus Stock Synthesis (Methot 1990).

2) The model period was extended back to 1928 (versus 1963), with the 1927 population assumed to be in an unfished equilibrium, and forward to include 2004, the most recent year with complete data available.

3) The parameters of the growth curve were estimated within the assessment model.

4) A Beverton-Holt stock recruitment relationship was assumed.

5) The AFSC slope and P.o.p. surveys were assumed to have the same length selectivity.

6) The only age compositions included in the model were based on ages read in 2004.

7) Discard data (rates in 1986 and 2000-2004, mean size of discard in 2002 and 2003, and length composition of discard in 1986) were added and discard was rates and retention curves were estimated within the model.

8) The AFSC slope survey index was re-estimated using a GLM model (Helser et al. 2005).

9) The AFSC slope survey length compositions were derived using larger strata to expand the data (Hamel 2005).

10) The NWFSC slope survey index (1999-2004) and length compositions (2000-2004) were added to the model.

Model Description

Description of new modeling techniques

Growth was fit within the model because any externally estimated curve was subject to potential bias from ager and/or aging time period. The distinct modes for the smaller fish in the shelf survey length compositions, which allowed tracking of strong year classes over time, were deemed to be as good or better estimations of growth than were the actual age compositions. Those modes also allowed the CV in length-at-age to be estimated within the model. That CV was assumed to remain constant with increasing age. The data supported this assumption (Figure 4F), and if the CV was allowed to change with age, it increased substantially to try to accommodate for growth curve underestimation of size-at-age for the older fish. The shape of the growth curve defined in the model could not fit the size-at-age for all ages of darkblotched rockfish, so it fit growth best for ages with the most data (Figure 4C,D)

A Beverton-Holt stock-recruitment relationship was assumed in the model, where in the previous model (STAR model from the 2000 assessment) recruitments were limited only by a lower bound of 10,000 fish. The steepness parameter (*h*) was initially fitted with an upper bound of 1.0. That bound was later revised downward to 0.95, because it was viewed as reasonable to assume some effect of stock size on the amount of recruitment. In deriving the base model, that bound was hit, so it was then fixed at a value of 0.95. The assumed standard deviation of log recruitments ($sigma_R$), is used to define both offset of the stock-recruitment curve when recruitment is stochastic, and the likelihood of the variability estimated about the expected stock-recruit curve. The input value for $sigma_R$ was iterated until the observed variability over the period of estimated recruitment deviations was approximately equal.

Discard rates and retention curves were estimated within the model. The landings in all years, discard rates in 1986 and 2000-2004, mean weight of discard in 2001 and 2002, and length compositions for the retained and discarded catch in 1986 should all provide information with which these parameters can be estimated. Discard was assumed to be exclusively size-related (discarding only smaller, unmarketable fish) before 2000. Previously, landings were inflated based on an assumed rate of discard external to the model and size-related discarding was assumed negligible. Management-induced discard for 2001 and 2002, based on Pacific Fisheries Management Council rate estimates, were included in the input landings data for those years.

Definition of fleets and areas

As in the 2000-2003 assessments, this assessment assumed one coast wide darkblotched rockfish stock from the Canadian border to the Mexican border. A single fishing fleet was modeled including all gear types and all areas.

Assessment program with last revision date

The assessment program was Stock Synthesis 2 (version 1.19) distributed on April 28, 2005 (Methot 2005 b).

List and description of all likelihood components

There were 10 basic types of likelihood components in the model (Table 16). They included: 1) indices, 2) survey and fishery length compositions, 3) shelf survey age composition, 4) rate of discard, 5) mean size of fish in the discard, 6) recruitment deviations, and 7) forecast recruitment deviations.

Model constraints or assumptions

There were both fixed and fitted parameters in the model, and no prior assumptions made regarding the fitted parameters (the lambda on the prior distributions was 0) (Tables 18,19). There were, however, bounds on all the parameters. The parameters were of four basic types: life history, stock-recruitment relationship, selectivity curves, and fishery retention curves. Aging error at age was input as data to the model and was not estimated. Survey catchability for each index of relative abundance was calculated analytically as a mean unbiased scaling factor. There were no prior assumptions made regarding survey catchability.

Life History Parameters

Fixed life history parameters included those determining natural mortality, weight-at-length for both sexes, and female maturity-at-length and fecundity-at-weight. The coefficient of variation in length-at age was estimated, but it was assumed to be constant with age and equal for both sexes. There were five estimated growth curve parameters: size at age 1.7 (males and females assumed to be equal), size at age 40, and the von-Bertanlaffy growth parameter (*k*) for each sex**.** The basis for selecting age 1.7 and 40 was that they were at opposite ends of the curve, yet still well represented in the data. Age 1.7 was also the estimated age for the first mode of fish captured in the shelf survey.

Stock-recruitment Parameters

A Beverton-Holt stock-recruitment relationship was assumed in the model. An upper bound on the steepness parameter was set at 0.95, because it was viewed as reasonable to assume some effect of stock size on the amount of recruitment. In the base model that bound was hit, so it was then fixed at a value of 0.95. The standard deviation of the log recruitment ($sigma_R$) was iterated until the input value (0.80 in the base model) was close to the root mean squared error of the estimated recruitment deviations 1968-2003.

Selectivity Curve Parameters

Separate size-based selectivity curves were fit for the fishery and the surveys, but the AFSC slope survey and the P.o.p. survey were assumed to have the same selectivity. In all cases, the curve was a double logistic curve with defined peak, but for the fishery and NWFSC slope survey the curve was forced to be asymptotic (selectivity of the largest sizes were assumed to be the same as selectivity of the medium sized fish). The size at initial selectivity was fixed at zero for the fishery and all surveys except the shelf survey, which was fixed at 0.005. The shelf survey initial selectivity was set at a low value because it caught a few fish in the minimum bin size (less than or equal to six cm). The peaks and width of the top of the peaks were fixed for each curve, with the values estimated through visual examination of the length compositions and the selectivities estimated in the 2003 assessment.

Retention Curve Parameters

The fishery retention curve was assumed to be a three parameter logistic function. The inflection and slope were estimated as time-invariant parameters and asymptote of the curve was allowed to vary in recent years. The curve produced by the model was the proportion retained of the proportion selected. To get curves representing the actual proportion retained, I multiplied the proportion selected by the proportion retained. For example, if the gear selected 0.5 of the 10 cm fish, and 0.5 of those were retained, the proportion retained was 0.5 times 0.5 or 0.25. The asymptote of the curve was fixed at 1.0, meaning discard was assumed to be size-based. That asymptote was, however, allowed to vary in the later time periods in the base model.

Aging error

Aging error was assumed to be unbiased in the one age composition included in the model. The accumulator age was set at 75. This age needs to be a very large percentage (99%) of L infinity in the von-Bertanlaffy growth curve (Methot 2005b). It also needs to be greater than the largest bin age (45 years) in order to effectively handle miss-aging of the older fish. The standard deviation of ageing precision, as estimated using the multiple otolith readings conducted in 2005 (described in the data section above), was input for each age from age 0 to age 75+.(Figure 4B).

Beginning of modeling period

The model period was begun in 1928, with the 1927 population assumed to be in an unfished equilibrium. That year was the first year with available estimates of rockfish landings. Estimated landings were minimal until the late 1940's when the bottom trawl fishery targeting rockfish first moved deeper, into the areas inhabited by slope rockfish.

Critical assumptions and consequences of assumption failures

The critical assumptions made in the base model are natural mortality (M), steepness of the stock-recruitment relationship, and the form of the growth curve. If M or steepness is overestimated, or growth underestimated, then the 2005 biomass and spawning depletion is lower than estimated in the base run. The opposite relationship is also true (if M is underestimated the biomass and spawning depletion is higher). Those assumptions are explored in developing the base model and testing sensitivity and uncertainty (below).

Model Selection and Evaluation

Evaluation of 2005 Changes

Each of the ten major changes to the 2003 data and model, as well as several minor changes, were made sequentially in order to evaluate their effects on the model results. In aggregate, this exercise indicated that the revised AFSC slope survey index and length compositions had the greatest effect on the estimates of 2002 age 1+ biomass and spawning depletion.

First, the 2003 assessment (Model A in Table 20) was converted from the older stock synthesis program to the stock synthesis 2 software (SS2), without changing any of the data or fixed parameters (Model B in Table 19). All previously estimated parameters were re-estimated, except that the new selectivity curve parameters were fixed at values producing the same selectivity curves estimated in the 2003 model. Since SS2 automatically estimates recruitments at age 0 and recruitments were estimated at age 1 in the 2003 model, the start year was changed from 1963 to 1962, so that the same year classes could be fit. Recruitment estimates were very similar in the two models, but not exactly replicated. In SS2, the standard deviation of the log recruitment parameter still affects the recruitments when the lambdas affecting recruitment are set to zero. In addition, in the 2003 assessment three early recruitments were stuck at the lower bound, which I did not replicate in the conversion. The new model produced slightly lower estimates of age 1+ biomass in 2002.

The second transition model (Model C in Table 20) included the following changes:

1) The model time period was extended to include 1928-2004, this change added landings estimates from 1928-1962, a 2004 shelf survey biomass estimate and length compositions, as well as fishery length composition data from 2003 and 2004.

2) The growth curve was estimated within the model.

3) A Beverton-Holt stock recruitment relationship was assumed.

4) The AFSC slope and P.o.p. surveys were forced to have the same estimated selectivity, since their separately estimated selectivities were similar.

5) There were also five minor changes. First, the 1977-1995 shelf survey biomass estimates and length and age compositions were modified to exclude tows that may not have tended bottom (Zimmerman 2001). Second, slight revisions were made to the weight-at-length and fecundity-at-weight parameters (Table 7). Third, fisheries length compositions that were from only California were given a maximum effective sample size of 100, rather than the previous 200. This was to reduce bias towards larger fish in the California length compositions than would be found coast wide, particularly in the early years (Lenarz 1993). Fourth, fishery length compositions by state were weighted by the numbers of fish in the landings before being combined. Previously, they were weighted by the weight of the landings. Fifth, the 1977 shelf survey, the 1979 P.o.p. survey, and the 1992 and 1996 AFSC slope survey length frequencies were all given an effective sample size of zero because they did not adequately cover the latitude and depth range of those surveys.

The results from the model with all these changes (Model C in Table 20) were somewhat lower than those from the 2003 model. The 2002 age 1+ biomass estimate decreased and the spawning depletion increased from 11% to 13%.

Third (Model D in Table 20), the age compositions used in the 2003 model were replaced with ages read in 2004 and the retention function was estimated within the model.

Fourth (Model E in Table 20), the AFSC slope survey index and length compositions were revised. The revised index was derived using the GLM-based index based on four depth and latitude strata (Helser et al. 2005), and length compositions expanded using those same strata (Hamel 2005). This change had the greatest effect, reducing both the 2002 age 1+ biomass and the spawning depletion. The STAR panel requested this intermediate model.

Fifth (Model F in Table 20), the NWFSC slope survey index (1999-2004) with length compositions from the 2000-2004 surveys and age compositions from the 2003 and 2004 surveys (both aged in 2004) were added to the model.

Sixth (Model G in Table 20), all the age compositions except the 2004 shelf survey were removed from the model, the upper bound on the stock-recruitment steepness parameter was set to 0.95, and time varying growth, ascending selectivity, and asymptotic retention were implemented.

The 2004 shelf survey age composition was deemed the best available because the aging was done in the latest time period by an experienced ager, it confirmed the strong modes in the shelf survey length compositions, and it covered the depth and latitude range of the assessed stock.

The Beverton-Holt steepness upper bound was revised downward to 0.95, because it was viewed as reasonable to assume some effect of stock size on the amount of recruitment.

The potential change over time in growth, selectivity and retention parameters was investigated by examining residuals from preliminary model runs. Three major changes matched expectations based on knowledge of the species and fishery: reduced fishery selectivity of smaller fish in 2002-2004 (when the fishery was forced to move deeper due to area closures), reduced retention of larger fish in 2000-2003 (when landings limits were very restrictive), and smaller size at age 1.7 and growth coefficient (k) in 1998 (evident in the shelf survey length modes and consistent with ager observation of a very small amount of growth after the last annuli in 1998). Those changes were allowed through the use of time blocks. Those blocks were: inflection of the fishery selectivity changed in 2000-2003, the asymptote of the retention curve changed in 2000-2003 and again in 2004, and size at age 1.7 and k changed in 1998.

Selection of Base Run Natural Mortality (M)

Since M is difficult to estimate, and recent work (Gunderson et al. 2003) indicated M may be 0.10, higher than the previously assumed value of 0.05, I did a likelihood profile to help determine our base model. Model G was refit given M fixed at values from 0.06 to 1.0 in 0.01 increments. The likelihood values for Model G at all values of M were then compared, with the lowest values indicating the best fit to the data (Table 21). Given that growth was allowed to vary, natural mortality fit nearly equally well over a wide range, i.e. the total log-likelihood when M was assumed to be 0.07 was only 2.5 units less than the model with M=0.10. The AFSC slope length compositions had the largest change in the total likelihood over the range of values for M, with the lowest value at M = 0.10. Most of that change was due to the 2001 female composition, but the model-estimated length composition was similar across the range of M values (none of the model’s estimates fit the data very well, but the M=0.10 model fit the data best). The highest percentage changes in likelihood were for the P.o.p and AFSC slope survey indices and the mean weight in the discards, with the lowest values at 01.0, 0.05, and 0.09, respectively.

Since the likelihood profile was relatively flat over a wide range of M values, I also examined graphs of the range of model estimates. The fishery length compositions had the highest estimated effective sample sizes (an indication of good fit) at the highest value of M in the early years, but in the later years the estimated sample sizes were highest at the lowest value of M (Figure 13). For the shelf survey, using the highest value of M tended to underestimate the index in the early years and overestimate it in later years (Figure 13). The lowest value of M underestimated the 2004 shelf survey estimate.

I selected the model with an assumption of M equal to 0.07 as the base run. It fit the overall data better than the previously assumed value of M (0.05), and had results comparable to the 2003 model. It also provided the best fit to the shelf survey data (although there were only slight differences in the likelihood values across the 0.07 to 0.10 range of M values). The shelf survey index provided the longest time series and was the only index which covered the depth and latitude range of the stock.

Do the parameter estimates make sense?

The Beverton-Holt steepness parameter (h) meta-analysis of rockfish productivity indicates that steepness is 0.65, lower than estimated in the Base Model (Dorn 2002). The high value for steepness (0.95) in the Base Model could indicate that darkblotched rockfish recruitment is more dependent, than is the case with other rockfish, upon the environment than on stock size. It is also possible, however, that recent high recruitments (Figure 14) are over-estimated.

The fishery selectivity and retention curves estimated in the base run appear reasonable (Table 22, Figure 15). The fishery after 2002 selects fewer of the medium sized fish as the fishery is forced to move deeper. Retention (in terms of selectivity times retention) of the larger fish was less in 2000-2003 when landings limits were low, but increased in 2004 when landings limits were raised (Table 2).

Although it has previously been difficult to account for the dome-shaped selectivities of the AFSC surveys (Figure 15), given that their latitudinal and depth ranges relative to the stock, it appears there may now be an explanation. The fishery has always caught the larger fish. The new NWFSC survey also caught those large fish. It also had a higher proportion of large catches, which tended to have larger than average fish. It is possible that the NWFSC surveys and the fishery have better access to higher densities of larger fish in rocky areas than did the AFSC surveys.

Growth estimated in the model appears reasonable compared to prior estimates (Figure 16). For both males and females, growth in all years except 1998 was the highest and growth in 1998 was intermediate when compared to the curves from Nichol (1990) and the 2000 assessment.

The GLM model-based estimates for the AFSC slope survey were substantially lower than the previous swept-area estimates, resulting in a lower catchability than previously estimated for that survey (0.55 in the 2003 assessment versus 0.27 in the Base Model). The very skewed distribution of the catches may have led to the higher than expected swept-area estimates, resulting in high catchabilites. This could explain the catchabilities close to 1.0 for the shelf and P.o.p. surveys, which are still based on swept-area estimates (Table 18).

Residual analysis

Survey index standardized residuals were less than +/- 4.0, with the 1977 shelf survey and the 2003 NWFSC slope survey having the largest absolute residuals (Figure 17). The 1977 survey did not cover the 30-50 fm area that was covered in the later shelf surveys. I determined that there were few darkblotched rockfish catches in that depth range, but it is possible that that change affected the survey catchability in 1977. The 2003 NWFSC survey estimate was an outlier that could probably not be fit given any model configuration.

The length composition standardized residuals were less than 10 and greater than –2. Plots of the residual ranges for each data source and year (considering residuals from each sex and length bin combination), showed that the highest residuals were from fitting slope survey data (Figure 18). As stated earlier, the large catches applied to large stratum areas led to noisy length compositions. The next largest standardized residuals were for the fishery length compositions in two early years, 1978 and 1985. Actual fits to the data are in Figures 19-23.

Discard estimates fit the sparse data fairly well (Figure 24). The estimates of discard prior to 2000, which were assumed to be only size-related, were somewhat higher than the five percent rate observed in 1986. Mean weights were slightly under-estimated.

Convergence status for the Base Run

The maximum gradient component for the Base Run was 0.001049.

Base Run Results

Parameters

All the explicit parameters fixed and estimated for the Base Model (G0.07), along with their starting values and bounds, are presented in Tables 18 and 19. No parameters were at their pre-defined bounds. Model outputs for all the life history relationships, both fixed and fit are in Table 23. Slower growth in 1998 was evident by comparing the size and length of fish at the beginning of 1999 to those at the beginning of 1928-1998.

Population numbers at age by sex and year

The population numbers estimated by the Base Model indicate a continual decline in the number of older fish, for both sexes (Tables 24 and 25). In the unfished population about 6% of the fish were older than 39 years and 0.05% were older than 75 years. By 2004, only 0.01 % of the fish in the population were older than 39 years.

Time Series

The biomass of age 1+ darkblotched rockfish declined by 84% from 1928 to 1999 in the base model (G07) (Table 26, Figure 25). Most of that decline occurred during the period of large foreign-fleet catches in the mid 1960’s and increased domestic-fleet catches in the 1980’s and 1990’s. Since 1999, the age 1+ biomass has more than doubled and the catch has been at low levels due to management restrictions. Both the 1999 and 2000 year classes are estimated to have a high number of recruitments, and the 1999 year class is the highest since 1980.

The darkblotched rockfish spawning output off the coasts of California, Oregon, and Washington is now estimated to have been beneath the current management target (S40%) since 1984, and below the minimum threshold (S25%) since 1989 (Figure 26). Both the spawning population ratio (SPR) and the spawning output (S) were below the proxy target levels in 1984-2002, indicating high fishing mortality and low spawning output (Figure 27).

Stock-recruitment relationship

Given the high steepness value (0.95), the expected value for recruitments has stayed between two and three million fish, even as the spawning output declined to less than the overfished level (25% of the unfished spawning output) (Figure 14, Table 27). There is high variability in recruitments and even given that weak relationship between stock and recruitment, the 1999 and 2000 year classes were greater than twice the expected value.

Uncertainty and Sensitivity Analysis

Uncertainty was addressed through two methods: asymptotic variance estimates capturing parameter uncertainty within models and comparison of alternative model structures or assumptions regarding assumed parameter values for those quantities which could not be estimated in the model.

Asymptotic variance estimates for the base case model with 95% confidence intervals are displayed in Figure 28. As expected, there was higher variance in recruitments estimated at the beginning and end of the expected time interval (least amount of data).

Five sources of structural uncertainty were explored though models with alternate assumptions regarding: natural mortality: steepness of the stock-recruitment curve, growth, and selectivity and landings in the historic fisheries. The STAR panel requested most of these analyses (requests 1-4,8 in Table 28).

Natural Mortality

As shown in the likelihood profiling done for selection of a natural mortality value, low natural mortality resulted in greater spawning depletion and lower estimates of age 1+ biomass in 2005. Uncertainty, given the range of natural mortality from the last assessment (M=0.05) to the estimate in the recent literature (M=0.10), was greater than the uncertainty of the estimates within the Base Model (M=0.07)(Table 29).

Stock-Recruitment Steepness

As mentioned, recent work by Dorn (2002) indicated rockfish in general might have a stock-recruitment steepness parameter of 0.65, much lower than the 0.95 value in the Base Model. To test the effect of steepness, I fixed values at 0.6 to 0.9 in model G07 and compared the results (Table 30). Decreasing steepness reduced both the 2005 age 1+ biomass and the spawning depletion. The likelihood components showed a distinct split in the fit to changing steepness. The age composition and discard estimates fit best at the lowest steepness, but the length compositions, indices, and recruitment fit best at the highest value (0.95).

Growth

Uncertainty in growth was a result of two separate problems. The first problem was that the age compositions were subject to bias from ager and aging period. It appears that aging by Nichol (1990) and ager 1 in the later time period (2004) may be the unbiased standard, but that is uncertain. The second problem was that even given that those ages were unbiased, the model was not flexible enough to fit the resulting growth curve. The SS2 model assumes growth will fit the von-Bertanlaffy function. Darkblotched rockfish growth appears to have a different shape of growth curve. It is possible that the curve was distorted by growth changing over time, but Nichol (1990) aged fish in 1986 and his age-length relationship was nearly identical to that derived using fish aged in 2004, nearly 20 years later.

Putting both the 2004 shelf survey age and length compositions in the model supplied some information upon which to fit growth. This was especially true given the strong modes in the length composition. After growth slowed, however, there was little information on the ages of the larger fish. In addition, the shelf survey did not catch the largest of those fish. The result may be that the model underestimates the number of older fish and natural mortality fits the data best at a value greater than the true value.

To test the effect of leaving out the age compositions, I profiled Model C using natural mortality from 0.05 to 1.0 while fitting growth, as I did for Model G (Table 31). The earliest age compositions in that model were for the fishery. In those early years, the data all came from California, which has a large proportion of slope area. Those age compositions may therefore overestimate the percentage of older, larger fish in the coast wide landings. The fishery age compositions fit best at M=0.05. The shelf survey ages and all the length compositions fit best at M=0.10. As in the Model G profiling, reducing the estimate of natural mortality reduced the 2005 age 1+ biomass and spawning depletion. For a given value of natural mortality, the 2005 biomass and depletion levels were higher for Model C than for Model G, but as shown in Table 13, this is likely due more to the change in the AFSC slope survey index and length compositions than to the change in the age composition information.

To test the effect of not being able to fit growth for all ages, growth at age 1.7 and growth at age 40 were fixed at lower bounds (14 and 40.28 cm) and also at upper bounds (16 and 45.20 cm)(Table 32, Figure 31). This was done with the intention of bracketing growth over the entire range of ages. The growth parameter (k) and CV in length at age (constant across years and sexes) was still fit within those models. When growth at both ages was fit within the model, they fit the majority of the data, providing poor fits to the lengths for the youngest and oldest ages. Fixing those parameters at an upper extreme forced the model to better fit the growth curve to the oldest-aged fish in all the available data (Figure 31). This resulted in lower 2005 Age 1+ biomass and depletion, a worse fit to the length compositions but a better fit to the age composition. The lower sizes at age 1.7 and 40 increased the 2005 age 1+ biomass and depletion. The CV in length-at-age increased and the estimated stock-recruitment steepness parameter (0.6) was closer to the value in the literature. Fit to both the length and age compositions was degraded.

As a final sensitivity analyses regarding growth, the length composition lambdas were down-weighted from 1.0 to 0.5 for all data sources. This reduced their influence in the model relative to the other types of data, including the age compositions. The 2005 biomass and depletion results were very similar to those from the Base Model (Table 32). As would be expected, the fits to all the other types of data improved slightly.

Historic Fisheries

The foreign fishery darkblotched rockfish catch estimates in 1966-1968 were substantial. That fishery is believed to have used smaller mesh in those years than did the domestic fishery. The base model assumes, however that the fishery selectivity was constant from 1928-2002. If the small mesh used by the foreign fishery led to greater selection of small fish than indicated by that constant selectivity, then the fishing mortality of the larger fish was overestimated in the Base Model. Since there were no length compositions available for the foreign fishery, selectivity could not be fit separately for that fishery. Therefore, I assumed the ascending limb of the fitted AFSC slope survey selectivity, with asymptotic selectivity of the larger sizes, was applicable to the foreign fishery in 1966-1968. Although the survey net probably had smaller mesh than did the net used by the foreign fishery, differences in the model results were minimal (Table 32).

I also explored a range of landings estimates for the historic fisheries. Since landings before 1978 were uncertain, I added or subtracted 30% of the landings and reran the Base Model (Table 32). When landings were lower, the steepness of the stock-recruitment relationship was reduced to 0.65. Spawning output and depletion also went down.

Uncertainty in the proportion of older fish

All the sources of uncertainty explored could potentially affect the proportion of older fish in the estimated population. In the 2003 update model estimates, 12% of the fish in the population in 1970 were greater 40 years of age. In this assessment, there were lower estimates for the proportion of older fish (Figure 32). Comparing the sensitivity runs to the base model indicated the decrease in the proportion of older fish was primarily due to the increasing natural mortality from 0.05 to 0.07. Forcing growth to fit higher and lower sizes at age affected the proportion of older fish when recruitment was stochastic.

Retrospective Analysis

A retrospective analysis was not conducted for this assessment because doing so would remove the only age composition data (2004).

Historical Analysis

Assessments conducted in 2000 and 2003 and the 2005 Base Model had similar spawning depletion time series, but differences in the level of spawning output. Estimates of spawning biomass in the previous assessments were higher than the estimates in the 2005 Base Model (Figure 32).

To compare recruitment between models, the age-1 recruitments in the 2000 and 2003 assessments were converted to age-0 recruitments by assuming total mortality of 0.05. The recruitments estimated in the 2000 and 2003 assessments were similar. Unfished recruitment was somewhat higher in the Base Model (2,623,000 age-0 fish versus 2,023,000 age-0 fish in the 2003 model). Recruitment in the earlier assessments was allowed to be stochastic for the 1962-1967 year classes, and the estimates varied widely. In this assessment, I made those recruitments deterministic because there was little information in the data. Recruitments from 1996 – 2001 were similar in the 2003 and 2005 models. In both models, those recruitments were based primarily on length composition information. The only age information on those year classes in the 2003 assessment were partially selected 1996-1997 year classes in the 1998 shelf survey. For the period in which the 2003 assessment had age composition data but the 2005 model did not, the year class pattern tended to be 1-2 years different in the two assessments. The 2003 model, for instance, estimated that 1979 and 1994 were the strongest year classes in that time period, while the Base Model estimated they were strongest in 1980 and 1995. In the Base Model, the1980 year class was stronger than the 1999 year class, but in the 2003 assessment the 1999 and 2000 year classes were stronger than in any previous year's estimate.

Uncertainty Bracketed by Natural Mortality

The STAR panel determined that uncertainty should be expressed through different assumptions regarding natural mortality. The panel felt that the upper bound on M should be 0.09, rather than 0.10, so that the range was +/- 0.02 around the base value. The panel also determined that the values should be the given subjective ratings of: 0.09 and 0.05 – unlikely, and 0.07 likely. Uncertainty in this range is displayed in Figure 33.

Rebuilding parameters

The rebuilding parameters and a full rebuilding analysis will be included in a separate document.

Reference Points

Darkblotched rockfish has been declared overfished (i.e. spawning stock has been below 25% of the unfished level and is not yet above 40%) and is currently under a rebuilding plan (Rogers 2003). Since 2004, the Optimum Yield (OY) has been equivalent to the Allowable Biological Catch (ABC). This rebuilding harvest rate policy adopted by the Council was estimated to have a slightly greater than 90% probability of rebuilding the spawning stock by the maximum year allowed (2028). Rebuilding occurs when the spawning stock (S) reaches the target level, which is 40% of the unfished level (S40%). This is the default Pacific Fishery Management Council's proxy for S at which the maximum sustained yield (MSY) is obtained. The ABC is based on the default harvest rate policy for Sebastes (F50%). The spawning stock ratio (SPR) is ratio of fished to unfished spawning stock, assuming recruitment is equal to virgin recruitment and growth and maturity schedules are at the current state. Higher values therefore indicate a lower rate of fishing mortality. In this assessment, spawning stock (S) is quantified in terms of egg production, or spawning stock output. Reference points estimated using the base model, with lower and upper bounds from the model where natural mortality was assumed equal to 0.05 or 0.09 are in Table 33.

Because growth was allowed to vary in 1998, the reference points reported in Table 33 are based on two different estimates of size-at-age. The unfished spawning output and biomass are calculated using the estimated size-at-age prior to 1998. However, MSY yield, which is used to calculate the MSY exploitation rate, is based on size-at-age in 2005, which is affected by the slower growth occurring in 1998.

Harvest projections and decision tables

Harvest projections were made using two criteria (Table 34). Those were the ABC rate (F50%) and a constant harvest rate (total catch/available biomass) of approximately 0.032. The GMT and STAR panel requested the constant harvest rate, an approximation of the fishing mortality rate used to determine the 2004 OY (John DeVore, PFMC, pers.comm.). Since setting a constant harvest rate was not an option in the forecast part of the SS2 model, this was achieved by setting the OY/ABC ratio equal to the ratio between the F50% harvest rate and 0.032. To complete these forecasts, landings in 2005 and 2006 were assumed equal to the OYs already adopted for those years (269 mt and 294 mt, respectively), assuming a discard rate of 35.3% (M. Burden, pers.comm.). Actual catch was estimated in the models and varied slightly from the OY values. Fishery selectivity in 2005-2016 was assumed equal to the selectivity estimated for 2003-2004. These forecasts are primarily for informational purposes and are based on deterministic future recruitments. Actual OYs beginning in 2007 will be based on forecasts from updated rebuilding analyses, which allow for stochastic recruitment.

The STAR panel specified the decision table format. OY catches given assumed values of M = 0.05, 0.07, or 0.09 were forecasted using the constant harvest rate of 0.032. Those OY forecasts were then harvested under alternative true values of M (Table 35). If M actually is 0.07, the M=0.07 OY will rebuild the stock by 2013. At the extremes, if M actually is 0.05 and the OY is based on M=0.09, depletion would be at the overfished level (0.25) at the end of the time period. Likewise, if M actually is 0.09 and the OY is based on M=0.05, the stock will be rebuilt by 2008.

Research and Data Needs

The stock assessment of darkblotched rockfish could be improved if 1) fish ageing was further validated to allow for proper corrections due to ager and aging-time-period biases, 2) the model allowed more flexibility in fitting growth, 3) survey length compositions and indices were based on stratification designed to reduce noise or bias due to the infrequent large catches, 4) comparing genetics and life history of fish found in the Washington areas with consistently large survey catches versus those in Northern California could lead to better understanding of latitudinal changes in the stock, 5) if those issues are resolved and there still does not appear to be a split in the coast wide stock, separate north-south fisheries and growth should be explored in the model.

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The STAR panel reviewed this assessment and asked for additional information that made it more complete. The panel consisted of: Steve Ralston – NOAA Fisheries, SWFSC (Chair); Vivian Haist – Center for Independent Experts (outside reviewer); Bob Mohn – Center for Independent Experts (outside reviewer); Paul Spencer – NOAA Fisheries, AFSC; and Theresa Tsou – Washington Department of Fish & Wildlife. The PFMC representatives were: Merrick Burden – Groundfish Management Team (GMT) representative and Rod Moore – Groundfish Advisory Panel (GAP) representative.

LITERATURE CITED

Barss, W.H. and E.L. Niska. 1978. Pacific ocean perch (*Sebastes alutus*) and other rockfish (*Scorpaenidae*) trawl landings in Oregon 1963-1977. Oregon Department of Fish and Wildlife Informational Report 78-6. 5 p.

Dorn, M. 2002. Advice on west coast rockfish harvest rates from Bayesian meta-analysis of stock-recruit relationships. North Am. J. Fish. Manage. 22:280-300.

Eschmeyer, W.N., E.S. Herald, and H. Hammann. 1983. A field guide to Pacific coast fishes of North America. Houghton Mifflin Company Boston, Mass. 336 pp.

Fraidenburg, M., J.E. Smith, W.H. Barss, and T. Jow. 1977. Minimum estimates of the all nation removals, north american trawl species composition and cpue for "other rockfish" in the northeastern Pacific ocean. State of Washington Department of Fisheries Technical Report 34. 26 pp.

Gomez-Uchida, D. and M.A. Banks. In press. Microsatellite analyses of spatial genetic structure in darkblotched rockfish (*Sebastes crameri*): is pooling samples safe? CJFAS.

Gunderson, D.R., M. Zimmerman, D.G. Nichol, and K.Pearson. 2003. Indirect estimates of natural mortality rate for arrowtooth flounder (*Atheresthes stomias*) and darkblotched rockfish (*Sebastes crameri*). Fish. Bull. 101:175-182.

Hamel, O.S. 2005 draft. Length and age composition calculations for the NWFSC west coast survey of groundfish resources for the 2005 assessment season. Available from O.Hamel, NMFS, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. 3 pp.

Helser, T.E., I.J. Stewart, C. Whitmire, and B. Horness. 2005 draft. Model-Based Estimates of Abundance for 11 species from the NMFS slope surveys. Available from T. Helser, NMFS, NWFSC, 2725 Montlake Blvd.E., Seattle, WA 98112. 142 pp.

Hannah, R.W., S.J. Parker, and Troy V. Buell. 2005. Evaluation of a selective flatfish trawl and diel variation in rockfish catchability as bycatch reduction tools in the deepwater complex fishery off the U.S. West Coast. 41 p.

Lauth, R.R., M.E.Wilkins, and P.A.Raymore Jr. 1997. Results of Trawl Surveys of groundfish resources of the west coast upper continental slope from 1989 to 1993. NOAA Tech. Memo. NMFS-AFSC-79.

Lenarz, W.H. 1993. An initial examination of the status of the darkblotched rockfish fishery off the coasts of California, Oregon, and Washington. Appendix C in Appendices to the status of the Pacific coast groundfish through 1993 and recommended acceptable biological catches for 1994. 22 p.

Love, M.S., M.Yoklavich, and L.Thorsteinson. 2002. The rockfishes of the northeast Pacific. University of California Press, Berkeley, CA, 404 pp.

Lynde, Marcelle Van Houten. 1986. The historical annotated landings (HAL) database: documentation of annual harvest of groundfish from the northeast Pacific and eastern Bering Sea from 1956-1980. NOAA Tech. Memo. NMFS-F/NWC103, 197 p.(data available from PacFIN, 7600 Sandpoint Way N.E., Bldg. 4, Seattle, WA. 98115.)

Methot, R.D. 1990. Synthesis model: an adaptable framework for analysis of diverse stock assessment data. INPFC Bull. 50:259-277.

Methot, R.D. 2005 a. Technical description of the Stock Synthesis II assessment program Version 1.17. Available from Richard Methot, NOAA Fisheries, Seattle, WA. 54 p.

Methot, R.D. 2005 b. User Manual for the assessment program Stock Synthesis 2 (SS2), Version 1.19. Available from Richard Methot, NOAA Fisheries, Seattle, WA. 47 pp.

Methot, R. and J.B. Rogers. 2001. Rebuilding analysis for darkblotched rockfish. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97201.

Nichols, D. 1990. Life history examination of darkblotched rockfish (Sebastes crameri) off the Oregon coast. M.S. Thesis. Oregon State University, Corvallis, OR. 124 pp.

Nitsos, R.J. 1965. Species composition of rockfish (family Scorpaenidae) landed by California otter trawl vessels, 1962-1963. Pac. Mar. Fish Comm. Rpt. (17): 55-60.

PFMC. 1992. Status of the Pacific Coast Groundfish Fishery through 1992 and Recommended Acceptable Biological Catches for 1993. Pacific Fishery Management Council, 2000 SW First Ave., Portland, OR 97201.

Ramsey, T.B., T.A.Turk,E.L.Fruh, J.R.Wallace, B.H.Horness, A.J.Cook, K.L.Bosley, D.J.Kamikawa, LawrenceC.Hufnagle, and K.Piner. The 1999 Northwest Fisheries Science Center Pacific west coast upper continental slope trawl survey of groundfish resources. NOAA Tech.Memo. NMFS-NWFSC-55.

Rogers, J.B. 1994. Assemblages of groundfish caught using commercial fishing strategies off the coasts of Oregon and Washington from 1985-1987. PhD Thesis. Oregon State University, Corvallis, OR. 134 p.

Rogers, J.B., R.D. Methot, T.L. Builder, K. Piner, and M. Wilkins. 2000. Status of the Darkblotched Rockfish (*Sebastes crameri*) Resource in 2000, appendix to Status of the Pacific coast groundfish fishery through 2000 and recommended acceptable biological catches for 2001.

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 management in 1997. Appendix E in Status of the Pacific Coast Groundfish Fishery through 1996 and Recommended Acceptable Biological Catches for 1997, Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council, 2000 SW First Ave., Portland, OR 97201.

Rogers, J.B. and E.K. Pikitch. 1992. Numerical definition of groundfish assemblages caught off the coasts of Oregon and Washington using commercial fishing strategies. Can. Journ. Fish. Aquat. Sci. 49(12): 2648-2656.

Shaw, W. and C.P. Archibald. 1981. Length and age data of rockfishes collected from B.C. coastal waters during 1977, 1978, and 1979. Can. Data Rep. Fish. Aquat. Sci. 289. 119 p.

Tagart, J.V. 1985. Estimated domestic trawl rockfish landings, 1963-1980. Unpubl.manuscr.and data. Wash. Dep.Fish. (Available in HAL database documents held by PacFIN, 7600 Sandpoint Way N.E., Bldg. 4, Seattle, WA. 98115.)

Westrheim, S.J. 1975. Reproduction, maturation, and identification of larvae of some Sebastes (Scorpaenidae) species in the northeast Pacific Ocean. J. Fish. Res. Board Can. 32: 2399-2411.

Wilkins, M.E. and J.T. Golden. 1983. Condition of the Pacific ocean perch resource off Washington and Oregon during 1979: Results of a cooperative trawl survey. North Am. Journ. Fish. Man. 3:103-122.

Zimmerman, M. 2001. Retrospective analysis of suspiciously small catches in the National Marine Fisheries Service west coast triennial bottom trawl survey. AFSC Processed Rep. 2001-03, 135 p. Alaska Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE., Seattle, WA 98115

Zimmerman, M, M.E.Wilkins, R.R. Lauth, and K.L.Weinberg. 1994. The 1992 Pacific coast bottom trawl survey of groundfish resources: Estimates of Distribution, abundance, and length composition. NOAA Tech.Memo.NMFS-AFSC-42.

Table 1. Summary of important management regulations that affected the catch of darkblotched rockfish before the year 2000. The information is taken from more detailed tables in Rogers 2003 (Table C-1) and Rogers 2000 (Table 1).

Fishery	Management Unit	Date	Regulation
Foreign	Sebastes and Sebastolobus	1966-1975	Increasing amounts of areas closed to directed fishery
		11/1968	No directed fisherysouth of 48 ^{0} 10' N latitude Minimum mesh size 2.4-2.8 inches in hake fishery
		1973	No directed fishery south of 50 ^{0} 30' N latitude
		1975	Incidental only, catch limits (2500 mt coastwide) Bottom trawling prohibited in 47^{0}45'-48^{0}30' and south of 38^{0}10.
Domestic	Sebastes Complex	1983	Landings limits, weekly limits north of 43^{0} N latitude
		1992	Two week landings limits coastwide Minimum codend mesh size 4.5 inches (for roller gear north of 30^{0}30' N latitude)
		1994	Monthly landings limits coastwide Minimum mesh size of 4.5 inches applied to entire net
		1998	Two month landings limits coastwide

Table 2. Recent management regulations affecting darkblotched rockfish. Cumulative two month limited entry landings limits (lbs) are for trawl slope rockfish complex by north versus south areas (above 36-38 ^{0} N latitude). Limits N of $40^0 10'$ do not include Pacific ocean perch, those to the south do not include splitnose rockfish. RCA = Rockfish Conservation Area, an area closed to trawling whose depth boundaries can change with season and cumulative limit period. * = no retention of darkblotched rockfish allowed coastwide

Area	**Year**	**Period**	**Landings(lbs)**	**RCA Depth (fm)**		
				min	**max**	**Sm. Footrope**
N of $40^0 10'$	2000	Jan-Dec	3000			for shelf rockfish
		Jul-Oct	5000			for shelf rockfish
		Nov.-Dec	3000			for shelf rockfish
	2001	Jan-Jun	1500			for shelf rockfish
		Jul-Oct 1	2000			for shelf rockfish
		Oct 2-Dec	0			for shelf rockfish
	2002	Jan-Aug	1800			
		Sep	600	0	250	
		Oct	600	100	250	shoreward of RCA
		Nov.-Dec	1800	100	250	shoreward of RCA
	2003	Jan-Dec	1800	0-100	200-250	shoreward of RCA
	2004	Jan-Apr	4000	60-75	200	shoreward of RCA
		May-Sep	8000	60-75	150	shoreward of RCA
		Oct	*8000	0	250	shoreward of RCA
		Nov.-Dec	*1800	0	250	shoreward of RCA
S of $40^0 10'$	2000	Jan-Jun	3000			
		Jul-Aug	7000			
		Sep-Dec	20000			
	2001	Jan-Jun	14000			
		Jul-Dec	25000			
$40^0 10'$-36^0	2002	Jan-Apr	50000			
		May-Aug	5000			
		Sep	600	0	250	
		Oct	600			
		Nov.-Dec	1800			
$40^0 10'$-38^0	2003	Jan-Dec	1800	0-60	200-250	shoreward of RCA
	2004	Jan-Apr	7000	75	150	shoreward of RCA
		May-Sep	50000	75-100	150	shoreward of RCA
		Oct	*50000	75	150	shoreward of RCA
		Nov-Dec	*10000	0	200	shoreward of RCA

Sources:

Table 3. Management performance for U.S. West Coast darkblotched rockfish. From 1997-2000, darkblotched rockfish was managed as part of a group of species with a combined Allowable Biological Catch (ABC) and Optimum Yield (OY). In 2001-2004, the individual species (OY) was the management goal. Catch and landings are in metric tons. Landings are taken from PacFIN as of 4/12/05. Actual discard rate are based on observer and logbook data (West Coast Groundfish Observer Program). Assumed discard in 2003 is from Merrick Burden (pers. comm.). 2004 estimates for ABC and OY are from Federal Register.

Year	**Goals**					**Actual**		
	Catch		**Discard**		**Landings**	**Landings**	**Discard**	**Catch**
	ABC	**OY**	**%**	**mt**	**OY**		**%**	
1997	256					747		
1998	256					842		
1999	256					359		
2000	256					226	32%	369
2001	302-349	130	16%		109	161	41%	271
2002	187	168	20%		135	103	46%	202
2003	205	172		20		80	45%	146
2004	240	240				204		
2005	240	122						

Table 4. Estimates of darkblotched rockfish landings from 1928-1977 for foreign fleets (Rogers 2003) and domestic fleets by state - see footnotes.

Year	California	Oregon	Washington	Foreign	Total
1928	1	0	0		1
1929	2	0	0		3
1930	2	0	0		3
1931	1	0	0		1
1932	1	0	0		1
1933	1	0	0		1
1934	1	0	0		2
1935	2	0	0		2
1936	2	0	0		2
1937	1	1	0		2
1938	5	1	0		5
1939	7	0	0		7
1940	5	2	0		8
1941	4	5	0		9
1942	2	7	0		10
1943	12	26	0		39
1944	48	43	0		91
1945	101	133	2		236
1946	76	83	1		160
1947	48	52	1		100
1948	122	35	3		160
1949	98	72	1		171
1950	119	80	2		201
1951	158	101	2		261
1952	86	107	2		195
1953	106	86	2		194
1954	99	100	2		201
1955	95	100	2		197
1956	102	136	7		244
1957	130	135	4		269
1958	126	114	6		246
1959	108	130	5		243
1960	100	151	7		258
1961	53	142	8		203
1962	55	213	7		276
1963	107	208	8		323
1964	50	150	8		208
1965	67	340	8		415
1966	55	259	8	3807	4129
1967	45	242	8	2706	3001
1968	55	7	8	2288	2358
1969	65	27	11	153	256
1970	77	33	6	149	265
1971	91	63	9	278	441
1972	111	107	3	374	595
1973	1	58	9	768	836
1974	253	110	24	346	733
1975	66	99	109	293	567
1976	136	248	72	118	574
1977	120	98	45		263

Table 4.(continued) Footnotes

CA
Rockfish landings
1928-1959,1976-1977 by region from CDFG Fish Bulletins.
1960-1961 by INPFC area (Fraidenburg et al. 1977)
Proportions used in allocation
1962-1963 averages for major ports (Nitsos 1965) applied to region landings
1/4 averages used in 1928-1947, full in 1948-1959
1962-1963 averages for INPFC areas (Fraidenburg et al. 1977) applied to INPFC landings
1973-1975 averages by INPFC areas (Fraidenburg et al. 1977) applied to region landings 1976-1977
1964-1972 = linear linterpolation of percents by INPFC using 63,63,73-75 percents.
1962-1963, 1973-1975 Fraidenburg et al. (1977)

OR
Rockfish landings
1928-1949 Cleaver, F.C.(editor), Fisheries Statistics of Oregon (1951)
1950-1953 Smith (1956)
1956-1962 Lynde (1986)
Proportions used in allocation
proportion rockfish to PFMC area, proportion darkblotched 1963-1965 averages (Barss and Niska 1978)
1956-1962, rockfish catch already by PFMC area
1/4 the proportions applied in 1928-1944, 1/2 in 1945-1948, full 1949-62
1963-1977 Tagart (1985)

WA
Rockfish landings
1930-1949 Pacific Fisherman Yearbook (1950)
1956-1962 PFMC 3B (Lynde 1986)
Proportions used in allocation
proportion rockfish to PFMC area 1965-1967 averages (Tagart 1985)
proportion darkblotched 1963-1965 averages (Barss and Niska 1978)
1969-1977 Tagart (1985)

landings in borders are assumed from adjacent landings

Table 5. Darkblotched rockfish west coast U.S. landings estimates by State from 1978-2004. Oregon 1981-1982 landings were taken from a database supplied by J.Tagart in 1995 because the PacFIN database had no Oregon darkblotched rockfish landings estimates for 1981 and minimal landings for 1982.

Year	California	Oregon	Washington	Other	Total
1978	58	163	189		410
1979	159	752	81		992
1980	164	294	98		557
1981	524	352	37	24	912
1982	170	920	24	1	1114
1983	509	407	22		938
1984	595	585	82	5	1268
1985	801	848	111	8	1769
1986	409	623	215	5	1252
1987	1626	682	68	10	2386
1988	749	789	108	4	1650
1989	439	737	91	3	1271
1990	867	766	16		1650
1991	332	775	54		1161
1992	187	456	20		663
1993	285	892	9		1186
1994	292	549	9		850
1995	366	337	28		732
1996	408	302	19		730
1997	452	297	22		771
1998	497	342	20		859
1999	113	227	10		350
2000	112	131	9		252
2001	87	66	8		161
2002	51	52	7		109
2003	12	66	2		80
2004	47	138	7		192

Sources:

PacFIN	4/4/05	CA 1981-2004,OR 1983-2004, WA 1981-2004
Cal Com	4/4/05	CA 1978-1980
Tagart (1985)	(1985)	OR, WA 1978-1980
Tagart (pers comm)	1995	OR 1981-1982

Table 6. Available estimates and data summaries discard rates and mean individual body weight for darkblotched rockfish discard in the California, Oregon, and Washington trawl fishery.

Year	Logbook,Observer		Observer only		Used in Assessment			
	rate	weight (ave kg)	rate	weight (ave kg)	rate	cv	weight (ave kg)	cv
2000	32%				32%	0.3		
2001	41%				41%	0.3		
2002	46%	0.52	52%	0.65	46%	0.3	0.52	0.3
2003	45%	0.73	51%	0.70	45%	0.3	0.73	0.3
2004			15%	0.74	15%	0.3		

Notes:
2002-03 area estimated using year specific observer data.
For 2000-2001, observer data from all years are pooled and applied to logbook data for those years.
2004 can't be estimated at this time because depth data were not keypunched for Oregon.
Observer data for 2004 are available only through August.
Observer data size discard is average across tows, weighted by amount discarded.
The All-depth average weight is obtained by weighting depth-interval average weights by the proportion of all-depth discard tonnage estimated for each interval.
size used for 2000 and 2001 is based on ratio of 2001 to 2002 in observer data
size used for 2004 is based on ratio of 2004 to 2003 in observer data

Table 7. Comparison of parameter estimates used in the 2000-2003 assessments versus those derived for this assessment. The estimates in boxes were derived from equations in Nichol (1990). In 2000, growth parameters were calculated using all available survey and fishery data, except for fish less than age 8 which were caught with groundfish trawls (due to bias from large mesh selectivity). In 2005, growth curve parameters were estimated using fish aged in 2004 which were collected in the surveys and shrimp fishery, and in the age range of 1-40 years. The cv in length at age 1.7 in 2005 was estimated using shrimp fishery data. The cv at age 40 was estimated using all data aged in 2004. The 2005 weight-at-age parameters were calculated using all available survey data.

Life History Parameters	2000	2005
Female growth		
Size (cm) at age 1.7	14.92	11.79
Size (cm) at age 40	41.70	42.93
k	0.16	0.20
Cv in Length at age 1.7	0.10	0.06
Cv in Length at age 40	0.07	0.06
Male growth		
Size (cm) at age 1.7	14.33	11.82
Size (cm) at age 40	37.40	37.88
k	0.21	0.25
Cv in Length at age 1.7	0.08	0.06
Cv in Length at age 40	0.04	0.06
Female Biology		
maturity at length - logistic inflection	34.59	34.59
maturity at length - logistic slope	-0.64	-0.64
eggs/km-at-body weight - intercept	0.11	0.15
eggs/km at body weight -slope	1.48	1.33
Weight at Length-Both Sexes		
coefficient	0.00	0.00
exponent	3.03	2.96

Table 8. Summary of available darkblotched rockfish ages for fisheries and surveys in the assessment. Agers 1-4 are associated with the Newport, Oregon aging laboratory.

Year aged	Source	Sample Years	Ager	# Aged
1990	OR fishery	86,87	Nichol (1990)	1060
1996	Shelf Survey	83,86,95	Agers 2, 3	984
1997	CA fishery	87,88	Agers 3, 2	1441
2000	CA fishery	77,78,80,82,90,93,95,96,97	Ager 2	2534
2000	OR fishery	99	Ager 1	171
2000	Shelf Survey	98	Ager 2	467
2001	Slope-AFSC	2000	Ager 2	114
2001	Slope-NWFSC	2000	Ager 2	320
2002	CA fishery	2000-2002	Agers 1, 2, 4	1202
2002	OR fishery	97, 2001, 2002	Agers 1, 2, 4	1380
2002	Slope-AFSC	2001	Ager 1	155
2002	Slope-NWFSC	2001-2002	Agers 2,1, 4	1186
2002	Shelf Survey	2001	Agers 2, 1	1031
2002	WA fishery	2002	Agesr 1, 4	339
2001-2002	OR fishery	2000	Agers 1, 2	466
2004	CA fishery	83,94,2003	Ager 1	1237
2004	WA fishery	2003	Ager 1	370
2004	OR fishery	2002-2003	Ager 1	243
2004	Shelf Survey	2004	Ager 1	1143
2004	Slope-NWFSC	2003-2004	Ager 1	1018

Table 9. Comparison of mean fork length (cm)/ age adjusted for month the fish was caught for age 5-6 fish by ager, data source (agency), and year aged. Shaded lines are for original age values less than 5.0. Re-aging was by Ager1 in 2003. *Not all AFSC shelf fish aged in 1996 were re-aged.

Ager	Source	Year Collected	Year aged	Age 5 # fish	Age 5 len/age	Ager 1 Reaged
2	AFSC shelf	1995	1996	139	5.1	5.4
2	AFSC slope	1984	1996	81	5.0	
3	CA	1987-1988	1997	31	5.5	
2	AFSC shelf	1998	2000	36	4.7	6.5
1	AFSC shelf	1998	2000	45	4.5	7
1	CA		2000	28	4.8	
2	CA		2000	55	5.2	
1	OR		2000	6	4.8	
2	NWFSC slope		2001	88	5.1	
2	AFSC slope		2001	35	4.7	
1	AFSC shelf		2002	75	5.4	5.1
2	AFSC shelf		2002	27	5.3	5.1
1	AFSC slope		2002	23	5.5	
1	NWFSC slope		2002	103	5.5	
2	NWFSC slope		2002	12	5.3	
4	NWFSC slope		2002	47	5.3	
1	CA		2002	88	5.4	
2	CA		2002	79	5.6	
4	CA		2002	89	5.4	
1	OR		2002	397	5.7	
2	OR		2002	77	5.7	
4	OR		2002	12	5.6	
1	W		2002	25	5.5	
4	W		2002	70	5.2	

Table 10. Comparison of the smallest two modes in the length compositions from AFSC shelf survey samples. Age is assumed to be 1 for the smallest mode and 2 for the next mode. The age is adjusted for average date of capture. Gear temp is the yearly average water temperature at the depth of the gear, weighted by the size (kg) of the darkblotched rockfish catch.

Year	Mode 1	age	Mode 2	age	gear temp
	fl (cm)	years	fl (cm)	years	^{0} C
1980	13	1.73	19	2.73	7.26
1983	13	1.71	18	2.75	7.91
1986	14	1.74	19	2.82	6.75
1989	14	1.74	19	2.73	7.06
1992	14	1.78	20	2.80	7.56
1995	14	1.67	19	2.66	6.69
1998	12	1.63	17	2.63	7.12
2001	13	1.66	19	2.63	6.79
2004	14	1.61	19	2.59	7

Table 11. Description of U.S. west coast surveys used to derive indices of relative abundance in past or present assessments of darkblotched rockfish.

Survey	Year	Vessel	Dates	Latitudes	Depths	Net	Gear	Knots	Min	Perio	Len	Age
Shelf (Triennial)	1977	P.Raider/Tor./Com./D.S. Jordan	7/4-9/27	34°00'-Border	50-250	nylonN	roller	3	30	day	Y	N
	1980	Pat San Marie/Mary Lou	7/12-9/28	36°48'-49°15'	30-200	nylonN	roller	3	30	day	Y	Y
	1983	WarriorII/Nordfjord	7/7-10/3	36°48'-49°15'	30-200	nylonN	roller	3	30	day	Y	Y
	1986	Alaska/Pat San Marie	7/9-9/30	36°48'-Border	30-200	nylonN, polyN	roller	3	30	day	Y	Y
	1989	Pat San Marie/Alaska	7/7-9/29	34°30'-49°40'	30-200	polyN	roller	3	30	day	Y	N
	1992	Alaska/Green Hope	7/12-10/7	34°30'-49°40'	30-200	polyN	roller	3	30	day	Y	N
	1995	Alaska/Vesteraalen	6/8-9/6	34°30'-49°40'	30-275	polyN	roller	3	30	day	Y	Y
	1998	Dominator/Vesteraalen	6/1-8/9	34°30'-49°40'	30-275	polyN	roller	3	30	day	Y	Y
	2001	Sea Storm/Frosti	6/1-8/27	34°30'-49°40'	30-275	polyN	roller	4	30	day	Y	Y
	2004	Morning Star/Vesteraalen	5/26-7/28	34°30'-Border	30-275		roller	4	30	day	Y	Y
P.o.p	1979	C. Horizon-Wash./New Life-Or.	4/18-5/2	44°37'-Border	90-260	nylonN,400E,mys	roller	3	30	day	Y	N
	1985	Marathon	4/3-5/28	44°37'-Border	90-260	nylonN	roller	3	30	day	Y	N
Slope	1988	Miller Freeman	11/28-12/14	44°05'-45°30'	100-700	polyN	mudsweep	2	30	24 hr	Y	N
	1990	Miller Freeman	10/26-11/15	40°30'-43°00'	100-700	polyN	mudsweep	2	30	24 hr	Y	N
	1991	Miller Freeman	10/21-11/18	38°20'-40°30'	100-700	polyN	mudsweep	2	30	24 hr	Y	N
	1992	Miller Freeman	10/17-11/12	45°30'-Border	100-700	polyN	mudsweep	2	30	24 hr	Y	N
	1993	Miller Freeman	10/14-11/8	43°00'-45°30'	100-700	polyN	mudsweep	2	30	24 hr	Y	N
	1995	Miller Freeman	10/30-11/16	40°30'-43°00'	100-700	polyN	modmudsw	2.3	30	24 hr	Y	N
	1996	Miller Freeman	10/28-11/13	43°00'-Border	100-700	polyN	modmudsw	2.3	30	24 hr	Y	N
	1997	Miller Freeman	10/20-11/25	34°30'-Border	100-700	polyN	modmudsw	2.3	30	24 hr	Y	N
	1999	Miller Freeman	10/14-11/19	34°30'-Border	100-700	polyN	modmudsw	2.3	30	24 hr	Y	N
	2000	Miller Freeman	10/10-11/9	34°30'-Border	100-700	polyN	modmudsw	2.3	30	24 hr	Y	Y
	2001	Miller Freeman	10/12-11/8	34°30'-Border	100-700	polyN	modmudsw	2.3	30	24 hr	Y	Y
NWFSC slope	1999	S.Eagle,C.Jack,M.Leona, B.Horizon	7/3-9/24	35°-48°10'	100-700	Olivine twine	Aberdeen	2.2	15	day	N	N
	2000	S.Eagle,C.Jack,Excalibur,C.Pride	7/3-9/23	35°-48°07'	100-700		Aberdeen	2.2	15	day	Y	Y
	2001	S.Eagle,C.Jack,Excalibur,L.Stalker	7/2-9/28	35°-48°08'	100-700		Aberdeen	2.2	15	day	Y	Y
	2002	S.Eagle,C.Jack,Excalibur,M.Julie	6/25-9/24	32°51'-48°07'	100-700		Aberdeen	2.2	15	day	Y	Y
NWFSC shelf-slope	2003	B. Horizon,C.Jack,Excalibur,M.Julie	6/24-10/23	32°34'-48°27'	13-734		Aberdeen	2.2	15	day	Y	Y
	2004	BJ Thomas,Excalibur,Ms.Julie	5/27-10/16	32°35'-48°22'	29-781		Aberdeen	2.2	15	day	Y	Y

Table 12. Survey biomass indices (mt) and standard deviation of log(index) [sqrt(Log(1+coefficient of variation squared)](in parenthesis) for darkblotched rockfish.

Year	**Survey**							
	AFSC Shelf		**AFSC P.o.p.**		**AFSC Slope-GLM**		**NWFSC Slope-GLM**	
	$36^0$48'-US Border 30-200 fm		**$44^0$70'-$47^0$30' 90-260 fm**		**36^0-U.S. Border 100-700 fm**		**$34^0$30-U.S. Border 100-700 fm**	
1977	3474	(0.12)						
1979			4555	(0.21)				
1980	5467	(0.26)						
1983	9281	(0.29)						
1985			4982	(0.17)				
1986	7436	(0.31)						
1989	3467	(0.18)						
1991								
1992	6854	(0.42)			764	(0.23)		
1993								
1995	5085	(0.57)						
1996					359	(0.26)		
1997					753	(0.59)		
1998	2560	(0.18)						
1999					453	(0.38)	687	(0.26)
2000					610	(0.47)	960	(0.31)
2001					904	(0.66)	617	(0.32)
2002							946	(0.35)
2003							4155	(0.38)
2004							1343	(0.35)

Table 13. Comparison of survey hauls with cpue of darkblotched rockfish greater than 130 kg/ha. Each line represents one haul.

Agency	**Type**	**Year**	**Strata**	**Cpue**	**Depth**	**Latitude**	**Mean Length (cm)**	
			(ha)	**(kg/ha)**	**(fm)**	**^{0} N**	**Haul**	**Survey**
AFSC	P.o.p	1979		217	112	47.2	29	31
				145	150	46.0	38	
		1985		377	105	47.2	24	29
				315	114	47.2	25	
				187	122	47.2	27	
				179	133	44.9	30	
				160	150	46.3	35	
				132	133	47.7	n/a	
	Shelf	1983	1123	382	163	43.1	39	25
		1986	62.08	291	113	47.2	28	26
		1992	2119	225	120	46.4	27	25
		1995	6014	279	184	45.1	38	25
		2001	125	171	109	47.8	33	27
	Slope	1992	389179	140	134	46.7	28	28
NWFSC	Slope	2000	389179	383	161	43.0	39	29
				192	107	47.3	29	
		2003	389179	590	126	47.3	35	29
			198426	343	197	40.2	41	
			389179	191	151	46.7	37	
			389179	137	171	45.1	38	

Table 14. Length compositions for darkblotched rockfish. Sex 1=males, 2=females, 3 both. Samp is the number of hauls or trips sampled. Adj.# = #fish*sqrt(#samples)/sqrt(20)) or assumed boundary (100 or 200), whichever is less.

Source	Year	sex	Fish	Samp	adj #	Lower Limit of Length Bin (cm)																
						6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
fishery	1978	2	263	26	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1979	2	86	11	64	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1980	2	221	33	100	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	0.5	0.0	0.0	0.0
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1981	2	198	30	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1982	2	759	59	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1983	2	792	115	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
fishery	1984	2	1995	162	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1985	2	3167	208	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
fishery	1986	2	2437	145	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1987	2	2704	124	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
fishery	1988	2	1337	92	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1989	2	1107	92	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source	Year	sex	23	24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51+
fishery	1978	2	0.0	0.0	0.9	1.9	4.2	2.3	2.7	2.3	2.7	3.4	6.5	7.6	6.5	6.8	6.5	4.9	0.0	0.4	0.0	0.0
fishery		1	0.0	1.1	1.4	0.8	0.0	2.7	0.4	0.4	2.3	2.3	5.3	12.2	8.0	3.0	0.8	0.0	0.0	0.0	0.0	0.0
fishery	1979	2	0.0	0.0	0.0	0.0	1.2	1.2	0.0	3.1	3.5	4.7	5.8	7.0	4.7	4.7	1.2	3.5	2.3	0.0	0.0	0.0
fishery		1	0.0	0.0	0.0	0.0	1.2	1.2	2.3	1.6	1.2	3.5	10.5	2.3	16.3	10.5	3.5	2.3	1.2	0.0	0.0	0.0
fishery	1980	2	0.5	0.0	0.5	0.0	0.9	2.7	1.4	1.2	4.1	4.2	7.4	7.6	7.0	6.3	6.3	5.0	1.4	0.9	0.0	0.9
fishery		1	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.6	1.8	5.3	8.9	12.8	7.9	2.3	0.5	0.0	0.0	0.0	0.0	0.0
fishery	1981	2	0.0	0.0	0.5	0.5	0.5	0.3	0.0	0.5	0.5	1.0	3.0	4.5	9.3	17.2	16.1	9.6	5.1	0.5	0.0	0.0
fishery		1	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	1.0	3.0	9.6	10.4	5.6	0.5	0.0	0.0	0.0	0.0	0.0
fishery	1982	2	0.0	0.0	0.1	0.2	0.3	0.1	0.4	0.4	1.2	1.3	4.4	7.0	15.3	14.8	9.4	5.0	2.5	0.1	0.3	0.0
fishery		1	0.1	0.1	0.1	0.1	0.2	0.4	0.7	0.2	1.3	1.9	6.4	15.6	6.9	2.1	0.4	0.2	0.0	0.0	0.1	0.0
fishery	1983	2	0.0	1.1	0.8	1.4	1.5	1.4	0.9	0.6	2.1	1.6	2.9	5.8	8.2	9.7	10.2	5.7	2.3	0.4	0.3	0.1
fishery		1	0.1	0.4	0.5	0.8	0.9	1.3	1.1	1.6	0.9	1.5	5.4	9.1	10.4	5.4	2.4	0.5	0.3	0.0	0.1	0.1
fishery	1984	2	0.0	0.2	0.1	0.4	0.7	1.3	1.4	2.1	1.4	1.5	3.1	6.8	13.5	10.6	9.3	9.0	6.8	1.3	0.0	0.0
fishery		1	0.0	0.0	0.2	0.5	0.4	1.0	1.6	1.1	1.3	2.3	6.4	7.3	5.0	2.4	0.9	0.1	0.0	0.0	0.0	0.0
fishery	1985	2	0.2	0.1	0.2	0.5	0.8	0.8	1.4	2.2	2.3	4.2	8.2	9.2	7.0	5.6	4.5	2.4	1.3	0.6	0.5	0.1
fishery		1	0.1	0.1	0.3	0.6	0.6	0.9	1.5	1.9	2.3	3.6	9.4	12.1	6.3	2.9	1.9	1.1	0.9	0.5	0.5	0.1
fishery	1986	2	0.0	0.0	0.1	0.5	0.5	0.8	1.9	2.3	3.9	6.6	8.5	6.4	6.1	7.1	6.2	1.8	0.7	0.1	0.0	0.0
fishery		1	0.0	0.1	0.4	0.3	0.9	1.5	1.4	4.7	4.5	5.8	8.9	9.9	5.2	2.3	0.2	0.0	0.0	0.0	0.0	0.0
fishery	1987	2	0.2	0.0	0.1	0.2	0.1	0.5	0.9	1.7	2.5	4.4	9.1	9.5	8.1	5.2	2.7	1.2	0.4	0.1	0.0	0.0
fishery		1	0.1	0.0	0.1	0.2	0.3	0.4	1.3	3.3	4.1	8.0	14.0	12.2	6.2	1.7	0.4	0.1	0.0	0.0	0.0	0.0
fishery	1988	2	0.0	0.1	0.0	0.3	0.4	0.4	0.5	1.0	1.0	3.2	10.2	11.4	8.8	7.7	3.7	1.0	0.2	0.1	0.0	0.0
fishery		1	0.0	0.0	0.1	0.5	0.4	0.7	0.9	1.3	1.8	5.4	15.2	13.7	7.3	2.2	0.2	0.1	0.0	0.0	0.0	0.0
fishery	1989	2	0.0	0.3	0.2	0.7	0.3	1.0	1.1	1.3	1.7	3.2	8.5	12.4	7.9	6.1	4.5	2.3	0.8	0.0	0.0	0.0
fishery		1	0.1	0.1	0.1	0.9	0.6	0.6	1.0	1.0	2.5	4.9	13.7	12.6	6.8	2.4	0.3	0.0	0.0	0.1	0.0	0.0

Table 14. (Continued) Length compositions for darkblotched rockfish.

Source	Year	sex	Fish	Samp	adj #	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
						Lower Limit of Length Bin (cm)																
fishery	1990	2	973	92	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1991	2	964	77	100	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	0.1
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
fishery	1992	2	429	49	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1993	2	566	56	100	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	0.4	0.0	0.2	0.1
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1
fishery	1994	2	795	53	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
fishery	1995	2	975	60	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
fishery	1996	2	2097	132	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
fishery	1997	2	2142	112	100	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	0.1
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
fishery	1998	2	2244	121	100	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	0.1
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4
fishery	1999	2	1543	79	100	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	0.2	0.5
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3
fishery	2000	2	2055	88	100	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
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
fishery	2001	2	3082	127	100	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	0.1	0.1	0.1
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0

Table 14. (Continued) Length compositions for darkblotched rockfish.

			23	24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51+
fishery	1990	2	0.0	0.0	0.2	0.6	0.7	2.2	0.6	1.1	2.5	3.8	8.0	8.2	10.6	5.6	3.1	4.7	1.6	0.7	0.5	0.0
fishery		1	0.0	0.0	0.1	0.1	0.2	0.4	2.5	3.5	3.2	3.8	12.6	9.5	6.8	2.1	0.5	0.1	0.0	0.0	0.0	0.0
fishery	1991	2	0.1	0.1	0.8	0.3	0.4	0.9	0.9	1.4	1.0	1.1	3.6	7.5	11.7	10.1	6.7	7.4	5.2	2.3	0.3	0.0
fishery		1	0.3	0.1	0.3	0.7	0.7	0.5	0.6	1.3	0.7	2.4	9.9	10.5	5.5	2.9	1.1	0.4	0.0	0.0	0.0	0.0
fishery	1992	2	0.0	0.5	0.5	0.7	0.7	1.4	0.8	2.2	2.2	3.3	4.0	7.2	8.7	10.7	7.7	4.2	0.9	0.2	0.0	0.0
fishery		1	0.0	0.5	0.0	0.5	1.2	1.2	2.5	2.5	2.5	1.9	7.4	11.7	8.3	2.6	0.9	0.3	0.5	0.0	0.0	0.0
fishery	1993	2	0.4	0.4	0.0	0.9	0.6	1.1	1.8	4.0	2.7	2.7	4.2	7.4	6.7	6.2	3.0	1.1	0.5	0.4	0.2	0.0
fishery		1	0.1	0.0	0.5	0.0	1.2	2.7	1.4	4.5	3.3	6.0	13.3	13.4	5.9	1.7	1.1	0.0	0.0	0.0	0.0	0.0
fishery	1994	2	0.1	0.1	0.2	0.0	0.3	0.3	1.0	1.1	1.8	3.9	4.9	6.3	10.4	10.5	6.8	5.3	2.5	0.4	0.0	0.0
fishery		1	0.0	0.1	0.0	0.1	0.1	0.7	0.7	2.8	1.9	5.7	9.4	10.9	8.8	2.6	0.4	0.0	0.1	0.0	0.0	0.0
fishery	1995	2	0.1	0.1	0.5	0.4	0.5	0.6	1.3	2.1	2.3	3.7	8.1	8.6	8.6	8.8	5.7	3.8	1.7	0.6	0.0	0.0
fishery		1	0.1	0.1	0.4	0.5	0.6	0.7	2.2	1.5	4.6	4.5	10.0	10.3	5.4	1.2	0.0	0.1	0.0	0.0	0.0	0.0
fishery	1996	2	0.1	0.3	0.6	1.0	2.0	2.3	1.3	1.3	2.1	2.8	7.1	6.7	6.4	5.6	4.1	2.3	1.3	0.6	0.0	0.0
fishery		1	0.2	0.6	0.9	1.4	1.1	1.7	2.0	2.6	4.1	5.8	13.3	10.9	5.1	1.5	0.8	0.1	0.1	0.1	0.0	0.0
fishery	1997	2	0.3	1.0	1.3	1.7	1.3	1.9	2.8	2.9	3.2	3.7	6.5	6.2	5.7	5.4	3.4	2.4	1.6	0.6	0.2	0.0
fishery		1	0.1	0.4	1.0	1.9	0.8	1.8	3.2	4.2	3.9	4.7	9.6	8.2	4.2	2.4	0.7	0.2	0.0	0.0	0.0	0.0
fishery	1998	2	0.4	0.4	0.7	0.9	0.9	1.3	1.4	1.6	2.0	2.2	6.5	8.8	8.9	6.9	6.4	3.2	1.1	0.3	0.0	0.0
fishery		1	0.2	0.3	1.4	1.3	1.1	1.3	1.5	1.7	2.2	4.5	12.8	9.0	5.3	2.1	0.5	0.0	0.1	0.1	0.0	0.0
fishery	1999	2	0.3	0.9	2.2	3.1	3.7	2.7	3.6	4.4	3.3	3.0	4.8	5.8	6.5	4.3	3.8	2.4	1.4	0.7	0.2	0.0
fishery		1	0.5	0.8	2.1	3.1	2.3	2.1	3.5	3.2	2.7	2.3	6.9	5.6	4.1	2.0	0.4	0.0	0.0	0.0	0.0	0.0
fishery	2000	2	0.1	0.4	0.5	0.9	2.0	2.7	3.5	4.1	4.4	4.7	5.3	5.6	5.0	4.7	3.6	2.9	1.2	0.3	0.1	0.0
fishery		1	0.3	0.3	0.5	1.2	2.3	2.7	4.2	4.3	4.3	5.3	8.5	6.8	4.2	2.1	0.6	0.1	0.1	0.0	0.0	0.0
fishery	2001	2	0.1	0.1	0.4	0.9	1.9	2.9	3.5	5.2	6.2	6.1	8.3	5.1	3.7	3.2	2.4	1.8	0.9	0.4	0.0	0.0
fishery		1	0.0	0.1	0.4	0.6	2.3	3.2	4.2	5.5	5.7	5.0	8.1	5.5	3.0	1.5	0.8	0.2	0.0	0.1	0.0	0.0

Table 14. (Continued) Length compositions for darkblotched rockfish.

Source	Year	sex	Fish	Samp	adj #	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
						Lower Limit of Length Bin (cm)																
fishery	2002	2	2802	116	100	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	0.8
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6
fishery	2003	1	2525	119	100	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	0.0	0.2	0.0	0.0
fishery		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
fishery	2004	1	2744	114	100	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
fishery		2				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
triennial	1977	2	3450	57	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	0.4	0.8	1.1	0.9	2.1
triennial		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	1.3	1.0	1.0	1.8
triennial	1980	2	656	11	200	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.0	0.1	0.2	0.4	0.6	1.4	0.1	0.7	0.8
triennial		1				0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.2	0.3	0.2	0.8	0.9	1.5	0.7	0.6	0.6
triennial	1983	2	4438	43	200	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.4	2.1	3.8	2.2	2.9	3.1	4.4
triennial		1				0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.2	0.2	0.5	2.1	3.1	3.2	2.6	3.8	6.6
triennial	1986	2	1834	38	200	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4	1.3	0.9	0.6	0.3	0.8	1.7	1.5	0.7	0.6
triennial		1				0.1	0.0	0.0	0.0	0.1	0.0	0.3	0.5	1.0	0.8	0.5	0.3	0.3	1.1	1.6	0.7	0.6
triennial	1989	2	3054	85	200	0.0	0.0	0.0	0.0	0.0	0.0	0.6	3.8	6.6	2.9	0.5	1.5	3.3	6.1	3.2	3.7	1.4
triennial		1				0.0	0.0	0.0	0.1	0.0	0.2	0.8	3.8	6.5	4.5	0.8	1.4	4.2	5.7	3.3	2.5	1.6
triennial	1992	2	1445	33	200	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.2	0.3	0.1	0.0	0.2	1.9	4.0	2.5	0.6
triennial		1				0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.5	0.3	0.1	0.4	1.8	2.9	2.9	1.1
triennial	1995	2	2389	106	200	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.8	2.3	1.2	0.2	0.1	0.6	1.3	0.9	0.9	1.0
triennial		1				0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.1	2.4	1.2	0.2	0.2	0.5	1.1	1.9	1.2	1.1
triennial	1998	2	2943	110	200	0.0	0.0	0.0	0.0	0.0	0.2	0.9	0.8	0.4	0.1	0.7	1.2	0.8	1.6	2.5	4.7	7.7
triennial		1				0.0	0.0	0.0	0.0	0.0	0.7	1.3	1.1	0.1	0.2	0.6	1.4	1.1	1.1	3.3	5.4	8.2
triennial	2001	2	2980	184	200	0.0	0.0	0.0	0.0	0.1	0.2	1.5	3.7	2.3	0.6	0.3	1.2	3.9	8.7	8.4	2.3	0.2
triennial		1				0.0	0.0	0.0	0.0	0.0	0.2	1.1	3.0	2.0	0.8	0.3	1.1	4.2	7.8	7.6	2.8	0.4
triennial	2004	2	3578	152	200	0.0	0.1	0.0	0.0	0.0	0.1	0.8	1.3	1.3	0.2	0.2	0.3	0.7	0.8	0.3	0.3	0.6
triennial		1				0.0	0.1	0.0	0.0	0.0	0.3	1.0	2.7	1.5	0.3	0.3	0.4	0.7	0.8	0.6	0.4	0.7

Table 14. (Continued) Length compositions for darkblotched rockfish.

Source	Year	sex	23	24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51+
fishery	2002	2	0.7	0.9	0.6	0.6	1.1	1.3	2.0	2.7	4.3	4.7	12.2	6.0	3.8	4.6	2.8	2.4	0.6	0.3	0.0	0.0
fishery		1	0.8	0.7	0.8	0.6	1.4	1.7	2.1	3.3	5.4	6.3	10.0	8.3	3.7	1.3	0.4	0.0	0.0	0.0	0.0	0.0
fishery	2003	1	0.1	0.2	0.2	0.1	0.5	0.4	0.3	0.7	1.3	1.8	7.9	11.8	7.6	5.0	4.3	3.9	1.9	0.6	0.3	0.1
fishery		1	0.3	0.3	0.1	0.5	0.7	1.1	1.5	1.4	2.1	4.9	15.6	12.0	6.5	1.7	0.8	0.2	0.3	0.0	0.0	0.1
fishery	2004	1	0.1	0.1	0.0	0.5	1.0	1.8	2.6	3.0	3.2	3.2	6.7	7.7	5.6	4.3	3.7	3.0	1.4	0.7	0.2	0.0
fishery		2	0.0	0.2	0.3	0.6	1.4	2.7	4.2	3.8	4.7	4.3	13.2	8.5	5.0	1.6	0.2	0.1	0.1	0.0	0.0	0.0
triennial	1977	2	4.0	4.7	3.4	1.7	2.6	2.8	1.8	3.3	1.8	2.2	5.3	4.0	1.6	1.2	1.2	1.1	1.1	0.6	0.5	0.4
triennial		1	4.3	4.5	2.6	2.6	3.3	2.5	2.3	1.9	2.2	2.2	5.0	3.1	3.0	2.6	0.8	0.2	0.2	0.1	0.0	0.0
triennial	1980	2	1.0	3.1	3.4	4.0	4.4	4.3	1.7	1.5	3.5	3.8	6.9	3.3	3.7	2.3	1.0	0.9	0.6	0.0	0.0	0.0
triennial		1	0.8	0.7	1.3	2.3	1.7	3.7	2.7	4.2	5.4	3.6	4.1	5.1	3.7	0.0	0.4	0.0	0.0	0.0	0.0	0.0
triennial	1983	2	4.0	3.5	3.4	4.0	2.3	1.5	0.5	0.6	0.6	0.4	0.7	0.8	0.9	2.1	2.1	1.1	0.4	0.1	0.0	0.0
triennial		1	5.5	4.0	3.7	3.6	2.6	1.1	0.5	0.7	0.4	0.4	0.6	2.2	2.0	0.8	0.2	0.1	0.0	0.0	0.0	0.0
triennial	1986	2	1.1	1.7	2.0	3.2	3.3	2.6	4.6	4.2	3.8	3.0	4.9	2.3	1.2	0.9	1.0	0.7	0.4	0.2	0.1	0.0
triennial		1	1.5	1.5	2.0	4.2	3.8	3.8	6.4	4.1	4.6	3.4	2.8	1.8	0.5	1.0	0.6	0.2	0.0	0.0	0.0	0.0
triennial	1989	2	2.0	2.1	1.7	1.7	1.4	1.0	0.9	0.9	1.0	0.3	1.0	0.9	0.7	0.6	0.5	0.0	0.1	0.0	0.0	0.0
triennial		1	1.8	1.3	1.7	1.1	1.5	1.1	1.1	1.2	0.5	0.7	1.0	0.4	0.3	0.3	0.1	0.1	0.0	0.0	0.0	0.0
triennial	1992	2	1.1	1.6	2.9	2.5	4.7	9.6	7.1	4.5	2.6	0.8	0.8	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0
triennial		1	0.7	3.1	2.6	1.9	9.3	11.1	7.7	3.1	0.9	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
triennial	1995	2	2.6	4.5	3.9	2.4	2.4	1.7	1.3	1.6	0.9	0.8	2.1	3.3	3.4	3.0	3.7	2.6	1.0	0.4	0.0	0.0
triennial		1	2.9	4.7	4.0	2.4	1.6	1.4	1.1	0.9	1.5	1.5	5.3	6.0	3.5	0.5	0.1	0.1	0.0	0.0	0.0	0.0
triennial	1998	2	8.2	3.6	3.2	2.9	2.7	1.9	1.1	0.6	0.4	0.3	0.6	0.5	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0
triennial		1	7.5	5.2	3.4	2.9	2.8	1.8	0.8	0.7	0.8	0.6	0.9	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0
triennial	2001	2	0.4	0.4	0.8	0.9	0.9	0.5	1.1	0.5	2.5	3.1	10.7	0.7	0.4	0.6	0.2	0.2	0.0	0.1	0.0	0.0
triennial		1	0.2	0.4	0.6	0.7	0.8	0.4	0.6	0.7	2.2	1.5	2.3	0.4	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0
triennial	2004	2	1.0	1.9	2.6	4.2	5.3	4.1	3.4	4.4	3.3	2.4	3.4	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
triennial		1	0.7	2.3	3.2	8.0	7.3	4.6	4.9	5.5	4.0	2.0	2.3	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 14. (Continued) Length compositions for darkblotched rockfish.

Source	Year	sex	Fish	Samp	adj #	Lower Limit of Length Bin (cm)																
						6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
pop	1979	2	1070	16	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	2.1
pop		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	2.4
pop	1985	2	3603	42	200	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	0.2	1.2	1.1	0.8
pop		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.3	1.7	1.2
slope	1991	2	1322	58	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	0.3	0.7	0.9	0.8
slope		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.7	1.0	1.4	0.6
slope	1995	2	725	48	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.3	0.4	1.3	1.7	1.3
slope		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.3	0.5	0.5	0.4	1.0	1.6	1.4
slope	1997	2	313	20	200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	3.0	3.4	4.9	5.0
slope		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	2.9	7.5	8.5	4.8
slope	1999	2	228	26	200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1
slope		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.0	0.0	0.0
slope	2000	2	223	20	200	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.0	0.4	0.8	0.5	3.6
slope		1				0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.3	0.9	0.3	0.0	0.0	0.0	1.5	3.7
slope	2001	2	324	14	200	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	0.2	2.8	2.5	1.3
slope		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	1.9	0.9
slopenw	2000	2	325	26	200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.5	0.4	0.4	0.6	0.0	0.1	1.4
slopenw		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	1.4	1.8	0.9	0.0	0.1	0.4	0.0	0.3
slopenw	2001	2	491	44	200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.5	1.1	3.2	6.6	1.8	0.8
slopenw		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1	0.5	0.7	2.1	4.9	3.1	1.2
slopenw	2002	2	1024	52	200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.5	2.2	1.4	1.2	0.3	2.4
slopenw		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	1.2	2.1	0.5	0.2	2.1
slopenw	2003	2	1652	59	200	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	0.3	0.6
slopenw		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9
slopenw	2004	2	527	45	200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	2.5	0.6	1.3	2.1	2.9	3.2
slopenw		1				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	5.1	6.2

Table 14. (Continued) Length compositions for darkblotched rockfish.

			23	24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51+
pop	1979	2	1.4	2.0	5.5	5.1	4.0	4.9	6.1	5.4	2.9	1.7	2.1	2.4	2.5	0.6	0.3	0.2	0.2	0.0	0.1	0.0
pop		1	1.9	3.6	1.7	2.6	4.0	5.8	6.9	5.1	2.6	1.6	4.3	3.6	1.1	0.8	0.4	0.0	0.0	0.0	0.0	0.0
pop	1985	2	2.1	4.3	3.4	3.2	4.5	5.8	4.6	4.3	3.0	3.2	2.6	0.4	0.5	0.5	0.5	0.1	0.1	0.1	0.0	0.0
pop		1	2.1	4.0	3.6	3.8	6.4	6.9	5.8	6.4	4.9	1.5	1.9	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0
slope	1991	2	1.5	2.1	2.2	3.9	5.7	5.8	8.0	2.9	3.8	2.7	1.6	0.8	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0
slope		1	1.3	2.3	4.2	4.6	9.0	8.1	6.5	4.3	3.8	2.0	2.4	1.4	0.9	0.4	0.1	0.0	0.0	0.0	0.0	0.0
slope	1995	2	1.3	1.0	1.5	1.3	1.5	1.5	3.4	2.7	3.9	2.6	7.9	8.6	3.0	0.5	0.6	0.2	0.3	0.0	0.1	0.1
slope		1	2.1	0.6	2.0	1.1	3.2	3.3	5.6	2.9	5.9	5.7	9.5	3.6	0.5	0.6	0.2	0.0	0.0	0.0	0.0	0.0
slope	1997	2	3.9	4.7	8.3	5.0	1.9	0.4	0.4	0.2	0.0	0.6	0.7	0.1	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0
slope		1	6.8	3.5	5.9	5.3	3.2	0.0	1.4	0.4	0.7	0.7	1.8	0.8	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0
slope	1999	2	0.3	0.7	0.0	2.3	5.4	12.8	10.1	5.7	6.7	2.3	1.3	0.1	0.6	0.3	0.3	0.1	0.0	0.0	0.0	0.0
slope		1	0.2	0.3	0.4	3.1	12.6	14.0	10.6	4.2	2.1	1.1	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
slope	2000	2	5.4	5.9	4.4	1.2	3.0	4.5	3.8	7.7	3.9	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.0	0.0
slope		1	6.3	9.3	3.9	2.0	1.0	6.5	3.0	6.6	2.3	0.0	2.0	0.5	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0
slope	2001	2	1.4	0.2	1.6	0.7	1.6	2.6	3.0	2.1	2.6	8.6	15.2	7.5	0.7	0.0	0.9	0.2	0.2	0.0	0.0	0.0
slope		1	0.8	0.8	1.6	2.2	4.2	2.8	1.5	1.2	7.5	10.7	5.3	0.2	0.0	0.9	0.2	0.0	0.0	0.0	0.0	0.0
slopenw	2000	2	1.5	1.3	0.1	0.7	1.9	5.6	8.9	9.0	1.8	1.4	3.0	0.0	2.1	2.5	3.7	3.0	2.1	0.0	0.0	0.0
slopenw		1	0.6	0.8	1.0	0.5	2.0	4.9	4.9	3.8	4.1	3.0	2.3	10.2	2.3	0.8	0.4	0.4	0.0	0.0	0.0	0.0
slopenw	2001	2	0.2	1.0	0.9	0.7	0.9	1.0	2.5	1.6	4.4	12.8	10.5	2.4	0.7	1.3	0.3	0.1	0.0	0.0	0.0	0.0
slopenw		1	0.7	0.5	0.2	1.7	2.2	0.3	2.2	3.6	4.7	6.4	2.3	3.8	2.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0
slopenw	2002	2	7.2	8.9	6.2	4.2	1.2	1.7	2.8	2.3	2.1	1.4	1.7	0.9	0.8	0.1	0.1	0.0	0.3	0.1	0.0	0.0
slopenw		1	5.1	7.6	6.5	5.1	2.3	2.6	3.2	2.7	1.7	1.8	1.9	0.7	1.1	0.7	0.2	0.0	0.0	0.0	0.0	0.0
slopenw	2003	2	1.7	2.0	1.3	1.0	2.1	2.2	1.6	0.6	0.9	2.9	9.0	15.7	8.7	4.2	2.4	1.9	1.4	0.4	0.0	0.0
slopenw		1	1.9	1.7	1.3	1.9	2.2	1.5	1.4	0.6	1.0	1.7	11.3	9.1	1.3	0.5	0.3	0.0	0.0	0.0	0.0	0.0
slopenw	2004	2	6.1	5.1	5.3	3.8	2.7	2.7	2.2	1.1	0.6	0.5	0.4	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
slopenw		1	5.2	3.8	5.2	6.1	5.6	3.5	2.1	1.7	2.0	3.4	2.6	0.8	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Table 15. Age compositions for darkblotched rockfish available for 2003 assessment. Sex 1=males, 2=females, 3 both. Samp is the number of hauls or trips sampled. Adj.# = #fish*sqrt(#samples)/sqrt(20)) or assumed boundary (200), whichever is less.

Source	Year	Fish	Tows	adj #	sex	Age 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
CA	1977	437	44	200	3	0.0	0.0	0.0	0.2	1.2	2.5	5.1	5.5	6.7	6.7	9.9	4.6	7.6	4.1	3.9	2.3	2.8	0.9	2.1	2.3	1.4
CA	1978	310	33	200	2	0.0	0.0	0.0	0.0	0.7	2.6	3.6	4.6	5.9	3.9	4.6	3.9	3.3	2.0	3.0	2.0	0.7	1.6	1.6	1.0	2.3
					1	0.0	0.0	0.0	0.0	0.3	1.3	3.0	1.0	1.0	2.0	2.6	2.6	3.0	2.0	2.0	0.0	0.3	1.0	0.3	2.0	1.6
CA	1980	221	27	200	3	0.0	0.0	0.0	0.0	0.0	1.4	5.1	8.3	7.8	10.1	5.1	4.1	5.5	3.7	4.6	3.2	0.9	1.8	2.8	1.8	1.4
CA	1982	434	56	200	3	0.0	0.0	0.0	0.0	0.9	2.8	5.9	6.1	3.0	6.3	5.6	4.2	5.4	4.9	2.8	4.7	4.2	3.0	2.6	3.3	2.1
CA	1987	1066	46	200	2	0.0	0.0	0.0	0.0	0.6	1.8	3.0	4.1	4.5	2.3	1.8	1.3	1.8	1.5	1.3	1.6	1.6	2.0	1.6	0.8	0.7
					1	0.0	0.0	0.1	0.1	1.2	0.4	3.3	5.5	4.1	3.2	2.8	2.6	1.8	1.7	2.3	1.7	2.0	1.9	1.9	1.8	1.2
CA	1988	375	30	200	2	0.0	0.0	0.0	0.3	1.1	1.3	4.5	2.9	5.9	5.1	4.0	1.9	1.3	1.1	1.1	0.8	0.5	1.1	1.3	0.8	1.1
					1	0.0	0.0	0.0	0.3	1.6	0.8	3.5	2.7	6.4	3.7	1.6	2.7	1.9	2.1	2.4	1.6	1.6	1.9	1.9	0.8	0.8
CA	1990	241	44	200	2	0.0	0.0	0.0	0.4	0.4	2.1	2.5	2.1	2.9	2.9	4.6	4.1	2.5	2.1	2.1	0.8	0.8	0.0	2.1	1.2	1.2
					1	0.0	0.0	0.0	0.0	0.0	0.4	1.7	1.7	0.8	3.3	7.5	5.4	6.6	1.7	2.9	0.8	2.5	2.5	1.7	1.2	0.0
CA	1993	233	29	200	2	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.9	3.9	1.3	2.6	3.0	2.1	0.9	1.3	2.1	0.4	0.9	1.3	0.9	1.7
					1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.0	0.4	1.3	0.9	2.1	3.4	3.4	2.6	2.6	3.0	3.0	4.3	2.1	2.1
CA	1995	169	17	156	2	0.0	0.0	0.0	0.0	1.2	2.4	2.4	4.1	2.4	7.1	3.0	2.4	3.6	1.2	1.8	1.8	1.2	3.6	1.8	2.4	2.4
					1	0.0	0.0	0.0	0.0	0.0	0.0	1.8	1.2	3.6	4.1	7.1	3.0	3.6	3.0	1.2	1.2	1.2	2.4	0.0	0.0	1.2
CA	1996	244	44	200	2	0.0	0.0	0.0	1.2	0.8	0.4	2.0	2.0	3.7	6.1	3.7	2.5	0.8	0.0	1.2	1.6	0.8	1.6	0.8	0.8	0.4
					1	0.0	0.0	0.0	0.0	0.4	2.0	2.9	4.1	5.3	4.1	7.4	2.0	3.7	0.4	3.3	2.0	0.8	1.6	1.6	1.2	0.8
CA,OR	1997	278	42	200	2	0.0	0.0	0.0	0.0	3.6	6.5	7.2	4.7	2.5	1.8	1.1	1.4	0.7	1.4	1.4	1.1	0.7	2.5	1.1	1.1	1.1
					1	0.0	0.0	0.0	0.4	1.1	3.6	2.5	2.5	2.5	3.3	1.8	1.4	1.1	1.4	1.4	0.4	0.4	2.2	1.1	0.0	0.0
OR	1999	171	4	76	2	0.0	0.0	0.0	0.0	0.0	2.9	8.2	8.2	7.6	6.4	3.5	1.2	1.2	2.3	0.0	1.8	0.6	1.2	0.6	1.2	2.9
					1	0.0	0.0	0.0	0.0	0.0	0.6	4.7	3.5	3.5	2.9	2.3	0.6	1.8	1.2	0.6	1.2	0.6	1.8	0.6	1.8	0.6
CA,OR	2000	1041	44	200	2	0.0	0.0	0.0	0.7	6.0	10.8	5.5	4.3	2.7	1.9	1.3	1.8	1.2	1.2	1.2	0.6	1.1	0.5	1.2	1.0	0.7
					1	0.0	0.0	0.1	1.2	5.4	8.6	6.8	4.1	3.0	1.8	1.3	1.2	1.3	1.2	1.3	1.2	1.1	0.3	1.0	1.0	0.9
CA,OR	2001	1561	59	200	2	0.0	0.0	0.1	0.7	8.1	16.1	10.3	3.2	1.6	0.9	1.0	1.0	0.4	0.6	0.9	0.5	0.7	0.4	0.4	0.3	0.4
					1	0.0	0.0	0.0	0.8	8.1	16.0	8.1	3.0	1.5	0.9	0.6	1.1	0.8	0.9	0.8	0.4	0.5	0.4	0.5	0.5	0.5
OR,WA	2002	750	23	200	2	0.0	0.0	0.0	0.3	3.3	8.7	14.1	10.5	4.5	1.7	0.9	0.8	0.9	0.3	0.4	0.7	0.3	0.0	0.1	0.1	0.0
					1	0.0	0.0	0.0	0.3	4.3	10.1	14.4	11.2	4.0	1.6	0.3	0.3	0.9	0.4	0.4	0.3	0.5	0.0	0.3	0.3	0.3
Shelf	1980	233	4	104	2	0.0	0.9	2.8	1.1	12.9	5.0	8.9	5.1	2.5	2.8	3.0	3.2	1.1	1.4	1.5	0.8	0.1	0.8	0.1	0.0	0.5
					1	0.0	0.6	5.6	0.0	6.0	2.2	7.2	8.0	6.9	4.3	2.6	1.1	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shelf	1983	117	1	0	2	0.0	0.0	0.0	8.8	8.2	1.0	4.2	0.8	0.5	0.0	0.2	0.0	0.7	0.0	0.5	0.4	0.0	0.0	0.0	2.3	1.3
					1	0.0	0.0	15.4	18.5	9.4	2.7	1.9	0.5	0.4	0.7	0.3	0.6	1.0	0.9	1.5	0.5	0.3	0.7	1.0	1.8	0.4
Shelf	1986	229	9	154	2	0.0	3.0	5.8	5.1	7.6	9.6	7.8	4.6	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					1	0.0	3.0	4.4	3.0	9.0	8.8	12.8	7.1	1.3	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shelf	1995	374	28	200	2	0.0	4.9	2.8	9.6	7.9	5.2	2.2	2.0	0.1	0.6	2.2	1.0	1.4	0.0	0.6	1.9	2.4	0.0	0.9	1.7	0.7
					1	0.0	5.4	4.3	9.9	6.1	4.3	3.6	1.1	1.0	0.4	1.4	2.1	1.9	1.3	1.2	0.8	1.3	0.8	0.5	0.4	0.3
Shelf	1998	467	63	200	2	0.0	0.0	4.1	4.7	18.6	8.7	4.1	3.3	2.2	0.4	0.4	0.1	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
					1	0.0	0.8	5.5	8.0	17.8	8.7	4.7	3.2	1.2	1.1	0.1	0.3	0.2	0.3	0.1	0.1	0.2	0.0	0.1	0.0	0.0
Shelf	2001	1031	101	200	2	0.0	6.2	26.0	2.4	3.0	7.7	7.6	2.7	0.6	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
					1	0.0	4.5	25.6	1.8	2.5	3.4	3.0	0.8	0.5	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFSC Slope	2000	114	19	111	2	0.0	0.3	0.7	9.1	11.7	12.3	4.5	3.1	3.6	1.6	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					1	0.0	0.1	1.3	13.9	8.4	17.5	5.1	2.6	0.2	0.5	0.6	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFSC Slope	2001	155	11	115	2	0.0	0.0	7.4	2.7	10.9	10.0	23.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
					1	0.0	0.0	3.9	3.4	11.9	8.5	15.0	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
NWFSC Slope	2000	320	26	200	2	0.0	0.3	0.2	0.8	1.4	2.3	1.6	0.4	1.8	0.0	0.0	0.0	1.5	2.9	1.5	1.5	2.9	1.5	2.9	2.9	0.0
					1	0.0	0.8	0.2	0.2	0.6	1.8	1.2	0.2	1.5	0.0	0.0	0.0	1.5	2.9	4.4	5.8	2.9	0.1	4.4	1.5	1.5
NWFSC Slope	2001	358	44	200	2	0.0	0.1	14.7	2.2	4.1	7.3	5.1	1.1	0.3	0.2	0.9	0.7	3.0	0.6	0.0	0.7	0.1	0.7	0.2	0.0	0.7
					1	0.0	0.4	15.8	1.9	4.2	4.9	7.5	1.3	2.0	2.9	1.0	0.1	0.0	0.8	2.6	1.7	0.6	0.6	0.0	0.0	1.6
NWFSC Slope	2002	828	44	200	2	0.0	0.0	4.4	29.6	4.8	5.4	3.0	2.1	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
					1	0.0	0.0	3.7	27.4	4.4	6.9	2.9	1.6	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.0	0.0

Table 15. (Continued). Age compositions for darkblotched rockfish.

Source	Year	sex	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40+
CA	1977	3	1.6	1.2	1.4	0.0	2.5	1.8	1.8	0.7	0.9	0.5	0.7	1.2	0.7	0.9	1.2	0.9	1.2	1.6	0.9	8.5
CA	1978	2	0.7	1.3	0.7	1.3	0.0	0.3	0.3	0.0	0.3	0.0	0.3	0.3	0.3	0.0	0.7	0.3	1.0	1.6	0.3	4.9
		1	0.7	1.0	0.7	0.7	0.3	0.3	0.7	0.3	0.3	0.0	0.7	0.7	0.3	0.0	0.3	1.0	0.7	0.0	0.0	3.6
CA	1980	3	3.2	3.2	2.3	0.5	0.9	0.9	1.8	0.5	0.9	1.8	0.5	0.5	0.9	0.9	0.9	1.4	1.4	0.0	0.5	9.2
CA	1982	3	3.3	3.5	2.6	1.6	0.5	1.4	0.5	1.2	1.6	0.9	0.7	0.5	0.9	0.5	0.5	0.9	0.7	0.0	0.5	9.8
CA	1987	2	0.8	0.8	0.8	0.8	0.3	0.7	0.6	0.6	0.4	0.4	0.1	0.4	0.2	0.3	0.4	0.5	0.4	0.2	0.4	4.1
		1	0.6	0.8	0.5	0.7	0.6	1.4	0.5	0.3	0.8	0.3	0.5	0.2	0.0	1.0	0.7	0.7	0.2	0.9	0.5	4.3
CA	1988	2	0.8	0.3	0.5	1.1	0.5	0.8	0.8	0.8	1.1	0.8	0.3	0.8	0.0	0.8	0.3	0.8	1.6	0.8	0.3	1.1
		1	1.1	0.8	0.8	0.5	1.6	0.8	0.5	1.3	0.8	0.3	0.3	0.0	0.3	0.8	0.3	0.8	0.0	0.0	0.0	0.8
CA	1990	2	1.2	1.2	0.8	0.4	0.8	0.8	0.8	0.4	0.0	0.0	0.0	0.4	0.0	0.8	0.0	0.4	0.0	0.0	0.0	5.0
		1	2.1	1.2	0.4	0.4	0.0	0.0	0.0	0.8	0.4	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	4.1
CA	1993	2	2.1	2.1	2.6	1.3	0.9	0.9	0.9	0.0	0.0	0.9	0.0	0.4	0.9	0.9	0.9	0.4	0.4	0.0	0.9	5.2
		1	2.6	1.3	0.9	0.9	0.0	0.4	1.7	1.7	0.4	0.0	0.0	2.1	0.4	0.4	0.4	0.4	0.9	0.0	0.0	5.2
CA	1995	2	1.2	0.0	0.0	1.8	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2	0.0	1.2	4.1
		1	1.2	0.0	0.0	0.6	0.6	0.6	3.0	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0	0.0	1.2
CA	1996	2	0.8	0.4	0.4	1.2	0.4	0.4	0.4	0.0	0.4	0.4	1.2	0.4	0.8	0.0	0.0	0.0	0.4	0.0	0.0	3.7
		1	1.6	0.4	1.6	0.8	0.4	0.4	0.8	0.0	0.8	1.2	0.0	0.4	0.8	0.0	0.0	1.6	0.4	0.4	0.0	2.0
CA,OR	1997	2	0.7	0.7	0.4	0.0	1.8	0.7	1.4	0.7	0.0	0.4	0.7	0.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	8.3
		1	0.7	1.8	1.8	0.7	2.5	0.0	1.4	0.4	1.1	0.7	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.7	0.0	2.2
OR	1999	2	0.6	1.2	0.0	1.8	0.0	0.0	0.0	0.0	1.2	0.0	0.6	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	1.8
		1	2.9	0.6	1.8	0.0	0.0	1.2	0.6	0.6	0.6	1.2	0.0	0.0	0.6	1.2	0.0	0.0	0.6	0.0	0.0	2.9
CA,OR	2000	2	1.0	0.8	0.9	0.6	0.3	0.2	0.1	0.3	0.0	0.4	0.0	0.2	0.1	0.1	0.2	0.0	0.3	0.2	0.2	1.6
		1	0.7	0.7	0.5	0.5	0.5	0.0	0.3	0.5	0.5	0.2	0.0	0.1	0.2	0.3	0.0	0.1	0.1	0.2	0.1	1.2
CA,OR	2001	2	0.4	0.2	0.5	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	1.0
		1	0.1	0.1	0.0	0.1	0.2	0.1	0.2	0.0	0.0	0.4	0.1	0.1	0.3	0.0	0.1	0.0	0.0	0.1	0.0	0.8
OR,WA	2002	2	0.4	0.1	0.3	0.5	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	0.0	0.0	0.1	0.0	0.0	0.1	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Shelf	1980	2	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
		1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shelf	1983	2	4.0	0.6	1.9	0.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.4
		1	0.6	0.0	0.2	0.8	0.1	0.2	0.2	0.0	0.1	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.5
Shelf	1986	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
		1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Shelf	1995	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
		1	0.1	0.2	0.3	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Shelf	1998	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
		1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shelf	2001	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
		1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFSC Slope	2000	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1	0.2	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFSC Slope	2001	2	0.5	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
NWFSC Slope	2000	2	2.9	1.5	2.9	2.9	2.9	1.5	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	4.4
		1	1.5	4.4	0.0	1.5	1.5	2.9	0.0	1.5	1.5	0.0	1.5	1.5	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0
NWFSC Slope	2001	2	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
		1	0.0	0.0	0.8	1.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	1.3
NWFSC Slope	2002	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.5
		1	0.3	0.0	0.0	0.4	0.1	0.1	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

Table 16. Age compositions for darkblotched rockfish new to this assessment. Sex 1=males, 2=females, 3 both. Samp is the number of hauls or trips sampled. Adj.# = #fish*sqrt(#samples)/sqrt(20)) or assumed boundary (100 or 200), whichever is less.

Source	Year	Fish	Tows	adj #	sex	0	1	2	3	4	5	6	7	8	9	10
CA	1983	577	75	200	3	0.00	0.00	0.00	0.36	5.86	6.75	4.80	2.31	3.91	1.95	3.37
CA	1994	360	30	200	2	0.00	0.00	0.00	0.00	0.29	0.86	4.60	7.47	7.72	4.89	3.39
					1	0.00	0.00	0.00	0.00	0.29	0.00	3.74	6.61	4.63	2.87	0.92
CA,OR,WA	2003	1695	71	200	2	0.00	0.27	0.23	0.46	1.41	3.64	12.52	6.88	3.00	2.05	1.30
					1	0.00	0.25	0.31	1.10	1.94	5.87	8.28	6.21	2.87	1.19	1.30
Shelf	2004	1121	134	200	2	0.11	3.72	2.59	3.14	17.38	13.91	2.48	0.45	0.40	0.38	0.00
					1	0.11	5.58	2.80	3.38	23.82	15.13	2.34	0.57	0.96	0.33	0.09
NW slope	2003	452	60	200	2	0.00	0.00	0.00	2.06	10.30	1.49	4.13	11.69	8.86	8.52	8.11
					1	0.00	0.00	0.00	7.10	9.71	2.54	4.00	6.68	1.85	0.58	0.20
Nwslope	2004	350	53	200	2	0.00	0.00	0.05	3.26	17.45	14.00	0.94	1.05	0.69	0.37	0.00
					1	0.00	0.00	0.91	6.10	27.23	8.27	0.60	9.24	2.40	0.00	2.46

Source	Year	sex	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CA	1983	3	2.31	3.02	2.66	3.55	2.13	2.49	2.84	2.13	2.31	1.60	1.07	3.20	2.13	1.24
CA	1994	2	1.15	2.30	1.44	1.15	0.86	0.57	0.86	1.15	1.15	0.86	0.29	0.57	1.15	0.00
		1	1.72	0.57	0.57	2.01	0.86	1.44	2.01	1.44	0.57	1.15	0.86	1.44	0.86	0.86
CA,OR,WA	2003	2	0.73	1.69	0.27	0.73	1.16	1.40	0.88	1.06	0.29	0.77	1.07	0.32	1.28	1.24
		1	0.70	1.44	0.86	0.72	1.98	1.43	0.81	0.24	1.26	1.05	0.82	0.74	0.90	0.66
Shelf	2004	2	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1	0.08	0.00	0.00	0.03	0.03	0.03	0.01	0.01	0.00	0.03	0.05	0.00	0.01	0.03
NW slope	2003	2	0.85	0.19	2.75	0.09	0.02	0.19	1.73	1.09	0.04	0.14	0.00	0.16	0.23	0.00
		1	0.35	0.23	0.00	0.14	0.05	0.00	0.02	0.41	0.27	0.00	0.00	0.14	0.00	0.00
Nwslope	2004	2	0.00	0.00	0.00	0.00	0.13	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1	0.00	0.00	0.13	0.13	0.19	0.52	0.58	0.06	0.00	0.06	0.00	0.06	0.05	0.00

Source	Year	sex	25	26	27	28	29	30	31	32	33	34	35	36	37	38
CA	1983	3	1.24	2.49	2.13	2.84	0.89	2.84	1.24	2.31	0.89	1.78	1.60	0.53	0.71	0.89
CA	1994	2	0.29	1.44	0.57	0.57	0.29	0.00	1.44	0.29	0.29	0.29	0.57	0.86	0.57	0.00
		1	0.57	2.30	0.86	0.00	0.57	0.57	0.29	0.29	0.29	0.00	0.00	0.57	0.00	0.29
CA,OR,WA	2003	2	0.29	0.45	0.15	0.49	0.36	0.39	0.30	0.30	0.29	0.30	0.15	0.25	0.30	0.00
		1	0.48	0.60	0.68	0.00	0.42	0.07	0.25	0.29	0.20	0.19	0.15	0.29	0.12	0.11
Shelf	2004	2	0.00	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW slope	2003	2	0.03	0.00	0.00	0.00	0.00	0.75	0.19	0.19	0.09	0.09	0.00	0.00	0.09	0.19
		1	0.00	0.14	0.09	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
Nwslope	2004	2	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00
		1	0.00	0.45	0.32	0.00	0.06	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source	Year	sex	39	40	41	42	43	44+
CA	1983	3	1.07	1.24	0.71	0.71	0.36	1.60
CA	1994	2	0.57	0.57	0.29	0.29	0.29	0.00
		1	0.00	0.29	0.29	0.57	0.00	0.86
CA,OR,WA	2003	2	0.12	0.29	0.01	0.00	0.19	2.57
		1	0.21	0.00	0.19	0.19	0.00	0.77
Shelf	2004	2	0.00	0.00	0.00	0.00	0.00	0.00
		1	0.00	0.00	0.00	0.00	0.00	0.00
NW slope	2003	2	0.00	0.09	0.00	0.00	0.23	0.36
		1	0.00	0.00	0.00	0.00	0.00	0.30
Nwslope	2004	2	0.00	0.00	0.00	0.00	0.00	0.62
		1	0.00	0.00	0.00	0.00	0.00	0.77

Table 17. Data included in the Base Model.

		Years									
Indices											
	Shelf Survey	1977	1980	1983	1986	1989	1992	1995	1998	2001	2004
	P.o.p. Survey	1979	1985								
	AFSC Slope Survey	1991	1995	1997	1999	2000	2001				
	NWFSC Slope Survey	1999	2000	2001	2002	2003	2004				
Length Compositions		Years									
	Fishery	1979-2004									
	Shelf Survey	1980	1983	1986	1989	1992	1995	1998	2001	2004	
	P.o.p. Survey	1985									
	AFSC Slope Survey	1997	1999	2000	2001						
	NWFSC Slope Survey	2000	2001	2002	2003	2004					
Age Composition											
	Shelf Survey	2004									
Discard		1986	2000-2004								
Size of Discard		2003	2004								

Table 18. Base Model life history, stock recruitment, and fishing mortality parameters, along with automatically calculated survey catchabilities (not actually estimated).

Parameter	Lower	Upper	Starting	Ending	Fixed	Estimated
Natural Mortality				0.07	x	
Female growth						
Size (cm) at age 1.7	12	16	13.5	15.18		x
Size (cm) at age 40	40	60	42.94	42.83		x
k	0.05	0.25	0.2	0.21		x
Cv in Length at age 1.7	0.05	0.25	0.06	0.06		x
Cv in Length at age 40 (exp offset age1.7)				0	x	
Male growth						
Size (cm) at age 1.7 (exp offset female)				0	x	
Size (cm) at age 40 (exp offset female)	-3	3	-0.13	-0.13		x
k (exp offset female)	-3	3	0.24	0.26		x
Cv in Length at age 1.7(exp offset female age 1.7)				0	x	
Cv in Length at age 40 (exp offset age1.7)				0	x	
Time Varying Growth (baseparm*exp(blockparm)						
1998 female size at age 1.7	-10	10	0	-0.42		x
1998 female k	-10	10	0	-0.15		x
Female Biology						
maturity logistic inflection				34.59	x	
maturity logistic slope				-0.64	x	
eggs/gm intercept				0.15	x	
eggs/gm slope				1.33	x	
Weight at Length-Both Sexes						
coefficient				0.000021	x	
exponent				2.96	x	
Stock-recruitment						
Log of virgin recruitment level	3	31	7.612	7.88		x
steepness of Stock-Recruitment curve				0.95	x	
Std. Dev. of log recruitment				0.80	x	
Recruitment-environmental linkage (none)				0	x	
Equilibrium=virgin recruitment				0	x	
Recruitment Deviations 1968-2003	-10	10	n/a	varied		x
Fishing mortality in 1927				0	x	
Survey Catchabilities						
Shelf survey			n/a	1.15		x
AFSC slope survey			n/a	0.27		x
P.o.p. survey			n/a	1.00		x
NWFSC slope survey			n/a	0.17		x

Table 19. Base Model selectivity and retention curve parameters.

Parameter	Lower	Upper	Starting	Ending	Fixed	Estimated
Fishery Selectivity						
peak				38	x	
initial				0	x	
ascending inflection	-10	10	0.87	0.39		x
ascending slope	0.01	10	0.60	0.46		x
final				99	x	
descending inflection				1	x	
descending slope				0.50	x	
width of top				20	x	
inflection_for_retention	20	70	20.00	27.92		x
slope_for_retention	0.1	10	1.00	2.10		x
asymptotic_retention				1	x	
Shelf Survey Selectivity						
peak				20	x	
initial				0.01	x	
ascending inflection	-10	10	-0.14	0.95		x
ascending slope	0.01	10	0.53	0.04		x
final	-5	10	-1.99	-1.82		x
descending inflection	-10	10	-2.29	-0.82		x
descending slope	0.01	10	-0.89	0.59		x
width of top				2	x	
AFSC slope-P.o.p. Survey Selectivty						
peak				28	x	
initial				0	x	
ascending inflection	-10	10	0.78	0.74		x
ascending slope	0.01	10	0.88	0.95		x
final	0.5	10	-2.59	-3.16		x
descending inflection	-10	10	-1.75	-1.55		x
descending slope	0.01	10	0.72	0.89		x
width of top				2	x	
NWFSC Slope Survey Selectivity						
peak				30	x	
initial				0	x	
ascending inflection	-10	10	0.78	0.47		x
ascending slope	0.01	10	0.88	0.62		x
final				99	x	
descending inflection				1	x	
descending slope				0.50	x	
width of top				2	x	
Fishery Time Varying Blocks						
Selectivity (baseparm*exp(blockparm)						
2003-2005 ascending inflection	-10	10	0.00	1.14		x
Retention (baseparm)						
2000-2003 asymptotic	0.5	1	0.00	0.68		x
2004-2005 asymptotic	0.5	1	0.00	0.92		x

Table 20. Progressive changes made to the 2003 model (A). Changes in shaded areas are new modifications (e.g., the difference between E and F is the addition of the NWFSC slope index, with its age compositions for 2003 and 2004). Natural mortality is fixed at a value of 0.05 in all the models. The upper bounds on Stock-Recruitment steepness were hit in all models (C-G).

Model	A	B	C	D	E	F	G
Model program	ss1	ss2	ss2	ss2	ss2	ss2	ss2
Startyear	1963	1963	1928	1928	1928	1928	1928
Endyear	2002	2002	2004	2004	2004	2004	2004
Shelf Index,length and age	old	old	new	new	new	new	new
Fecundity-weight,weight-length	old	old	new	new	new	new	new
Length frequency eff.sam,weight	old	old	new	new	new	new	new
Fit growth	no	no	yes	yes	yes	yes	yes
Pop, slope selectivities same	no	no	yes	yes	yes	yes	yes
Age frequencies (year aged)	<2002	<2002	<2002	2004	2004	2004	2004
Aging error,bins	old	old	old	new	new	new	new
Discard	old	old	old	new	new	new	new
AFSC slope	old	old	old	old	new	new	new
# Age frequencies	18	18	18	2	2	4	1
Indices	3	3	3	3	3	4	4
Upper bound on S-R steepness			1	1	1	1	0.95
Time varying	no	no	no	no	no	no	blocks
Biomass age 1+ in 2002	8374	8177	7265	6673	5616	5184	4680
Depletion spawn in 2002	0.11	0.11	0.13	0.11	0.08	0.07	0.06
Number of parameters	60	44	60	62	62	65	70
LIKELIHOODS							
Total	2062	1979	1054	1102	1168	1704	1455
Indices	8	15	20	15	14	19	19
Length_comps	1434	1353	909	924	1013	1406	1397
Age_comps	631	611	107	124	104	259	15
Recruitment			18	18	22	18	21
Discard rate				19	13	3	3
Discard mean_body_wt				2	2	0	0

Table 21. Comparison of results and likelihood components for Model G in Table 19 across a range of fixed natural mortality (*M*) values. Negative log likelihood values in boxes are the lowest across all values of *M* (lowest values = best fit to the data).

Model	**G05**	**G06**	**G07**	**G08**	**G09**	**G10**
Natural mortality	0.05	0.06	0.07	0.08	0.09	0.1
Biomass age 1+ in 2005	7026	8603	10403	12365	14467	16524
Depletion spawn in 2005	0.12	0.13	0.17	0.2	0.21	0.29
LIKELIHOODS						
Total	1455	1448	1444	1442	1442	$\boxed{1442}$
Shelf Survey Index	12.85	12.33	$\boxed{12.32}$	12.68	13.28	14.00
AFSC Slope Survey Index	$\boxed{0.87}$	0.94	1.11	1.32	1.55	1.76
P.o.p. Survey Index	0.13	0.09	0.06	0.04	0.02	$\boxed{0.01}$
NWFSC Slope Survey Index	5.32	5.25	5.21	$\boxed{5.20}$	5.21	5.24
Fishery Length Compositions	379.29	378.19	377.65	$\boxed{377.54}$	377.70	377.92
Shelf Survey Length Compositions	245.63	245.21	$\boxed{245.14}$	245.27	245.39	245.39
AFSC Slope Survey Lengths	386.35	383.96	382.15	380.77	379.63	$\boxed{378.73}$
P.o.p. Survey Lengths	10.54	9.97	9.47	9.04	8.70	$\boxed{8.45}$
NWFSC Slope Survey Lengths	375.00	374.44	$\boxed{374.22}$	374.22	374.35	374.52
Shelf survey Age Composition	$\boxed{14.99}$	15.48	15.90	16.24	16.49	16.64
Discard Rate	3.05	3.46	3.45	3.10	2.59	$\boxed{2.09}$
Discarded mean size (wt)	0.03	0.03	0.02	0.01	$\boxed{0.00}$	0.01
Recruitment	21.20	18.61	17.38	16.83	$\boxed{16.67}$	16.79

Table 22. Base Model (G0.07) selectivity and retention (proportion selected*proportion of that retained) estimated in different time periods

	Selectivity					Retention			
Size	**Fishery**		**Surveys**			**Fishery**			
(cm)				**AFSC**	**NWFSC**				
			Shelf	**Slope-P.o.p.**	**slope**				
	1928 -2002	**2003 -2004**	**all**	**all**	**all**	**1928 1999**	**2000 2002**	**2003**	**2004**
6.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
7.5	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
8.5	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
9.5	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
10.5	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
11.5	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00
12.5	0.00	0.00	0.16	0.00	0.01	0.00	0.00	0.00	0.00
13.5	0.00	0.00	0.26	0.00	0.01	0.00	0.00	0.00	0.00
14.5	0.01	0.00	0.39	0.00	0.02	0.00	0.00	0.00	0.00
15.5	0.01	0.00	0.54	0.01	0.04	0.00	0.00	0.00	0.00
16.5	0.02	0.00	0.70	0.02	0.07	0.00	0.00	0.00	0.00
17.5	0.03	0.00	0.82	0.04	0.12	0.00	0.00	0.00	0.00
18.5	0.05	0.00	0.92	0.10	0.21	0.00	0.00	0.00	0.00
19.5	0.07	0.00	0.98	0.23	0.33	0.00	0.00	0.00	0.00
20.5	0.11	0.01	1.00	0.43	0.47	0.00	0.00	0.00	0.00
21.5	0.16	0.01	1.00	0.66	0.62	0.01	0.00	0.00	0.00
22.5	0.23	0.02	1.00	0.83	0.76	0.02	0.01	0.00	0.00
23.5	0.32	0.03	1.00	0.93	0.85	0.04	0.02	0.00	0.00
24.5	0.43	0.05	0.99	0.97	0.92	0.07	0.05	0.01	0.01
25.5	0.54	0.08	0.98	0.99	0.95	0.13	0.09	0.01	0.02
26.5	0.65	0.12	0.96	1.00	0.98	0.22	0.15	0.03	0.04
27.5	0.75	0.18	0.93	1.00	0.99	0.34	0.23	0.05	0.07
28.5	0.83	0.26	0.87	1.00	1.00	0.47	0.32	0.10	0.14
29.5	0.88	0.36	0.79	1.00	1.00	0.60	0.41	0.17	0.23
30.5	0.92	0.47	0.67	0.98	1.00	0.72	0.49	0.25	0.34
31.5	0.95	0.59	0.54	0.92	1.00	0.81	0.55	0.34	0.46
32.5	0.97	0.71	0.41	0.80	1.00	0.87	0.59	0.43	0.58
34.0	0.99	0.84	0.27	0.50	1.00	0.94	0.64	0.54	0.73
36.0	1.00	0.95	0.18	0.16	1.00	0.98	0.66	0.63	0.85
38.0	1.00	1.00	0.15	0.06	1.00	0.99	0.68	0.68	0.91
40.0	1.00	1.00	0.14	0.05	1.00	1.00	0.68	0.68	0.92
42.0	1.00	1.00	0.14	0.04	1.00	1.00	0.68	0.68	0.92
44.0	1.00	1.00	0.14	0.04	1.00	1.00	0.68	0.68	0.92
46.0	1.00	1.00	0.14	0.04	1.00	1.00	0.68	0.68	0.92
48.0	1.00	1.00	0.14	0.04	1.00	1.00	0.68	0.68	0.92
50.0	1.00	1.00	0.14	0.04	1.00	1.00	0.68	0.68	0.92
52.0	1.00	1.00	0.14	0.04	1.00	1.00	0.68	0.68	0.92

Table 23. Beginning of the year size at age as output from the Base Model (G0.07). Growth was slow in 1998, so size and weight at the beginning of 1999 was less than in the previous years. Growth following 1998 was the same as in 1928-1997, but the 1998 slow growth affected those fish in subsequent years. Estimates for fish older than 32 years was similar to that at age 32.

Age	Female				Male			
	Length		Weight		Length		Weight	
	1928-1998	1999	1928-1998	1999	1928-1998	1999	1928-1998	1999
years	cm	cm	kg	kg	cm	cm	kg	kg
0	2.4	2.4	0.01	0.01	0.9	0.9	0.01	0.01
1	10.4	5.2	0.02	0.01	10.1	4.7	0.02	0.01
2	16.8	16.0	0.09	0.08	16.9	16.1	0.09	0.08
3	22.0	21.3	0.20	0.18	22.1	21.4	0.20	0.19
4	26.1	25.6	0.33	0.31	25.9	25.4	0.33	0.31
5	29.4	29.0	0.48	0.46	28.8	28.4	0.45	0.43
6	32.1	31.7	0.62	0.60	30.9	30.7	0.55	0.54
7	34.2	33.9	0.74	0.73	32.6	32.4	0.64	0.63
8	35.9	35.7	0.86	0.84	33.8	33.6	0.72	0.71
9	37.3	37.1	0.96	0.95	34.7	34.6	0.78	0.77
10	38.4	38.2	1.04	1.03	35.4	35.3	0.82	0.82
11	39.2	39.1	1.12	1.11	35.9	35.8	0.86	0.85
12	39.9	39.9	1.18	1.17	36.2	36.2	0.88	0.88
13	40.5	40.4	1.23	1.22	36.5	36.5	0.90	0.90
14	41.0	40.9	1.27	1.26	36.7	36.7	0.92	0.92
15	41.3	41.3	1.30	1.30	36.9	36.9	0.93	0.93
16	41.6	41.6	1.33	1.32	37.0	37.0	0.94	0.94
17	41.8	41.8	1.35	1.35	37.1	37.1	0.95	0.95
18	42.0	42.0	1.37	1.37	37.2	37.2	0.95	0.95
19	42.2	42.2	1.38	1.38	37.2	37.2	0.96	0.96
20	42.3	42.3	1.39	1.39	37.3	37.3	0.96	0.96
21	42.4	42.4	1.40	1.40	37.3	37.3	0.96	0.96
22	42.5	42.5	1.41	1.41	37.3	37.3	0.96	0.96
23	42.5	42.5	1.42	1.42	37.3	37.3	0.96	0.96
24	42.6	42.6	1.42	1.42	37.4	37.4	0.96	0.96
25	42.6	42.6	1.43	1.43	37.4	37.4	0.97	0.97
26	42.7	42.7	1.43	1.43	37.4	37.4	0.97	0.97
27	42.7	42.7	1.43	1.43	37.4	37.4	0.97	0.97
28	42.7	42.7	1.43	1.43	37.4	37.4	0.97	0.97
29	42.7	42.7	1.44	1.44	37.4	37.4	0.97	0.97
30	42.7	42.7	1.44	1.44	37.4	37.4	0.97	0.97
31	42.7	42.8	1.44	1.44	37.4	37.4	0.97	0.97
32	42.8	42.8	1.44	1.44	37.4	37.4	0.97	0.97

Table 24. Base Model (G07) estimates of the numbers of females (x1,000) in the population (continued on next three pages).

	Age (years)																																		
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1927	1311	1223	1140	1063	991	924	862	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1928	1311	1223	1140	1063	991	924	862	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1929	1311	1223	1140	1063	991	924	862	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1930	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1931	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1932	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1933	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1934	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1935	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113
1936	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	160	150	140	130	121	113
1937	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	160	150	140	130	121	113
1938	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	527	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	160	150	140	130	121	113
1939	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	527	492	458	427	399	372	346	323	301	281	262	244	228	212	198	185	172	160	150	139	130	121	113
1940	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	527	492	458	427	398	372	346	323	301	281	262	244	228	212	198	184	172	160	150	139	130	121	113
1941	1311	1223	1140	1063	991	924	861	803	748	698	651	606	565	527	492	458	427	398	371	346	323	301	281	262	244	228	212	198	184	172	160	150	139	130	121	113
1942	1311	1223	1140	1063	991	924	861	803	748	698	650	606	565	527	491	458	427	398	371	346	323	301	281	262	244	227	212	198	184	172	160	149	139	130	121	113
1943	1311	1223	1140	1063	991	924	861	802	748	697	650	606	565	527	491	458	427	398	371	346	323	301	281	262	244	227	212	198	184	172	160	149	139	130	121	113
1944	1311	1223	1140	1063	990	923	860	802	747	696	649	605	564	526	491	457	426	398	371	346	322	300	280	261	243	227	212	197	184	172	160	149	139	130	121	113
1945	1311	1223	1140	1063	990	921	858	799	745	694	647	603	562	524	489	456	425	396	369	344	321	299	279	260	243	226	211	197	183	171	159	149	139	129	120	112
1946	1311	1223	1140	1062	987	916	852	793	739	688	641	598	557	520	484	452	421	393	366	341	318	297	277	258	240	224	209	195	182	169	158	147	137	128	119	111
1947	1311	1222	1140	1062	988	916	850	789	735	684	638	594	554	517	482	449	419	390	364	339	316	295	275	256	239	223	208	194	181	168	157	146	137	127	119	111
1948	1311	1222	1140	1062	989	918	851	789	733	682	636	592	552	515	480	447	417	389	362	338	315	294	274	255	238	222	207	193	180	168	156	146	136	127	118	110
1949	1311	1222	1140	1062	988	918	851	789	731	679	632	589	549	512	477	445	414	386	360	336	313	292	272	254	237	221	206	192	179	167	155	145	135	126	117	110
1950	1311	1222	1140	1062	988	917	850	789	731	677	629	586	545	508	474	442	412	384	358	334	311	290	270	252	235	219	204	190	178	166	154	144	134	125	117	109
1951	1310	1222	1139	1062	987	915	849	787	730	676	627	582	542	505	470	438	409	381	355	331	309	288	268	250	233	217	203	189	176	164	153	143	133	124	116	108
1952	1310	1222	1139	1061	986	913	845	783	726	673	624	578	537	500	466	434	404	377	351	328	305	285	265	248	231	215	201	187	174	163	152	141	132	123	115	107
1953	1310	1222	1139	1062	987	914	845	782	725	672	623	577	535	497	462	431	401	374	349	325	303	283	263	246	229	214	199	186	173	161	150	140	131	122	114	106
1954	1310	1222	1139	1062	987	915	846	782	724	671	622	576	534	495	460	428	399	371	346	323	301	280	261	244	227	212	198	184	172	160	149	139	130	121	113	105
1955	1310	1222	1139	1061	987	914	846	783	724	670	620	575	533	494	458	425	396	369	343	320	298	278	259	242	225	210	196	183	170	159	148	138	129	120	112	104
1956	1310	1221	1139	1061	986	914	846	783	724	669	619	574	532	493	457	423	393	366	341	318	296	276	257	240	224	208	194	181	169	158	147	137	128	119	111	103
1957	1310	1221	1139	1061	986	913	845	782	723	668	618	572	529	491	455	422	391	363	338	315	293	273	255	237	221	206	192	179	167	156	145	136	126	118	110	102
1958	1310	1221	1139	1061	985	911	843	779	721	667	616	570	527	488	453	420	389	360	335	312	290	270	252	235	219	204	190	177	165	154	144	134	125	117	109	101
1959	1309	1221	1139	1061	985	911	842	778	719	665	615	569	526	487	451	418	387	359	333	309	288	268	250	233	217	202	188	176	164	153	142	133	124	115	108	100
1960	1309	1221	1138	1061	985	911	842	777	718	664	614	568	525	485	449	416	386	357	331	307	285	265	247	230	215	200	187	174	162	151	141	131	123	114	106	99
1961	1309	1221	1138	1060	985	911	842	777	717	662	612	566	524	484	448	414	384	356	330	305	283	263	245	228	212	198	185	172	160	150	139	130	121	113	105	98
1962	1309	1221	1138	1061	985	912	843	778	718	663	612	566	524	484	448	414	383	355	329	305	282	262	243	226	211	196	183	171	159	148	138	129	120	112	104	97
1963	1309	1221	1138	1060	984	911	842	777	717	662	611	564	522	483	446	413	381	353	327	303	281	260	241	224	209	194	181	169	157	147	137	127	119	111	103	96
1964	1309	1220	1138	1060	983	908	839	774	715	660	609	562	519	480	444	410	379	351	325	301	279	258	239	222	206	192	179	166	155	145	135	126	117	109	102	95
1965	1309	1220	1138	1060	985	910	840	775	716	661	610	563	519	480	443	410	379	351	324	300	278	257	239	221	205	190	177	165	154	143	134	125	116	108	101	94

Table 24. (Continued) Base Model (G07) estimates of the numbers of females (x1,000) in the population.

Year	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
1927	106	98	92	86	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1928	106	98	92	86	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1929	106	98	92	86	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1930	105	98	92	86	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1931	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1932	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1933	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1934	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1935	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1936	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1937	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1938	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1939	105	98	92	85	80	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1940	105	98	92	85	80	74	69	65	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1941	105	98	92	85	80	74	69	65	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1942	105	98	92	85	80	74	69	65	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1943	105	98	92	85	80	74	69	64	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1944	105	98	91	85	79	74	69	64	60	56	52	49	45	42	39	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	101
1945	105	98	91	85	79	74	69	64	60	56	52	49	45	42	39	37	34	32	30	28	26	24	22	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	101
1946	104	97	90	84	78	73	68	64	59	55	52	48	45	42	39	36	34	32	29	27	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	100
1947	103	96	90	84	78	73	68	63	59	55	51	48	45	42	39	36	34	31	29	27	25	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	100
1948	103	96	89	83	78	72	68	63	59	55	51	48	44	41	39	36	34	31	29	27	25	24	22	21	19	18	17	16	14	13	13	12	11	10	10	9	8	8	7	99
1949	102	95	89	83	77	72	67	63	58	54	51	47	44	41	38	36	33	31	29	27	25	23	22	20	19	18	17	15	14	13	13	12	11	10	9	9	8	8	7	99
1950	101	95	88	82	77	71	67	62	58	54	50	47	44	41	38	35	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	98
1951	101	94	87	82	76	71	66	62	57	54	50	47	43	41	38	35	33	31	29	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	97
1952	100	93	87	81	75	70	65	61	57	53	49	46	43	40	37	35	32	30	28	26	25	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	96
1953	99	92	86	80	75	70	65	61	56	53	49	46	43	40	37	35	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	11	10	9	9	8	7	7	95
1954	98	91	85	79	74	69	64	60	56	52	49	45	42	39	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	95
1955	97	91	85	79	74	69	64	60	56	52	48	45	42	39	37	34	32	30	28	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	94
1956	96	90	84	78	73	68	63	59	55	51	48	45	42	39	36	34	31	29	27	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	93
1957	96	89	83	77	72	67	63	59	55	51	47	44	41	38	36	33	31	29	27	25	24	22	20	19	18	17	15	14	13	13	12	11	10	9	9	8	8	7	7	92
1958	94	88	82	77	71	67	62	58	54	50	47	44	41	38	35	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	91
1959	94	87	81	76	71	66	61	57	53	50	46	43	40	38	35	33	31	28	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	7	90
1960	93	86	80	75	70	65	61	57	53	49	46	43	40	37	35	32	30	28	26	24	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	6	89
1961	92	85	80	74	69	65	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	88
1962	91	85	79	74	69	64	60	56	52	48	45	42	39	37	34	32	30	28	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	88
1963	90	84	78	73	68	63	59	55	51	48	45	42	39	36	34	31	29	27	25	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	87
1964	89	83	77	72	67	62	58	54	51	47	44	41	38	36	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	85
1965	88	82	76	71	66	62	58	54	50	47	44	41	38	35	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	85

Table 24. Continued. Base Model estimates of females in the population x 1000.

	Age (years)																																			
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1966	1308	1220	1138	1059	981	906	835	770	710	655	605	558	515	476	439	406	376	347	321	297	275	254	236	219	203	188	174	162	151	141	131	122	114	106	99	92
1967	1304	1220	1137	1045	916	792	707	644	591	545	502	463	428	395	364	336	311	288	266	246	227	210	195	181	167	155	144	134	124	116	108	101	94	87	81	76
1968	681	1216	1136	1046	913	754	634	560	508	466	429	395	365	337	310	287	265	245	226	209	193	179	165	153	142	132	122	113	105	98	91	85	79	74	69	64
1969	758	635	1133	1047	919	760	612	510	449	407	373	343	316	292	269	248	229	212	196	181	167	155	143	132	122	114	105	98	90	84	78	73	68	63	59	55
1970	927	707	592	1055	969	845	697	561	467	411	373	341	314	289	267	246	227	210	194	179	166	153	142	131	121	112	104	96	89	83	77	72	67	62	58	54
1971	1285	864	659	551	976	891	775	639	514	428	376	341	312	287	265	244	226	208	192	177	164	152	140	130	120	111	103	95	88	82	76	70	66	61	57	53
1972	1148	1198	806	613	507	890	809	702	578	465	387	341	309	283	260	240	221	204	188	174	161	148	137	127	117	108	100	93	86	80	74	69	64	59	55	51
1973	813	1071	1116	749	562	459	800	725	629	518	416	346	305	276	253	233	215	198	183	169	156	144	133	123	114	105	97	90	83	77	71	66	61	57	53	49
1974	2609	758	998	1036	682	501	405	704	637	553	455	366	304	268	243	222	205	189	174	160	148	137	126	117	108	100	92	85	79	73	68	63	58	54	50	47
1975	557	2433	707	926	945	611	445	359	622	563	488	402	323	269	237	214	196	181	167	154	142	131	121	111	103	95	88	81	75	70	65	60	55	51	48	44
1976	774	520	2268	657	849	854	548	398	321	556	503	436	359	289	240	211	192	175	161	149	137	127	117	108	100	92	85	79	73	67	62	58	53	50	46	43
1977	518	721	485	2107	602	766	765	489	355	286	496	449	389	320	257	214	189	171	156	144	133	122	113	104	96	89	82	76	70	65	60	56	51	48	44	41
1978	431	483	673	451	1949	552	701	699	447	325	261	453	410	356	293	235	196	172	156	143	132	121	112	103	95	88	81	75	69	64	59	55	51	47	44	40
1979	1023	402	451	625	415	1776	501	635	633	404	294	236	410	371	322	265	213	177	156	141	129	119	110	101	93	86	79	73	68	63	58	54	50	46	43	39
1980	4349	953	374	418	566	366	1548	435	550	548	350	254	205	355	321	278	229	184	153	135	122	112	103	95	88	81	75	69	64	59	54	50	46	43	40	37
1981	2959	4055	889	348	383	511	329	1385	389	491	489	313	227	183	317	287	249	205	164	137	120	109	100	92	85	78	72	67	61	57	52	49	45	41	38	35
1982	1327	2759	3779	824	315	338	446	286	1202	337	426	424	271	197	159	275	249	216	177	143	119	104	95	87	80	74	68	63	58	53	49	45	42	39	36	33
1983	732	1237	2571	3497	740	274	289	380	243	1020	286	361	360	230	167	134	233	211	183	150	121	101	89	80	73	68	62	57	53	49	45	42	39	36	33	30
1984	472	683	1153	2381	3153	648	236	248	326	208	873	245	310	308	197	143	115	200	181	156	129	104	86	76	69	63	58	53	49	45	42	39	36	33	31	28
1985	826	440	636	1065	2121	2697	544	197	207	270	173	725	203	257	256	163	119	96	166	150	130	107	86	71	63	57	52	48	44	41	38	35	32	30	27	25
1986	545	770	410	586	933	1756	2172	433	156	164	214	137	575	161	204	203	130	94	76	131	119	103	85	68	57	50	45	41	38	35	32	30	28	25	23	22
1987	1346	508	718	378	522	798	1474	1812	361	130	136	178	114	477	134	169	168	108	78	63	109	99	85	70	57	47	41	38	34	32	29	27	25	23	21	20
1988	2509	1255	473	657	322	409	600	1092	1335	265	96	100	131	83	350	98	124	124	79	57	46	80	72	63	52	42	35	30	28	25	23	21	20	18	17	16
1989	228	2340	1169	435	570	261	321	466	843	1029	204	74	77	101	64	270	76	96	95	61	44	36	62	56	48	40	32	27	23	21	19	18	16	15	14	13
1990	543	212	2179	1076	380	470	209	255	368	666	812	161	58	61	79	51	213	60	75	75	48	35	28	49	44	38	31	25	21	18	17	15	14	13	12	11
1991	316	507	198	1994	912	295	348	153	185	266	481	587	116	42	44	57	37	154	43	54	54	35	25	20	35	32	28	23	18	15	13	12	11	10	9	9
1992	785	295	472	181	1718	730	228	266	116	140	202	365	444	88	32	33	43	28	116	33	41	41	26	19	15	27	24	21	17	14	11	10	9	8	8	7
1993	214	732	275	436	161	1464	610	189	220	96	116	167	301	367	73	26	27	36	23	96	27	34	34	22	16	13	22	20	17	14	11	9	8	8	7	6
1994	1220	200	681	252	373	128	1114	458	141	164	71	86	124	224	273	54	19	20	27	17	71	20	25	25	16	12	9	16	15	13	11	8	7	6	6	5
1995	3099	1137	186	626	219	305	101	874	358	110	128	56	67	97	175	213	42	15	16	21	13	56	16	20	20	13	9	7	13	12	10	8	7	5	5	4
1996	325	2889	1059	171	547	180	244	80	690	282	87	101	44	53	76	137	167	33	12	13	16	10	44	12	16	15	10	7	6	10	9	8	6	5	4	4
1997	1193	303	2691	974	149	445	142	190	62	534	218	67	78	34	41	59	106	129	26	9	10	13	8	34	9	12	12	8	6	4	8	7	6	5	4	3
1998	370	1112	282	2467	834	118	339	107	142	46	398	162	50	58	25	30	44	79	96	19	7	7	9	6	25	7	9	9	6	4	3	6	5	5	4	3
1999	3606	345	1036	258	2086	637	85	241	75	100	33	280	114	35	41	18	21	31	56	68	13	5	5	7	4	18	5	6	6	4	3	2	4	4	3	3
2000	2997	3362	321	959	232	1801	539	72	202	63	84	27	234	95	29	34	15	18	26	46	57	11	4	4	6	4	15	4	5	5	3	2	2	3	3	3
2001	836	2795	3133	299	865	202	1538	457	61	171	53	71	23	197	81	25	29	13	15	22	39	48	9	3	4	5	3	13	4	4	4	3	2	2	3	3
2002	385	779	2605	2908	277	776	179	1360	404	53	150	47	62	20	174	71	22	25	11	13	19	35	42	8	3	3	4	3	11	3	4	4	2	2	1	3
2003	1848	359	726	2422	2676	254	702	162	1228	364	48	136	42	56	18	157	64	20	23	10	12	17	31	38	8	3	3	4	2	10	3	4	4	2	2	1
2004	1215	1723	334	677	2256	2481	235	644	148	1120	332	44	124	39	51	17	143	58	18	21	9	11	16	28	35	7	2	3	3	2	9	3	3	3	2	1

Table 24. Continued. Base Model estimates of females in the population x 1000.

Year	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
1966	61	57	53	49	46	43	40	37	35	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	11	10	9	9	8	7	7	6	6	83
1967	50	46	43	40	38	35	33	31	28	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	7	6	6	5	5	68
1968	42	39	37	34	32	30	28	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	4	4	58
1969	36	34	31	29	27	25	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	49
1970	35	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	49
1971	35	32	30	28	26	25	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	6	6	6	5	5	5	4	4	4	3	48
1972	34	31	29	27	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	46
1973	32	30	28	26	25	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	6	6	6	5	5	5	4	4	4	3	3	44
1974	31	28	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3	42
1975	29	27	25	23	22	20	19	18	17	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	40
1976	28	26	24	22	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	4	4	4	4	3	3	3	3	38
1977	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3	36
1978	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	5	4	4	4	3	3	3	3	3	36
1979	25	24	22	20	19	18	17	15	14	13	13	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	35
1980	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	32
1981	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	4	4	4	4	3	3	3	3	3	2	2	31
1982	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	4	4	4	4	3	3	3	3	3	2	2	2	29
1983	19	18	17	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2	26
1984	18	16	15	14	13	12	11	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	24
1985	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	21
1986	14	13	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	1	1	18
1987	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	16
1988	10	9	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	13
1989	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	10
1990	7	6	6	5	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	8.8
1991	5	5	5	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	6.8
1992	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	5.6
1993	4	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	4.9
1994	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	3.9
1995	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3.3
1996	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.8
1997	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3
1998	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.8
1999	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.4
2000	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.2
2001	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1
2002	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1
2003	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2004	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table 25. Base Model (G07) estimates of the numbers of males (x1,000) in the population (continued on next three pages).

	Age (Years)																																								
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
1927	1311	1223	1140	1063	991	924	862	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	106	98	92	86	80
1928	1311	1223	1140	1063	991	924	862	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	106	98	92	86	80
1929	1311	1223	1140	1063	991	924	862	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	106	98	92	86	80
1930	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	105	98	92	86	80
1931	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	105	98	92	85	80
1932	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	105	98	92	85	80
1933	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	105	98	92	85	80
1934	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	105	98	92	85	80
1935	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	161	150	140	130	121	113	105	98	92	85	80
1936	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	160	150	140	130	121	113	105	98	92	85	80
1937	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	528	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	160	150	140	130	121	113	105	98	92	85	80
1938	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	527	492	459	428	399	372	347	323	301	281	262	244	228	212	198	185	172	160	150	140	130	121	113	105	98	92	85	80
1939	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	527	492	458	427	399	372	347	323	301	281	262	244	228	212	198	185	172	160	150	139	130	121	113	105	98	92	85	80
1940	1311	1223	1140	1063	991	924	861	803	749	698	651	607	566	527	492	458	427	398	372	346	323	301	281	262	244	228	212	198	184	172	160	150	139	130	121	113	105	98	92	85	80
1941	1311	1223	1140	1063	991	924	861	803	748	698	651	607	565	527	492	458	427	398	371	346	323	301	281	262	244	228	212	198	184	172	160	150	139	130	121	113	105	98	92	85	80
1942	1311	1223	1140	1063	991	924	861	803	748	698	650	606	565	527	491	458	427	398	371	346	323	301	281	262	244	227	212	198	184	172	160	149	139	130	121	113	105	98	92	85	80
1943	1311	1223	1140	1063	991	924	861	803	748	697	650	606	565	527	491	458	427	398	371	346	323	301	281	262	244	227	212	198	184	172	160	149	139	130	121	113	105	98	92	85	80
1944	1311	1223	1140	1063	990	923	860	802	747	696	649	605	564	526	491	457	426	398	371	346	322	300	280	261	244	227	212	197	184	172	160	149	139	130	121	113	105	98	91	85	79
1945	1311	1223	1140	1063	990	921	858	799	745	694	647	603	562	524	489	456	425	396	369	344	321	299	279	260	243	226	211	197	183	171	159	149	139	129	121	112	105	98	91	85	79
1946	1311	1223	1140	1062	987	917	852	793	739	688	642	598	557	520	485	452	421	393	366	341	318	297	277	258	240	224	209	195	182	169	158	147	137	128	119	111	104	97	90	84	78
1947	1311	1222	1140	1062	988	916	850	790	735	685	638	595	554	517	482	449	419	390	364	339	316	295	275	256	239	223	208	194	181	168	157	146	137	127	119	111	103	96	90	84	78
1948	1311	1222	1140	1062	989	918	851	790	734	683	636	593	552	515	480	447	417	389	362	338	315	294	274	255	238	222	207	193	180	168	156	146	136	127	118	110	103	96	89	83	78
1949	1311	1222	1140	1062	988	918	852	789	732	680	633	589	549	512	477	445	415	386	360	336	313	292	272	254	237	221	206	192	179	167	155	145	135	126	117	110	102	95	89	83	77
1950	1311	1222	1140	1062	988	917	851	789	731	678	630	586	546	509	474	442	412	384	358	334	311	290	270	252	235	219	204	191	178	166	154	144	134	125	117	109	101	95	88	82	77
1951	1310	1222	1139	1062	987	916	849	787	730	676	627	583	542	505	470	438	409	381	355	331	309	288	268	250	233	217	203	189	176	164	153	143	133	124	116	108	101	94	88	82	76
1952	1310	1222	1139	1061	986	913	846	784	727	674	624	579	538	500	466	434	405	377	352	328	306	285	266	248	231	215	201	187	174	163	152	141	132	123	115	107	100	93	87	81	75
1953	1310	1222	1139	1062	987	914	846	783	725	673	624	578	535	497	463	431	402	374	349	325	303	283	264	246	229	214	199	186	173	161	150	140	131	122	114	106	99	92	86	80	75
1954	1310	1222	1139	1061	987	915	846	783	725	671	622	577	534	495	460	428	399	372	346	323	301	281	262	244	227	212	198	184	172	160	149	139	130	121	113	105	98	91	85	80	74
1955	1310	1222	1139	1061	987	915	847	783	724	670	621	576	534	494	458	426	396	369	344	320	299	278	259	242	225	210	196	183	170	159	148	138	129	120	112	104	97	91	85	79	74
1956	1310	1221	1139	1061	986	915	847	784	725	670	620	574	532	494	457	424	394	366	341	318	296	276	257	240	224	209	194	181	169	158	147	137	128	119	111	104	97	90	84	78	73
1957	1310	1221	1139	1061	986	913	845	782	724	669	619	572	530	491	456	422	391	363	338	315	293	274	255	238	222	207	193	180	167	156	145	136	126	118	110	102	96	89	83	77	72
1958	1310	1221	1139	1061	985	912	843	780	722	667	617	571	528	489	453	420	389	361	335	312	290	271	252	235	219	204	190	178	166	154	144	134	125	117	109	101	95	88	82	77	71
1959	1309	1221	1139	1061	985	912	842	779	720	666	616	570	527	487	451	418	388	359	333	309	288	268	250	233	217	202	189	176	164	153	142	133	124	115	108	100	94	87	81	76	71
1960	1309	1221	1138	1061	985	912	842	778	719	665	615	569	526	486	450	417	386	358	332	307	286	266	247	231	215	200	187	174	162	151	141	131	123	114	107	99	93	86	81	75	70
1961	1309	1221	1138	1060	985	911	842	778	718	663	613	567	525	485	448	415	384	356	330	306	284	263	245	228	213	198	185	172	161	150	140	130	121	113	105	98	92	85	80	74	69
1962	1309	1221	1138	1061	985	912	843	779	719	664	613	567	524	485	448	414	384	355	329	305	283	262	243	227	211	197	183	171	159	148	138	129	120	112	105	97	91	85	79	74	69
1963	1309	1221	1138	1060	984	911	842	778	718	663	612	565	523	483	447	413	382	353	327	303	281	261	242	224	209	194	181	169	157	147	137	128	119	111	103	96	90	84	78	73	68
1964	1309	1220	1138	1060	983	909	839	775	716	661	610	563	520	481	445	411	380	351	325	301	279	259	240	222	206	192	179	167	155	145	135	126	117	109	102	95	89	83	77	72	67
1965	1309	1220	1138	1060	985	911	841	776	717	661	611	563	520	480	444	411	380	351	325	300	278	258	239	221	205	191	177	165	154	144	134	125	116	108	101	94	88	82	76	71	66

Table 25. Continued. Base Model (G07) estimates of the numbers of males (x 1,000) in the population.

Year	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
1927	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1928	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1929	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1930	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1931	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1932	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1933	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1934	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1935	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1936	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1937	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1938	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1939	74	69	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1940	74	69	65	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1941	74	69	65	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1942	74	69	65	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1943	74	69	64	60	56	52	49	45	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	102
1944	74	69	64	60	56	52	49	45	42	39	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	101
1945	74	69	64	60	56	52	49	45	42	39	37	34	32	30	28	26	24	22	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	101
1946	73	68	64	59	55	52	48	45	42	39	36	34	32	29	27	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	100
1947	73	68	63	59	55	51	48	45	42	39	36	34	31	29	27	25	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	100
1948	72	68	63	59	55	51	48	44	41	39	36	34	31	29	27	25	24	22	21	19	18	17	16	14	13	13	12	11	10	10	9	8	8	7	99
1949	72	67	63	58	54	51	47	44	41	38	36	33	31	29	27	25	23	22	20	19	18	17	15	14	13	13	12	11	10	9	9	8	8	7	99
1950	71	67	62	58	54	50	47	44	41	38	36	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	98
1951	71	66	62	57	54	50	47	43	41	38	35	33	31	29	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	97
1952	70	65	61	57	53	49	46	43	40	37	35	33	30	28	26	25	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	96
1953	70	65	61	56	53	49	46	43	40	37	35	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	11	10	9	9	8	7	7	95
1954	69	64	60	56	52	49	45	42	39	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	95
1955	69	64	60	56	52	48	45	42	39	37	34	32	30	28	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	94
1956	68	63	59	55	51	48	45	42	39	36	34	31	29	27	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	93
1957	67	63	59	55	51	47	44	41	38	36	33	31	29	27	25	24	22	20	19	18	17	15	14	13	13	12	11	10	9	9	8	8	7	7	92
1958	67	62	58	54	50	47	44	41	38	35	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	91
1959	66	61	57	53	50	46	43	40	38	35	33	31	28	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	7	90
1960	65	61	57	53	49	46	43	40	37	35	32	30	28	26	24	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	6	89
1961	65	60	56	52	49	46	42	40	37	34	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	88
1962	64	60	56	52	48	45	42	39	37	34	32	30	28	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	88
1963	63	59	55	51	48	45	42	39	36	34	31	29	27	25	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	87
1964	62	58	54	51	47	44	41	38	36	33	31	29	27	25	23	22	20	19	18	17	15	14	13	12	12	11	10	9	9	8	8	7	7	6	85
1965	62	58	54	50	47	44	41	38	35	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	85

Table 25. Continued. Base Model (G07) estimates of the numbers of males (x 1,000) in the population.

	Age (Years)																																								
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
1966	1308	1220	1138	1059	982	906	836	771	711	656	606	559	516	476	440	407	376	348	322	297	275	255	236	219	203	188	175	163	151	141	131	123	114	106	99	93	86	80	75	70	65
1967	1304	1220	1137	1044	917	798	713	649	595	547	504	465	429	396	365	337	312	288	267	247	228	211	195	181	168	155	144	134	125	116	108	101	94	88	82	76	71	66	62	57	54
1968	681	1216	1136	1045	913	759	642	567	514	470	432	398	367	338	312	288	266	246	227	210	194	180	166	154	143	132	122	114	105	98	91	85	79	74	69	64	60	56	52	49	45
1969	758	635	1133	1046	919	764	619	519	456	412	376	346	318	293	271	249	230	213	197	182	168	155	144	133	123	114	106	98	91	84	78	73	68	63	59	55	51	48	45	42	39
1970	927	707	592	1055	969	846	701	568	475	418	378	345	317	292	269	248	229	211	195	180	166	154	142	132	122	113	104	97	90	83	77	72	67	62	58	54	51	47	44	41	38
1971	1285	864	659	551	976	892	776	643	520	435	383	346	316	290	267	246	227	209	193	178	165	152	141	130	120	111	103	96	89	82	76	71	66	61	57	53	50	46	43	40	37
1972	1148	1198	806	613	507	891	810	704	582	471	394	346	313	286	262	242	223	205	189	175	161	149	138	128	118	109	101	93	87	80	74	69	64	60	55	52	48	45	42	39	36
1973	813	1071	1116	749	562	459	802	727	631	521	422	353	310	280	256	235	216	199	184	170	156	144	134	123	114	106	98	90	84	77	72	67	62	57	53	50	46	43	40	37	35
1974	2609	758	998	1036	682	502	407	707	640	555	458	371	310	273	246	225	206	190	175	162	149	137	127	117	108	100	93	86	79	73	68	63	58	54	50	47	44	41	38	35	33
1975	557	2433	707	926	945	612	447	361	626	566	490	405	328	274	241	218	199	182	168	155	143	132	121	112	104	96	89	82	76	70	65	60	56	52	48	44	41	39	36	33	31
1976	774	520	2268	657	849	855	549	400	323	559	506	438	362	293	245	215	194	177	163	150	138	128	118	108	100	93	86	79	73	68	63	58	54	50	46	43	40	37	34	32	30
1977	518	721	485	2107	602	767	767	492	358	288	499	451	391	323	261	219	192	173	158	145	134	123	114	105	97	89	83	76	71	65	60	56	52	48	44	41	38	35	33	31	29
1978	431	483	673	451	1948	553	703	702	449	327	263	456	412	358	295	239	200	176	158	145	133	122	113	104	96	88	82	76	70	65	60	55	51	47	44	41	38	35	32	30	28
1979	1023	402	451	625	415	1777	502	637	635	407	296	238	413	373	323	267	216	181	159	143	131	120	111	102	94	87	80	74	68	63	58	54	50	46	43	40	37	34	32	29	27
1980	4349	953	374	418	566	367	1553	436	552	551	352	256	206	357	323	280	231	187	156	137	124	113	104	96	88	81	75	69	64	59	55	51	47	43	40	37	34	32	29	27	25
1981	2959	4055	889	348	383	512	330	1391	390	494	492	315	229	184	319	289	250	207	167	140	123	111	101	93	86	79	73	67	62	57	53	49	45	42	39	36	33	31	28	26	24
1982	1327	2759	3779	824	315	339	448	287	1209	339	429	427	273	199	160	277	250	217	179	145	121	107	96	88	81	74	68	63	58	54	50	46	42	39	36	33	31	29	27	25	23
1983	732	1237	2571	3496	740	275	291	382	245	1028	288	364	362	232	168	136	235	212	184	152	123	103	90	82	74	68	63	58	54	49	46	42	39	36	33	31	28	26	24	23	21
1984	472	683	1153	2380	3153	650	238	250	328	210	881	247	312	311	199	144	116	201	182	158	130	105	88	77	70	64	59	54	50	46	42	39	36	33	31	28	26	24	23	21	19
1985	826	440	636	1065	2122	2708	547	199	209	273	174	732	205	259	258	165	120	96	167	151	131	108	87	73	64	58	53	49	45	41	38	35	32	30	28	26	24	22	20	19	17
1986	545	770	410	585	933	1765	2194	439	159	166	217	139	581	163	206	205	131	95	77	133	120	104	86	69	58	51	46	42	39	36	33	30	28	26	24	22	20	19	17	16	15
1987	1346	508	718	378	522	802	1489	1836	366	132	138	181	115	483	135	171	170	109	79	64	110	100	86	71	58	48	42	38	35	32	30	27	25	23	21	20	18	17	16	14	13
1988	2509	1255	473	657	323	412	608	1111	1360	270	97	102	133	85	355	99	126	125	80	58	47	81	73	63	52	42	35	31	28	26	24	22	20	18	17	16	14	13	12	11	11
1989	228	2340	1169	435	570	263	326	474	861	1051	209	75	78	102	65	274	77	97	96	62	45	36	62	56	49	40	33	27	24	22	20	18	17	15	14	13	12	11	10	10	9
1990	543	212	2180	1075	380	472	212	260	376	682	831	165	59	62	81	52	216	60	76	76	49	35	28	49	44	39	32	26	22	19	17	16	14	13	12	11	10	10	9	8	8
1991	316	507	198	1992	912	297	354	156	189	274	495	602	119	43	45	59	37	156	44	55	55	35	26	21	36	32	28	23	19	16	14	12	11	10	10	9	8	7	7	6	6
1992	785	295	472	181	1718	736	232	272	119	144	208	375	457	90	33	34	44	28	119	33	42	42	27	19	16	27	24	21	17	14	12	10	9	9	8	7	7	6	6	5	5
1993	214	732	275	435	161	1470	617	193	225	99	119	172	310	378	75	27	28	37	23	98	27	35	34	22	16	13	22	20	17	14	12	10	9	8	7	6	6	6	5	5	4
1994	1220	200	681	252	373	129	1128	466	145	168	74	89	128	231	281	56	20	21	27	17	73	20	26	26	16	12	10	17	15	13	11	9	7	6	6	5	5	4	4	4	3
1995	3099	1137	186	626	219	307	103	890	366	113	132	57	69	100	180	220	43	16	16	21	14	57	16	20	20	13	9	7	13	12	10	8	7	6	5	4	4	4	3	3	3
1996	325	2889	1059	171	547	181	247	82	704	289	89	104	45	55	79	142	173	34	12	13	17	11	45	13	16	16	10	7	6	10	9	8	7	5	4	4	4	3	3	3	3
1997	1193	303	2691	973	149	448	144	193	64	547	224	69	80	35	42	61	110	134	26	10	10	13	8	35	10	12	12	8	6	5	8	7	6	5	4	3	3	3	2	2	2
1998	370	1112	282	2465	834	119	344	109	145	48	409	167	52	60	26	32	45	82	100	20	7	7	10	6	26	7	9	9	6	4	3	6	5	5	4	3	3	2	2	2	2
1999	3606	345	1036	258	2086	643	87	247	77	103	34	288	118	36	42	18	22	32	58	70	14	5	5	7	4	18	5	6	6	4	3	2	4	4	3	3	2	2	2	1	1
2000	2997	3362	321	959	232	1807	546	73	207	65	86	28	241	99	30	35	15	19	27	48	59	12	4	4	6	4	15	4	5	5	3	2	2	3	3	3	2	2	2	1	1
2001	836	2795	3133	299	865	202	1549	465	62	175	55	73	24	204	83	26	30	13	16	23	41	50	10	4	4	5	3	13	4	5	5	3	2	2	3	3	2	2	2	1	1
2002	385	779	2605	2907	276	777	180	1372	411	55	155	48	64	21	180	74	23	26	11	14	20	36	44	9	3	3	4	3	11	3	4	4	3	2	1	3	2	2	2	1	1
2003	1848	359	726	2422	2676	253	704	163	1239	371	49	140	44	58	19	162	66	20	24	10	13	18	32	40	8	3	3	4	2	10	3	4	4	2	2	1	2	2	2	2	1
2004	1215	1723	334	677	2255	2483	234	647	149	1133	339	45	127	40	53	17	148	60	19	22	9	11	16	30	36	7	3	3	3	2	9	3	3	3	2	2	1	2	2	2	1

Table 25. Continued. Base Model (G07) estimates of the numbers of males (x1000) in the population.

Year	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
1966	61	57	53	49	46	43	40	37	35	32	30	28	26	24	23	21	20	18	17	16	15	14	13	12	11	11	10	9	9	8	7	7	6	6	83
1967	50	47	43	40	38	35	33	31	29	27	25	23	22	20	19	17	16	15	14	13	12	11	11	10	9	9	8	8	7	7	6	6	5	5	68
1968	42	39	37	34	32	30	28	26	24	22	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	4	4	58
1969	36	34	31	29	27	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	50
1970	36	33	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	49
1971	35	33	30	28	26	25	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	7	6	6	5	5	5	4	4	4	3	48
1972	34	32	29	27	26	24	22	21	19	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	46
1973	33	30	28	26	25	23	21	20	19	17	16	15	14	13	12	11	11	10	9	9	8	7	7	7	6	6	5	5	5	4	4	4	3	3	45
1974	31	29	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	42
1975	29	27	25	24	22	20	19	18	17	15	14	13	13	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	40
1976	28	26	24	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	5	4	4	4	3	3	3	3	38
1977	27	25	23	22	20	19	18	16	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	3	3	3	3	3	36
1978	26	24	23	21	20	18	17	16	15	14	13	12	11	11	10	9	9	8	7	7	6	6	6	5	5	5	4	4	4	3	3	3	3	3	36
1979	25	24	22	21	19	18	17	16	14	13	13	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	35
1980	24	22	20	19	18	17	15	14	13	13	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	2	32
1981	23	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	5	4	4	4	3	3	3	3	3	2	2	31
1982	21	20	18	17	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	6	5	5	4	4	4	4	3	3	3	3	3	2	2	2	29
1983	19	18	17	16	14	13	13	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	2	2	2	2	26
1984	18	17	15	14	13	12	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2	2	24
1985	16	15	14	13	12	11	10	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	21
1986	14	13	12	11	10	9	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	1	1	18
1987	12	11	11	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	16
1988	10	9	8	8	7	7	6	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	13
1989	8	8	7	6	6	6	5	5	4	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	11
1990	7	6	6	6	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	9
1991	5	5	5	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	7
1992	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	6
1993	4	4	3	3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	5
1994	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	4
1995	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	3
1996	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
1997	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1998	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
1999	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2000	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2001	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2002	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2003	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2004	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table 26. Time series of estimates from the Base Model (G0.07). Depletion is spawning output/unfished spawning output, discard rate is (catch-landings)/catch, and Harvest rate is catch/biomass available to the fishermen.

Year	Age 1+ biomass (mt)	Spawning Output 10^7 eggs	Depletion	Age 0 Recruits x 1000	Catch (mt)	Landings (mt)	Discard rate	Harvest rate
unfished	28525	26977	1.00	2623	0			0.00
1928	28525	26977	1.00	2623	1	1	0.04	0.00
1929	28524	26976	1.00	2623	3	3	0.04	0.00
1930	28521	26973	1.00	2623	3	3	0.04	0.00
1931	28518	26970	1.00	2623	1	1	0.04	0.00
1932	28517	26969	1.00	2623	1	1	0.04	0.00
1933	28517	26968	1.00	2623	1	1	0.04	0.00
1934	28516	26967	1.00	2623	2	2	0.04	0.00
1935	28514	26966	1.00	2623	2	2	0.04	0.00
1936	28513	26964	1.00	2623	2	2	0.04	0.00
1937	28511	26962	1.00	2623	2	2	0.04	0.00
1938	28510	26960	1.00	2623	5	5	0.04	0.00
1939	28506	26956	1.00	2623	7	7	0.04	0.00
1940	28499	26949	1.00	2623	8	8	0.04	0.00
1941	28492	26942	1.00	2622	9	9	0.04	0.00
1942	28484	26933	1.00	2622	10	10	0.04	0.00
1943	28476	26924	1.00	2622	41	39	0.04	0.00
1944	28438	26885	1.00	2622	95	91	0.04	0.00
1945	28348	26794	0.99	2622	246	236	0.04	0.01
1946	28113	26555	0.98	2622	167	160	0.04	0.01
1947	27963	26395	0.98	2622	104	100	0.04	0.00
1948	27881	26299	0.97	2622	167	160	0.04	0.01
1949	27743	26146	0.97	2621	178	171	0.04	0.01
1950	27601	25986	0.96	2621	210	201	0.04	0.01
1951	27434	25801	0.96	2621	272	261	0.04	0.01
1952	27214	25560	0.95	2621	204	195	0.04	0.01
1953	27072	25394	0.94	2620	203	194	0.04	0.01
1954	26940	25236	0.94	2620	210	201	0.04	0.01
1955	26808	25079	0.93	2620	206	197	0.04	0.01
1956	26688	24934	0.92	2620	255	244	0.04	0.01
1957	26526	24749	0.92	2619	281	269	0.04	0.01
1958	26348	24547	0.91	2619	257	246	0.04	0.01
1959	26202	24376	0.90	2619	254	243	0.04	0.01
1960	26067	24216	0.90	2619	270	258	0.04	0.01
1961	25925	24049	0.89	2618	212	203	0.04	0.01
1962	25848	23946	0.89	2618	289	276	0.04	0.01
1963	25701	23777	0.88	2618	338	323	0.04	0.01
1964	25514	23568	0.87	2618	218	208	0.04	0.01
1965	25454	23483	0.87	2617	434	415	0.04	0.02

Table 26. Continued. Time series of estimates from the Base Model (G0.07).

Year	Age 1+ biomass (mt)	Spawning Output 10^7 eggs	Depletion	Age 0 Recruits x 1000	Catch (mt)	Landings (mt)	Discard rate	Harvest rate
1966	25186	23196	0.86	2617	4321	4129	0.04	0.18
1967	21096	19175	0.71	2609	3151	3001	0.05	0.16
1968	18269	16304	0.60	1361	2487	2358	0.05	0.14
1969	16172	14110	0.52	1516	272	256	0.06	0.02
1970	16282	14036	0.52	1854	281	265	0.06	0.02
1971	16343	14021	0.52	2569	466	441	0.05	0.03
1972	16194	13911	0.52	2296	626	595	0.05	0.04
1973	15898	13706	0.51	1626	878	836	0.05	0.06
1974	15371	13257	0.49	5219	773	733	0.05	0.05
1975	15020	12849	0.48	1115	601	567	0.06	0.04
1976	14960	12567	0.47	1547	609	574	0.06	0.04
1977	14928	12294	0.46	1037	282	263	0.07	0.02
1978	15177	12358	0.46	861	440	410	0.07	0.03
1979	15162	12343	0.46	2045	1054	992	0.06	0.07
1980	14431	11903	0.44	8698	586	557	0.05	0.04
1981	14242	11908	0.44	5918	953	912	0.04	0.07
1982	14034	11522	0.43	2653	1173	1114	0.05	0.09
1983	13969	10810	0.40	1464	1030	938	0.09	0.08
1984	14210	10164	0.38	943	1441	1268	0.12	0.11
1985	13976	9303	0.34	1653	1994	1769	0.11	0.15
1986	12984	8386	0.31	1090	1374	1252	0.09	0.11
1987	12377	8227	0.30	2692	2560	2386	0.07	0.21
1988	10417	7247	0.27	5019	1755	1650	0.06	0.17
1989	9256	6627	0.25	455	1352	1271	0.06	0.15
1990	8599	6090	0.23	1087	1784	1650	0.08	0.23
1991	7533	5052	0.19	633	1308	1161	0.11	0.19
1992	6873	4366	0.16	1569	750	663	0.12	0.11
1993	6671	4166	0.15	428	1302	1186	0.09	0.20
1994	5828	3696	0.14	2439	918	850	0.07	0.16
1995	5308	3485	0.13	6198	790	732	0.07	0.16
1996	5027	3280	0.12	650	790	730	0.08	0.17
1997	4961	2985	0.11	2385	862	771	0.11	0.20
1998	4951	2598	0.10	740	1041	859	0.18	0.25
1999	4606	2136	0.08	7212	434	350	0.19	0.10
2000	5067	2103	0.08	5995	436	252	0.42	0.09
2001	5799	2304	0.09	1672	272	161	0.41	0.05
2002	6964	2739	0.10	769	192	109	0.43	0.03
2003	8279	3282	0.12	3695	127	80	0.37	0.02
2004	9595	3848	0.14	2459	227	192	0.15	0.03
2005	10403	4453	0.17	1766				

Table 27. Base Model (M=0.07) beginning of the year estimates related to the Stock-Recruitment Relationship for the later years in the model period. Recruitment was stochastic in 1968-2003.

Year	Spawning Output 107 eggs	Expected Recruitment Age 0 x 1000	Bias Adjustment Age 0 x 1000	Predicted Recruitment Age 0 x 1000
Unfished	26977	2623	1904	2623
1963	23777	2618	1901	2618
1964	23568	2618	1901	2618
1965	23483	2617	1901	2617
1966	23196	2617	1900	2617
1967	19175	2609	1894	2609
1968	16304	2600	1888	1361
1969	14110	2591	1882	1516
1970	14036	2591	1882	1854
1971	14021	2591	1881	2569
1972	13911	2591	1881	2296
1973	13706	2590	1880	1626
1974	13257	2587	1879	5219
1975	12849	2585	1877	1115
1976	12567	2584	1876	1547
1977	12294	2582	1875	1037
1978	12358	2582	1875	861
1979	12343	2582	1875	2045
1980	11903	2580	1873	8698
1981	11908	2580	1873	5918
1982	11522	2577	1871	2653
1983	10810	2572	1868	1464
1984	10164	2567	1864	943
1985	9303	2559	1858	1653
1986	8386	2548	1850	1090
1987	8227	2546	1849	2692
1988	7247	2532	1838	5019
1989	6627	2521	1830	455
1990	6090	2509	1822	1087
1991	5052	2481	1801	633
1992	4366	2455	1783	1569
1993	4166	2446	1776	428
1994	3696	2422	1759	2439
1995	3485	2409	1749	6198
1996	3280	2395	1739	650
1997	2985	2372	1722	2385
1998	2598	2334	1695	740
1999	2136	2275	1652	7212
2000	2103	2269	1648	5995
2001	2304	2299	1669	1672
2002	2739	2349	1706	769
2003	3282	2395	1739	3695
2004	3848	2430	1765	2430
2005	4453	2459	1786	2459

Table 28. Requests made by the STAR panel during the May 16-19, 2005 meeting.

Request	Description
1	Using Model C in Table 20, profile natural mortality from 0.05 to 0.10 (Table 31)
2	Using Model G07(base model), assume selectivity for the 1966-1968 foreign fishery equal to the AFSC slope survey ascending limb with asymptotic selectivity for the larger sizes (Table 32, Model G-07e)
3	Using Model G07(base model), profile Stock-Recruitment steepness from 0.60 to 1.0 (Table 30)
4	Using Model G07(base model) downweight the length composition likelihood lambdas to 0.5 (Table 32, Model G-07b)
5	For Model G07(base model), provide a Stock-Recruitment figure (Figure 14)
6	For Model G07(base model), provide figures of the standardized residuals (Figures 17, 19)
7	Add Model E to Table 20 (with the GLM model for AFSC slope survey without NWFSC slope survey)
8	Using Model G07(base model), fix size at age 1.7 and age 40 at a lower bound (14 and 40.28 cm) and at an upper bound (16 and 45.20 cm) (Table 32, Models G-07c,d)
9	Plot the growth curves from request 8 versus the age-length data (Figure 30)
10	Provide figures demonstrating variation in aging with ager and aging period (Figures 5,6)

Table 29. Comparison of uncertainty within the models, for each assumption of natural mortality.

Model	G05	G06	G07	G08	G09	G10
natural mortality	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**	**0.1**
biomass age 1+ in 2005 (mt)	**7026**	**8603**	**10403**	**12365**	**14467**	**16524**
depletion spawn in 2005	**0.10**	**0.13**	**0.17**	**0.20**	**0.25**	**0.29**
-2 std	0.07	0.09	0.12	0.15	0.18	0.17
+2 std	0.14	0.17	0.21	0.26	0.31	0.41
Spawning Output in 2005 10^7 eggs	**3009**	**3682**	**4453**	**5292**	**6190**	**7066**
-2 std	2010	2487	3024	3585	4152	4278
+2 std	4007	4878	5882	6999	8228	9853
recruitment in 2005 x 1000	**1561**	**1992**	**2459**	**2972**	**3547**	**4173**
-2 std	1428	1817	2229	2671	3150	3387
+2 std	1694	2168	2689	3273	3944	4958

Table 30. Base Model (G07) compared to the same model with the Stock-Recruitment steepness parameter fixed at levels from 0.09 to 0.06.

			Profile S-R steepness			Baseline
Model						**F07**
Natural mortality	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**
steepness	**0.06**	**0.06**	**0.07**	**0.08**	**0.09**	**0.95**
biomass age 1+ in 2005	8221	8440	8682	9257	9967	10403
depletion spawn in 2005	0.12	0.12	0.13	0.14	0.16	0.17
LIKELIHOOD	1461.54	1457.35	1453.87	1448.66	1445.27	1444.08
indices	20.99	20.55	20.14	19.43	18.89	18.70
discard	2.06	2.32	2.57	3.01	3.35	3.45
length_comps	1398.32	1396.08	1394.19	1391.26	1389.30	1388.62
age_comps	14.73	14.91	15.09	15.45	15.80	15.90
mean_body_wt	0.004	0.01	0.009	0.013	0.016	0.02
Recruitment	25.43	23.48	21.88	19.49	17.92	17.38

Table 31. Comparison of model C across varying assumptions of natural mortality. Model C has the age compositions that were in the 2003 update, but growth is fit within the model.

Model	**C05**	**C06**	**C07**	**C08**	**C09**	**C10**
Natural mortality	0.05	0.06	0.07	0.08	0.09	0.1
biomass age 1+ in 2005	9797	12103	14458	15767	17421	19525
depletion spawn in 2005	0.20	0.26	0.31	0.33	0.35	0.38
LIKELIHOODS						
TOTAL	1053.6	1050.1	1048.4	1047.4	1046.4	1045.5
shelf survey index	12.37	12.97	13.88	14.52	15.19	15.88
slope survey index	7.69	8.49	9.09	9.19	9.29	9.39
P.o.p. survey index	0.05	0.03	0.02	0.01	0.00	0.00
fishery lengths	362.18	360.44	359.46	359.02	358.63	358.29
shelf survey lengths	278.48	276.80	275.28	274.09	272.87	271.63
slope survey lengths	258.09	256.39	255.18	254.57	253.99	253.44
P.o.p. survey lengths	10.13	9.71	9.40	9.22	9.05	8.89
fishery ages	85.42	87.12	88.40	88.81	89.15	89.45
shelf survey ages	21.31	21.16	21.08	21.04	21.01	20.98
Recruitment	17.86	16.95	16.64	16.89	17.22	17.59

Table 32. Comparison of Base Model (G07) to selected sensitivity runs. Values in boxes are fixed, other values are fitted in the models.

Model Designation	G-07	G-07a	G-07b	G-07c	G-07d	G-07e	G-07f	G-07g
Description	Baseline	S-R steepness meta value	downweight lengths	lower growth	upper growth	selectivity 66-68 foreign fishery	hist land 30% lower	hist land 30% higher
female size at age 1.7	15.07	15.07	15.09	14.00	16.00	15.05	15.07	15.08
female size at age 40	42.79	42.34	42.76	40.28	45.20	42.64	42.22	42.96
female growth coeff. (k)	0.22	0.23	0.22	0.25	0.18	0.22	0.23	0.22
cv of lengths at age	0.06	0.06	0.06	0.09	0.06	0.06	0.07	0.06
S-R curve Steepness	0.95	0.65	0.95	0.60	0.95	0.95	0.65	0.95
biomass age 1+ in 2005	10403	8440	10131	16236	6644	10319	8308	11575
depletion spawn in 2005	0.17	0.12	0.16	0.22	0.13	0.16	0.13	0.17
LIKELIHOOD	1444.08	1457.35	747.55	1585.82	1595.85	1452.43	1461.73	1442.61
indices	18.70	20.55	17.74	21.67	19.66	18.27	21.12	18.45
length_comps	1388.62	1396.08	699.84	1514.95	1533.21	1396.49	1399.10	1387.36
age_comps	15.90	14.91	13.04	19.10	13.18	15.16	14.70	16.34
Discard	3.45	2.32	1.36	5.02	0.57	4.28	2.06	3.68
Discard mean_body_wt	0.02	0.01	0.00	0.12	0.31	0.10	0.01	0.01
Recruitment	17.38	23.48	15.57	24.95	28.91	18.13	24.76	16.77

Table 33. Reference points from the Base Model, with uncertainty expressed through a range of values for natural mortality. Unfished spawning output and Age 1+ biomass are based on size-at-age prior to 1998, while MSY yield is based on size-at-age in 2005, which is affected by the slower growth in 1998.

	Natural Mortality (M)		
	0.05	**0.07 (base)**	**0.09**
Unfished Spawning Output (10^7 eggs)	28894	26650	24696
Unfished Age 1+ Biomass (mt) (B age 1+)	29201	28286	27796
Unfished Recruitment (numbers age 0 fish x 1000)	1739	2622	3688
Spawning Stock Output at MSY (S_{msy}) (10^7 eggs)	11557	10660	9878
Basis for S_{msy}		S40% proxy	
Spawning Potential Ratio$(SPR)_{msy}$	0.50	0.50	0.50
Basis for SPR_{msy} or Fmsy		F50% proxy	
Exploitation Rate at MSY(=Yield/B age 1+)	0.031	0.038	0.044
MSY_Yield (mt) based on F50% proxy	524	650	760

Table 34. Forecast for the Base Model G07 given two criteria. For 2005 and 2006, catch was estimated within the model to approximate the previously set Oys (269 and 294 mt, repectively). Landings were assumed to be 174 in 2005 and 179 mt in 2006, with a discard rate of 35.3% in both years (input as data) (M. Burden, pers.comm.).

	Beginning of Year					
Year	Age 1+ Biomass (mt)	Spawning Output (10^7 eggs)	Depletion	Age 0 recruits x 1000	Catch (mt)	Harvest Rate
F50%-ABC						
2005	10717	4447	0.16	1785	271	0.033
2006	11676	5393	0.20	1809	291	0.031
2007	12241	6596	0.24	1830	450	0.05
2008	12696	7573	0.28	2537	476	0.05
2009	13121	8579	0.32	2550	501	0.05
2010	13377	9270	0.34	2558	514	0.05
2011	13483	9578	0.36	2561	514	0.05
2012	13717	9993	0.37	2565	520	0.05
2013	13919	10214	0.38	2567	525	0.05
2014	14127	10368	0.38	2568	532	0.05
2015	14340	10511	0.39	2569	539	0.05
2016	14531	10621	0.39	2570	547	0.05
Constant Harvest Rate 0.032						
2005	10717	4447	0.16	1785	271	0.033
2006	11676	5393	0.20	1809	291	0.031
2007	12241	6596	0.24	1830	319	0.032
2008	12824	7669	0.28	2538	342	0.032
2009	13381	8797	0.33	2553	364	0.032
2010	13770	9621	0.36	2561	377	0.032
2011	14000	10061	0.37	2565	381	0.032
2012	14353	10613	0.39	2570	388	0.032
2013	14665	10965	0.41	2573	395	0.032
2014	14974	11241	0.42	2575	403	0.032
2015	15282	11497	0.43	2576	411	0.032
2016	15560	11711	0.43	2578	419	0.032

Table 35. Decision table with uncertainty bounded by assuming natural mortality (M) is equal to a value of 0.05 or 0.09. For 2005 and 2006, catch was estimated within the model to approximate the previously set Oys (269 and 294 mt, repectively). Landings were assumed to be 174 in 2005 and 179 mt in 2006, with a discard rate of 35.3% in both years (input as data) (M. Burden, pers.comm.). Actual catches for those years varied slightly among models. Catches in 2007-2016 are based on forecasting given each value of M and assuming a constant harvest rate of 0.032. The actual OY in 2007 will be based on an update of the rebuilding plan.

			Spawning Output (10^7 eggs)			**Depletion**		
			True State of Nature			**True State of Nature**		
			M=0.05	**M=0.07**	**M=0.09**	**M=0.05**	**M=0.07**	**M=0.09**
			UNLIKELY	**LIKELY**	**UNLIKELY**	**UNLIKELY**	**LIKELY**	**UNLIKELY**
Assumed State of Nature								
	Year	**Catch(MT)**						
M=0.05	2005	269	3004	4447	6182	0.10	0.16	0.25
	2006	294	3637	5393	7456	0.12	0.20	0.30
	2007	221	4441	6596	9061	0.15	0.24	0.36
	2008	239	5237	7813	10629	0.18	0.29	0.42
	2009	258	6086	8889	11969	0.21	0.33	0.48
	2010	271	6744	9820	13084	0.23	0.36	0.52
	2011	279	7166	10592	13953	0.25	0.39	0.56
	2012	288	7662	11203	14578	0.26	0.42	0.58
	2013	298	8038	11670	14991	0.28	0.43	0.60
	2014	308	8368	12019	15238	0.29	0.45	0.61
	2015	319	8689	12274	15357	0.30	0.46	0.61
	2016	329	8982	12454	15382	0.31	0.46	0.61
M=0.07	2005	269	3004	4447	6182	0.10	0.16	0.25
	2006	294	3637	5393	7456	0.12	0.20	0.30
	2007	319	4441	6596	9061	0.15	0.24	0.36
	2008	342	5208	7669	10553	0.18	0.28	0.42
	2009	364	5871	8797	11800	0.20	0.33	0.47
	2010	377	6432	9621	12810	0.22	0.36	0.51
	2011	381	6890	10061	13571	0.24	0.37	0.54
	2012	388	7253	10613	14091	0.25	0.39	0.56
	2013	395	7532	10965	14405	0.26	0.41	0.57
	2014	403	7745	11241	14562	0.27	0.42	0.58
	2015	411	7906	11497	14601	0.27	0.43	0.58
	2016	419	8024	11711	14555	0.28	0.43	0.58
M=0.09	2005	269	3004	4447	6182	0.10	0.16	0.25
	2006	294	3637	5393	7456	0.12	0.20	0.30
	2007	425	4441	6596	9061	0.15	0.24	0.36
	2008	449	5132	7664	10371	0.18	0.28	0.41
	2009	471	5702	8557	11720	0.20	0.32	0.47
	2010	481	6159	9284	12629	0.21	0.34	0.50
	2011	478	6510	9844	12984	0.22	0.36	0.52
	2012	480	6769	10250	13493	0.23	0.38	0.54
	2013	481	6950	10524	13712	0.24	0.39	0.55
	2014	483	7073	10696	13831	0.24	0.40	0.55
	2015	487	7153	10793	13926	0.25	0.40	0.55
	2016	490	7200	10833	13974	0.25	0.40	0.56

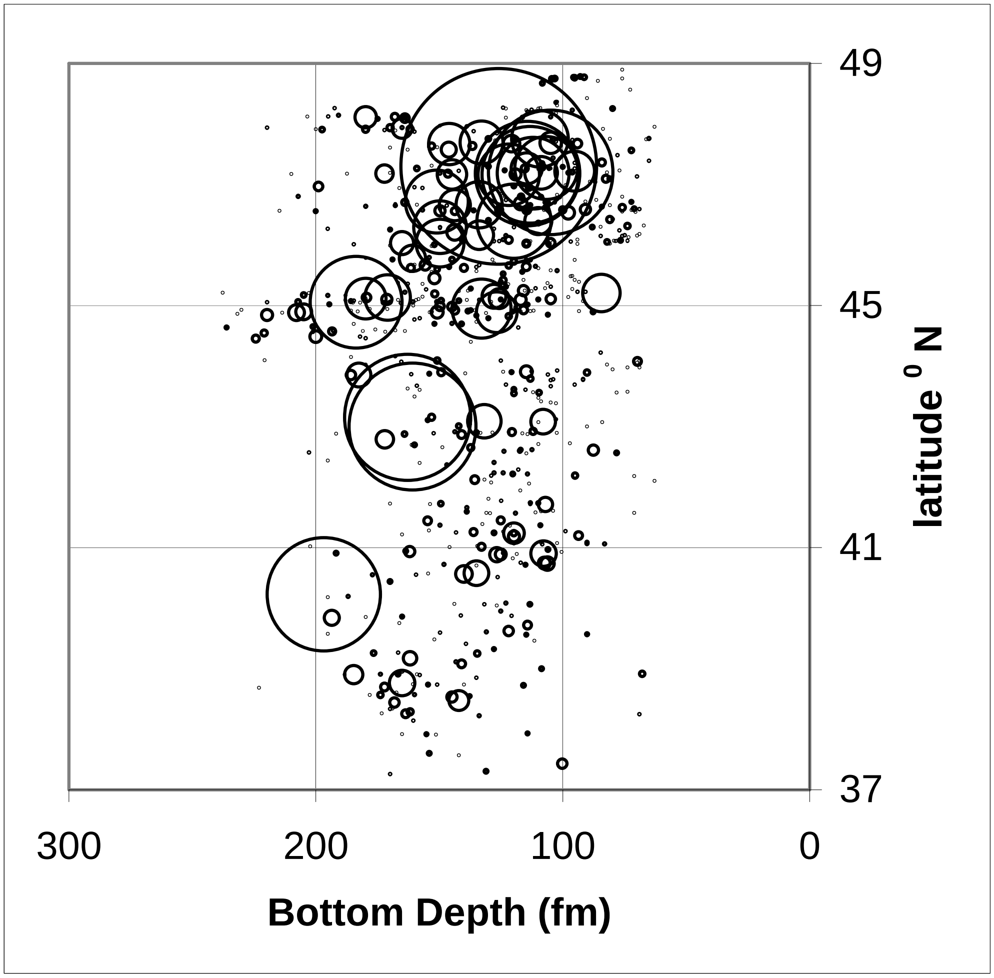


Figure 1. Survey catch of darkblotched rockfish per unit effort (kg/ha) by depth and latitude. Presented are all good tows for the years in which the surveys were used in the assessment. Surveys include shelf, slope, and directed Pacific ocean perch. The size of the circle is directly related to the size of the catch per unit effort (cpue). Center of circle is tow location. There are a total of 2795 tows with catch of darkblotched rockfish, catches with cpue less than 20 kg/ha are not visible.

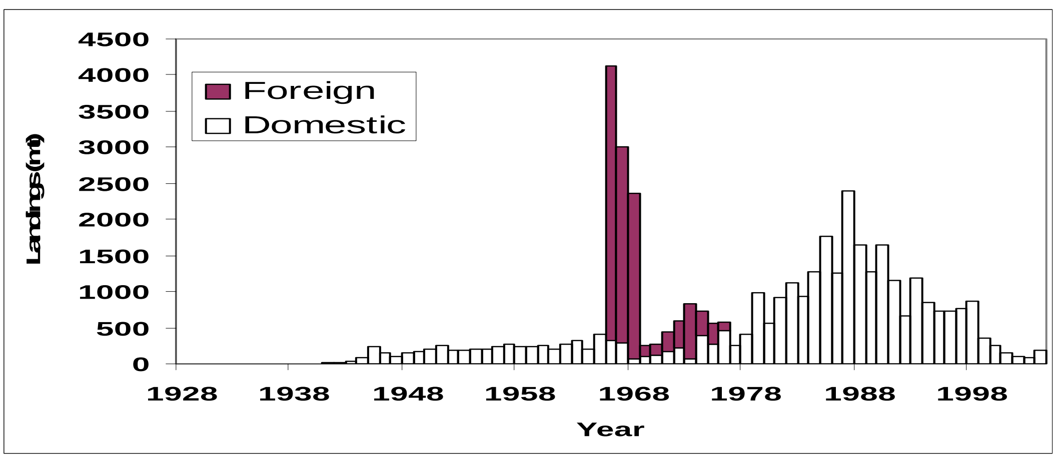


Figure 2. Darkblotched rockfish landings estimates for domestic (California, Oregon, and Washington) versus foreign fleets.

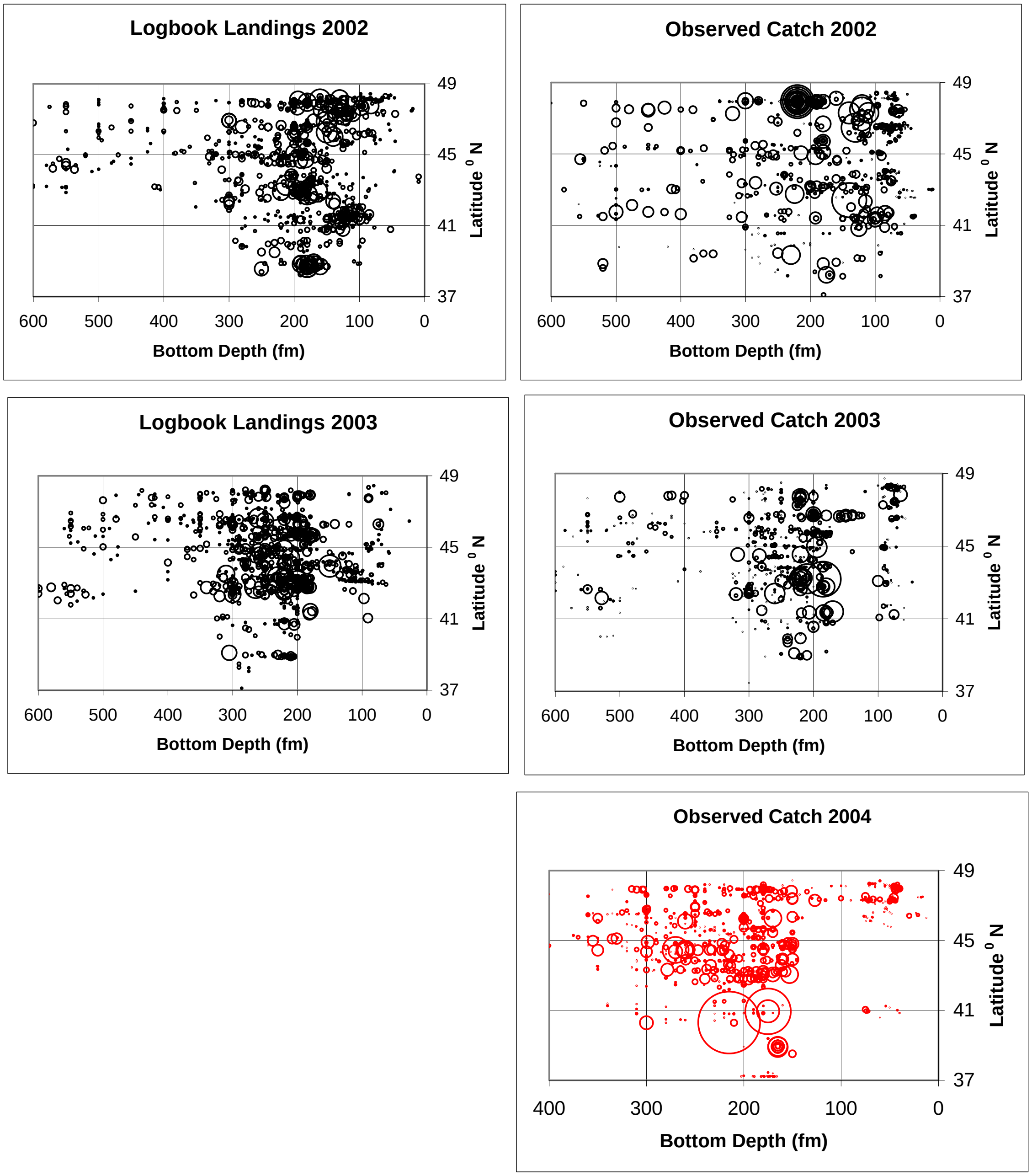


Figure 3. Starting location of tows with landings and catch of darkblotched rockfish in 2002-2004, as reported by fishermen. Within a graph, the size of the circle is directly related to the size of the landing or catch. Smallest landings and catch are not visible.

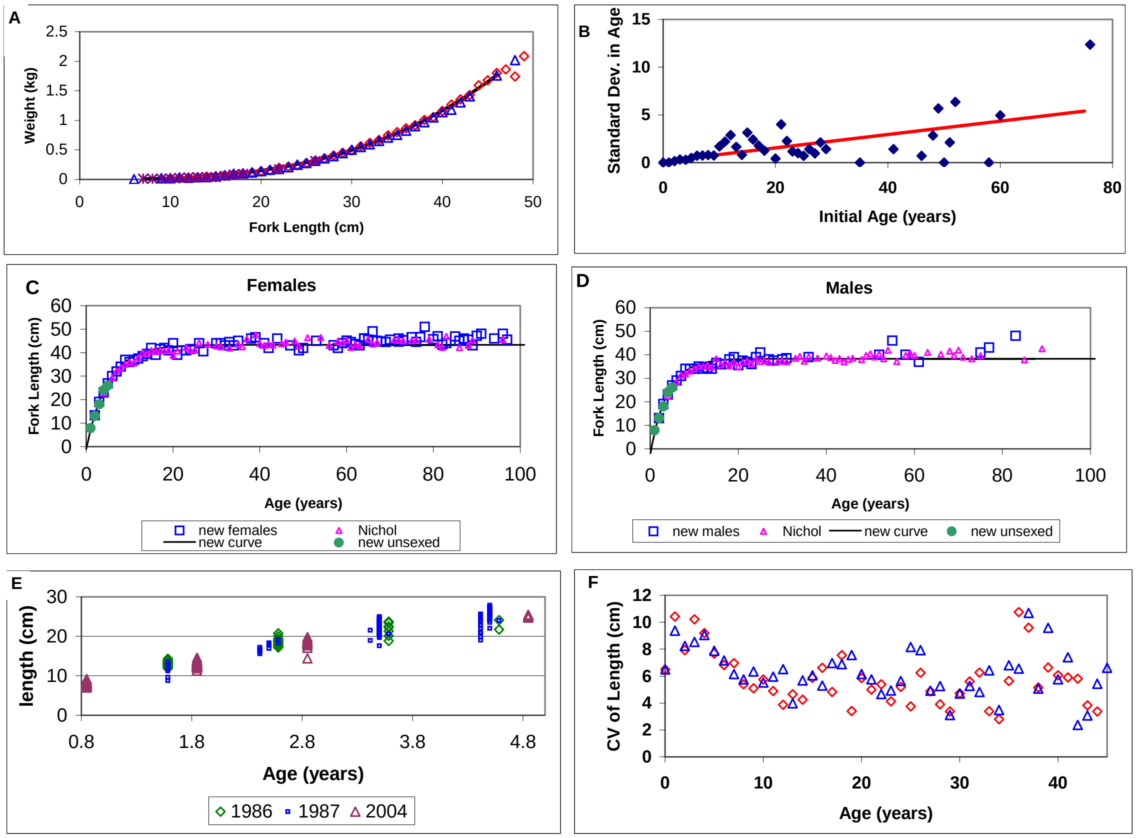


Figure 4. Life history relationships estimated using available data. In graph A and E, triangles = males, diamonds = females. In graphs C and D, symbols are median length at age, curves were fit to the raw data. In graph E, otoliths from 1986 and 1987 were read by Nichol (1990).

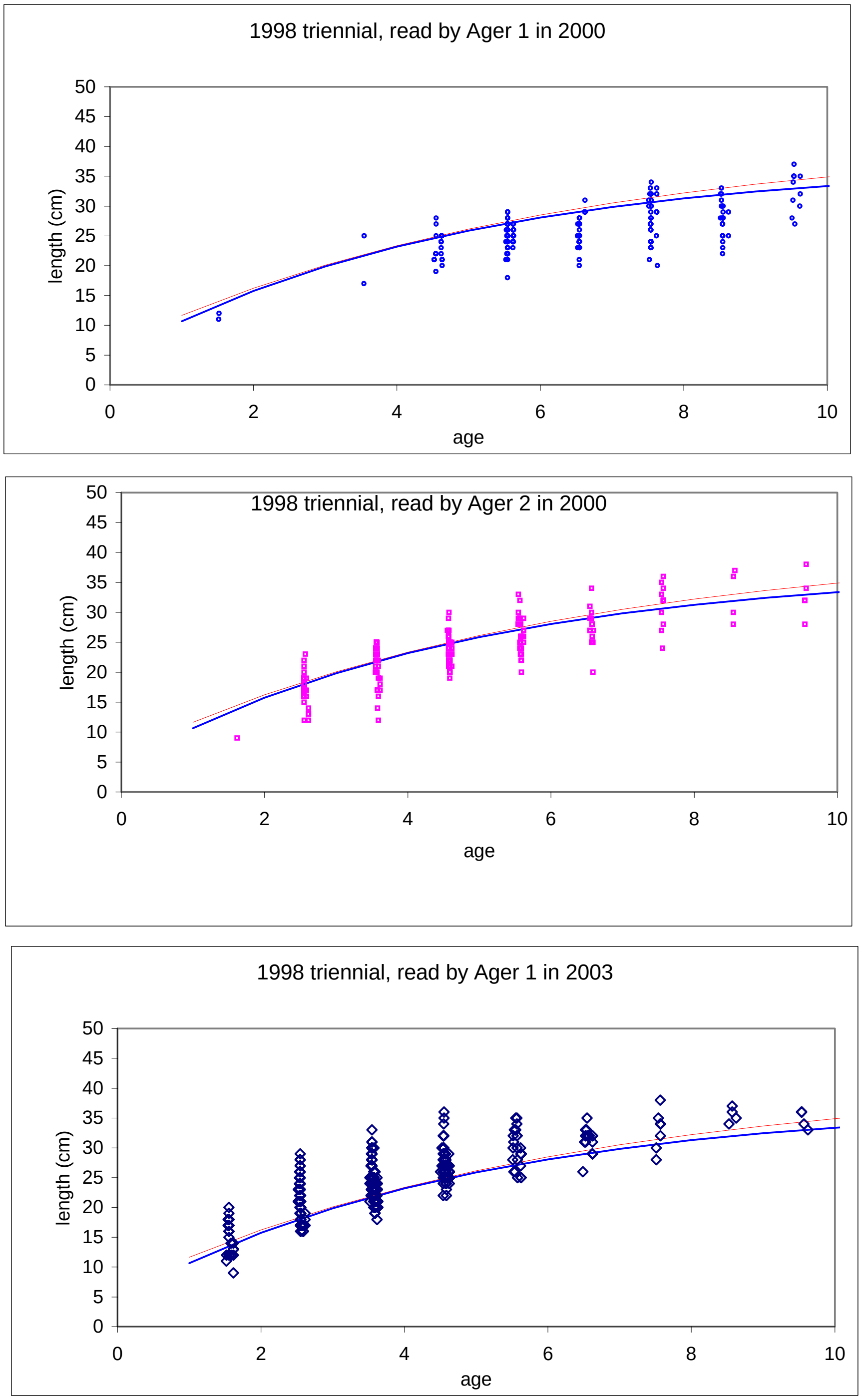


Figure 5. Comparison of the age-length relationship for the first 10 years of age, by ager and time period aged for the 1998 shelf survey otoliths. The growth curves shown are the male and female curves used in the 2000-2003 assessments.

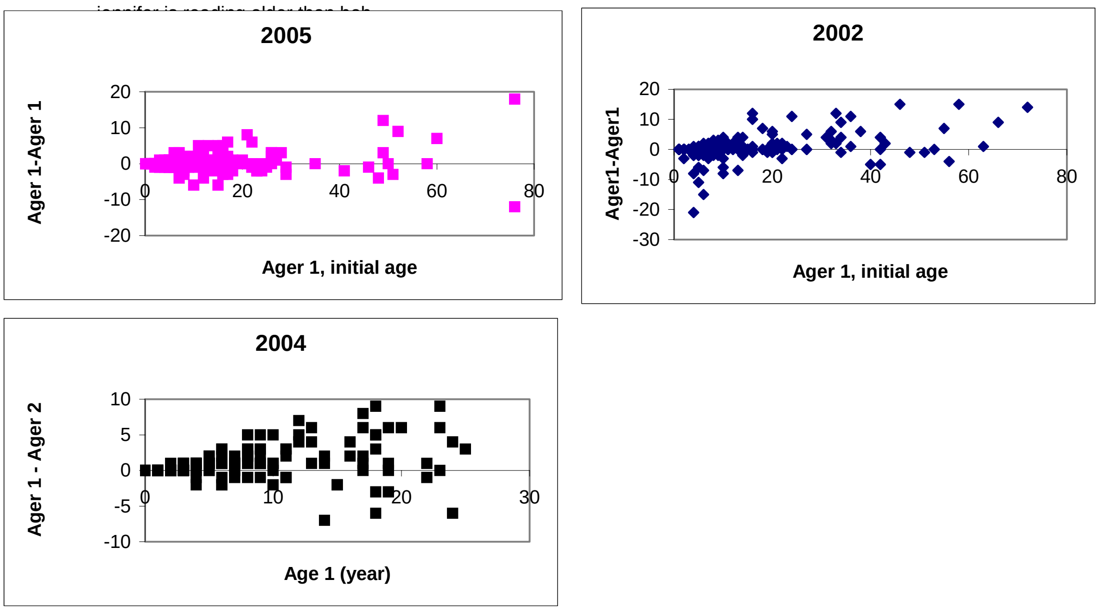


Figure 6. Comparison of 2004-2005 re-aging of otoliths initially aged by ager 1 in 2004.

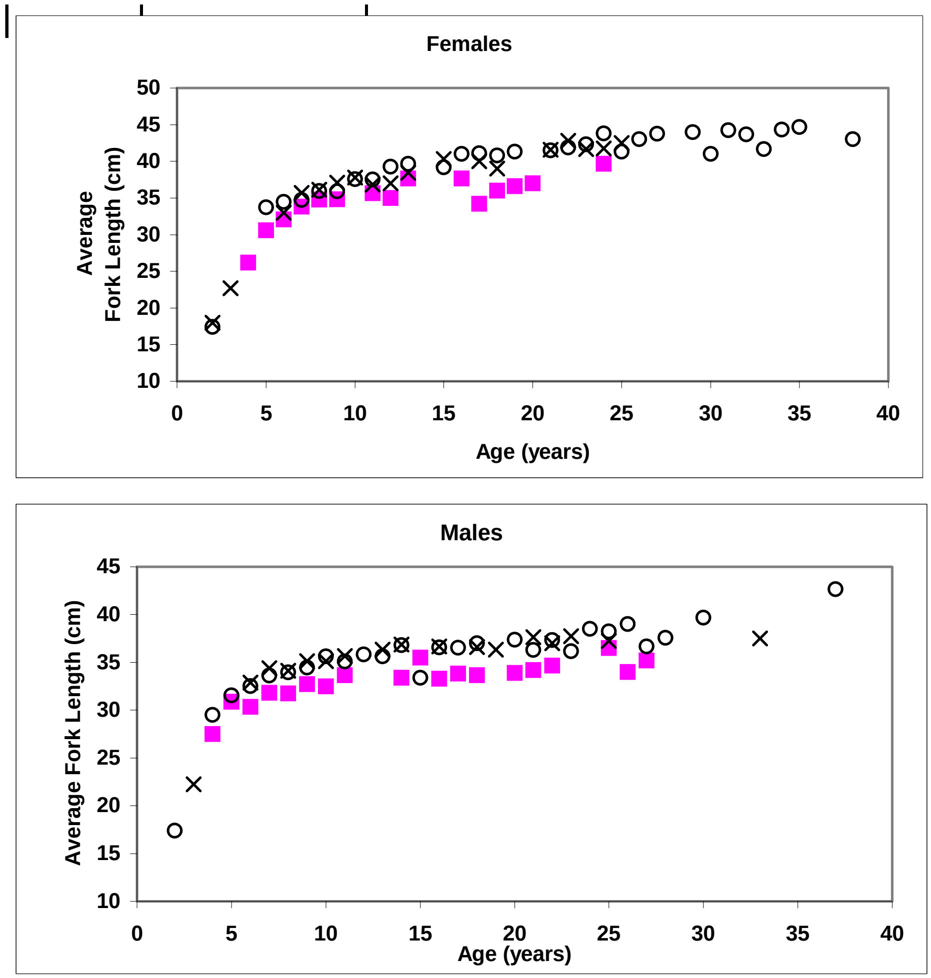


Figure 7. Comparison of darkblotched rockfish average size at age by state for the 2003 fishery. X = Washington, O = Oregon, and Filled Squares = California.

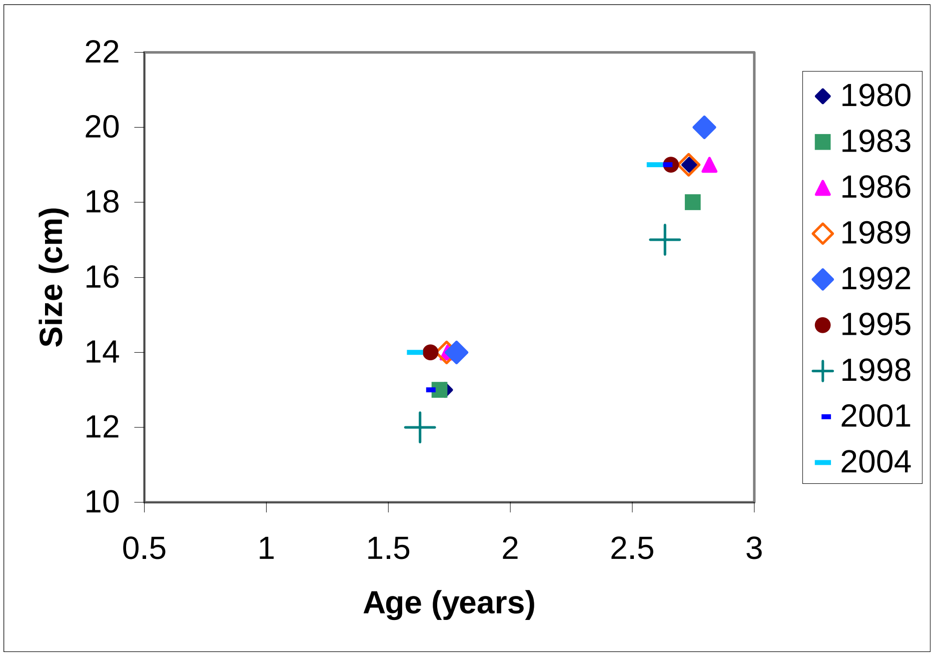


Figure 8. Comparison of the two smallest modes in the AFSC shelf survey length compositions. Age is assumed to be one for the smallest size and two for the next mode, adjusted for average date of capture for the fish in that size and year.

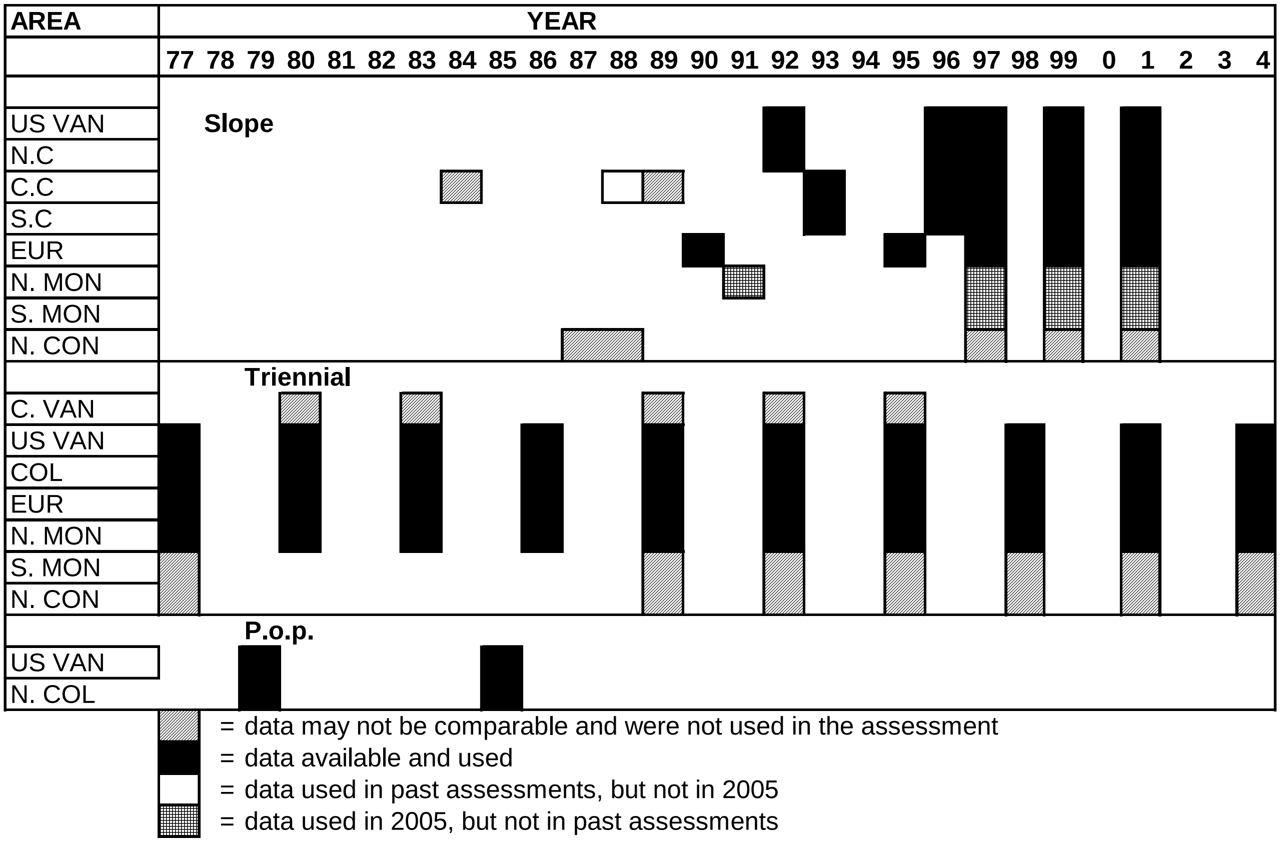


Figure 9. Summary of AFSC survey data available for darkblotched rockfish by INPFC area. INPFC abbreviations are as follows: VAN=Vancouver, C.C.=Central
and year, N.C.=Northern Columbia, Columbia, S.C=Southern Columbia, EUR=
Eureka, MON=Monterey and CON=Conception.

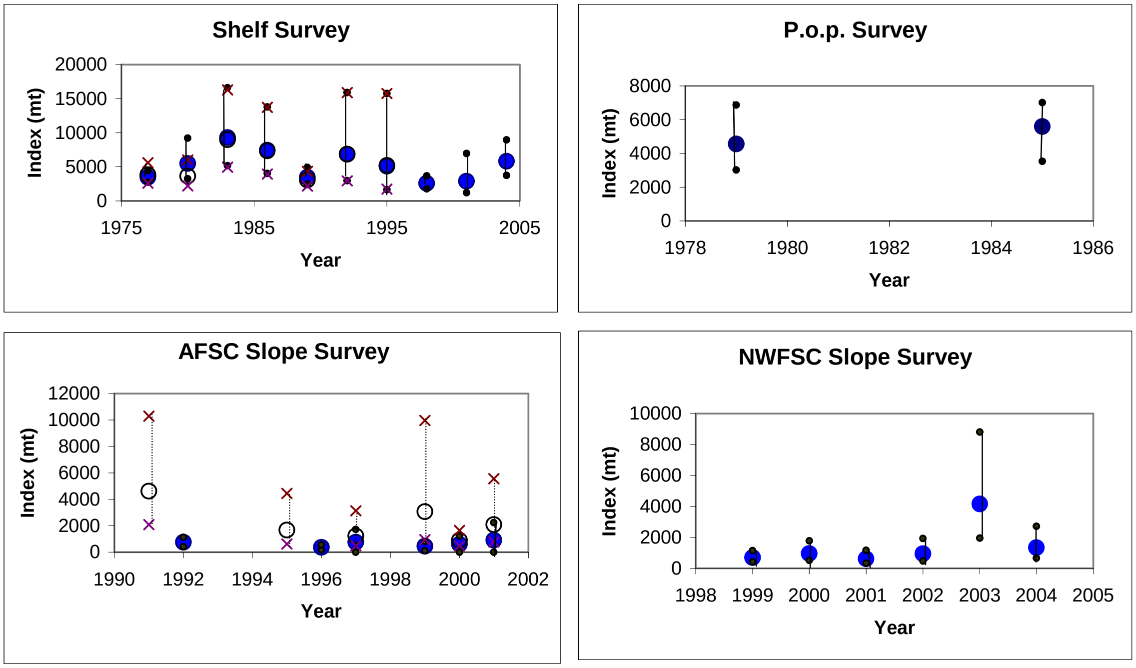


Figure 10. Comparison of survey indices used in this assessment versus the ones used in the 2000-2003 assessments. The solid large dots are the data used in this assessment. The empty large dots are data used in past assessments. The small dots connected by vertical solid lines are +/- 2 std, assuming a log-normal error for the data used in this assessment. For the AFSC slope survey, the new estimate bounds are small dots, but with no line connecting them. In that figure, the x's connected by vertical dotted lines are +/2 2 std, assuming log-normal error for the old AFSC slope survey estimates. The new shelf survey is without water tows and the new AFSC slope survey is based on different data from the early years and on a GLM model.

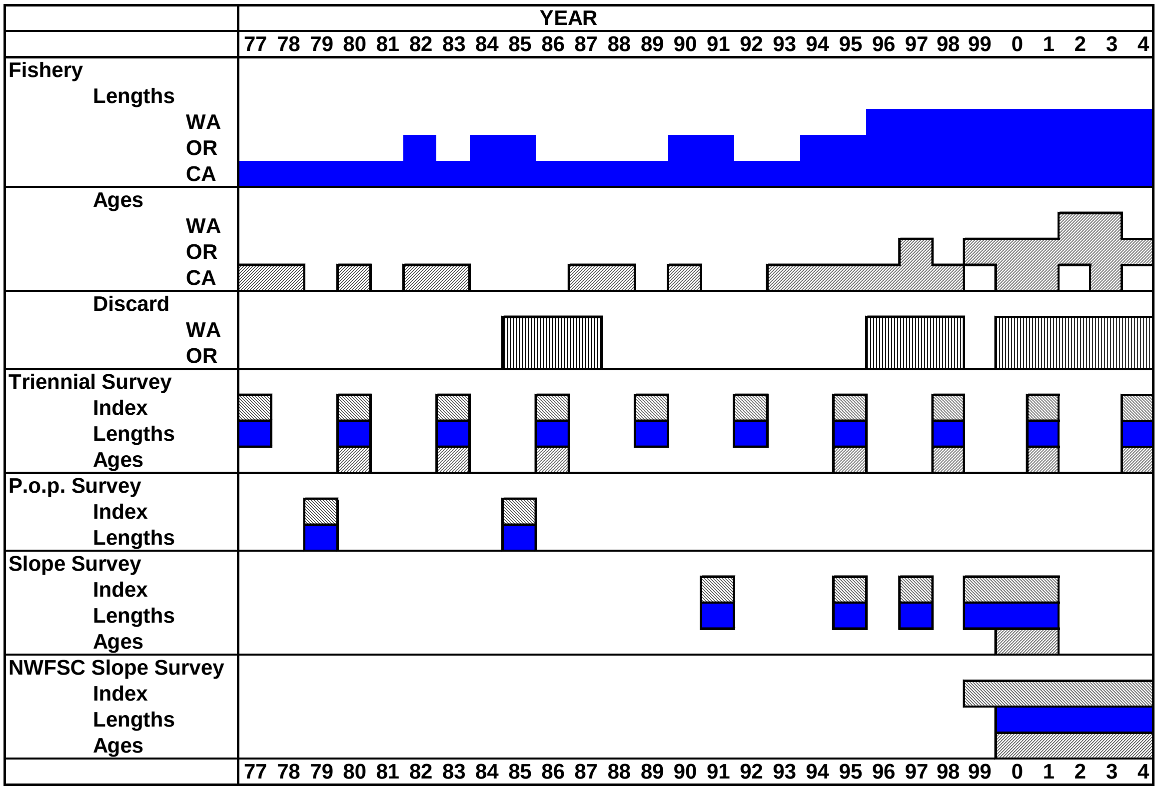


Figure 11. Available darkblotched rockfish data for the U.S. west coast.

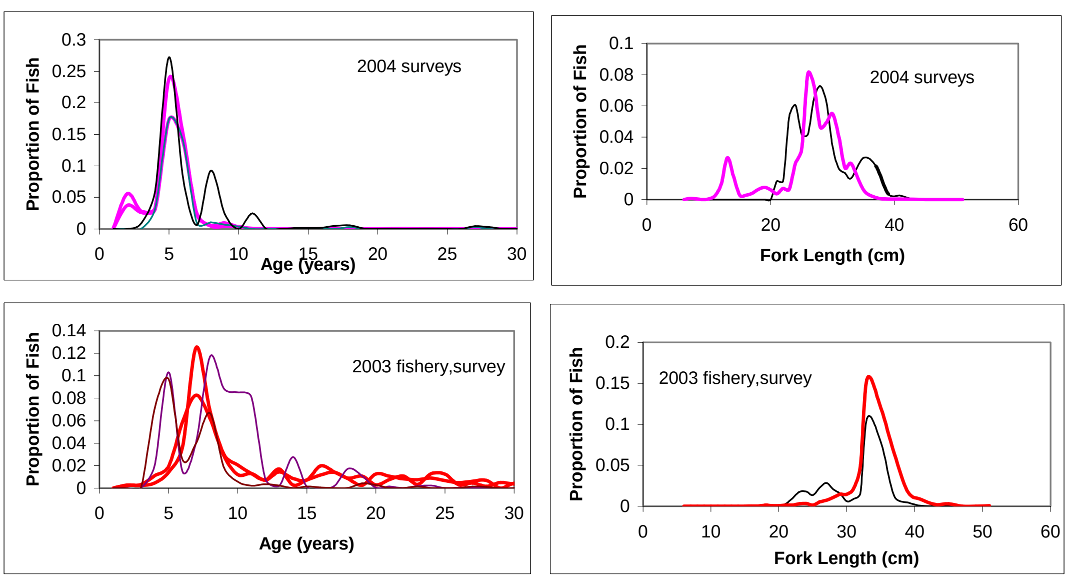
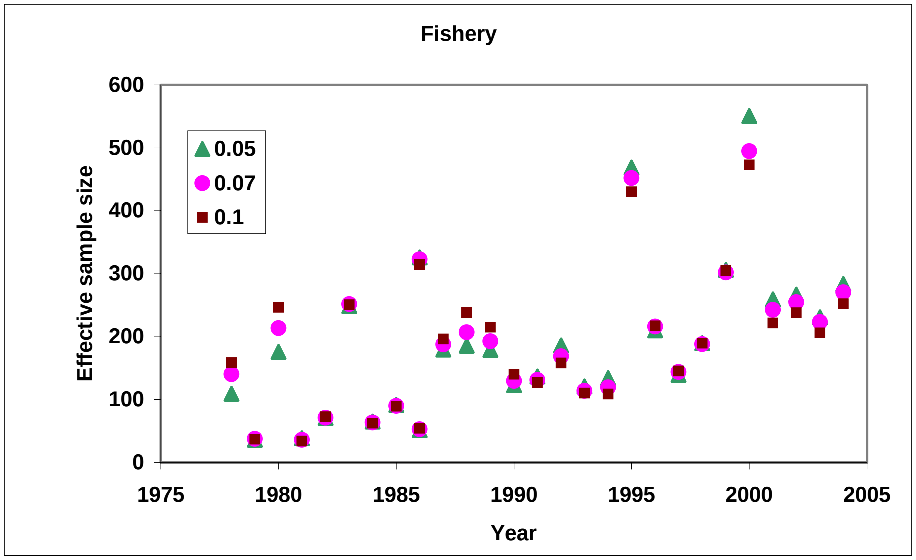


Figure 12. Comparison of recent length and age compositions using fish aged in 2004. In the age graphs, males and females are plotted separately but not distinguished. In the length graphs, only males are plotted. The heavy lines in 2004 are the shelf survey, in 2003 they are the fishery. The light lines are the slope survey.



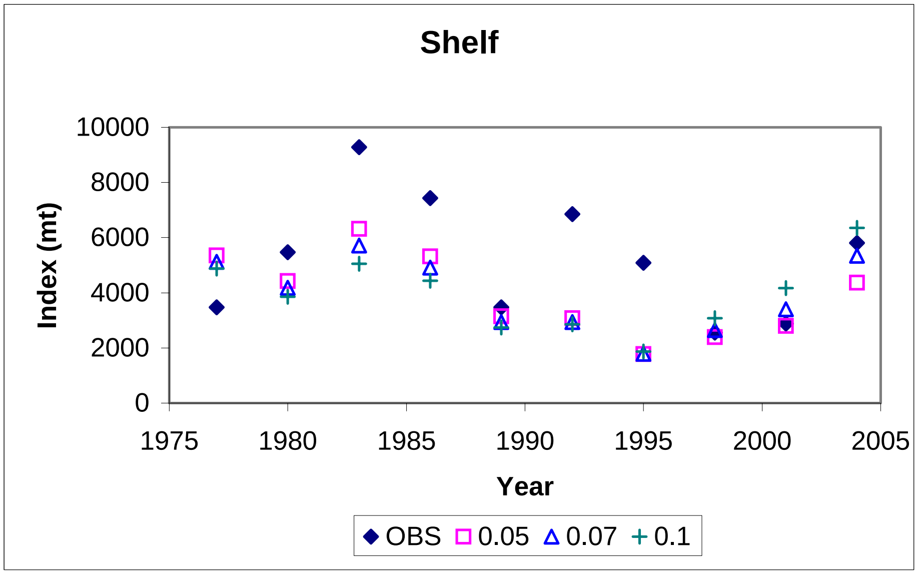


Figure 13. Comparisons of estimates from Model G given three assumptions of natural mortality (0.05, 0.07,.0.1). Top graph are estimates of effective sample size by year for the fishery. Higher sizes indicate better fits to the model. Input sample sizes range from a maximum of 100 (years with only California data) to 200. Bottom graph compares estimates from the models to the observed index, given automatic adjustments of catchability

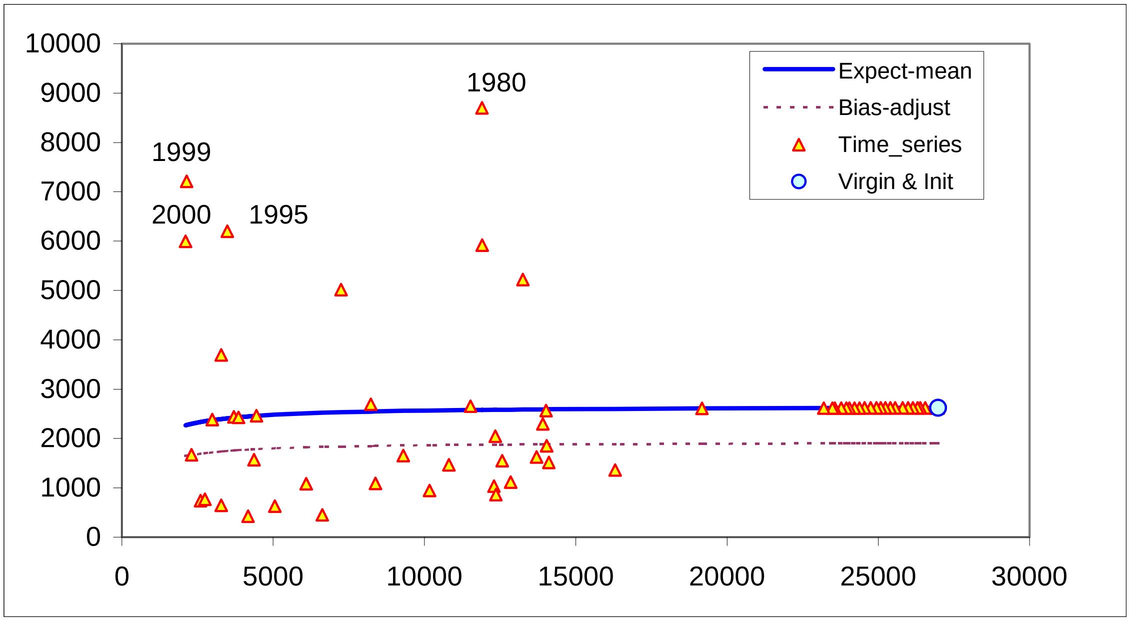


Figure 14. Stock-Recruitment results from the Base Model.

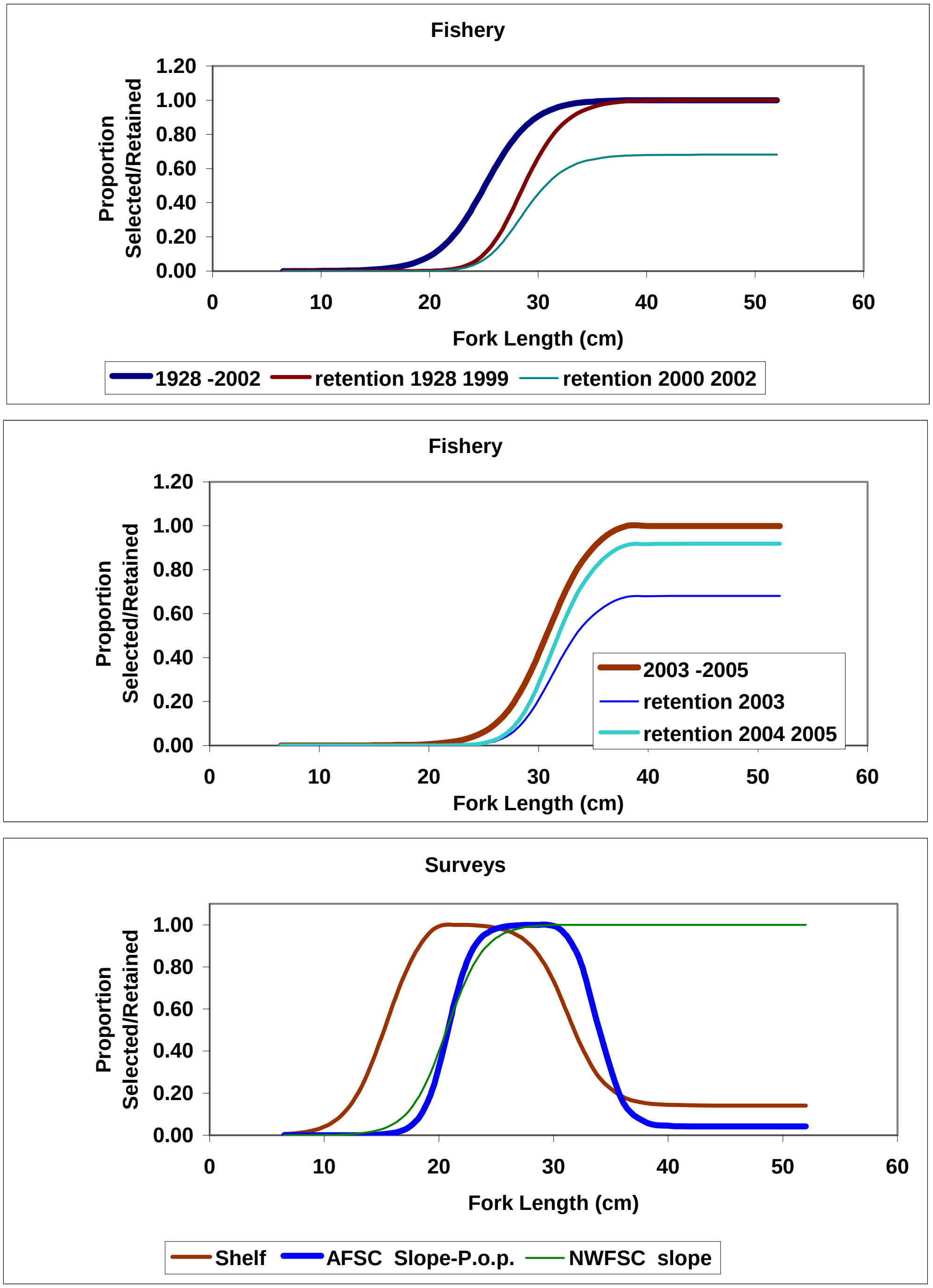


Figure 15. Estimated selectivities and retention in the base run.

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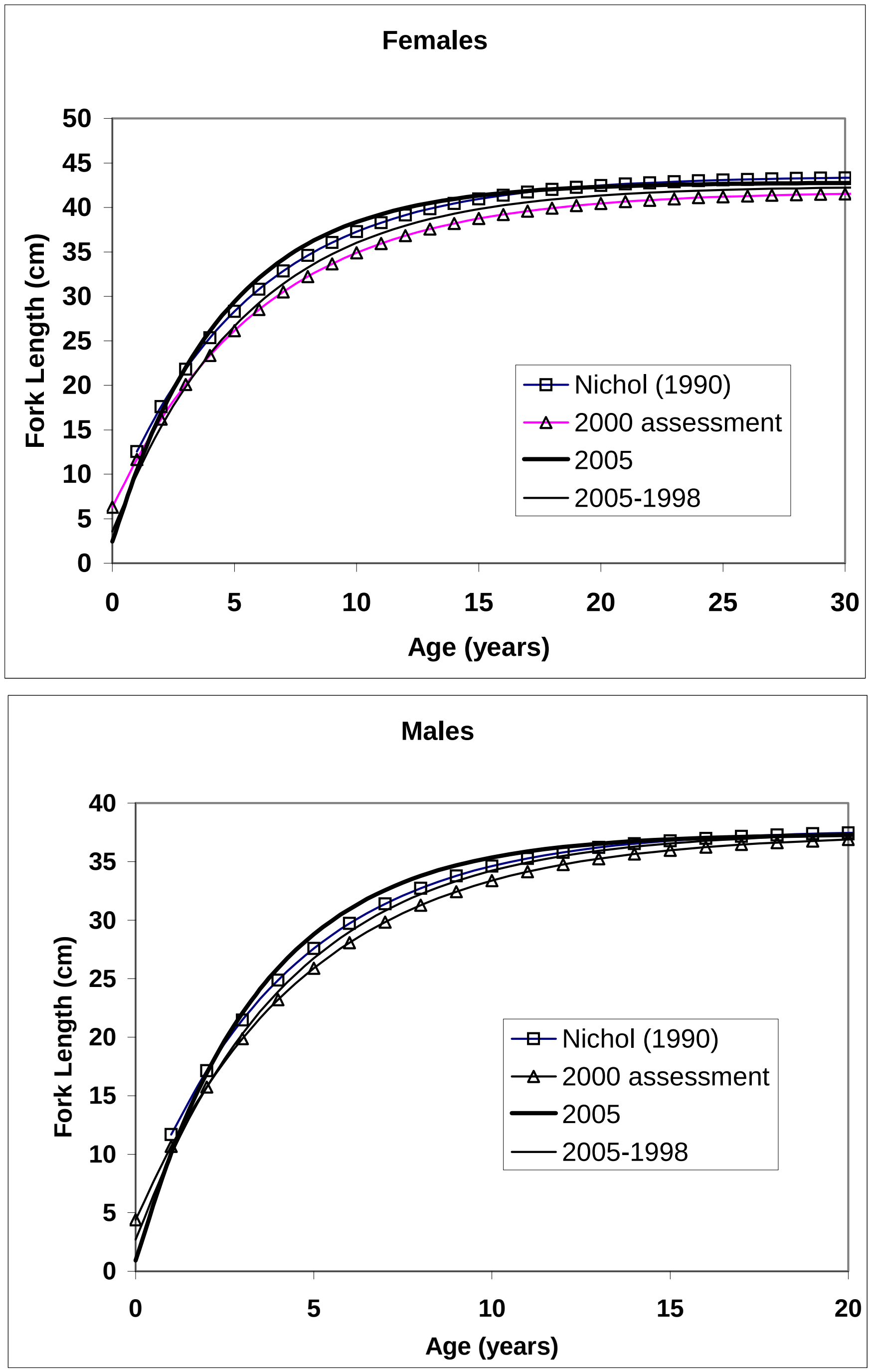


Figure 16. Comparison of growth curves estimated in the base model to those estimated previously.

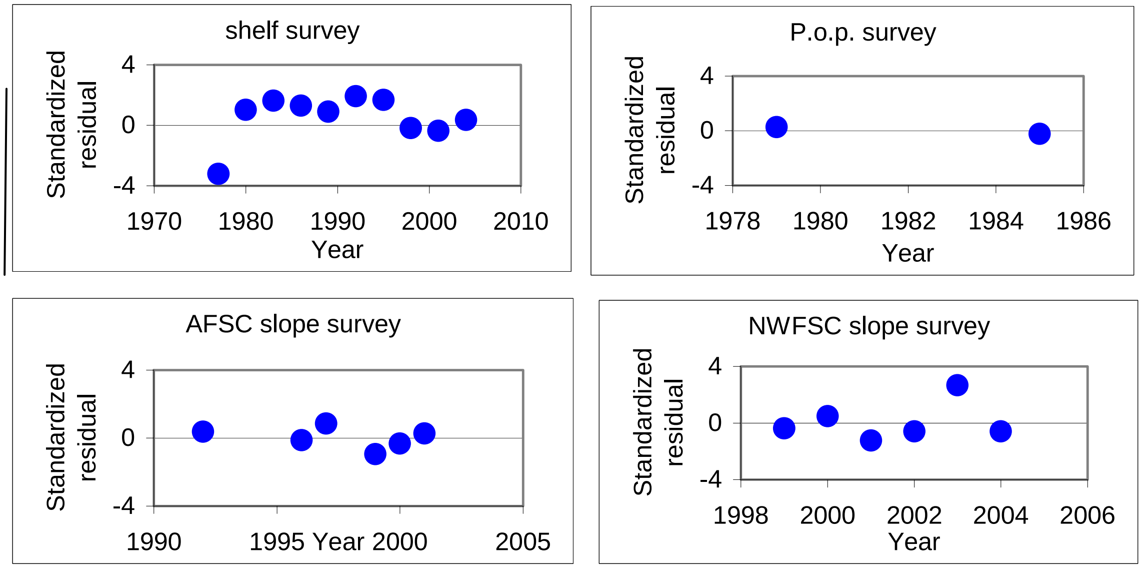


Figure 17. Standardized residuals from base model (G07) to the survey indices, automatically adjusted for catchability.

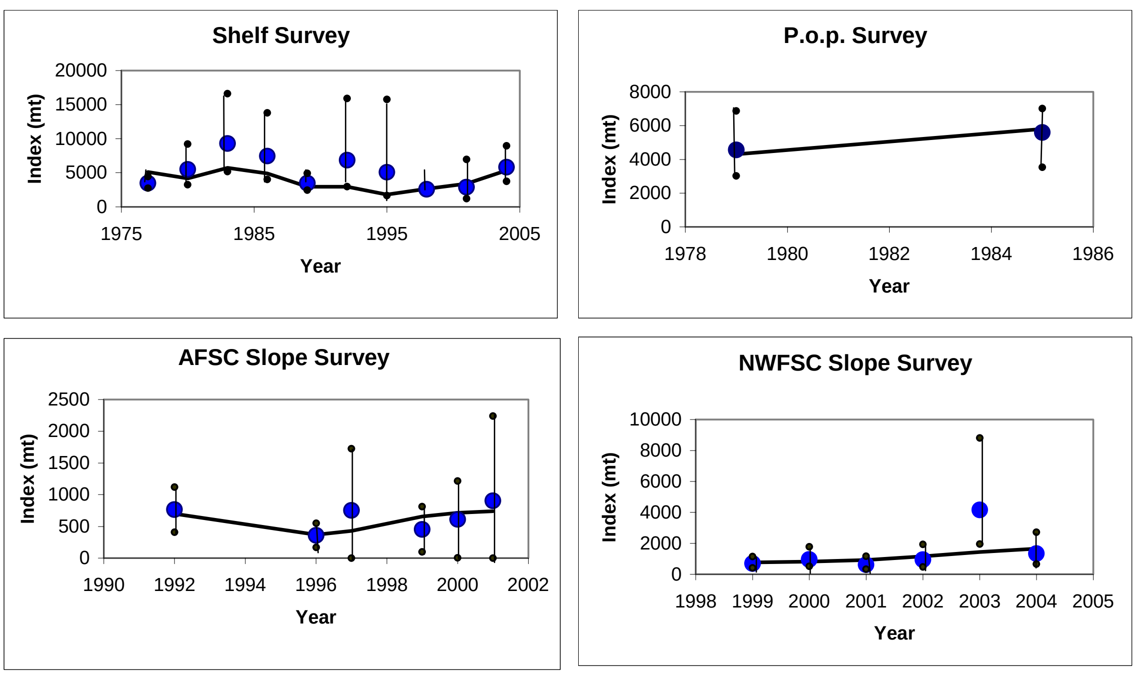


Figure 18. Comparison of Base Model index estimates (thick lines) to the data (solid large dots) + or – 2 standard deviations (small dots connected by vertical lines), assumed log-normal error.

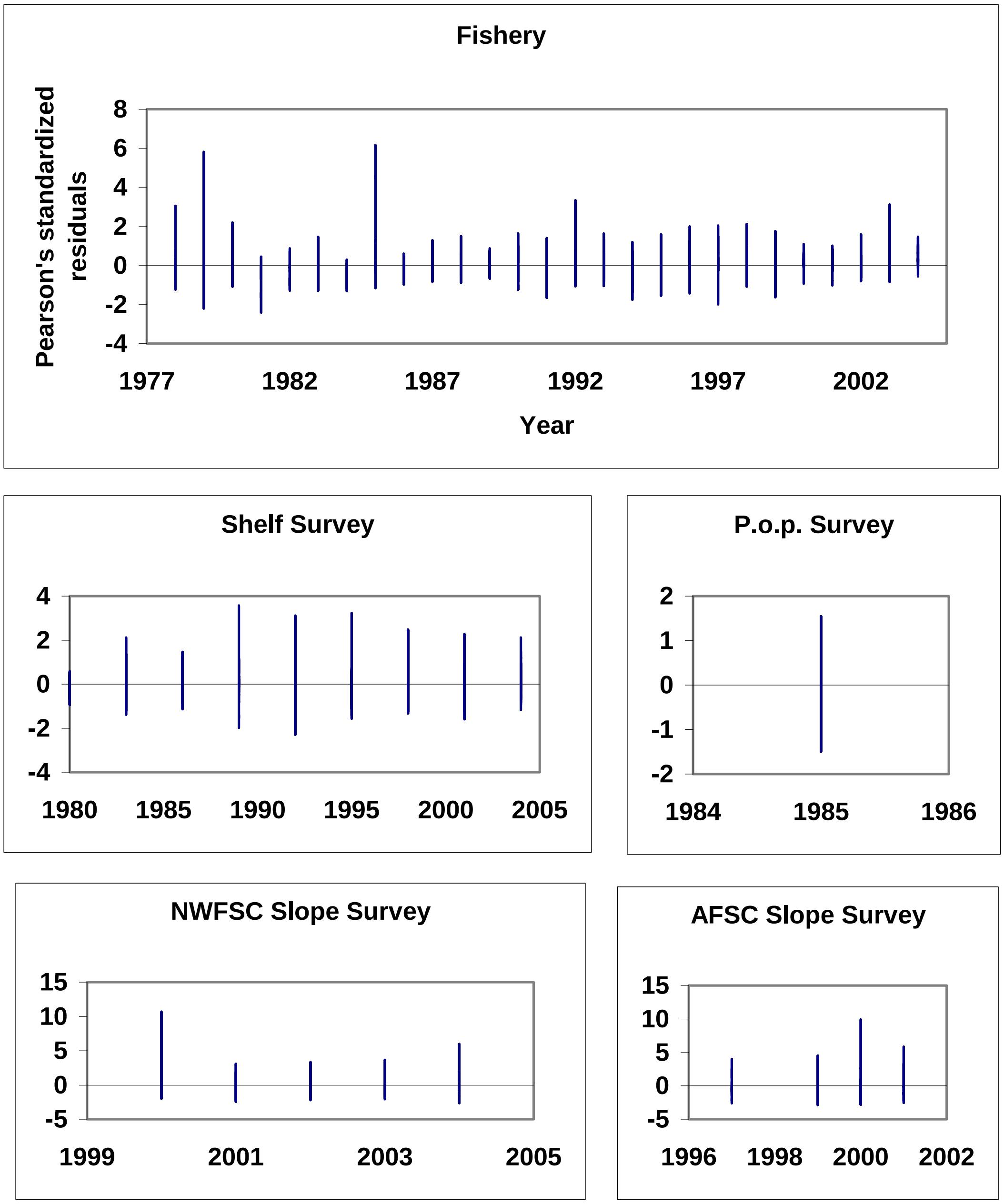


Figure 19. Length composition standardized residuals in the Base Model (G07). The lines represent the range of residuals for both sexes and all size bins for that year and data source.

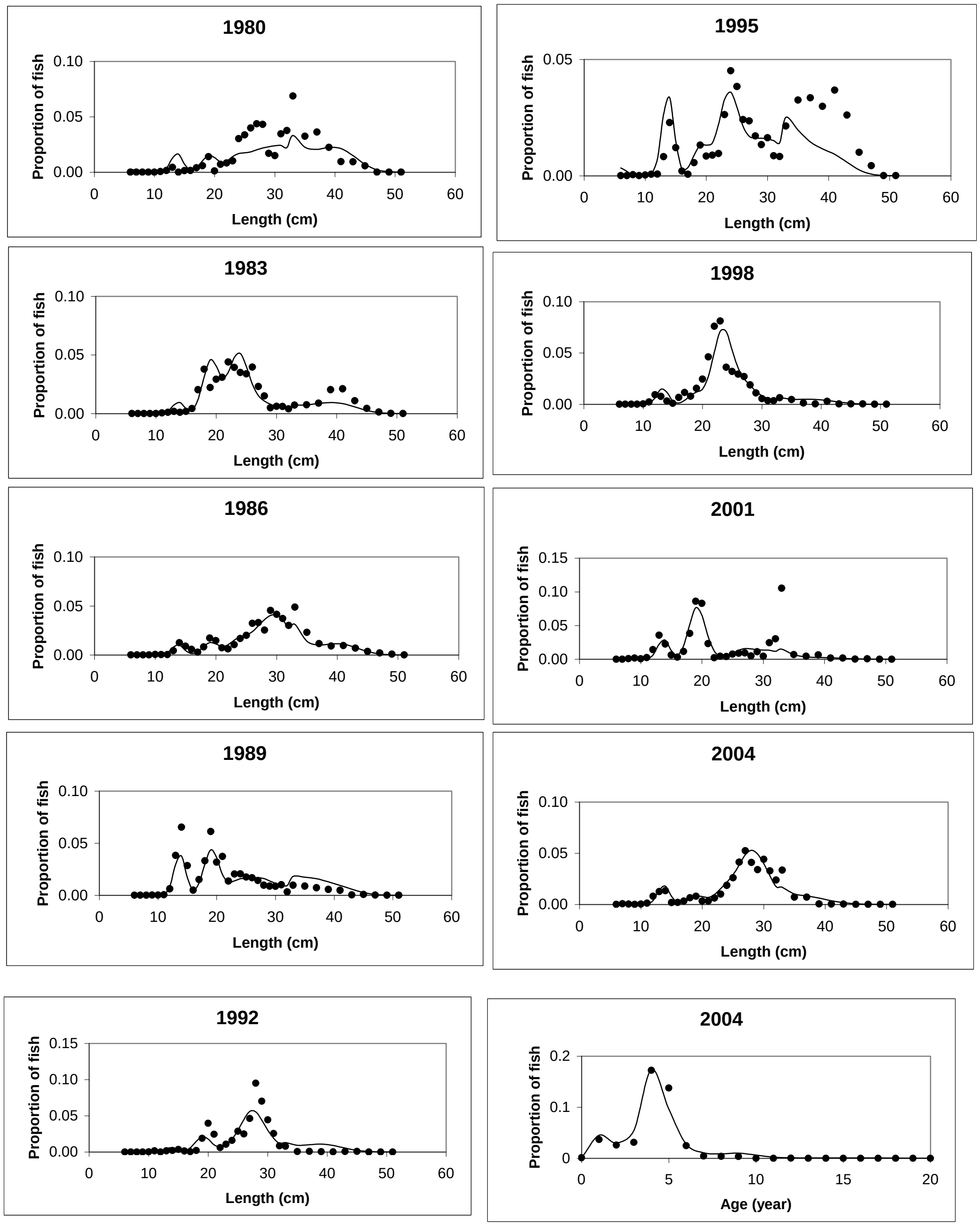


Figure 19. Fit of the base model estimates (line) to the shelf survey female length and age compositions (symbols).

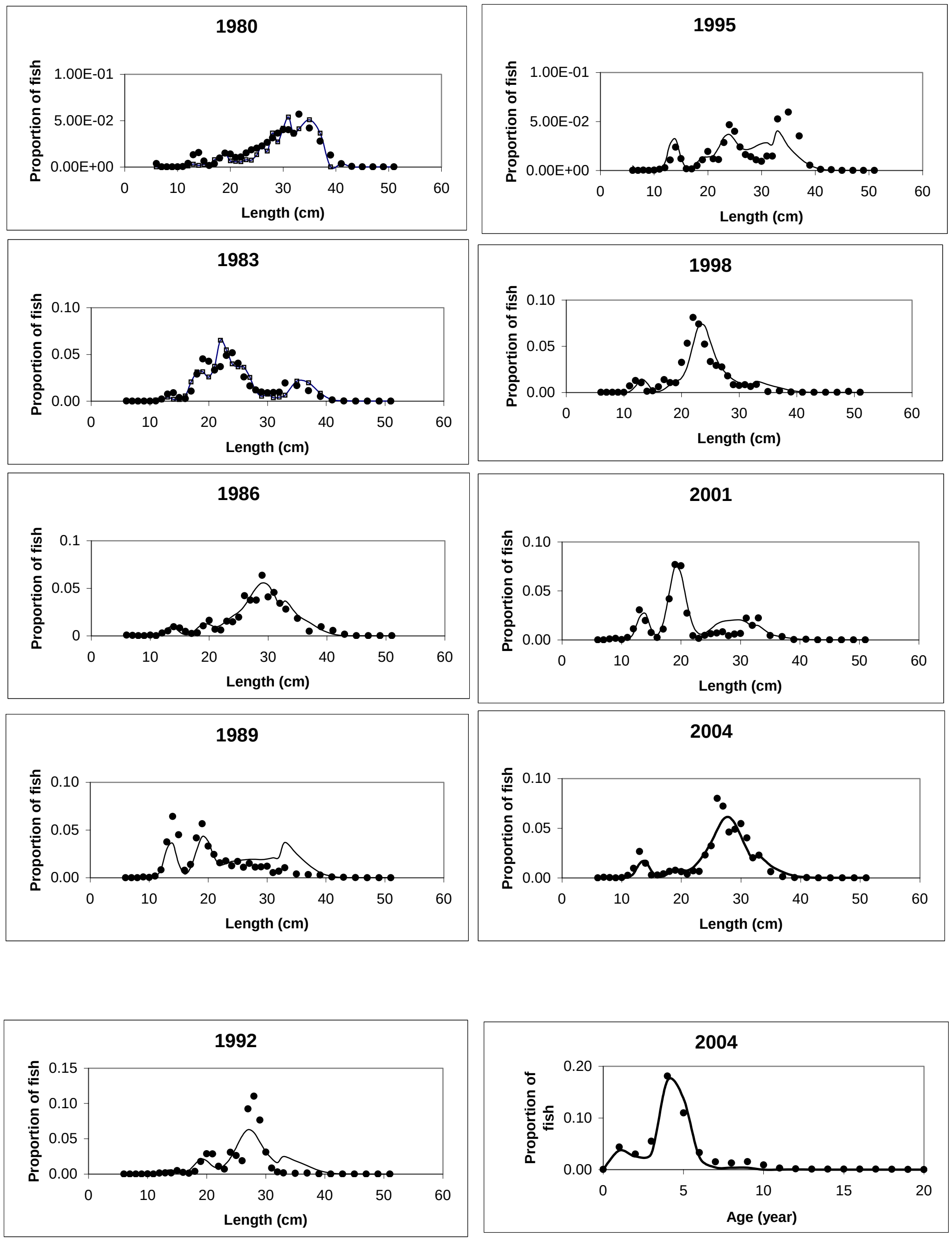


Figure 20. Fit of base run estimates (line with no markers) to the shelf survey male length and age compositions.

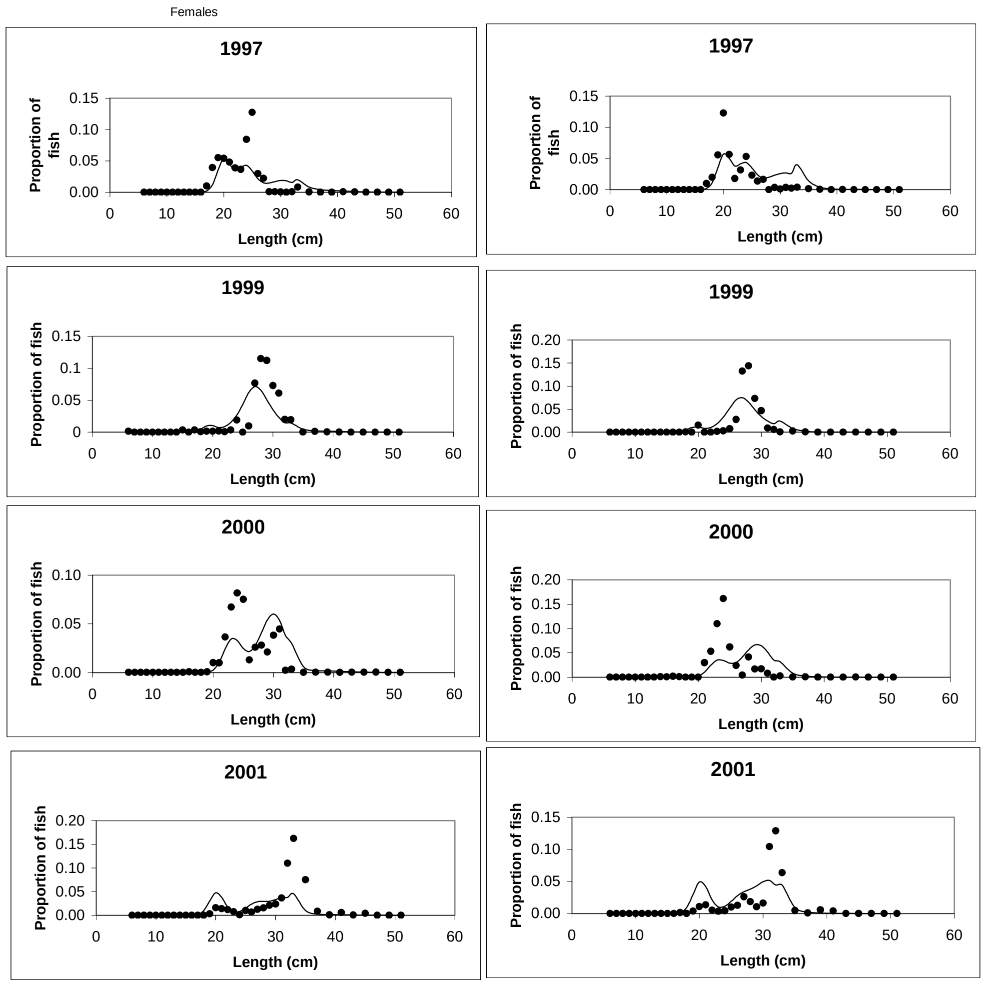


Figure 21. Fit of base run estimates (line with no markers) to the AFSC slope survey length compositions (Females on left, males on right).

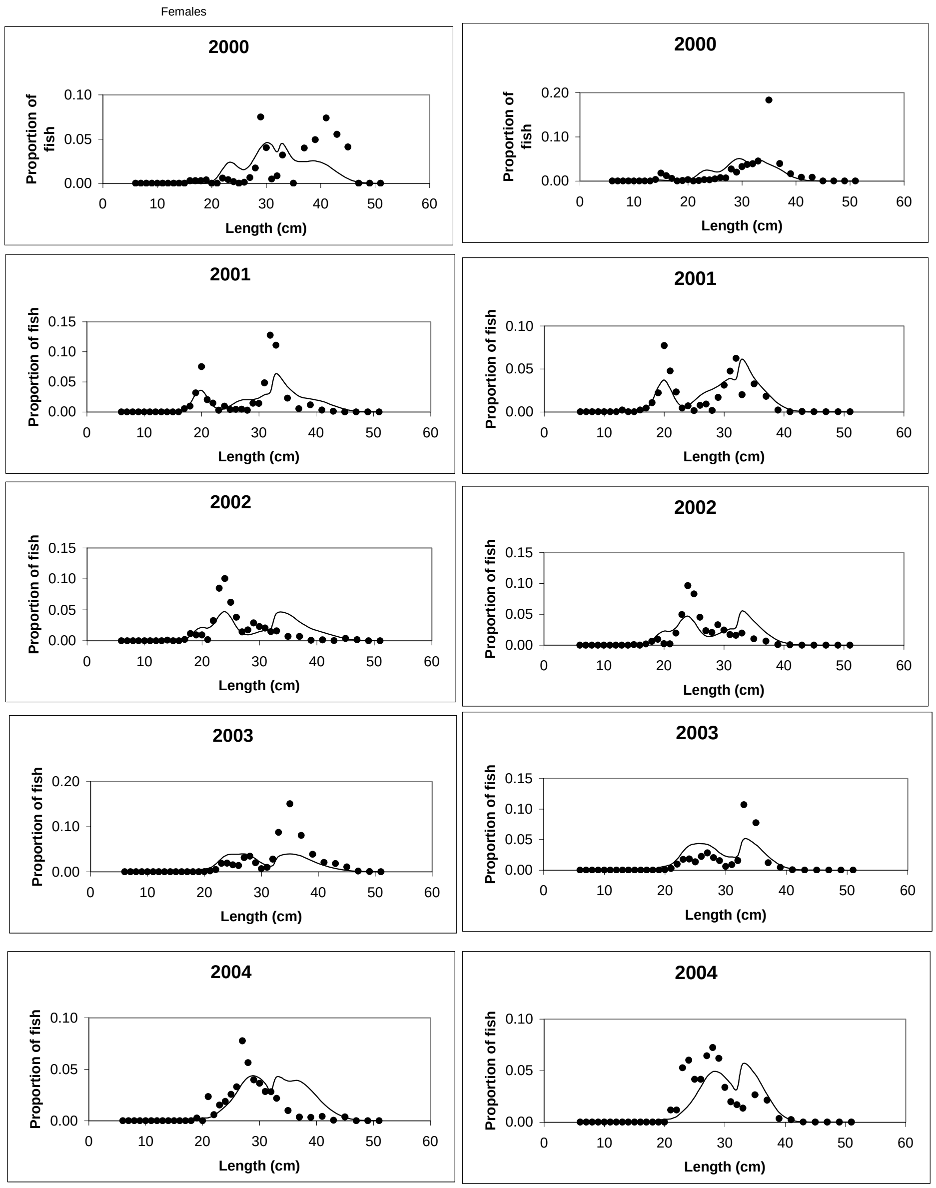


Figure 23. Fit of base run estimates (line with no markers) to the NWFSC slope survey length compositions (Females on left, males on right).

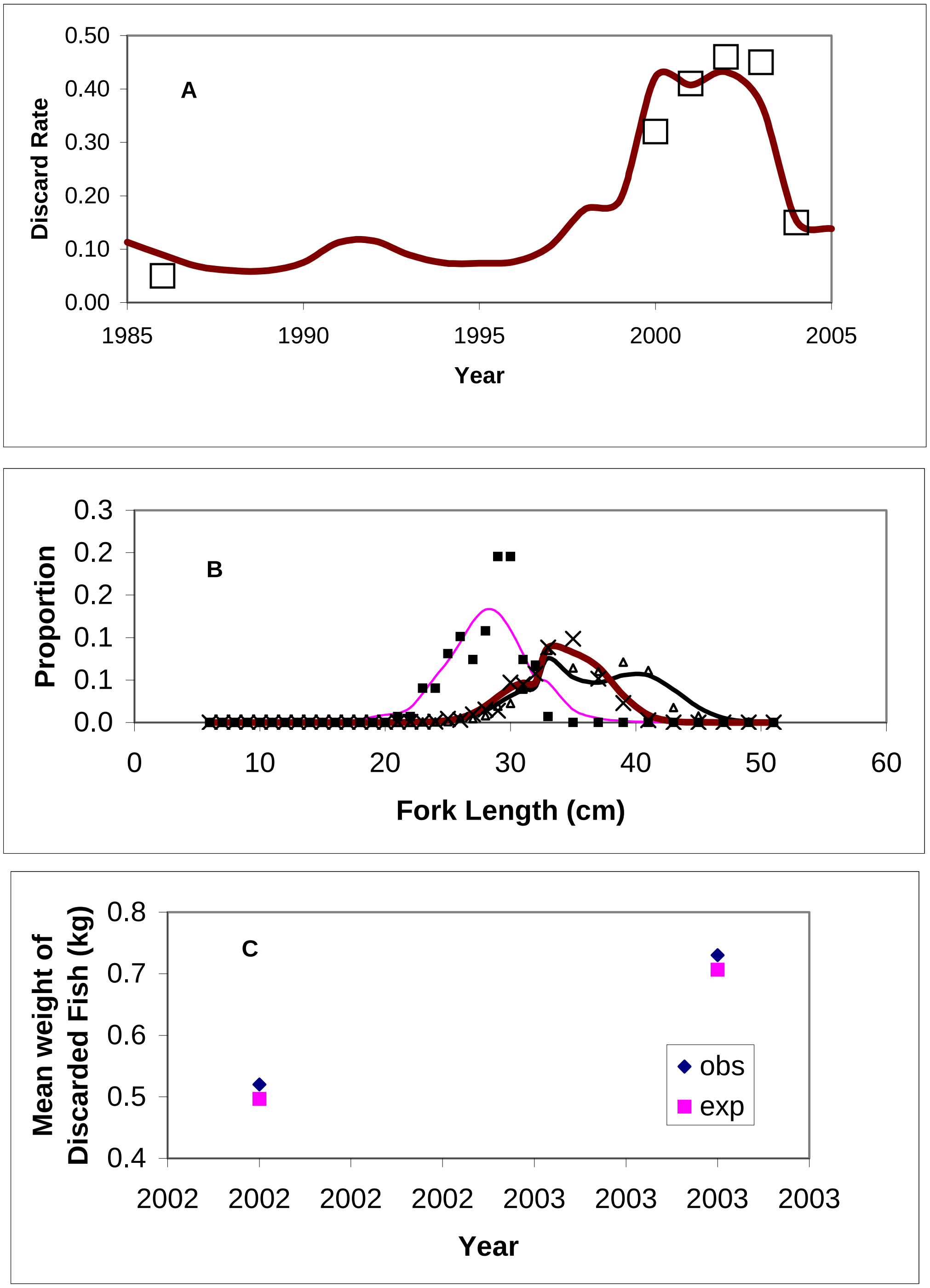


Figure 24. Fit of Base Model to discard-related data. Graph B is the 1986 length composition for unsexed discard versus sex retained. Symbols are data, lines are model estimates in both A and B.

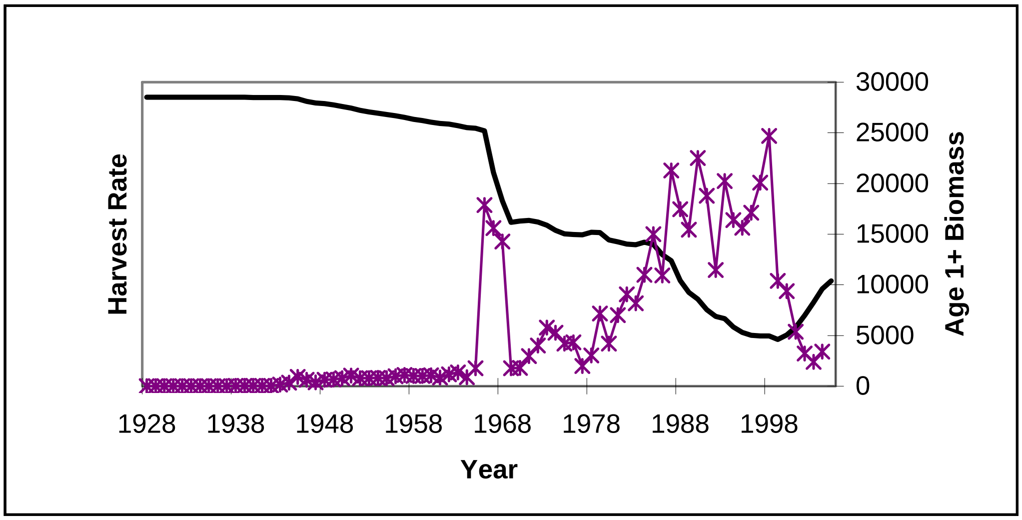


Figure 25. Time series of biomass (line without symbols) versus harvest rate. Harvest rate maximum is 1.0, and represents catch/biomass available to the fishermen.

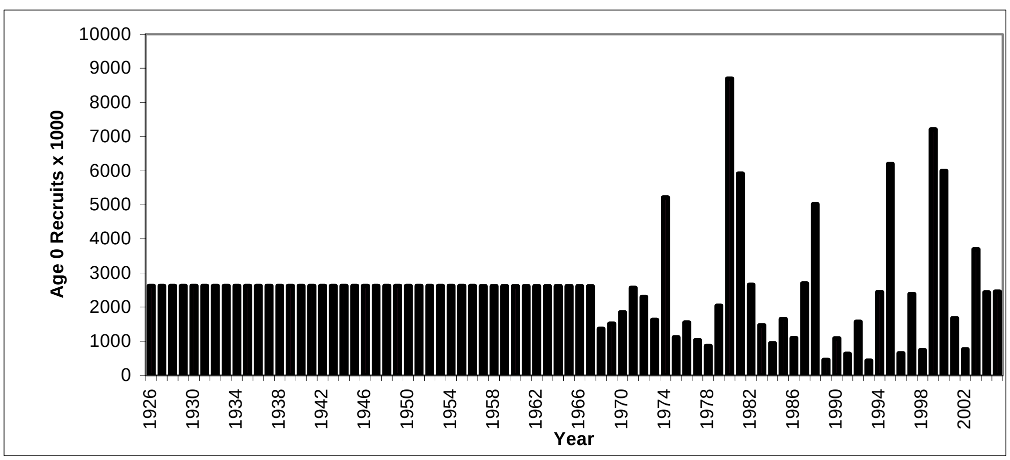


Figure 26. Recruitments estimated in the Base Model G07.

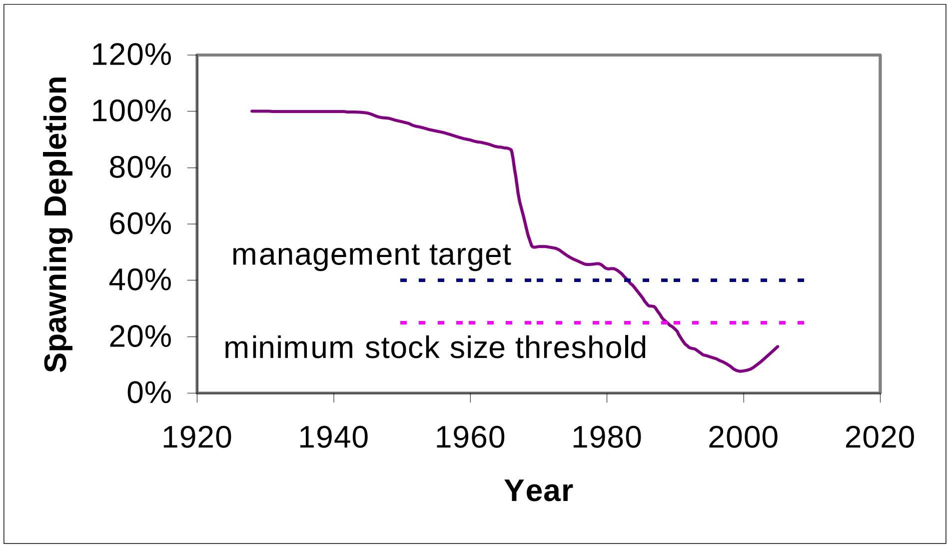


Figure 27. Spawning depletion over time compared to the target (40%) and the minimum stock size (25%).

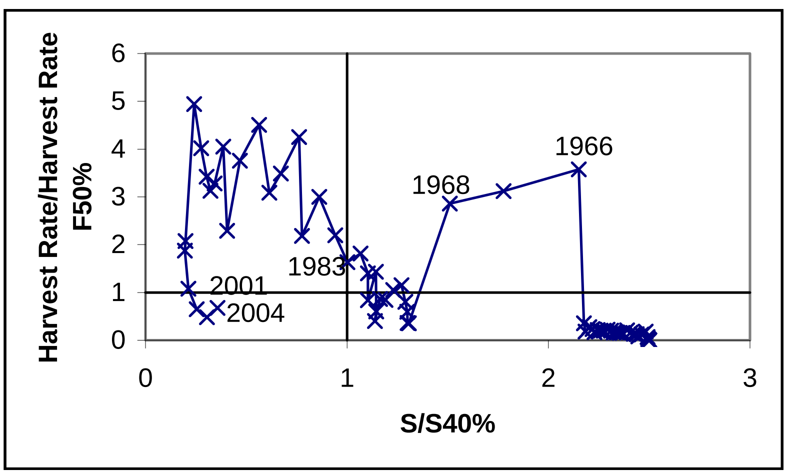


Figure 28. Comparison of spawning output (S) and the harvest rate (catch/available biomass) to the proxy values for maximum sustained yield (MSY). The vertical axis represents the historical harvest rates relative to the harvest rate at the MSY proxy of F50%. Values along the horizontal axis represent ratios of historical spawning output to the MSY proxy spawning output at 40% of the unfished level. From 1983 through 2001, the harvest rate was higher than the MSY proxy and the spawning output was lower than the MSY proxy.

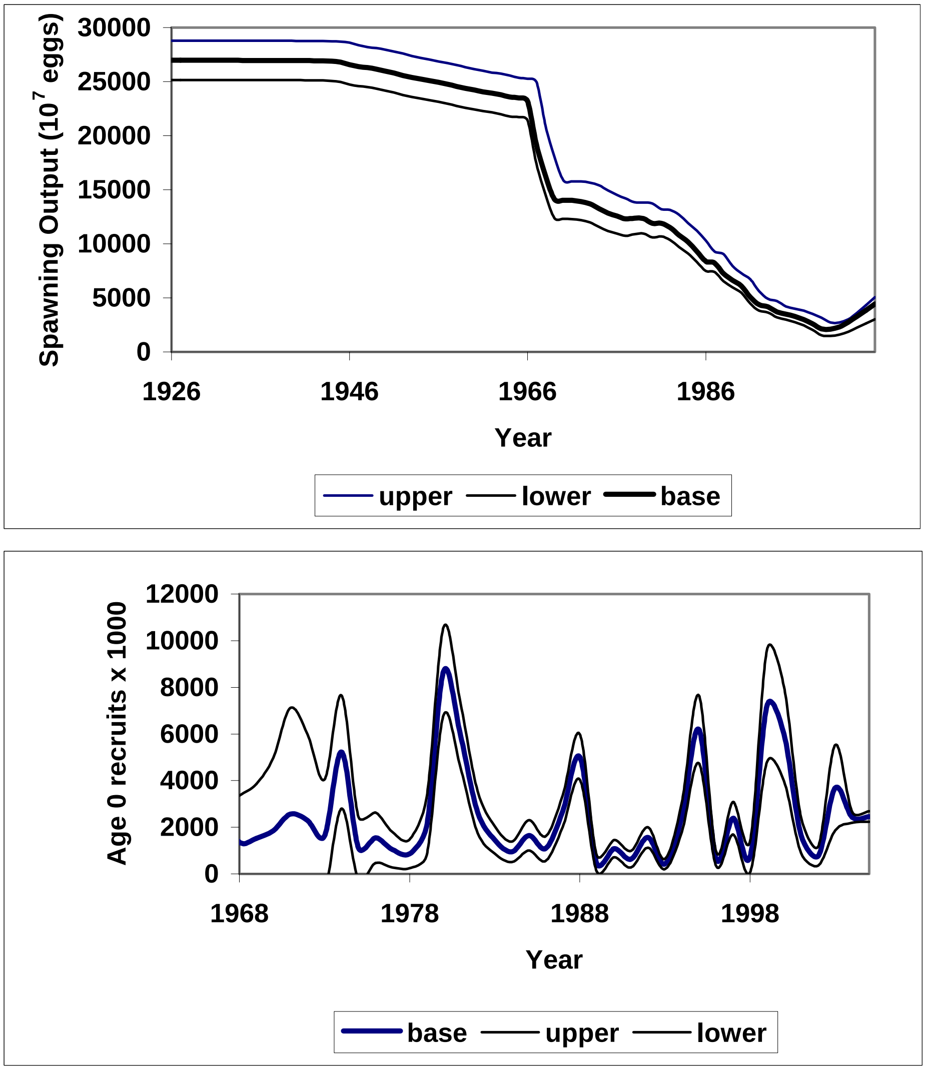
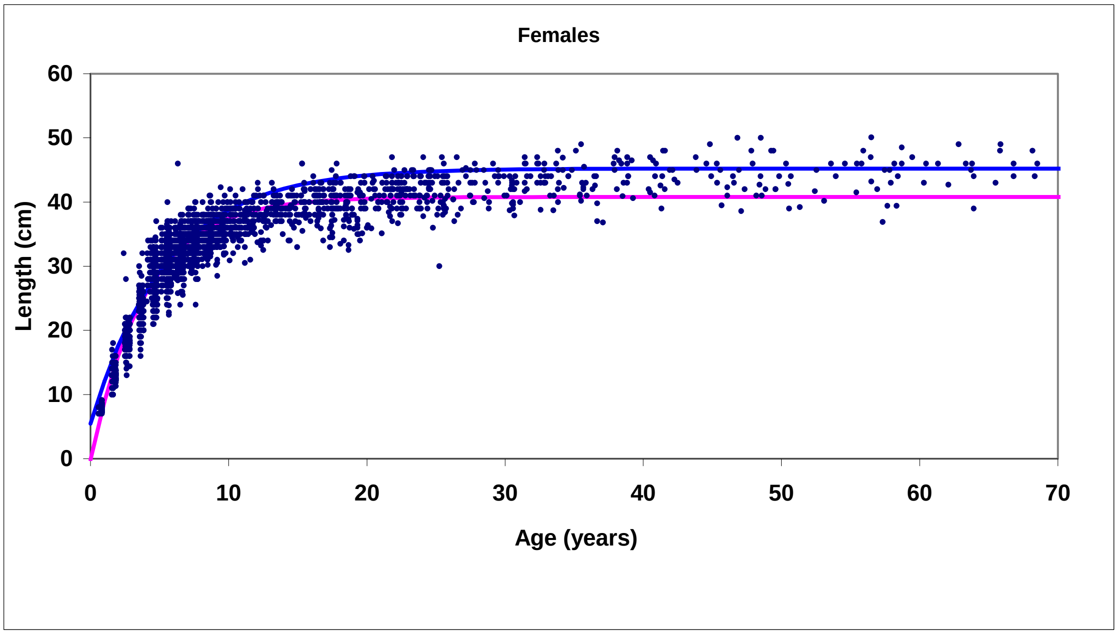


Figure 29. Time series estimates from the Base Model (G07) with 95% confidence intervals.



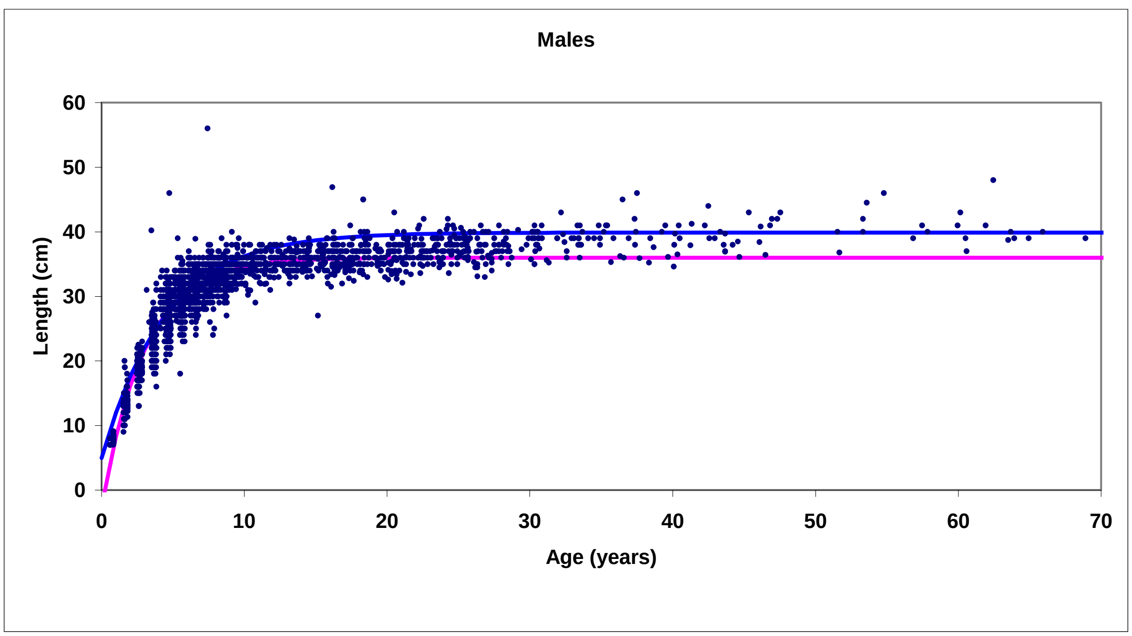
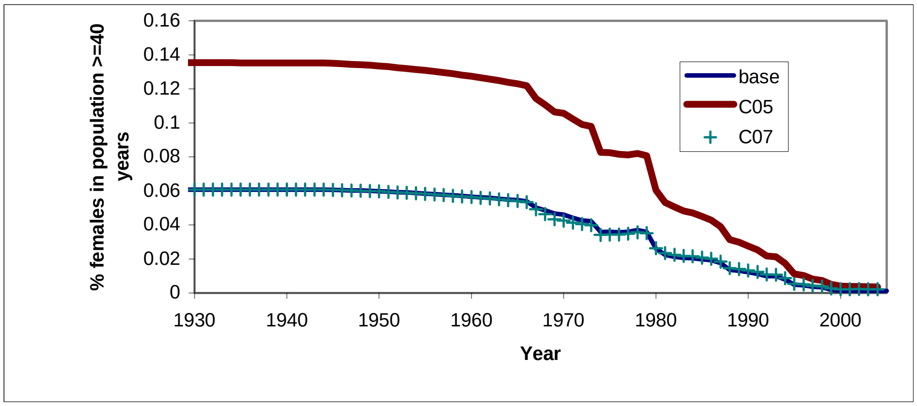


Figure 30. Comparison of curves forced to have high and low lengths at ages 1.7 years and 40 years to all the available data.



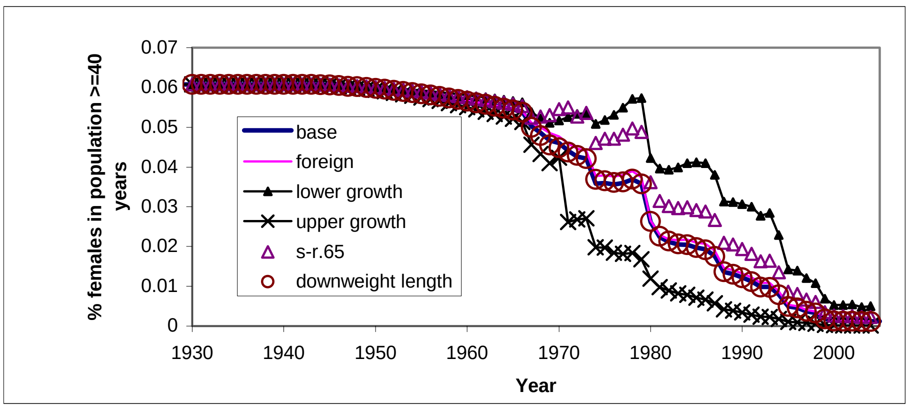


Figure 31. Comparison of sensitivity runs to the base model in terms of the proportion of older fish in the population over time. In the upper graph, Models C05 and C07 are in Table 25. In the lower graph, the model labeled "foreign" is model G-07a in Table 28, lower growth is G-07d, upper growth is G-07e, s-r .65 is G07-b, and downweight length is G-07c.

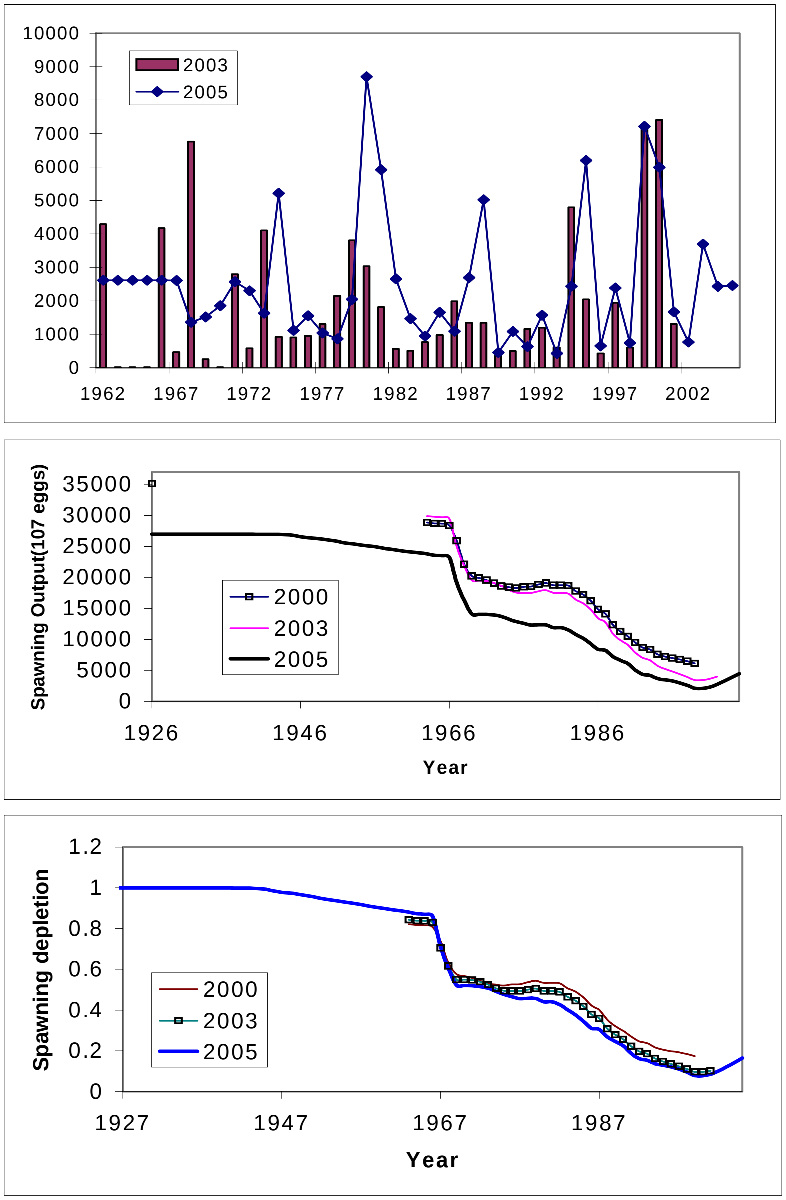


Figure 32. Comparison of spawning output, depletion, and recruitment estimates from prior assessments to the Base Model estimates in this assessment.

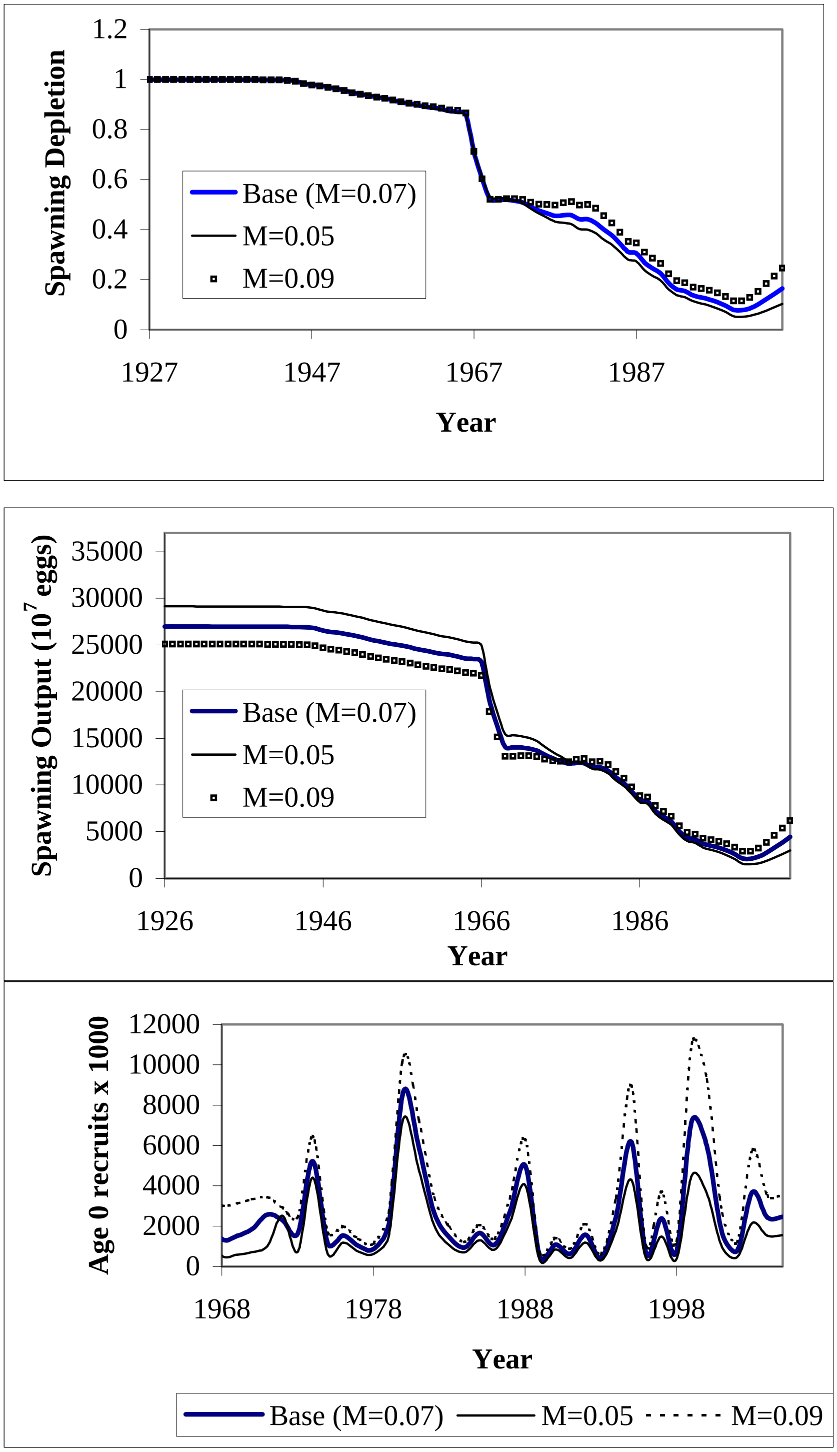


Figure 33. Comparison of time series uncertainty due to different assumptions regarding natural mortality.

SS2 Control File

2 #_N_growthmorphs
1 2 #SEX 1=FEMALE,2=MALE
1 #_N_Areas_(populations)
1 1 1 1 1 #area_for_each_fleet/survey
0 #do_migration_(0/1)
3 #_N_Block_Designs
1 1 2
1998 1998
2003 2004
2000 2003 2004 2004

4 #_Last_age_for_natmort_young
15 #_First_age_for_natmort_old
1.7 #_age_for_growth_Lmin
40 #_age_for_growth_Lmax
7 #_MGparm_dev_phase

#	LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-variabl	use_dev	dev_minyr	dev_maxyr	dev_stddev	use_block	block_type	
	0.05	0.15	0.07	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_of
	12	16	13.5	36	0	1	5	0	0	0	0	0.5	1	0	#M1_Lmin
	40	60	42.94	70	0	10	5	0	0	0	0	0.5	0	0	#M1_Lmax
	0.05	0.25	0.201	0.15	0	0.8	5	0	0	0	0	0.2	1	0	#M1_VBK
	0.05	0.25	0.06	0.086	0	0.8	6	0	0	0	0	0.5	0	0	#M1_CV-young
	-3	3	0	0	0	0.8	-6	0	0	0	0	0.5	0	0	#M1_CV-old_as_exponential_offs
	-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_natM_young_as_exponentia
	-3	3	0	0	0	0.8	-3	0	0	0	0	0.5	0	0	#M2_natM_old_as_exponential_of
	-3	3	0	0	0	0.8	-5	0	0	0	0	0.5	0	0	#M2_Lmin_as_exponential_offset
	-3	3	-0.1253	0	0	0.8	5	0	0	0	0	0.5	0	0	#M2_Lmax_as_exponential_offset
	-3	3	0.2363	0	0	0.8	5	0	0	0	0	0.5	0	0	#M2_VBK_as_exponential_offset
	-3	3	0	0	0	0.8	-6	0	0	0	0	0.5	0	0	#M2_CV-young_as_exponential_c
	-3	3	0	0	0	0.8	-6	0	0	0	0	0.5	0	0	#M2_CV-old_as_exponential_offs
#	Add	2+2*gende	lines	to	read	the	wt-Len	and	mat-Len	parameters					
	-3	3	2.10E-05	2.44E-06	0	0.8	-3	0	0	0	0	0.5	0	0	#Female wt-len-1
	-3	3	2.96142	3.34694	0	0.8	-3	0	0	0	0	0.5	0	0	#Female wt-len-2
	-3	3	34.59	55	0	0.8	-3	0	0	0	0	0.5	0	0	#Female mat-len-1
	-3	3	-0.6429	-0.25	0	0.8	-3	0	0	0	0	0.5	0	0	#Female mat-len-2
	-3	3	0.1458	1	0	0.8	-3	0	0	0	0	0.5	0	0	#Female eggs/km intercept
	0	0	1.325	1	0	0.8	-3	0	0	0	0	0.5	0	0	#Female eggs/km slope
	-3	3	2.10E-05	0	0	0.8	-3	0	0	0	0	0.5	0	0	#Male wt-len-1
	-3	3	2.96142	3.34694	0	0.8	-3	0	0	0	0	0.5	0	0	#Female wt-len-2
#	pop*gmorp	lines	For	the	proportion	of	each	morph	in	each	area				
	0	1	0.5	0.2	0	9.8	-3	0	0	0	0	0.5	0	0	#frac to morph 1 in area1
	0	1	0.5	0.2	0	9.8	-3	0	0	0	0	0.5	0	0	#frac to morph 2 in area 1
#	pop	lines	For	the	proportion	assigned	to	each	area						
	0	1	1	1	0	0.8	-3	0	0	0	0	0.5	0	0	#frac to area 1

SS2 Control File (cont.)

0	#_custom-env_read						
0	#_custom-block_read						
#	LO	HI	INIT	PRIOR	PR_type	SD	PHASE
	-10	10	0	0	0	99	7
#_Spawner-Recruitment_parameters							
1	#	SR_fxn:	1=Beverton-Holt				
#LO	HI	INIT	PRIOR	Pr_type	SD	PHASE	
3	31	7.612	9.3	0	10	1	#Ln(R0)
0.2	0.95	0.95	0.7	2	0.2	-2	#steepness
0	2	0.8	0.8	0	0.8	-1	#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						
#	start_rec_year	end_rec_year	Lower_limi	Upper_limit	phase		
	1968	2003	-8	8	3		
#init_F_setupforeachfleet							
#	LO	HI	INIT	PRIOR	PR_type	SD	PHASE
	0	1	0	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/	#env-Var	#Num/Bio(0/1)	for each fleet and survey	
0	0	0	0	0	1		
0	0	0	0	0	1		
0	0	0	0	0	1		
0	0	0	0	0	1		
0	0	0	0	0	1		
#_SELEX_&_RETENTION_PARAMETERS							
#Selex_type	Do_retention(0/1	Do_male	Mirrored_selex_number				
2	1	0	0	#_fleet_1			
2	0	0	0	#_fleet_2			
2	0	0	0	#_fleet_3			
5	0	0	3	#_fleet_4			
2	0	0	0	#_fleet_5			
#_Age	selex						
10	0	0	0	#_fleet_1			
10	0	0	0	#_fleet_2			
10	0	0	0	#_fleet_3			
10	0	0	0	#_fleet_4			
10	0	0	0	#_fleet_5			

SS2 Control File (cont.)

#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-var	use_dev	dev_minyr	dev_maxyr	dev_sd	Block	Blktype	
20	45	38	35	0	10	-2	0	0	0	0	0.5	0	0	#peak
1E-04	0.1	0	0	0	99	-2	0	0	0	0	0.5	0	0	#init
-10	10	0.868	0	0	3	2	0	0	0	0	0.5	2	0	#infl
0.01	10	0.597	0.1	0	99	2	0	0	0	0	0.5	0	0	#slope
-5	10	99	2	0	99	-2	0	0	0	0	0.5	0	0	#final
-10	10	1	0	0	3	-4	0	0	0	0	0.5	0	0	#infl2
0.01	10	0.5	0.1	0	99	-5	0	0	0	0	0.5	0	0	#slope2
0.1	30	20	20	0	99	-4	0	0	0	0	0.5	0	0	#width of top
20	70	20	40	0	99	3	0	0	0	0	0.5	0	0	#_inflection_for_retention
0.1	10	1	1	0	99	3	0	0	0	0	0.5	0	0	#_slope_for_retention
0.001	1	1	1	0	99	-3	0	0	0	0	0.5	3	2	#_asymptotic_retention
0	0	0	0	0	99	-3	0	0	0	0	0.5	0	0	#_male offset
14	45	20	28	0	10	-2	0	0	0	0	0.5	0	0	#peak
0	0.1	0.005	0	0	99	-2	0	0	0	0	0.5	0	0	#init
-10	10	-0.143	0	0	3	2	0	0	0	0	0.5	0	0	#infl
0.01	10	0.532	0.1	0	99	3	0	0	0	0	0.5	0	0	#slope
-5	10	-1.994	2	0	99	3	0	0	0	0	0.5	0	0	#final
-10	10	-2.285	0	0	3	8	0	0	0	0	0.5	0	0	#infl2
0.01	10	-0.889	0.1	0	99	8	0	0	0	0	0.5	0	0	#slope2
0.1	10	2	2	0	99	-4	0	0	0	0	0.5	0	0	#width of top
20	45	28	28	0	10	-2	0	0	0	0	0.5	0	0	#peak
0.001	0.1	0	0	0	99	-2	0	0	0	0	0.5	0	0	#init
-10	10	0.776	0	0	3	2	0	0	0	0	0.5	0	0	#infl
0.01	10	0.8775	0.1	0	99	3	0	0	0	0	0.5	0	0	#slope
-5	10	-2.586	2	0	99	3	0	0	0	0	0.5	0	0	#final
-10	10	-1.751	0	0	3	4	0	0	0	0	0.5	0	0	#infl2
0.01	10	0.716	0.1	0	99	5	0	0	0	0	0.5	0	0	#slope2
0.1	10	2	2.8	0	99	-4	0	0	0	0	0.5	0	0	#width of top
20	45	1	28	0	10	-2	0	0	0	0	0.5	0	0	#minbin
0.001	0.1	37	0	0	99	-2	0	0	0	0	0.5	0	0	#maxbin
20	45	30	28	0	10	-2	0	0	0	0	0.5	0	0	#peak
0.001	0.1	0	0	0	99	-2	0	0	0	0	0.5	0	0	#init
-10	10	0.776	0	0	3	2	0	0	0	0	0.5	0	0	#infl
0.01	10	0.8775	0.1	0	99	3	0	0	0	0	0.5	0	0	#slope
-5	10	99	2	0	99	-3	0	0	0	0	0.5	0	0	#final
-10	10	1	0	0	3	-4	0	0	0	0	0.5	0	0	#infl2
0.01	10	0.5	0.1	0	99	-5	0	0	0	0	0.5	0	0	#slope2
0.1	10	2	20	0	99	-4	0	0	0	0	0.5	0	0	#width of top

```
     0 #_custom-env_read
     3 #_custom-block_read
   -10    10     0      0      0   99      5
   0.5     1     1      1      0   99      3
   0.5     1     1      1      0   99      3

     4 #_phase_for_selex_parm_devs
     1 #_max_lambda_phases:_read_this_Number_of_values_for_each_componentxtype_below
     0 #      sd_offset,0=Log(like)w/0Logterm_for_rec_dev
#_survey_lambdas
     1     1     1      1      1
#_discard_lambdas
     1     0     0      0      0
#_meanbodywt
     1
#_lenfreq_lambdas
     1     1     1      1      1
#_age_freq_lambdas
     0     1     0      0      0
#_size@age_lambdas
     0     0     0      0      0
#_initial_equil_catch
     1
#_recruitment_lambda
     1
#_parm_prior_lambda
     0
#_parm_dev_timeseries_lambda
     1
#      crashp lambda
   100
#max   F
   0.9

   999 #_end-of-file
```

SS2 Data File

\# MODEL DIMENSIONS
1928 # start_year
2004 # end_year
1 # N_seasons_per_year
#_vector_with_N_months_in_each_season
12
1 # spawning_season
1 # N_fishing_fleets
4 # N_surveys;
fishery%triennial%slope%pop%nwslope
0.5 0.7 0.92 0.42 0.6 #_surveytiming_in_season
2 #_number_/ 2)
75 #_accumulator_age;_model_always_starts_with_age_0

# catch (mt)	#	Year	Season
0	#	initial_equilibrium	
1	#	1928	1
3	#	1929	1
3	#	1930	1
1	#	1931	1
1	#	1932	1
1	#	1933	1
2	#	1934	1
2	#	1935	1
2	#	1936	1
2	#	1937	1
5	#	1938	1
7	#	1939	1
8	#	1940	1
9	#	1941	1
10	#	1942	1
39	#	1943	1
91	#	1944	1
236	#	1945	1
160	#	1946	1
100	#	1947	1
160	#	1948	1
171	#	1949	1
201	#	1950	1
261	#	1951	1
195	#	1952	1
194	#	1953	1
201	#	1954	1
197	#	1955	1
244	#	1956	1
269	#	1957	1
246	#	1958	1
243	#	1959	1

SS2 Data File (cont.)

258	#	1960	1
203	#	1961	1
276	#	1962	1
323	#	1963	1
208	#	1964	1
415	#	1965	1
4129	#	1966	1
3001	#	1967	1
2358	#	1968	1
256	#	1969	1
265	#	1970	1
441	#	1971	1
595	#	1972	1
836	#	1973	1
733	#	1974	1
567	#	1975	1
574	#	1976	1
263	#	1977	1
410	#	1978	1
992	#	1979	1
557	#	1980	1
912	#	1981	1
1114	#	1982	1
938	#	1983	1
1268	#	1984	1
1769	#	1985	1
1252	#	1986	1
2386	#	1987	1
1650	#	1988	1
1271	#	1989	1
1650	#	1990	1
1161	#	1991	1
663	#	1992	1
1186	#	1993	1
850	#	1994	1
732	#	1995	1
730	#	1996	1
771	#	1997	1
859	#	1998	1
350	#	1999	1
252	#	2000	1
161	#	2001	1
109	#	2002	1
80	#	2003	1
192	#	2004	1

SS2 Data File (cont.)

SS2 Data File (cont.)

```
#_Abundance_Indices
                    24 #_N_observations
#Year       Seas        Type        Value       se(log)
                  1977          1           2        3474         0.12 #1977     TRIENNIAL
                  1980          1           2        5467         0.26 #1980     TRIENNIAL
                  1983          1           2        9281         0.29 #1983     TRIENNIAL
                  1986          1           2        7436         0.31 #1986     TRIENNIAL
                  1989          1           2        3467         0.18 #1989     TRIENNIAL
                  1992          1           2        6854         0.42 #1992     TRIENNIAL
                  1995          1           2        5085         0.57 #1995     TRIENNIAL
                  1998          1           2        2560         0.18 #1998     TRIENNIAL
                  2001          1           2        2875         0.44 #2001     TRIENNIAL
                  2004          1           2        5802         0.22 #2004     triennial
                  1992          1           3         764         0.23 #1991     AFSCslope
                  1996          1           3         359         0.26 #1995     AFSCslope
                  1997          1           3         753         0.59 #1997     AFSCslope
                  1999          1           3         453         0.38 #1999     AFSCslope
                  2000          1           3         610         0.47 #2000     AFSCslope
                  2001          1           3         904         0.66 #2001     AFSCslope
                  1979          1           4        4555         0.21 #1979     pop-survey
                  1985          1           4        5595         0.17 #1985     pop-survey
                  1999          1           5         687         0.26 #1999     NWFSCSLOPE
                  2000          1           5         960         0.31 #2000     NWFSCSLOPE
                  2001          1           5         617         0.32 #2001     NWFSCSLOPE
                  2002          1           5         946         0.35 #2002     NWFSCSLOPE
                  2003          1           5        4155         0.38 #2003     NWFSCSLOPE
                  2004          1           5        1343         0.35 #2004     NWFSCSLOPE

#_Discard_Biomass
                     2 #_(1=biomass;_2=fraction)
            6#_N_observations
#Year       Seas        Type        Value       CV
#                 1966          1           1        0.01          0.3
      1986            1           1        0.05         0.3
      2000            1           1        0.32         0.3
      2001            1           1        0.41         0.3
      2002            1           1        0.46         0.3
      2003            1           1        0.45         0.3
      2004            1           1        0.15         0.3
#_Mean_BodyWt
          2 #_N_observations
#Year       Seas        Type        Mkt         Value       CV
      2002            1           1           1        0.52          0.3
      2003            1           1           1        0.73          0.3

         -1 #min_proportion_for_compressing_tails_of_observed_composition
     0.0001 #_constant added        to          expected    frequencies
```

SS2 Data File (cont.)

37	#_N_length_bins																
#_lower_edge_of_length_bins																	
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
49	#N_observations																
#Year	Seas	Fleet	sexes	Mkt	Nsam	begin	data:	femal	then	males							
1978	1	1	3	2	100	#78	Fishery Length Comp										
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
1979	1	1	3	2	64	#79	Fishery Length Comp										
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
1980	1	1	3	2	100	#80	Fishery Length Comp										
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
1981	1	1	3	2	100	#81	Fishery Length Comp										
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
1982	1	1	3	2	100	#82	Fishery Length Comp										
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
1983	1	1	3	2	100	#83	Fishery Length Comp										
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
1984	1	1	3	2	100	#84	Fishery Length Comp										
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
1985	1	1	3	2	100	#85	Fishery Length Comp										
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

24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51
0	0.01	0.02	0.04	0.02	0.03	0.02	0.03	0.03	0.06	0.08	0.06	0.07	0.06	0.05	0	0	0	0
0.01	0.01	0.01	0	0.03	0	0	0.02	0.02	0.05	0.12	0.08	0.03	0.01	0	0	0	0	0
0	0	0	0.01	0.01	0	0.03	0.03	0.05	0.06	0.07	0.05	0.05	0.01	0.03	0.02	0	0	0
0	0	0	0.01	0.01	0.02	0.02	0.01	0.03	0.1	0.02	0.16	0.1	0.03	0.02	0.01	0	0	0
0	0	0	0.01	0.03	0.01	0.01	0.04	0.04	0.07	0.08	0.07	0.06	0.06	0.05	0.01	0.01	0	0.01
0	0	0	0	0	0	0.01	0.02	0.05	0.09	0.13	0.08	0.02	0	0	0	0	0	0
0	0.01	0.01	0.01	0	0	0.01	0.01	0.01	0.03	0.05	0.09	0.17	0.16	0.1	0.05	0.01	0	0
0	0	0	0	0	0.01	0	0	0.01	0.03	0.1	0.1	0.06	0.01	0	0	0	0	0
0	0	0	0	0	0	0	0.01	0.01	0.04	0.07	0.15	0.15	0.09	0.05	0.02	0	0	0
0	0	0	0	0	0.01	0	0.01	0.02	0.06	0.16	0.07	0.02	0	0	0	0	0	0
0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.03	0.06	0.08	0.1	0.1	0.06	0.02	0	0	0
0	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.05	0.09	0.1	0.05	0.02	0.01	0	0	0	0
0	0	0	0.01	0.01	0.01	0.02	0.01	0.02	0.03	0.07	0.14	0.11	0.09	0.09	0.07	0.01	0	0
0	0	0.01	0	0.01	0.02	0.01	0.01	0.02	0.06	0.07	0.05	0.02	0.01	0	0	0	0	0
0	0	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.08	0.09	0.07	0.06	0.05	0.02	0.01	0.01	0	0
0	0	0.01	0.01	0.01	0.01	0.02	0.02	0.04	0.09	0.12	0.06	0.03	0.02	0.01	0.01	0	0	0

#_lower_edge_of_length_bins

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
49	#N_observations																
#Year	Seas	Fleet	sexes	Mkt	Nsam	begin	data:	female	then	males							
1986	1	1	0	1	150	#86	Fishery	Length	Comp								
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.04
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	1	1	3	2	100	#86	Fishery	Length	Comp								
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
1987	1	1	3	2	100	#87	Fishery	Length	Comp								
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
1988	1	1	3	2	100	#88	Fishery	Length	Comp								
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
1989	1	1	3	2	100	#89	Fishery	Length	Comp								
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
1990	1	1	3	2	200	#90	Fishery	Length	Comp								
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
1991	1	1	3	2	200	#91	Fishery	Length	Comp								
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
1992	1	1	3	2	100	#92	Fishery	Length	Comp								
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

24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51
0.04	0.08	0.1	0.07	0.11	0.2	0.2	0.07	0.07	0.01	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	0.01	0	0.01	0.02	0.02	0.04	0.07	0.09	0.06	0.06	0.07	0.06	0.02	0.01	0	0	0
0	0	0	0.01	0.02	0.01	0.05	0.05	0.06	0.09	0.1	0.05	0.02	0	0	0	0	0	0
0	0	0	0	0.01	0.01	0.02	0.02	0.04	0.09	0.1	0.08	0.05	0.03	0.01	0	0	0	0
0	0	0	0	0	0.01	0.03	0.04	0.08	0.14	0.12	0.06	0.02	0	0	0	0	0	0
0	0	0	0	0.01	0.01	0.02	0.02	0.04	0.09	0.1	0.08	0.05	0.03	0.01	0	0	0	0
0	0	0	0	0	0.01	0.03	0.04	0.08	0.14	0.12	0.06	0.02	0	0	0	0	0	0
0	0	0.01	0	0.01	0.01	0.01	0.02	0.03	0.09	0.12	0.08	0.06	0.05	0.02	0.01	0	0	0
0	0	0.01	0.01	0.01	0.01	0.01	0.03	0.05	0.14	0.13	0.07	0.02	0	0	0	0	0	0
0	0	0.01	0.01	0.02	0.01	0.01	0.03	0.04	0.08	0.08	0.11	0.06	0.03	0.05	0.02	0.01	0	0
0	0	0	0	0	0.03	0.04	0.03	0.04	0.13	0.09	0.07	0.02	0.01	0	0	0	0	0
0	0.01	0	0	0.01	0.01	0.01	0.01	0.01	0.04	0.08	0.12	0.1	0.07	0.07	0.05	0.02	0	0
0	0	0.01	0.01	0	0.01	0.01	0.01	0.02	0.1	0.11	0.06	0.03	0.01	0	0	0	0	0
0	0	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.07	0.09	0.11	0.08	0.04	0.01	0	0	0
0	0	0	0.01	0.01	0.03	0.02	0.02	0.02	0.07	0.12	0.08	0.03	0.01	0	0	0	0	0

SS2 Data File (Cont.)

#_lower_edge_of_length_bins																	
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
49	#N_observations																
#Year	Seas	Fleet	sexes	Mkt	Nsam	begin	data:	femal	then	males							
1993	1	1	3	2	100	#93	Fishery	Length	Comp								
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
1994	1	1	3	2	200	#94	Fishery	Length	Comp								
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
1995	1	1	3	2	200	#95	Fishery	Length	Comp								
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
1996	1	1	3	2	200	#96	Fishery	Length	Comp								
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
1997	1	1	3	2	200	#97	Fishery	Length	Comp								
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
1998	1	1	3	2	200	#98	Fishery	Length	Comp								
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
1999	1	1	3	2	200	#99	Fishery	Length	Comp								
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	0.01
2000	1	1	3	2	200	#2000	Fishery	Length	Comp								
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

24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51
0	0	0.01	0.01	0.01	0.02	0.04	0.03	0.03	0.04	0.07	0.07	0.06	0.03	0.01	0.01	0	0	0
0	0.01	0	0.01	0.03	0.01	0.04	0.03	0.06	0.13	0.13	0.06	0.02	0.01	0	0	0	0	0
0	0	0	0	0	0.01	0.01	0.02	0.04	0.05	0.06	0.1	0.1	0.07	0.05	0.03	0	0	0
0	0	0	0	0.01	0.01	0.03	0.02	0.06	0.09	0.11	0.09	0.03	0	0	0	0	0	0
0	0.01	0	0	0.01	0.01	0.02	0.02	0.04	0.08	0.09	0.09	0.09	0.06	0.04	0.02	0.01	0	0
0	0	0	0.01	0.01	0.02	0.02	0.05	0.05	0.1	0.1	0.05	0.01	0	0	0	0	0	0
0	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.03	0.07	0.07	0.06	0.06	0.04	0.02	0.01	0.01	0	0
0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.13	0.11	0.05	0.01	0.01	0	0	0	0	0
0.01	0.01	0.02	0.01	0.02	0.03	0.03	0.03	0.04	0.06	0.06	0.06	0.05	0.03	0.02	0.02	0.01	0	0
0	0.01	0.02	0.01	0.02	0.03	0.04	0.04	0.05	0.1	0.08	0.04	0.02	0.01	0	0	0	0	0
0	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.06	0.09	0.09	0.07	0.06	0.03	0.01	0	0	0
0	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.04	0.13	0.09	0.05	0.02	0.01	0	0	0	0	0
0.01	0.02	0.03	0.04	0.03	0.04	0.04	0.03	0.03	0.05	0.06	0.07	0.04	0.04	0.02	0.01	0.01	0	0
0.01	0.02	0.03	0.02	0.02	0.04	0.03	0.03	0.02	0.07	0.06	0.04	0.02	0	0	0	0	0	0
0	0.01	0.01	0.02	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.05	0.05	0.04	0.03	0.01	0	0	0
0	0.01	0.01	0.02	0.03	0.04	0.04	0.04	0.05	0.09	0.07	0.04	0.02	0.01	0	0	0	0	0

SS2 Data File (Cont.)

#_lower_edge_of_length_bins																	
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
49 #N_observations																	
#Year	Seas	Fleet	sexes	Mkt	Nsam	begin	data:	femal	then	males							
2001	1	1	3	2	200	#2001 Fishery Length Comp											
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
2002	1	1	3	2	200	#2002 Fishery Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01
2003	1	1	3	2	200	#2003 Fishery Length Comp											
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
2004	1	1	3	2	200	#2004 Fishery Length Comp											
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
1977	1	2	3	0	0	#1977 Shelf Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.02	0.04
0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.02	0.04
1980	1	2	3	0	69	#1980 Shelf Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0.01	0.01	0.01
0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1983	1	2	3	0	200	#1983 Shelf Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0.02	0.04	0.02	0.03	0.03	0.04	0.04
0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.03	0.03	0.03	0.04	0.07	0.06
1986	1	2	3	0	200	#1986 Shelf Survey Length Comp											
0	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0.01	0.02	0.01	0.01	0.01	0.01
0	0	0	0	0	0	0	0.01	0.01	0.01	0	0	0	0.01	0.02	0.01	0.01	0.02

24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51
0	0	0.01	0.02	0.03	0.04	0.05	0.06	0.06	0.08	0.05	0.04	0.03	0.02	0.02	0.01	0	0	0
0	0	0.01	0.02	0.03	0.04	0.06	0.06	0.05	0.08	0.06	0.03	0.02	0.01	0	0	0	0	0
0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.12	0.06	0.04	0.05	0.03	0.02	0.01	0	0	0
0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.1	0.08	0.04	0.01	0	0	0	0	0	0
0	0	0	0.01	0	0	0.01	0.01	0.02	0.08	0.12	0.08	0.05	0.04	0.04	0.02	0.01	0	0
0	0	0.01	0.01	0.01	0.01	0.01	0.02	0.05	0.16	0.12	0.06	0.02	0.01	0	0	0	0	0
0	0	0	0.01	0.02	0.03	0.03	0.03	0.03	0.07	0.08	0.06	0.04	0.04	0.03	0.01	0.01	0	0
0	0	0.01	0.01	0.03	0.04	0.04	0.05	0.04	0.13	0.09	0.05	0.02	0	0	0	0	0	0
0.05	0.03	0.02	0.03	0.03	0.02	0.03	0.02	0.02	0.05	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0
0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.05	0.03	0.03	0.03	0.01	0	0	0	0	0
0.03	0.03	0.04	0.04	0.04	0.02	0.02	0.03	0.04	0.07	0.03	0.04	0.02	0.01	0.01	0.01	0	0	0
0.01	0.01	0.02	0.02	0.04	0.03	0.04	0.05	0.04	0.04	0.05	0.04	0	0	0	0	0	0	0
0.04	0.03	0.04	0.02	0.02	0.01	0.01	0.01	0	0.01	0.01	0.01	0.02	0.02	0.01	0	0	0	0
0.04	0.04	0.04	0.03	0.01	0.01	0.01	0	0	0.01	0.02	0.02	0.01	0	0	0	0	0	0
0.02	0.02	0.03	0.03	0.03	0.05	0.04	0.04	0.03	0.05	0.02	0.01	0.01	0.01	0.01	0	0	0	0
0.01	0.02	0.04	0.04	0.04	0.06	0.04	0.05	0.03	0.03	0.02	0	0.01	0.01	0	0	0	0	0

#_lower_edge_of_length_bins

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
49	#N_observations																
#Year	Seas	Fleet	sexes	Mkt	Nsam	begin	data:	femal	then	males							
1989	1	2	3	0	200	#1989 Shelf Survey Length Comp											
0	0	0	0	0	0	0.01	0.04	0.07	0.03	0	0.02	0.03	0.06	0.03	0.04	0.01	0.02
0	0	0	0	0	0	0.01	0.04	0.06	0.05	0.01	0.01	0.04	0.06	0.03	0.02	0.02	0.02
1992	1	2	3	0	200	#1992 Shelf Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.04	0.02	0.01	0.01
0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.03	0.03	0.01	0.01
1995	1	2	3	0	200	#1995 Shelf Survey Length Comp											
0	0	0	0	0	0	0	0.01	0.02	0.01	0	0	0.01	0.01	0.01	0.01	0.01	0.03
0	0	0	0	0	0	0	0.01	0.02	0.01	0	0	0.01	0.01	0.02	0.01	0.01	0.03
1998	1	2	3	0	200	#1998 Shelf Survey Length Comp											
0	0	0	0	0	0	0.01	0.01	0	0	0.01	0.01	0.01	0.02	0.02	0.05	0.08	0.08
0	0	0	0	0	0.01	0.01	0.01	0	0	0.01	0.01	0.01	0.01	0.03	0.05	0.08	0.07
2001	1	2	3	0	200	#2001 Shelf Survey Length Comp											
0	0	0	0	0	0	0.01	0.04	0.02	0.01	0	0.01	0.04	0.09	0.08	0.02	0	0
0	0	0	0	0	0	0.01	0.03	0.02	0.01	0	0.01	0.04	0.08	0.08	0.03	0	0
2004	1	2	3	0	200	#2004 Shelf Survey Length Comp											
0	0	0	0	0	0	0.01	0.01	0.01	0	0	0	0.01	0.01	0	0	0.01	0.01
0	0	0	0	0	0	0.01	0.03	0.01	0	0	0	0.01	0.01	0.01	0	0.01	0.01
1997	1	3	3	0	200	#97	AFSC Slope Survey Length Comp										
0	0	0	0	0	0	0	0	0	0	0	0.01	0.04	0.06	0.05	0.05	0.04	0.04
0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.06	0.12	0.06	0.02	0.03
1999	1	3	3	0	200	#99	AFSC Slope Survey Length Comp										
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	0.02	0	0	0

24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51
0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0	0.01	0.01	0.01	0.01	0	0	0	0	0	0
0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0
0.02	0.03	0.03	0.05	0.1	0.07	0.04	0.03	0.01	0.01	0	0	0	0	0	0	0	0	0
0.03	0.03	0.02	0.09	0.11	0.08	0.03	0.01	0	0	0	0	0	0	0	0	0	0	0
0.05	0.04	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.02	0.03	0.03	0.03	0.04	0.03	0.01	0	0	0
0.05	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.05	0.06	0.04	0.01	0	0	0	0	0	0
0.04	0.03	0.03	0.03	0.02	0.01	0.01	0	0	0.01	0	0	0	0	0	0	0	0	0
0.05	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0	0	0	0	0	0	0	0	0
0	0.01	0.01	0.01	0	0.01	0	0.02	0.03	0.11	0.01	0	0.01	0	0	0	0	0	0
0	0.01	0.01	0.01	0	0.01	0.01	0.02	0.01	0.02	0	0	0	0	0	0	0	0	0
0.02	0.03	0.04	0.05	0.04	0.03	0.04	0.03	0.02	0.03	0.01	0.01	0	0	0	0	0	0	0
0.02	0.03	0.08	0.07	0.05	0.05	0.05	0.04	0.02	0.02	0.01	0	0	0	0	0	0	0	0
0.09	0.13	0.03	0.02	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0
0.05	0.02	0.01	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.02	0	0.01	0.08	0.12	0.11	0.07	0.06	0.02	0.02	0	0	0	0	0	0	0	0	0
0	0.01	0.03	0.13	0.14	0.07	0.05	0.01	0.01	0	0	0	0	0	0	0	0	0	0

SS2 Data File (Cont.)

#_lower_edge_of_length_bins

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
49 #N_observations																	
#Year	Seas	Fleet	sexes	Mkt	Nsamp	begin	data:	female	then	males							
2000	1	3	3	0	200	#2000 AFSC Slope Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.04	0.07
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.05	0.11
2001	1	3	3	0	200	#2001 AFSC Slope Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.01	0.01	0.01
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0
1979	1	4	3	0	0	#79 P.o.p. survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.01
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.02
1985	1	4	3	0	200	#85 P.o.p. survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.02
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.01	0.02
2000	1	5	3	0	200	#2000 NWFSC Slope Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0
0	0	0	0	0	0	0	0	0	0.02	0.01	0.01	0	0	0	0	0	0
2001	1	5	3	0	200	#2001 NWFSC Slope Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.03	0.08	0.02	0.01	0
0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.08	0.05	0.02	0
2002	1	5	3	0	200	#2002 NWFSC Slope Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0.03	0.09
0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0.02	0.05
2003	1	5	3	0	200	#2003 NWFSC Slope Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.02
2004	1	5	3	0	200	#2004 NWFSC Slope Survey Length Comp											
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.01	0.02
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.05

24	25	26	27	28	29	30	31	32	33	35	37	39	41	43	45	47	49	51
0.08	0.08	0.01	0.03	0.03	0.02	0.04	0.04	0	0	0	0	0	0	0	0	0	0	0
0.16	0.06	0.02	0	0.04	0.02	0.02	0.01	0	0	0	0	0	0	0	0	0	0	0
0	0.01	0.01	0.01	0.02	0.02	0.02	0.04	0.11	0.16	0.08	0.01	0	0.01	0	0	0	0	0
0	0.01	0.01	0.03	0.02	0.01	0.02	0.11	0.13	0.06	0	0	0.01	0	0	0	0	0	0
0.02	0.06	0.05	0.04	0.05	0.06	0.05	0.03	0.02	0.02	0.02	0.03	0.01	0	0	0	0	0	0
0.04	0.02	0.03	0.04	0.06	0.07	0.05	0.03	0.02	0.04	0.04	0.01	0.01	0	0	0	0	0	0
0.04	0.03	0.03	0.05	0.06	0.05	0.04	0.03	0.03	0.03	0	0.01	0.01	0.01	0	0	0	0	0
0.04	0.04	0.04	0.06	0.07	0.06	0.06	0.05	0.02	0.02	0.01	0.01	0	0	0	0	0	0	0
0	0	0	0.01	0.02	0.08	0.04	0	0.01	0.03	0	0.04	0.05	0.07	0.06	0.04	0	0	0
0	0	0.01	0.01	0.03	0.02	0.03	0.04	0.04	0.05	0.18	0.04	0.02	0.01	0.01	0	0	0	0
0.01	0	0	0	0	0.01	0.01	0.05	0.13	0.11	0.02	0.01	0.01	0	0	0	0	0	0
0.01	0	0.01	0.01	0	0.02	0.03	0.05	0.06	0.02	0.03	0.02	0	0	0	0	0	0	0
0.1	0.06	0.04	0.01	0.02	0.03	0.02	0.02	0.01	0.02	0.01	0.01	0	0	0	0	0	0	0
0.1	0.08	0.05	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0	0	0	0	0	0	0
0.02	0.02	0.01	0.03	0.03	0.02	0.01	0.01	0.03	0.09	0.15	0.08	0.04	0.02	0.02	0.01	0	0	0
0.02	0.01	0.02	0.03	0.02	0.02	0.01	0.01	0.02	0.11	0.08	0.01	0	0	0	0	0	0	0
0.02	0.03	0.03	0.08	0.06	0.04	0.04	0.03	0.03	0.02	0.01	0	0	0	0	0	0	0	0
0.06	0.04	0.04	0.06	0.07	0.06	0.03	0.02	0.02	0.01	0.03	0.02	0	0	0	0	0	0	0

SS2 Data File (Cont.)

```
   45 #_N_age'_bins
#_lower_age_of_age'_bins
    0     1     2     3     4     5     6     7     8     9    10    11    12    13    14    15    16
    1 #_number_of_ageerr_types
#_vector_with_stddev_ ageing_precision_for_each_AGE_and_type
  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
 0.00  0.00  0.16  0.32  0.28  0.48  0.72  0.74  0.79  0.75  0.84  0.91  0.98  1.05  1.12  1.19  1.26

   17    18    19    20    21    22    23    24    25    26    27    28    29    30    31    32

 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
 1.33  1.40  1.47  1.54  1.61  1.68  1.75  1.82  1.89  1.96  2.03  2.10  2.17  2.24  2.31  2.38

   33    34    35    36    37    38    39    40    41    42    43    44    45    46    47    48

 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
 2.45  2.52  2.59  2.66  2.73  2.80  2.87  2.94  3.01  3.08  3.15  3.22  3.29  3.36  3.43  3.50

   49    50    51    52    53    54    55    56    57    58    59    60    61    62    63    64

 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
 3.57  3.64  4.26  4.34  4.42  4.50  4.58  4.66  4.74  4.82  4.90  4.98  5.06  5.14  5.22  5.30

      65    66    67    68    69    70    71    72    73    74    75

    65.5  66.5  67.5  68.5  69.5  70.5  71.5  72.5  73.5  74.5  75.5
    5.38  5.46  5.54  5.62  5.70  5.78  5.86  5.94  6.02  6.10  6.18
```

SS2 Data File (Cont.)

```
     4 #_N_age_observations
  #Yea Seas Fleet Gend Mkt   ageer Lbin_ Lbin_ Nsamp
  2004    1    2    3    0    1    1   -1  200 #04   Shelf Survey Age Comp
   0.00 0.04 0.03 0.03 0.17 0.14 0.02 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.06 0.03 0.03 0.24 0.15 0.02 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2003    1    1    3    2    1    1   -1  200 #04   Fishery Age Comp
   0.00 0.00 0.00 0.00 0.01 0.04 0.13 0.07 0.03 0.02 0.01 0.01 0.02 0.00 0.01 0.01 0.01 0.01 0.01 0.00 0.01
   0.00 0.00 0.00 0.01 0.02 0.06 0.08 0.06 0.03 0.01 0.01 0.01 0.01 0.01 0.01 0.02 0.01 0.01 0.00 0.01 0.01
  2003    1    5    3    0    1    1   -1  200 #04   NWFSC Slope Survey Age Comp
   0.00 0.00 0.00 0.02 0.10 0.01 0.04 0.12 0.09 0.09 0.08 0.01 0.00 0.03 0.00 0.00 0.00 0.02 0.01 0.00 0.00
   0.00 0.00 0.00 0.07 0.10 0.03 0.04 0.07 0.02 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
  2004    1    5    3    0    1    1   -1  200 #04   NWFSC Slope Survey Age Comp
   0.00 0.00 0.00 0.03 0.17 0.14 0.01 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
   0.00 0.00 0.01 0.06 0.27 0.08 0.01 0.09 0.02 0.00 0.02 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.00 0.00 0.00

     0 #_N_size@age_observations;_values_on_row1;_N_on_row2
  #Yea Seas Fleet Gend Mkt   ageer Nsamp

     0 #      N_variables
     0 #      N_observations
  #_Ye Varia Value


   999 #end of      file



0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
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0.01 0.00 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.03
0.01 0.01 0.01 0.01 0.00 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01

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0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01
```