From:

Status of the Pacific coast groundfish fishery through 2009, stock assessment and fishery evaluation

Stock assessments, STAR Panel reports, and rebuilding analyses

November 2009

Pacific Fishery Management Council
Portland, Oregon

http://www.pcouncil.org/groundfish/stock-assessments/safe-documents/

Final - SAFE version

Status of the U.S. splitnose rockfish (*Sebastes diploproa*) resource in 2009.

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October 28, 2009

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EXECUTIVE SUMMARY

Stock

Splitnose rockfish (*Sebastes diploproa*) are distributed from the northern Gulf of Alaska (Prince William Sound) to central Baja California. This assessment reports the status of the splitnose rockfish resource off the continental coast of the United States from the U.S.-Canadian border in the north to the U.S.-Mexican border in the south. Within the assessment area the resource is treated as a single stock due to the lack of biological and genetic data supporting the presence of multiple stocks. Nevertheless, management decisions on a coast-wide population need to account for effort concentration, since abundance is higher in some areas such as off central California.

Catches

Splitnose rockfish have not been a target of commercial fisheries, but have been taken incidentally. Off Washington and Oregon, it was historically bycaught in the Pacific ocean perch fishery. Since the adoption of the formal rebuilding plan for Pacific ocean perch, splitnose rockfish have been caught primarily in fisheries for mixed slope rockfish or other deepwater targets. Because of their small size, splitnose rockfish have a limited market and are often discarded. Over the last twenty years, discard rates ranged between 27% and 80% of the total catch.

Splitnose rockfish are not consistently sorted to species, and landings are estimated from applying port sampling species compositions to mixed rockfish landings. Trawl landings on average comprise 90% of annual catches, with 80% of fish landed in California. Only 10% of splitnose rockfish on average are caught by non-trawl commercial fisheries. The vast majority of non-trawl landings are caught by net gear, and only a small portion is caught by hook-and-line in the sablefish fishery. This species is rarely taken in the recreational fishery.

The landed catch of splitnose rockfish was reconstructed back to 1900 from variety of published sources and databases. The fishery removals were divided among three fisheries - domestic trawl, foreign trawl and domestic non-trawl. Landings peaked in the 1960s, when foreign trawl fleets operated in U.S. waters, and reached 5313 mt in 1967. The highest catch by domestic fleets was in 1998, when 1526 mt of splitnose rockfish was landed. For the last ten years landings were relatively low and ranged between 65 and 274 mt.

Table ES-1. Recent landings (mt) of splitnose rockfish in domestic trawl (by state) and non-trawl fisheries.

Year	Trawl CA	Trawl OR	Trawl WA	Non Trawl	Total (mt)
1999	231	35	1	1	267
2000	101	23	2	6	132
2001	99	9	1	2	110
2002	57	4	1	3	65
2003	151	4	1	1	157
2004	170	11	1	0	182
2005	86	10	0	1	97
2006	269	4	0	1	274
2007	61	7	1	0	69
2008	61	3	2	0	67

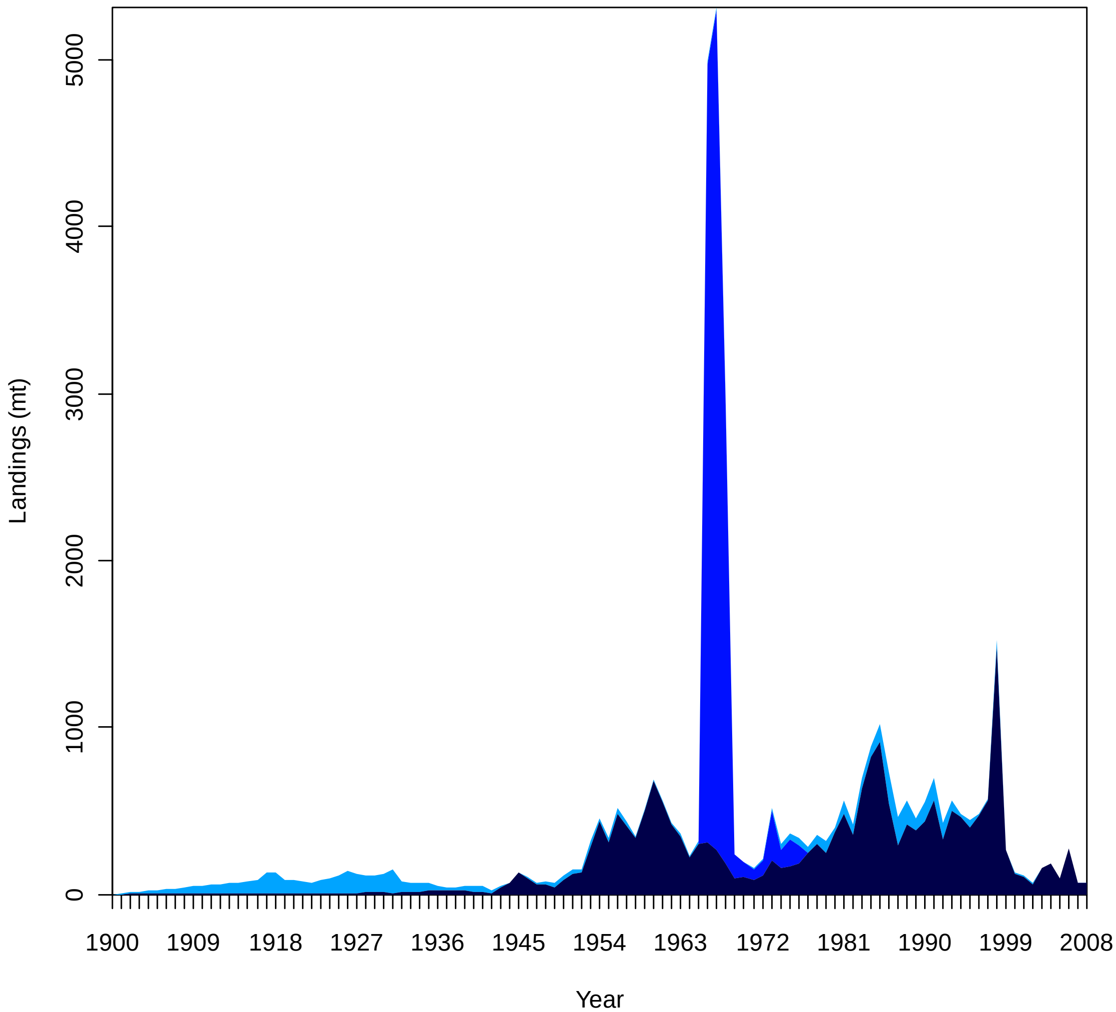

Figure ES-1. Reconstructed historical landings (mt) for splitnose rockfish by domestic trawl (dark blue), foreign trawl (mid blue) and non-trawl (light blue) fisheries.

Data and Assessment

This is the first full assessment for splitnose rockfish on the U.S. West Coast. Preliminary assessment of the splitnose rockfish status was conducted in 1994, when the available data about the species were compiled. However, since the data were sparse and no evident trends in biomass or mean size were detected, the results were inconclusive. In 1996, the status of the remaining rockfish species in the *Sebastes* complex was assessed, and species-specific Allowable Biological Catch (ABC) for splitnose rockfish was calculated.

In this assessment, the Stock Synthesis modeling program (version 3.02E) was used to conduct the analysis and estimate management quantities. The assessment is based on a two-sex model. The modeling period begins in 1900, assuming an unfished equilibrium state of the stock in 1899. The model includes three fisheries (domestic trawl, foreign trawl and domestic non-trawl) that operate within the entire area of assessment. Fishery-dependent data used in the assessment include landings by domestic trawl (1916-2008), foreign trawl (1966-1976) and non-trawl (1916-2008) fisheries; length frequency distributions for domestic trawl (1978-2008) and non-trawl (1983-1998, 2002) fleets; domestic trawl discards and discard length frequency distributions from Pikitch's study (1987) and the West Coast Groundfish Observer Program (2002-2007). Fishery-independent data include survey abundance estimates (1983-2008) from four National Marine Fisheries Service (NMFS) surveys conducted on the continental shelf and slope, length frequency distributions (1983-2008) from three of the four NMFS surveys and age compositions (2003-2008) from one of the surveys.

Stock spawning output

The splitnose rockfish assessment model uses a non-proportional egg-to-weight relationship, and the spawning output is reported in millions of eggs. The unexploited level of spawning stock output for splitnose rockfish is estimated to be 12853 million eggs. At the beginning of 2009, the spawning stock output is estimated to be 8426 million eggs, which represents 65.55% of the unfished spawning output.

Splitnose rockfish were relatively lightly exploited until 1940s, when the trawl fishery for the rockfish first became important. With the development of the Pacific ocean perch fishery (a species with which splitnose rockfish co-occur), spawning output of splitnose rockfish began to decline. A sharp drop in the 1960s was associated with large harvests of Pacific ocean perch by foreign trawl fleets operating in the current U.S. EEZ. Another drop occurred in 1998 when the increased availability of splitnose rockfish led to high removals off California. Since 1999, the splitnose spawning output was estimated to have been increasing in response to below-average removals and above-average recruitment during the last decade.

Table ES-2. Recent trend in estimated splitnose rockfish spawning output (million eggs) and depletion level.

Year	Estimated spawning output (million eggs)	95% confidence interval	Estimated depletion
1998	4913	2681-7145	38%
1999	4602	2363-6841	36%
2000	4651	2372-6931	36%
2001	4763	2430-7096	37%
2002	4909	2508-7311	38%
2003	5125	2627-7623	40%
2004	5404	2770-8038	42%
2005	5807	2975-8639	45%
2006	6365	3273-9457	50%
2007	6972	3574-10370	54%
2008	7690	3960-11420	60%
2009	8426	4357-12494	66%

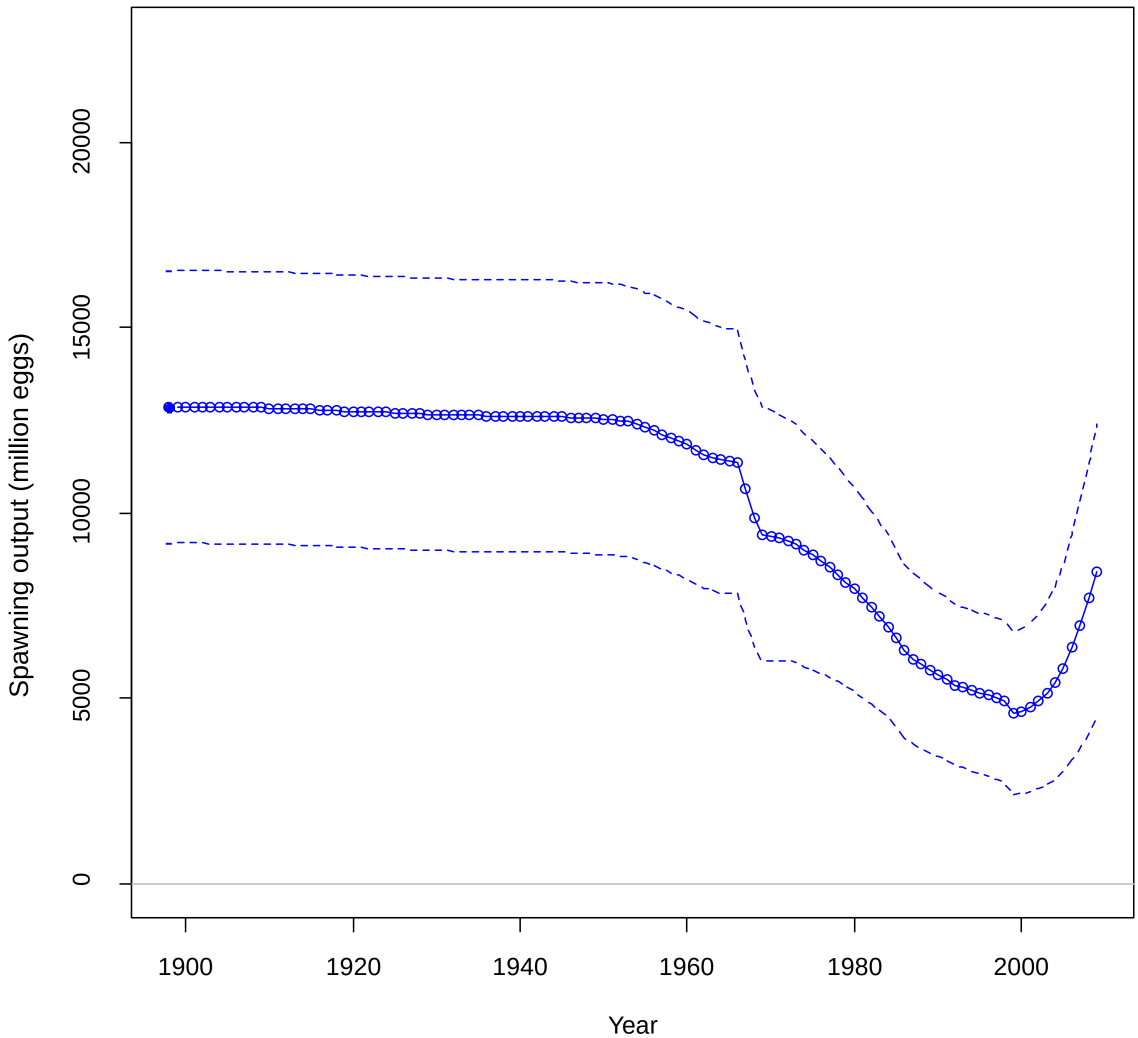

Figure ES-2. Time-series of estimated spawning output (million eggs) with 95% confidence interval.

Recruitment
In the assessment, the Beverton-Holt model was used to describe the stock-recruitment relationship. The level of virgin recruitment was estimated in order to assess the magnitude of the initial stock size. Recruitment deviations were estimated for each year between 1960 and 2006, which is the period best informed by the data based on evaluation of the variance of the recruitment deviations. Prior to 1960 and after 2006, recruits were taken deterministically from the stock-recruit curve. The standard deviation of log recruitment, used to define offset of the stock recruitment curve when recruitment deviations were estimated, was iteratively fit within the model and then fixed at the resulting level of 1. Steepness of the stock-recruitment curve was fixed at a value of 0.58, as estimated by meta-analysis for unassessed rockfish.

The model estimated above-average recruitments in the most recent years beginning 1999, which along with low catches during the last decade determine a population increase in recent and early forecast years. Uncertainty in recent recruitment was used to define alternative states of nature and develop the decision table.

Table ES-3. Recent trend in estimated recruitment for splitnose rockfish.

Year	Estimated recruitment (1000s)	95% confidence interval
1998	23423	7047-39799
1999	61319	28733-93905
2000	35504	14008-57000
2001	44958	20992-68924
2002	35903	16308-55498
2003	22388	8681-36095
2004	21043	6965-35121
2005	39992	14406-65578
2006	52273	11335-93211
2007	78203	0-186159
2008	12440	0-37683
2009	12741	0-38585

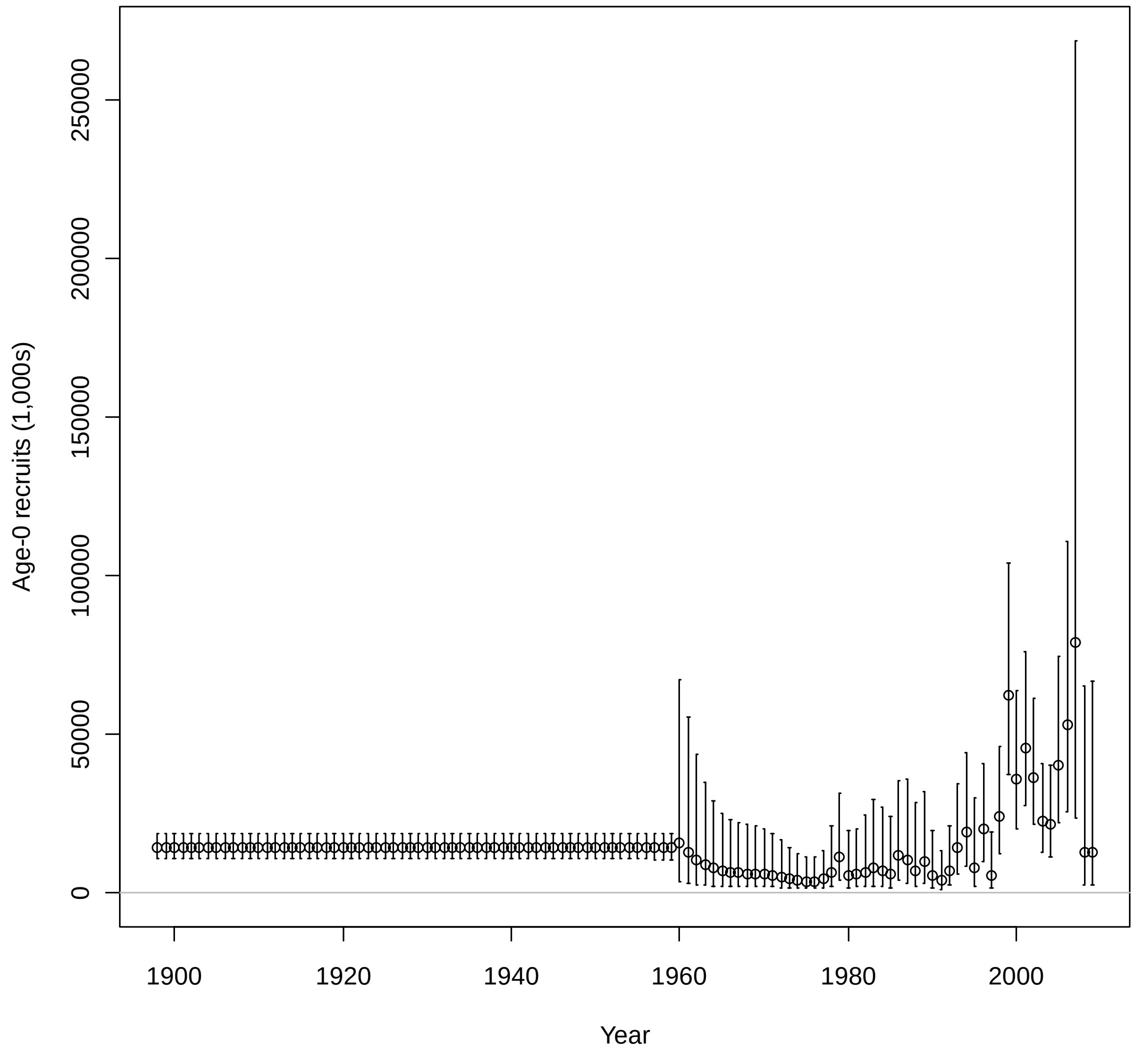

Figure ES-3. Time-series of estimated recruitment with 95% confidence interval.

Reference Points

Unfished spawning stock output for splitnose rockfish was estimated to be 12853 million eggs (95% confidence interval: 9105-16601 million eggs). The management target for splitnose rockfish is defined as 40% of the unfished spawning output ($SB_{40\%}$), which is estimated by the model to be 5141 million eggs (95% confidence interval: 3642-6641 million eggs). The stock is declared overfished if the current spawning output is estimated to be below 25% of unfished level. The MSY-proxy harvest rate for splitnose rockfish is SPR=F50%, which corresponds to an exploitation rate of 0.033. This harvest rate provides an equilibrium yield of 1236 mt at $SB_{40\%}$ (95% confidence interval: 883-1589 mt). The model estimate of maximum sustainable yield (MSY) is 1268 mt (95% confidence interval: 906-1630 mt). The estimated spawning stock output at MSY is 4121 million eggs (95% confidence interval: 2900-5342 million eggs). The exploitation rate corresponding to the estimated SPR_{MSY} of F44% is 0.039.

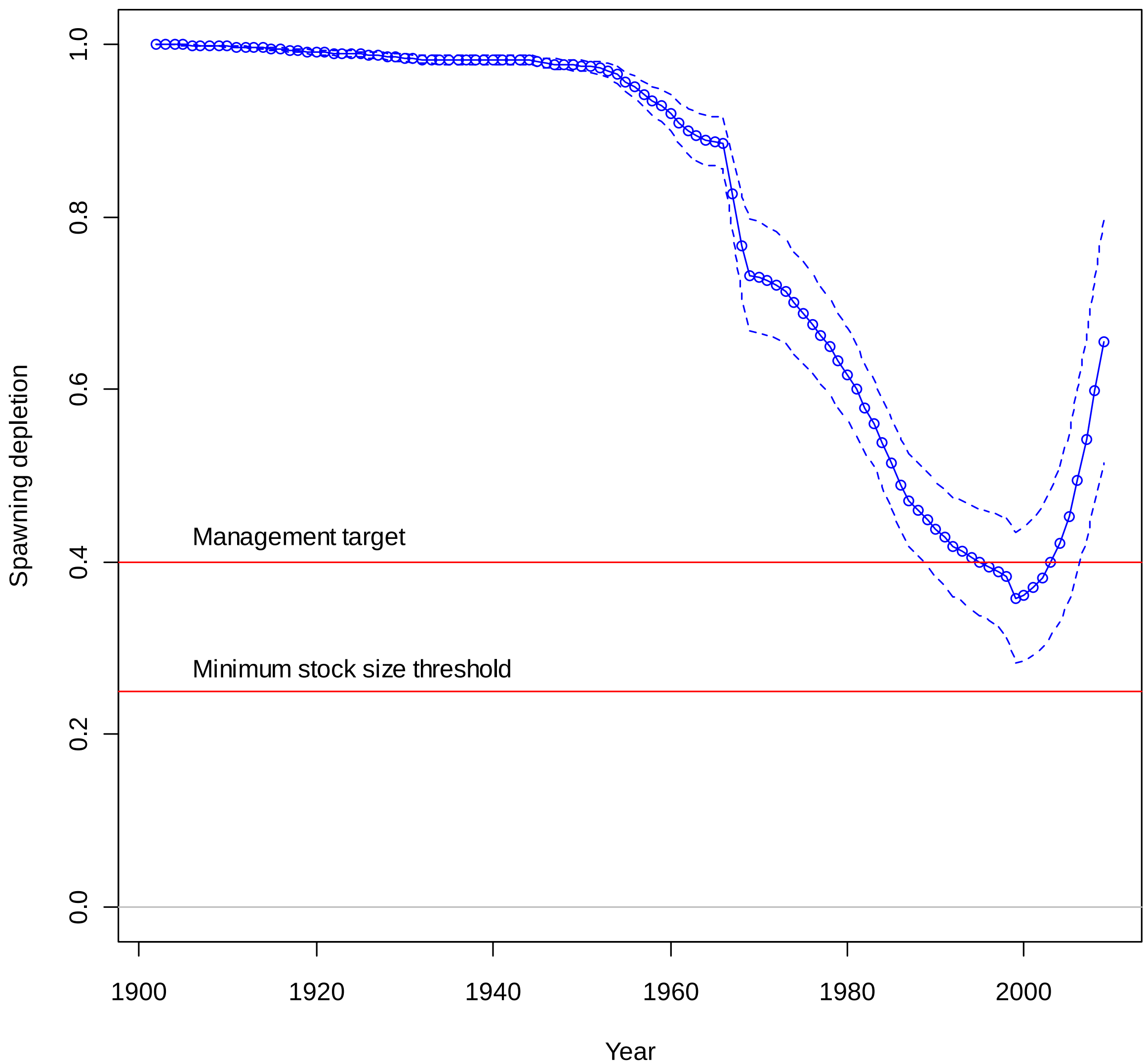

Figure ES-4.Time-series of estimated spawning depletion with 95% confidence interval

Exploitation Status

The assessment shows that the stock of splitnose rockfish in the U.S. West Coast is currently at 66% of its unexploited level and, therefore, not overfished. Historically, the abundance of splitnose rockfish was estimated to have dropped below the $SB_{40\%}$ management target in 1995, after experiencing sharp reductions from the large catches by foreign fishery in mid-1960s and increasing domestic catches in 1980s. However, the spawning stock has been increasing since the early 2000s, and stayed above the $SB_{40\%}$ management target since 2003. The assessment identifies two historical periods in which exploitation rates exceeded the current F_{MSY} proxy harvest rate: during the foreign fishery peak in the mid 1960s, and in 1998.

Table ES-4. Recent trends in estimated spawning potential ratio (SPR) and exploitation rate for splitnose rockfish.

Year	SPR (%)	Exploitation rate
1998	28.25%	0.0766
1999	70.77%	0.0145
2000	83.66%	0.0069
2001	86.02%	0.0058
2002	91.56%	0.0033
2003	81.58%	0.0075
2004	79.74%	0.0082
2005	88.68%	0.0041
2006	74.14%	0.0108
2007	92.69%	0.0025
2008	93.45%	0.0023

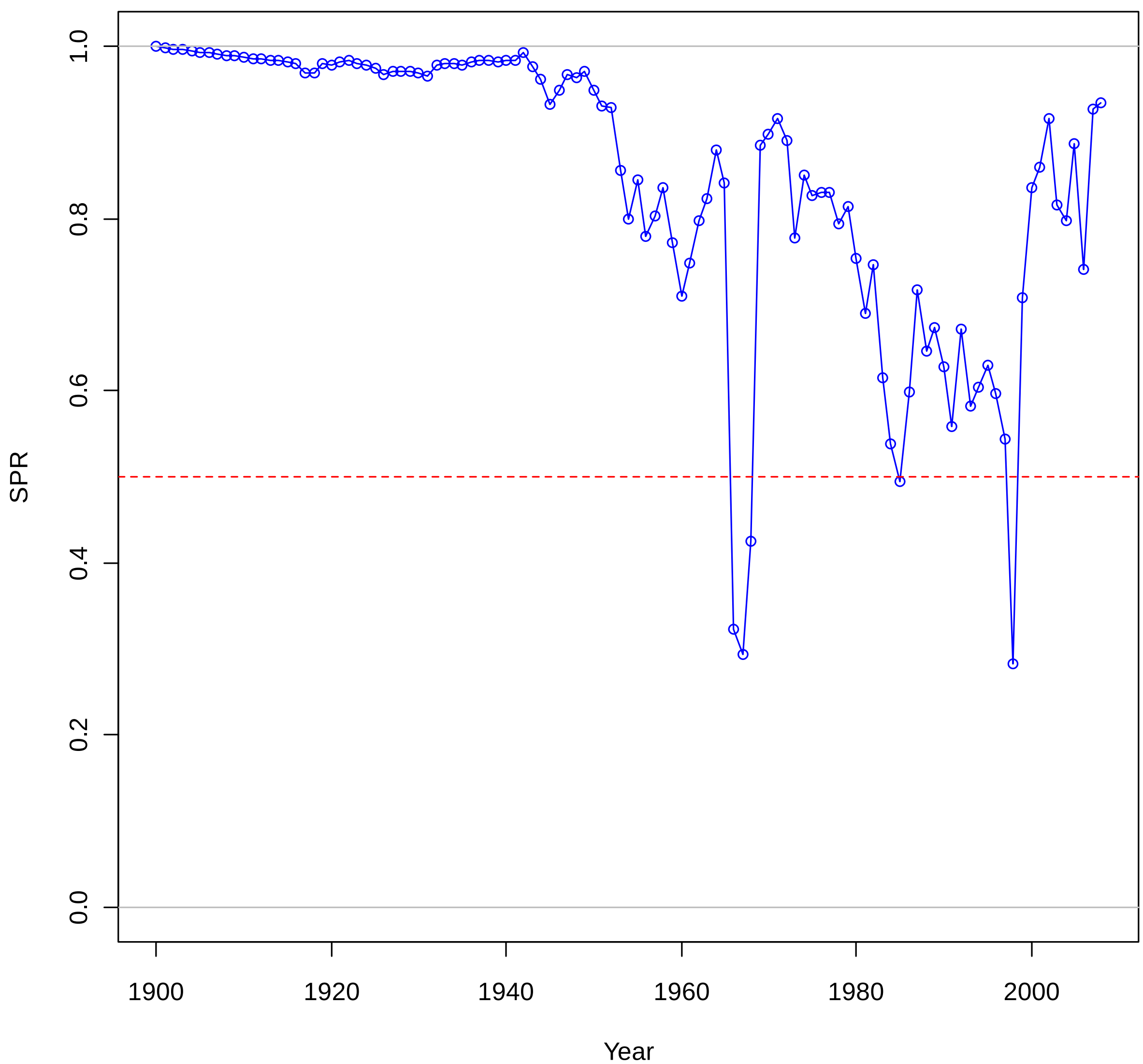

Figure ES-5. Time-series of estimated spawning potential ratio (SPR) with SPR target of 0.5. Values below target reflect harvest that exceeded current overfishing proxy.

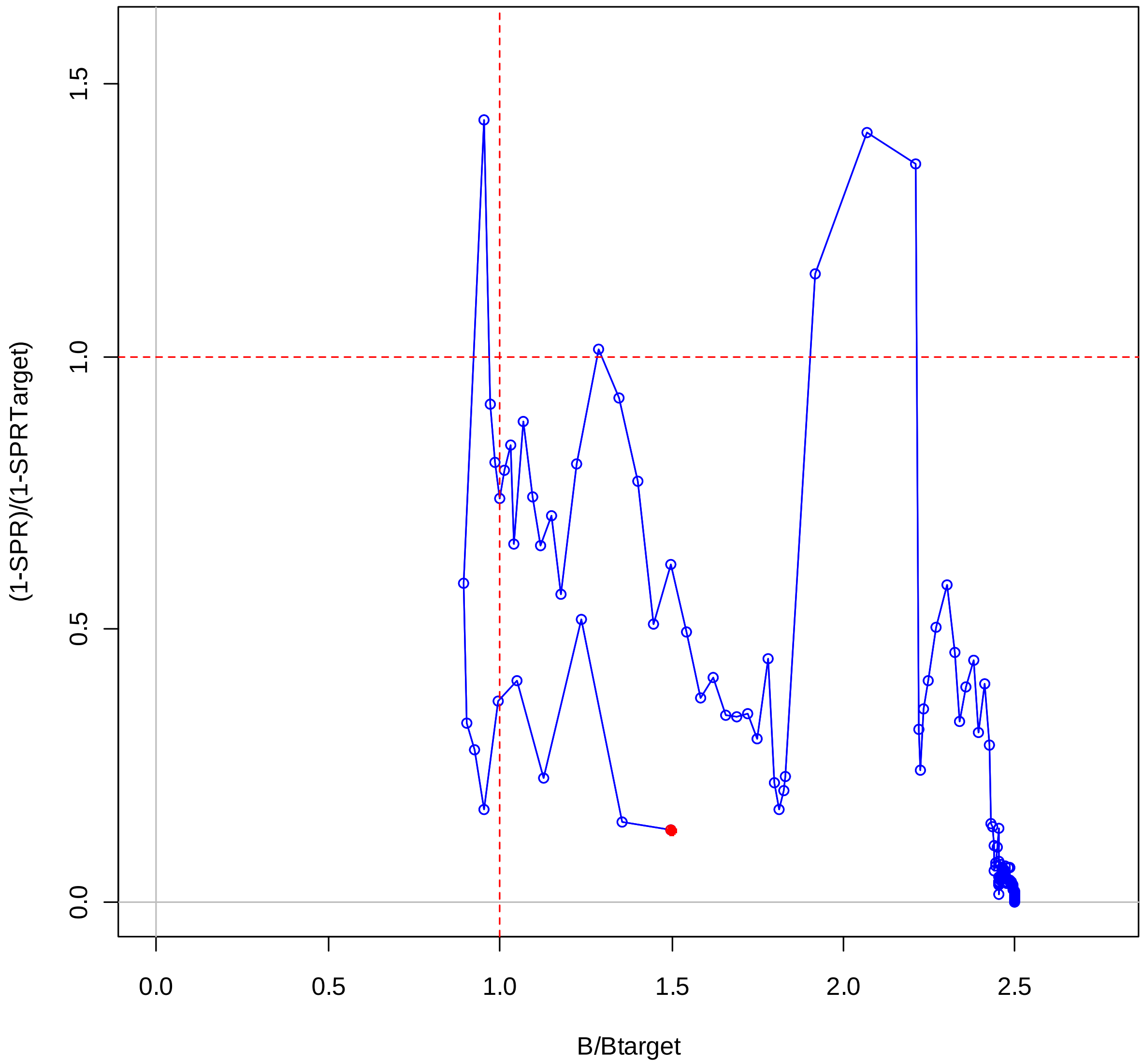

Figure ES-6. Estimated spawning potential ratio relative to its target of 0.5 versus estimated spawning output relative to its target of $SB_{40\%}$. Red dot indicates the point that corresponds to 2009.

Management

Splitnose rockfish were historically managed within the *Sebastes* complex. In 1994, the *Sebastes* complex was divided into southern (Conception, Monterey and Eureka INPFC areas) and northern (Columbia and US Vancouver INPFC areas) management areas, and harvest guidelines were established for the complex in each area. In 1999, after unusually high splitnose rockfish catches in 1998 that were mostly landed in California, splitnose rockfish for the first time were individually separated from the *Sebastes* complex in the southern area. Individual Allowable Biological Catch (ABC) and Optimum Yield (OY) for splitnose rockfish in that area have been specified along with splitnose-specific trip limits.

In 1999, the general *Sebastes* complex was divided into near-shore, shelf, and slope assemblages, and the dividing line between the northern and southern management units was shifted southward to $40^{o}10'$ N. latitude, near Cape Mendocino. In the northern area, splitnose has been managed under trip limits for minor slope rockfish since 1999. For 2000, harvest specifications for splitnose rockfish were set for the Conception and Monterey INPFC areas only, and 48 metric tons for the Eureka area were added to the northern minor rockfish ABC. Also, a precautionary adjustment of the OY (reduced from the ABC by 25%) was specified to account for a less rigorous assessment. In 2000, the ABC and OY for splitnose rockfish south of $40^{o}10'$ N. latitude were reduced based on the revised F_{MSY} harvest rate policy. For the last 10 years, the coast-wide landings and total catch of splitnose rockfish were relatively low, and the limits established for the area south of $40^{o}10'$ N. latitude have not been exceeded.

Table ES-5. Management guidelines, recent trends in landings and estimated total catch for splitnose rockfish.

	South of 40°10' N latitude		North of 40°10' N latitude		Coaswide	
Year	**ABC**	**Total Catch OY**	**ABC**	**Total Catch OY**	**Landings**	**Total catch**
1998	NA	NA	NA	NA	1526	2780
1999	868	868	NA	NA	267	500
2000	820	615	NA	NA	132	245
2001	615	461	NA	NA	110	211
2002	615	461	NA	NA	65	125
2003	615	461	NA	NA	158	320
2004	615	461	NA	NA	182	383
2005	615	461	NA	NA	97	210
2006	615	461	NA	NA	274	610
2007	615	461	NA	NA	68	154
2008	615	461	NA	NA	66	149

Uncertainty

Uncertainty in the model was explored though asymptotic variance estimates and sensitivity analyses. Asymptotic confidence intervals were estimated within the model and reported throughout the assessment for key model parameters and management quantities. Sensitivity analysis allowed evaluation of the responsiveness of model outputs to changes in model assumptions. A variety of sensitivity runs were performed in regards to omission and inclusion of data sources, increase and decrease in reconstructed historical catches, timing of recruitment deviations, assumptions regarding selectivity parameters (asymptotic versus dome-shaped), female fecundity (proportional versus non-proportional female egg-weight relationship), and others. The uncertainty regarding natural mortality and stock-recruitment curve steepness was explored through likelihood profile analysis.

Decision table

Three states of nature were defined based on the alternative assumptions regarding recent recruitments for years between 2000 and 2006. The middle scenario uses the recent recruitment deviations estimated by the base model. The "low" and "high" recruitment scenarios were generated by fixing recruitment deviations between 2000 and 2006 at the limits of the 95% confidence interval of the expected deviations for each year (at the low limit for the "low" scenario; at the high limit for the "high" scenario). Recruitment deviations between 1960 and 1999 in both "low" and "high" scenarios were fixed at the base model expectations.

Research and data needs

In this assessment, several critical assumptions were made based on limited supporting data and research. There are several research and data needs which, if satisfied could improve the assessment. These research and data needs include:

1) Genetic studies of splitnose rockfish stock structure in the Northeast Pacific ocean;
2) Comprehensive historical reconstruction of splitnose rockfish catches in Oregon and Washington;
3) Age-determination and age-validation studies to develop a consistent set of aging criteria for the species that could help reduce the differences among agers;
4) Histological studies of splitnose rockfish maturity to reliably estimate and reduce uncertainty in female maturity parameters;
5) Studies of the spatial dynamics of splitnose rockfish to better understand their distribution and explain increased availability of the species off California in 1998;
6) Further exploration of climate-growth relationships for splitnose rockfish and incorporation of this relationship into the stock assessment model.

It is also very important to continue to monitor discard in order to improve the accuracy of total catch estimates.

Table ES-6. Decision table of 12-year projections for alternative states of nature defined based on the alternative scenarios for recent recruitment deviations (2000-2006), with "low" and "high" scenarios corresponding to the high and low limits of the 95% confidence interval around the base model recruitment deviations for the same period.

			Low recent recruitments		**Base Case**		**High recent recruitments**	
Forecast	Year	Total removals (mt)	Spawning output (million eggs)	Depletion	Spawning output (million eggs)	Depletion	Spawning output (million eggs)	Depletion
1998 removals	2009	2,780	7,432	62%	8,426	66%	8,177	66%
	2010	2,780	7,601	64%	8,825	69%	8,785	71%
	2011	2,780	7,754	65%	9,261	72%	9,503	76%
	2012	2,780	7,906	66%	9,750	76%	10,342	83%
	2013	2,780	8,062	67%	10,275	80%	11,256	91%
	2014	2,780	8,190	68%	10,765	84%	12,124	98%
	2015	2,780	8,263	69%	11,154	87%	12,845	103%
	2016	2,780	8,268	69%	11,416	89%	13,376	108%
	2017	2,780	8,208	69%	11,552	90%	13,719	110%
	2018	2,780	8,094	68%	11,581	90%	13,898	112%
	2019	2,780	7,936	66%	11,520	90%	13,941	112%
	2020	2,780	7,745	65%	11,391	89%	13,875	112%
Average removals of the last 10 years	2009	291	7,432	62%	8,426	66%	8,177	66%
	2010	291	7,935	66%	9,153	71%	9,107	73%
	2011	291	8,436	71%	9,929	77%	10,159	82%
	2012	291	8,943	75%	10,768	84%	11,344	91%
	2013	291	9,461	79%	11,653	91%	12,615	101%
	2014	291	9,956	83%	12,509	97%	13,848	111%
	2015	291	10,396	87%	13,268	103%	14,940	120%
	2016	291	10,766	90%	13,897	108%	15,842	127%
	2017	291	11,065	93%	14,395	112%	16,551	133%
	2018	291	11,300	94%	14,775	115%	17,086	137%
	2019	291	11,480	96%	15,054	117%	17,472	141%
	2020	291	11,615	97%	15,250	119%	17,734	143%
50% of average removals of the last 10 years	2009	145	7,432	62%	8,426	66%	8,177	66%
	2010	145	7,955	67%	9,172	71%	9,126	73%
	2011	145	8,475	71%	9,968	78%	10,198	82%
	2012	145	9,004	75%	10,827	84%	11,403	92%
	2013	145	9,543	80%	11,733	91%	12,694	102%
	2014	145	10,060	84%	12,611	98%	13,949	112%
	2015	145	10,522	88%	13,392	104%	15,063	121%
	2016	145	10,913	91%	14,043	109%	15,986	129%
	2017	145	11,233	94%	14,562	113%	16,717	134%
	2018	145	11,488	96%	14,963	116%	17,273	139%
	2019	145	11,688	98%	15,262	119%	17,679	142%
	2020	145	11,842	99%	15,476	120%	17,961	144%

Table ES-7. Summary of recent trends in estimated splitnose rockfish exploitation and stock level from the assessment model.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Landings (mt)	132	110	65	158	182	97	274	68	66	NA
Estimated Discards (mt)	113	101	60	162	201	113	336	86	83	NA
Estimated Total Catch (mt)	245	211	125	320	383	210	610	154	149	316
ABC (mt) south of 40°10' N lat	820	615	615	615	615	615	615	615	615	615
OY * (if different from ABC) (mt) south of 40°10' N lat	615	461	461	461	461	461	461	461	461	461
ABC (mt) north of 40°10' N lat										
OY * (if different from ABC) (mt) north of 40°10' N lat										
SPR	83.66%	86.02%	91.56%	81.58%	79.74%	88.68%	74.14%	92.69%	93.45%	87.96%
Exploitation Rate (total catch/summary biomass)	0.0069	0.0058	0.0033	0.0075	0.0082	0.0041	0.0108	0.0025	0.0023	NA
Summary Age 4+ Biomass (B) (mt)	35566	36217	38024	42794	46722	51676	56724	60729	64923	70196
Spawning Stock Output (SB) (million eggs)	4651	4763	4909	5125	5404	5807	6365	6972	7690	8426
Uncertainty in Spawning Stock Output estimate	2372-6931	2430-7096	2508-7311	2627-7623	2770-8038	2975-8639	3273-9457	3574-10370	3960-11420	4357-12494
Recruitment at age 0	35504	44958	35903	22388	21043	39992	52273	78203	12440	12741
Uncertainty in Recruitment estimate	14008-57000	20992-68924	16308-55498	8681-36095	6965-35121	14406-65578	11335-93211	0-186159	0-37683	0-38585
Depletion (SB/SB_0)	36.19%	37.06%	38.20%	39.87%	42.04%	45.18%	49.52%	54.24%	59.83%	65.55%
Uncertainty in Depletion estimate									46.68%-72.98%	51.22%-79.89%

Table ES-8. Summary of splitnose rockfish reference points from the assessment model.

	Point estimate	95% confidence interval
Unfished Spawning Stock Output (SB_0) (million eggs)	12853	9105-16601
Unfished Summary Age 4+ Biomass (B_0) (mt)	87584	NA
Unfished Recruitment (R_0) at age 0	13953	9874-18031
Reference points based on $SB_{40\%}$		
MSY Proxy Spawning Stock Output ($SB_{40\%}$) (million eggs)	5141	3642-6641
SPR resulting in $SB_{40\%}$ ($SPR_{SB40\%}$)	50.86%	50.86%-50.86%
Exploitation rate resulting in $SB_{40\%}$	3.18%	NA
Yield with $SPR_{SB40\%}$ at $SB_{40\%}$ (mt)	1236	883-1589
Reference points based on SPR proxy for MSY		
Spawning Stock Output at SPR (SB_{SPR}) (million eggs)	5006	3546-6466
$SPR_{MSY\text{-}proxy}$	50%	
Exploitation rate corresponding to SPR	3.28%	NA
Yield with $SPR_{MSY\text{-}proxy}$ at SB_{SPR} (mt)	1244	888-1599
Reference points based on estimated MSY values		
Spawning Stock Output at MSY (SB_{MSY}) (million eggs)	4121	2900-5342
SPR_{MSY}	44.36%	43.90%-44.83%
Exploitation Rate corresponding to SPR_{MSY}	3.98%	NA
MSY (mt)	1268	906-1630

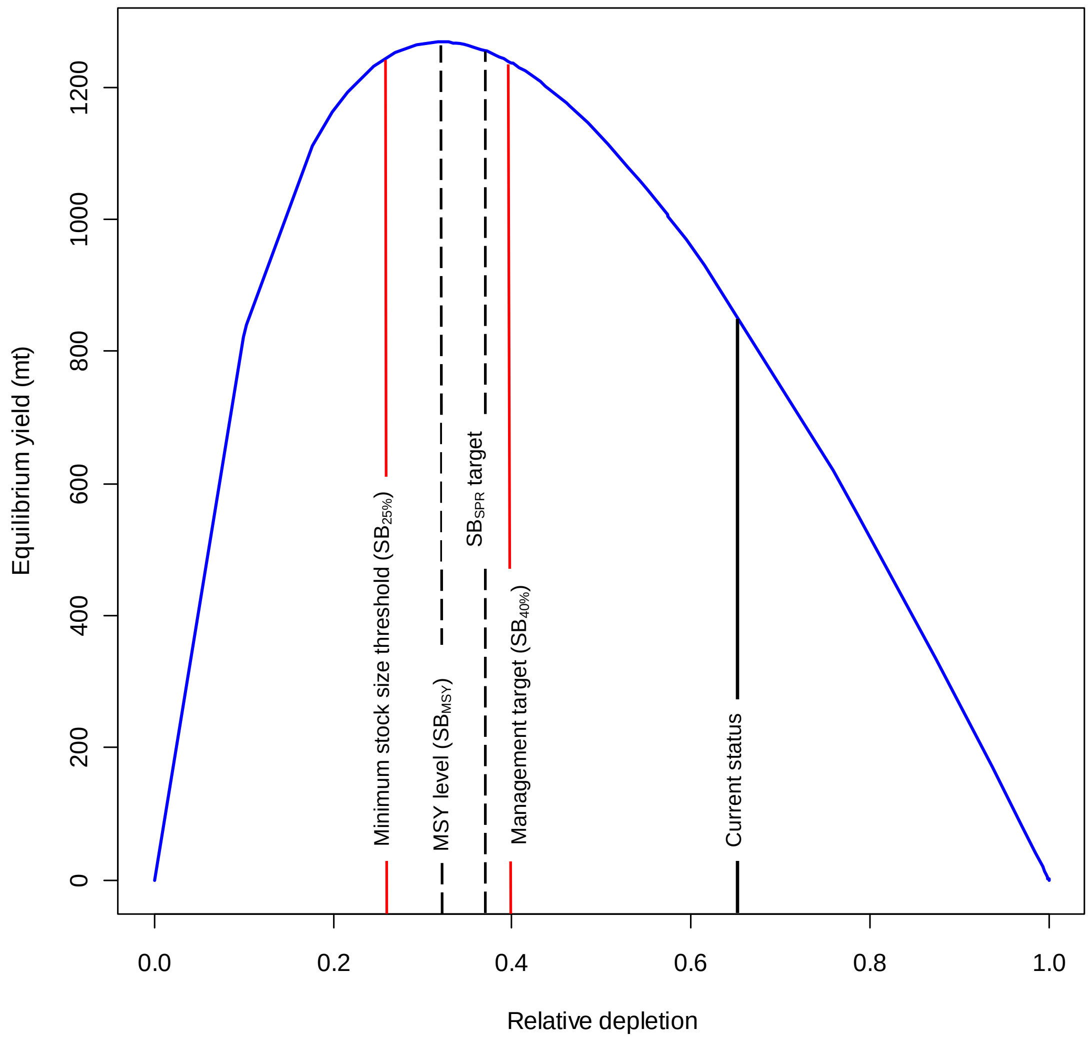

Figure ES-7. Equilibrium yield curve for splitnose rockfish from the assessment model (based on Table ES-8).

1. Introduction

1.1. Distribution and stock delineation

Splitnose rockfish (*Sebastes diploproa*) are distributed from the northern Gulf of Alaska (Prince William Sound) to central Baja California and occur at depths between 91-795 meters. Adults are the most abundant between British Columbia and southern California at depths from 215 to 350 meters (Alverson et al. 1964, Gunderson and Sample 1980, Love et al. 2002). The species is distinguished by having a deeply notched upper jaw, which inspired its Greek name *diploproa*, meaning "double prow" (Fig. 1). Splitnose rockfish are commonly seen on low-relief mud fields of the continental shelf and upper slope, often near isolated rock, cobble or shell debris. Solitary individuals are often found resting on the seafloor, although they occasionally form schools that move more than 100 meters in the water column (Love et al. 2002, Rogers 1994a).

Splitnose rockfish co-occur with an assemblage of slope rockfish, including Pacific ocean perch (*Sebastes alutus*), darkblotched rockfish (*Sebastes crameri*), yellowmouth rockfish (*Sebastes reedi*), and sharpchin rockfish (*Sebastes zacentrus*) off Washington and Oregon, and striptail rockfish (*Sebastes saxicola*), darkblotched rockfish and shortspine thornyhead (*Sebastolobus alascanus*) off central California. 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 northern coast of California. Lesser amounts of splitnose have also been noted in a deepwater dover sole assemblage and with shrimp catch (Rogers and Pikitch 1992, Rogers 1994b, Weinberg 1994).

There are no clear stock delineations for splitnose rockfish in the U.S. waters. No molecular markers have yet been developed for this species, and no genetic data are currently available to suggest the presence of several stocks (Waples et al. 2008). No distinct breaks are seen in the fishery landings and catch distributions (Fig. 2). Survey catches imply a continuous distribution (Fig. 3). The spatial dynamic cluster analysis of the Northwest Fisheries Science Center (NWFSC) survey abundance indices (Cope and Punt 2009) provided no evidence of spatial stock structure for splitnose rockfish off Washington, Oregon and California.

In this assessment, the splitnose rockfish population in the waters off continental U.S. west coast from the U.S.-Canadian border in the north to the U.S.-Mexican border in the south is treated as a single coast-wide stock. A map depicting the scope of the assessment is shown in Fig. 4.

1.2. Life history characteristics

Splitnose rockfish are documented in the literature to live to at least 86 years (Bennett et al. 1982), although a fish encountered in a National Marine Fisheries Service (NMFS) survey was aged at 103 years old. This is a small species – the maximum size reported in the literature is 46 cm (Love et al. 2002); the vast majority of individuals caught in NMFS surveys were under 44 cm in fork length, although a few fish larger than this were caught.

Splitnose rockfish exhibit sexual dimorphism in growth. Although the males grow to their maximum lengths earlier than females, females reach larger sizes than males (Boehlert 1980, Love et al. 2002). It was hypothesized that life history characteristics may vary with latitude, but that is uncertain. Boehlert and Kappenman (1980) detected greater size-at-age with increasing latitude and suggested more rapid growth of fish in the northern end of their range. Analysis of the NWFSC shelf-slope survey data, however, did not show a distinct gradient in growth rate between north and south, although the asymptotic length (L_{inf}) exhibits a latitudinal gradient (Figs. 31-32). Growth of splitnose rockfish was found to correlate with climate and environmental variables, including sea surface temperature, ENSO index and Pacific Decadal Oscillation (PDO) (Black et al. 2008, Black 2009), but more information is needed to develop climate-growth relationships for the stock assessment purposes.

Female splitnose rockfish off California mature at 6-9 years old (18-23 cm long) (Echeverria 1987), and their fecundity increases with size (Phillips 1964). It was shown, however, that off British Columbia splitnose rockfish mature somewhat later - both males and females reach 50% maturity at size of 27 cm (Westrheim 1975). Like other rockfishes, splitnose utilize internal fertilization and bear live young (Love et al. 2002). This species can exhibit a long reproductive season, with young larvae found in all months off southern California, from January to September off central California, from March to September in Oregon, and in July off Washington (Love et al. 2002, Moser et al. 2000).

Young juveniles live at the surface for several months, then go through a transitory midwater residence, and finally settle to benthic habitats near the end of their first year of life (Love et al. 2002). During their first year, splitnose have been found living among drifting vegetation in Puget Sound and southern California, and under floating objects in Queen Charlotte Sound, British Columbia (Shaffer et al. 1995). Pelagic juvenile splitnose feed on calanoid copepods and amphipods (Shaffer et al. 1995), while benthic juveniles and adults eat krill, copepods, sergestid shrimps and amphipods. Splitnose are prey of Steller sea lions and other pinnipeds (Love et al. 2002).

Size-composition data for splitnose rockfish show a strong gradient of body size with depth, with smaller fish in shallow waters (Figs. 22-23), suggesting ontogenetic movements of splitnose rockfish to deeper waters with increasing size and age, a common phenomenon in genus *Sebastes* (Boehlert 1980).

1.3. Historical and current fishery

Splitnose have not been a target of commercial fisheries (Rogers 1994a, Boehlert 1980). The only information of a directed fishery for splitnose rockfish was reported by Heinmann (1964), who stated the species was targeted in 1959 and 1960 in areas of high abundance off California. All other sources suggest that splitnose rockfish have been historically taken as bycatch. Off Washington, Oregon and British Columbia splitnose rockfish were an incidental catch in the Pacific ocean perch fishery (Tagart and Kimura 1982, Tagart 1985). Since the adoption of a formal rebuilding plan for Pacific ocean perch in late 1990s, splitnose rockfish have been caught primarily in fisheries for mixed slope rockfish or other deepwater targets. Because of their small size splitnose rockfish have a limited market value (Love et al. 2002, Rogers 1994a). They are rarely taken in the recreational fishery (Boehlert 1980, Love et al. 2002). Pacific States Marine Fisheries Commission's Recreational Fisheries Monitoring database (RecFIN) does not include any retained catch or reported discards of this species.

Records obtained from the Pacific Coast Fisheries Information Network (PacFIN), which serves as a clearinghouse for recent commercial fisheries data, indicate that since 1981 trawl landings comprise 90% of annual retained catches, on average (Figs.5-6), and 80% of fish are landed in California (Figs. 7-8). Only 10% of splitnose rockfish on average are caught by non-trawl commercial fisheries. Non-trawl fishery primarily represents net gear, but includes a small portion of hook-and-line catches, a bycatch in the longline sablefish fishery (Fig. 5). All of the non-trawl catches of splitnose rockfish are landed in California. The use of net gear for groundfish has been severely limited throughout the past decade, and current non-trawl landings are small (Fig. 6).

1.3.1. Trawl fishery

The trawl catches of splitnose rockfish first became significant in the mid-1940s due to increased demands during World War II (Clever 1951). The introduction of the balloon trawl gear in 1943 increased overall rockfish catches (Love et al. 2002). Rockfish catches dropped following World War II (Clever 1951), but in early 1950s, the Pacific ocean perch fishery developed in Oregon and Washington (Love et al. 2002), and landings of splitnose rockfish, which co-occur with this species, also increased.

Between 1966 and 1976, Pacific ocean perch became a target of the foreign fleets from Soviet Union, Japan, Poland, Bulgaria and East Germany (Rogers 2003, Love et al. 2002). Like the domestic fishery, foreign fleets caught an assemblage of slope rockfish species, which included splitnose rockfish, but unlike the domestic fishery, high capacity foreign fleets did not discard rockfish based on either size or species (Rogers 2003). Foreign catches of splitnose peaked in 1967 at over 5,000 metric tons (Rogers 2003), but by the 1970 the targeting of the species by the foreign fleets was eliminated with the establishment of the 200-milw EEZ. The annual domestic retained catch of splitnose in that period was around 250 metric tons (Fig. 9).

In the late 1970s and early 1980s, domestic trawl catches of splitnose increased through 1985, when landed catch reached 913 metric tons (Fig. 4). The observer studies conducted in Oregon and Washington between 1985 and 1987 showed that about 27% of the catch was discarded due to small size and various market considerations (Rogers 1994b). Between 1986 and 1997, total landings were generally between 400 and 700 mt. In 1998, the landings of splitnose rockfish reached 1477 metric tons, the highest level ever observed in the domestic fishery (Fig. 9). Most of splitnose that year was landed in the Eureka and Monterey International North Pacific Fisheries Commission (INPFC) areas. Nineteen ninety eight was a strong El Nino year, and there has been speculation that this may have led to re-distribution and increased availability of the species, which in turn led to high catches of splitnose off California. But more investigation of the environment-driven spatial dynamics of splitnose rockfish is needed to confirm this. After 1998 splitnose landings dropped significantly, at least in part due to management measures aimed to rebuilding darkblotched rockfish and Pacific ocean perch. Landings have ranged between 62 and 273 metric tons during the last 10 years (Table 4). The Westcoast Groundfish Observer program reported that the discard rates for the last several years ranged between 46% and 80% coast-wide.

1.3.2. Non-trawl fishery

Prior to the 1940s when the trawl fishery for rockfish first became important, virtually all splitnose rockfish were caught by non-trawl gear (presumably net) in the southern California, south of point Conception (Ralston 2009, pers. comm.). Between 1940 and mid-1970s, the rise of trawl fishing technology, non-trawl catches dropped and comprised only 16 % of annual landings of splitnose rockfish.

In the 1970s however, non-trawl catches of splitnose increased again (Fig. 9). At that time, California experienced a wave of immigrants from Southeast Asia, particularly Vietnam, who soon established a gillnet fishery to harvest rockfish in central and southern California (Love et al. 2002). Catches of splitnose rockfish by net gears peaked in 1987 when they reached 175 metric tons, which was 38% of overall landings of splitnose rockfish coast-wide. Anecdotal evidence suggest that the Vietnamese gillnet fishery in the mid 1980s had very little discard and kept virtually all fish. Gillnetting has never been permitted north of 38^o N. latitude in either state or federal waters. In 1992 the use of gillnet was banned in the state waters of California waters (within the three mile limit), and the Vietnamese gillnet fishery faded away. Since the mid-1990s, non-trawl catches were minimal. Only small numbers of splitnose caught by nets in federal waters off southern Conception INPFC area are currently landed. Hook-and-line landings do not exceed 1 % of splitnose annual landed catch.

1.4. Management history and performance

Splitnose rockfish is one of more than 60 rockfish species that inhabit the northeast Pacific Ocean, between Gulf of Alaska and central Baja California. Limits on domestic rockfish catches were first instituted in 1983, with splitnose rockfish managed as a part of the *Sebastes* complex, which included around 50 species. The Allowable Biological Catch (ABC) for the *Sebastes* complex was estimated for each International North Pacific Fisheries Council (INPFC) area along the coast based on historic landings. In 1994, the *Sebastes* complex was divided into southern and northern management areas, and harvest guidelines were established for the complex in each area. The southern area included Conception, Monterey and Eureka INPFC areas, and the northern area included Columbia and U.S. Vancouver INPFC areas.

In response to a concern that deepwater species off Oregon and Washington might have been overharvested, Rogers (1994) conducted a preliminary assessment of splitnose rockfish, which focused on compiling and reviewing the available data. However, since the data were sparse and no evident trends in biomass or mean size were detected, the results were inconclusive (Rogers 1994a). In 1996 the status of several rockfish species, which were part of the *Sebastes* complex, were assessed (Rogers et al. 1996), and Allowable Biological Catches (ABC) for splitnose rockfish in the southern area were calculated to be 868 metric tons for the southern management area (Conception, Monterey and Eureka), and 274 metric tons for the northern management area (Columbia and U.S. Vancouver). These amounts were not specified individually, but included in the total ABCs for the *Sebastes* complex.

In 1998, unusually high splitnose rockfish landings drove *Sebastes* complex harvests in the southern management area sharply upward. In 1999, for the first time, splitnose rockfish were individually separated from the southern *Sebastes* complex. Individual Allowable Biological Catches (ABC) and Optimum Yield (OY) for splitnose rockfish in that area have been specified along with splitnose-specific trip limits since then. The ABC for the southern management area was set at 868 mt, as estimated in 1996 assessment of the remaining rockfish in the *Sebastes* complex (Rogers et al. 1996).

Additionally in 1999, the general *Sebastes* complex was divided into near-shore, shelf, and slope assemblages, and the dividing line between the northern and southern management areas was shifted southward to 40^{o}10’ N. latitude, near Cape Mendocino. Since that time, in the northern area, splitnose has been managed under trip limits for minor slope rockfish. In 2000, harvest specifications for splitnose rockfish were set for the Conception and Monterey areas only, and 48 metric tons for Eureka area were added to the northern minor rockfish ABC. Also, a precautionary adjustment of the OY (reduced from the ABC by 25%) was specified to account for the limited nature of the assessment. In 2000, the ABC and OY for splitnose rockfish south of 40^{o}10’ N. latitude were reduced based on the revised F_{MSY} harvest rate policy. During the last 10 years, the coast-wide landings and total catch of splitnose rockfish were relatively low, and the limits established for the area south of 40^{o}10’ N. latitude have not been exceeded.

Table 1 summarizes management guidelines since 1999, recent trends in landings and estimated total catch for splitnose rockfish in the U.S. west coast. Appendix 1 provides a list of management regulations for splitnose rockfish since 1983 and a history of major management shifts for groundfish fishery summarized by Denial Erickson, splitnose rockfish STAR Panel GMT representative (Erickson 2009, pers. comm.).

1.5. Fishery in Canada and Alaska

Splitnose rockfish historically have been of moderate importance off British Columbia, where they are taken as an incidental catch in the Pacific ocean perch fishery (Love et al. 2002). Bottom trawl gears have accounted for most of the commercial harvest of rockfish in Canadian waters (Parker et al. 2000). As in waters off Washington, Oregon and California, splitnose rockfish off British Columbia are the most abundant at depth between 182-549 m (100-300 fm); only traces are found between 91-183 m (50-100 fm) (Alverson et al. 1964). Tagart (1985) estimated the proportion of splitnose rockfish in the overall rockfish landings reported by the Canada Department of Fisheries and Oceans between 1977 and 1980 a little over 0.1%. Splitnose rockfish have never been assessed in British Columbia waters. It is managed within the “other rockfish” category, and no specific quota for splitnose rockfish catches has been established.

In waters off Alaska splitnose rockfish do not register as a significant catch in groundfish fisheries. They were found only in the southeastern Alaska region and in small amount. They were absent in the Strait of Juan de Fuca, however small quantities were encountered in a shrimp survey in Prince William Sound (Alverson et al. 1964).

2. Assessment data

To develop an assessment model, conduct the analysis and estimate management quantities, a variety of fishery-dependent and fishery-independent data were used. These data are summarized in Tables 2 and 3.

2.1. Fishery-dependent data

Fishery-dependent data used in the assessment included:

1. Domestic trawl landings (1916-2008)
2. Non-trawl landings (1916-2008)
3. Foreign trawl landings (1966-1976)
4. Domestic trawl length frequency distributions (1978-2008)
5. Non-trawl length frequency distributions (1983-1998, 2002)
6. Domestic trawl discards (1987, 2002-2007)
7. Discard length frequency distributions (1987, 2006-2007)

2.1.1. Landings

The landed catch of splitnose rockfish was reconstructed back to 1900, assuming a zero equilibrium catch in 1899. The fishery removals were divided among three fisheries - domestic trawl, foreign trawl and domestic non-trawl, with non-trawl representing primarily removals by net gear. Domestic and foreign trawl fisheries were separated because of the differences in discards. The reconstructed time-series of splitnose rockfish landings is shown in Fig. 9.

2.1.1.1.Recent landings (1981-2008)

Annual estimates of recent landings of splitnose rockfish between 1981 and 2008 by gear were obtained from PacFIN and California Cooperative Groundfish Survey database (CalCOM). Landings in California, Oregon and Washington were extracted from PacFIN (extraction date: March 25, 2009). California landings were also obtained from CalCOM (extraction date: February 26, 2009). CalCOM data were in agreement with data from PacFIN, and CalCOM was used as a source for California landings in the assessment. Recent landings by gear category and state are shown in Figs. 5 and 7 and described in Section 1.3.

2.1.1.2.Historical Catch Reconstruction (1900-1980)

Prior to 1981, commercial trawl and non-trawl landings were derived by state from a variety of published sources and databases. The methods used to reconstruct splitnose rockfish historical landings by state are described below:

2.1.1.2.1. California

The majority of the splitnose rockfish commercial catches are landed in California (Figs. 7-8), where they are taken in both trawl and non-trawl fisheries, often with stripetail rockfish (*Sebastes saxicola*), darkblotched rockfish (*Sebastes crameri*) and shortspine thornyhead (*Sebastolobus alascanus*) (Love et al. 2002). It is landed in several market categories, and historically landings were estimated from applying port sampling species compositions.

The California Cooperative Groundfish Survey database (CalCOM) contains estimates of splitnose rockfish landings by gear since 1969 (Table 4). The time-series of California splitnose landings between 1916 and 1968 have recently been reconstructed by the Southwest Fisheries Science Center (SWFSC) (Ralston et al. 2009). Historical landings were reconstructed for trawl, non-trawl and unspecified gear categories, with the latter category including both trawl and non-trawl catches (Fig. 10). To assign unspecified-gear landings to trawl and non-trawl gears, we applied the proportion of known trawl and non-trawl landings each year to the unspecified gear catches. Between 1900 and 1916 the landings of splitnose rockfish in trawl and non-trawl fisheries were ramped linearly from zero in 1900 up to the catch level in 1916 (Table 4).

2.1.1.2.2. Oregon

Splitnose rockfish in Oregon are caught by trawl fishery. The species has commonly been taken as bycatch in the Pacific ocean perch fishery along with Pacific ocean perch (*Sebastes alutus*), darkblotched rockfish (*Sebastes crameri*), yellowmouth rockfish (*Sebastes reedi*), and sharpchin rockfish (*Sebastes zacentrus*) (Rogers and Pikitch 1992, Rogers 1994b).

In Oregon, splitnose rockfish have never been sorted to species, and all splitnose landings are estimated from applying port sampling species compositions to mixed rockfish landings. Since 2000, splitnose have been landed in the SLOPE ROCKFISH category. Prior to that, they were landed in the market category OTHER ROCKFISH. Since splitnose rockfish is caught in the Pacific ocean perch fishery, it could have been landed in PACIFIC OCEAN PERCH market category, but those numbers would be minimal, since 95% of PACIFIC OCEAN PERCH was *Sebastes alutus* (Barss and Niska 1978).

To reconstruct historical landings of splitnose rockfish in Oregon, we first reconstructed historical landings of the OTHER ROCKFISH market category and then appointed the earliest available species proportions to the OTHER ROCKFISH landings. The time-series of OTHER ROCKFISH landings in Oregon were available since 1927 and were derived from the following sources:

1927	Fish and Wildlife Service U.S. Fisheries Statistics series (1928)
1928-1949	Fisheries Statistics of Oregon (Cleaver 1951)
1950-1953	Fisheries Statistics of Oregon 1950-1953 (Smith 1956)
1954-1955	Fish and Wildlife Service U.S. Fisheries Statistics series (1955, 1956)
1956-1962	Historical Annotated Landings Database (Lynde 1986)
1963-1964	Estimated Domestic Trawl Rockfish Landings, 1963-1980 (Tagart 1985)
1965	Fish and Wildlife Service U.S. Fisheries Statistics series (1966)
1966-1980	Estimated Domestic Trawl Rockfish Landings, 1963-1980 (Tagart 1985)

Other sources of historical landings of OTHER ROCKFISH, such as the Fish and Wildlife Service U.S. Fisheries Statistics series (1928-1977) and the 1950 Pacific Fisherman Yearbook (1942-1949), were also analyzed. The numbers from all sources exhibited very close agreement (Fig. 11).

To estimate the proportion of splitnose within the OTHER ROCKFISH category, we used rockfish species composition data from Tagart (1985), who compiled Oregon rockfish trawl landings data from Pacific Fishery Management Council (PFMC) and Technical Sub-committee reports for the period of 1963-1980 and estimated rockfish species composition. The average proportion of splitnose rockfish within OTHER ROCKFISH as estimated by Tagart (1985) was 1.5%. We applied this proportion to OTHER ROCKFISH landings for years between 1927 and 1962. Between 1963 and 1980 we used species composition by year as estimated by Tagart (1985), except for 1965. The proportion of splitnose rockfish in 1965, estimated by Tagart appeared to be a high anomaly that possibly represents foreign off-loading to domestic ports, a biased expansion or an error (Rogers 1994a). Therefore, for 1965 we applied the average splitnose proportion (1.5%) to OTHER ROCKFISH landings from 1966 Fish and Wildlife Service U.S. Fisheries Statistics. Between 1900 and 1926, when the OTHER ROCKFISH landings were not available, the landings of splitnose rockfish were ramped linearly from zero in 1900 up to the splitnose landed catch in 1927.

2.1.1.2.3. Washington

In Washington, splitnose rockfish are also caught by trawl gear, and taken with darkblotched rockfish (*Sebastes crameri*), Pacific ocean perch (*Sebastes alutus*), yellowmouth rockfish (*Sebastes reedi*), and sharpchin rockfish (*Sebastes zacentrus*) (Rogers and Pikitch 1992, Rogers 1994b).

In Washington splitnose rockfish do not have its own market category, and all landings of splitnose are from species compositions applied data. Since 2000, splitnose have been landed in the SLOPE ROCKFISH category. Historically, it was reported within the OTHER ROCKFISH landings. As in Oregon, part of the splitnose rockfish could have also been landed as PACIFIC OCEAN PERCH. However, prior to 1968, landings of the PACIFIC OCEAN PERCH complex in Washington were invariably 100 % Pacific ocean perch (Tagart and Kimura 1982).

To reconstruct historical landings of splitnose rockfish in Washington, we first reconstructed the time-series of historical landings of OTHER ROCKFISH and then applied the earliest available species proportions to the OTHER ROCKFISH landings. Time-series of historical landings of OTHER ROCKFISH were derived from the following sources:

1927-1977	Fish and Wildlife Service US Fisheries Statistics series (1927-1977)
1978-1980	Estimated Domestic Trawl Rockfish Landings, 1963-1980 (Tagart 1985)

Tagart (1985) compiled Washington rockfish trawl landings data from PFMC reports and Technical Sub-committee reports for the period of 1969-1980 and estimated rockfish species composition. The average proportion of splitnose rockfish within OTHER ROCKFISH as estimated by Tagart (1965) was 0.4 %. We applied this proportion to OTHER ROCKFISH landings for years between 1927 and 1977. Between 1978-1980 proportions of splitnose rockfish were used as estimated by Tagart (1985). Between 1900 and 1926, when the OTHER ROCKFISH landings were not available, the landings were linearly ramped from zero in 1900 up to the splitnose landed catch in 1927.

Additional source for OTHER ROCKFISH landings in Washington were available from the 1950 Pacific Fisherman Yearbook (1930-1949) and the Historical Annotated Landings Database (Lynde 1986). Time-series from U.S. Fishery Statistics series were lower than those of other sources (Fig. 12). In the assessment, the Fish and Wildlife statistics series were used because they specifically separated Puget Sound and Canadian catches from the landings of the coastal fishery. The Pacific Fisherman Yearbook was unclear whether Puget Sound landings had been included in the rockfish totals or not; also a level of uncertainty was associated with separating Canadian and U.S. catches in Tagart (1985) (Tagart 2009, pers. comm.).

2.1.1.2.4. Foreign Catches

From 1966 through 1976, foreign trawl fleets from the Soviet Union, Japan, Poland, Bulgaria and East Germany harvested substantial amounts of rockfish off the United States West Coast (Love et al. 2002). Using very large vessels (often called factory trawlers), foreign fleets, particularly the Soviet fleet, had the capacity and markets to take large amount of catch and not discard fish based on either size or species (Rogers 2003). Foreign catch estimates of splitnose rockfish by year were used as allocated by Rogers (2003) (Table 4, Fig. 9).

2.1.2. Fishery biological data

Biological information from the domestic trawl and non-trawl fishery was extracted for each state from the PacFIN (extraction data: March 19, 2009). California data was also obtained from CalCOM (extraction data: February 26, 2009). The extracted biological data included sex, length, age and maturity of splitnose rockfish in commercial landings (Table 2). No biological data from the foreign trawl fleet were available.

Biological data were used to generate coast-wide fishery length-frequency distributions and conditional age-at-length compositions, and estimate female maturity parameters (as described in Section 2.3.3).

2.1.2.1.Length frequency distributions

In California, length data from trawl fishery landings were collected between 1978 and 2008. In Oregon, length observations were available for 1995-1998, 2001, 2003-2008, and in Washington for 1998-2008. Length data for the non-trawl fishery (which operates only in California) was collected between 1983 and 1998 and in 2002.

To generate annual coast-wide length frequency distributions by fleet, the length data were expanded to account for differences in landings among trips and among states. For the expansion, we used the following algorithm:

1. Within a specific year and fleet, length data by sex were acquired at the trip level;
2. For each trip, raw length observations were scaled up to represent splitnose landings of the entire trip:
    a. An expansion factor was calculated by dividing the total weight of trip landings by the total weight of organisms sampled for length within this trip;
    b. The observed raw length frequencies within each trip were multiplied by the expansion factor and then summed up within state.
3. The expanded and summed lengths in each state were then expanded again to account for differences in landings of the species among states:
    a. The expansion factor was computed by dividing the total weight of state landings by the total weight of organisms sampled for length within this state;
    b. The length frequencies for each state (from step 2 of this algorithm) were multiplied by expansion factor and then summed up to receive the coast-wide sex-specific length frequency distributions by year and fleet.

We used only randomly collected samples. Large expansion factors created by very small samples of very large landings were limited to a maximum of 500. When a large proportion of the length data were recorded as unidentified sex, the sexes were combined. This was the case for non-trawl fishery in 1983-1984, 1992-1998 and 2002. In California, the port samplers are instructed to obtain the sex of the fish whenever possible. In some cases, however, when a dealer does not allow the fish to be cut or sexing the fish from one sample would prevent samplers from getting the sample of critical more important market category, the sampler may not be able to get sex observations.

California length frequency distributions, expanded in a similar way, were also obtained from CalCOM (Pearson and Erwin 1997). Length frequency distributions among states did not exhibit noticeable differences. Because of this, and since the majority of splitnose rockfish landings ($\approx$80%) were made in California, the fact that length data from California dominated coast-wide length frequency distributions was considered appropriate.

The initial input sample sizes (N_{input}) for annual length frequency distributions were calculated as a function of both number of trips sampled and number of fish sampled using the method developed by Stewart and Miller (Stewart and Miller 2009, pers. comm., Hamel 2008):

$$N_{input} = N_{trips} + 0.138 N_{fish} \quad \text{when} \quad \frac{N_{fish}}{N_{trips}} < 44 \qquad (1)$$

$$N_{input} = 7.06 N_{trips} \quad \text{when} \quad \frac{N_{fish}}{N_{trips}} \geq 44 \qquad (2)$$

The generated coast-wide length-frequency compositions by sex for trawl and non trawl fisheries are shown in Figs. 13-15. The summary of sampling efforts by year, fishery and state used to generate length frequency distributions are shown in Table 6.

2.1.2.2.Conditional age-at-length distributions

Age-frequency data were available from the California trawl fishery between 1980-1981 and 1983-1985 (Table 2). These data were used to generate sex-specific conditional age-at-length compositions. The conditional age-at-length approach uses an age-length matrix, in which columns correspond to ages and rows to length bins. The distribution of ages in each row, in this case, is treated as a separate observation, conditioned on the corresponding length bin (row).

The conditional age-at-length approach has been used in a number of recent stock assessments (Stewart 2008, Hamel 2008) since it has several advantages over the use of standard age compositions. Age structures are usually collected from the individuals that have been measured for length. If the standard age compositions are used along with length frequency distributions in the assessment, the information on sex ratio and year class strength is double-counted since the same fish are contributing to likelihood components that are assumed to be independent. The use of conditional age distributions within each length bin allows avoiding such double-counting (Stewart 2008). Also, the use of conditional age-at-length distributions allows the reliable estimation of growth parameters within the assessment model, including the coefficient of variation (CV) of length at minimum and maximum ages (Stewart 2008).

Available trawl fishery age data were from otoliths aged in the early 1990s by a reader (Reader 1.1) from the South West Fisheries Science Center (SWFSC) in La Jolla, California, using the break and burn method. Some of the age structures were read again in 2009 by another reader (Reader 2) from Ageing Laboratory in the Hatfield Marine Science Center in Newport, Oregon using the same method. We evaluated whether differences between readers were too large and inconsistent to provide an informative relationship between age and length, because using data with greatly biased or highly uncertain ageing can obscure the signal of recruitment and bias estimates of productivity. We explored age data from the same fish read by two readers and found that the ageing agreement between them was unsystematically biased and highly imprecise (Fig. 39). When the initial reader re-read a subset of age data (Reader 1.2), large uncertainty in the ageing was produced between Reader 1.2 and Reader 2, and between the first and second reads of first reader (Reader 1.1 and Reader 1.2) (Fig. 39). Such large discrepancies compromise the usefulness of this data set; therefore, the trawl fishery conditional age-at-length composition data were not included in the base model, but were retained as a sensitivity run.

2.1.3. Discards

Discard observations of splitnose rockfish were available for the domestic trawl fishery for the years 1987 and 2002-2007. The foreign trawl discards were assumed to be zero, since the existing information suggests that the foreign fleets did not discard rockfish based on their size or species (Rogers 2003). No discard data for the non-trawl splitnose fishery were ever collected. Anecdotal evidence, however, suggests that the Vietnamese net fishery in the mid 1980s had virtually no discard and had a market for even very small fish (such as 15 cm). The model, therefore, assumes the discards in the non-trawl fishery as zero also.

The discard rate in 1987 was estimated using observations of retained and discarded catch of splitnose rockfish in the Oregon and Washington bottom trawl fisheries (Pikitch study). Both groundfish and shrimp trawl fisheries were observed, although most catches were from groundfish fishery. The discard rate was computed as a ratio of the amount of discarded catch to overall splitnose rockfish catch observed, and was 0.27 (27%). Fishermen attributed more than 50% of the discards to small fish sizes, although a portion was discarded because of other market considerations (Rogers 1994b).

Data from another set of fishery observations, the Enhanced Data Collection Project (EDCP), conducted during 1995-1998 off Oregon and Washington were not used in this assessment, because discards of splitnose rockfish were not estimated by species, but recorded within discards for the small rockfish category.

Annual discard rates for 2002-2007 were estimated from discard observations available for splitnose rockfish from the West Coast Groundfish Observer Program. Discard rates were calculated as the ratio of total estimated discard to total estimated catch. The observer and logbook data were analyzed by latitude and depth to account for spatial variability, and then expanded to the coast-wide level. The discard rates were estimated between 2002 and 2007 varied between 46% and 80% (Table 5).

The annual average weight of discarded splitnose rockfish were estimated for 2002-2008 by the West Coast Groundfish Observer Program. Length observations of the discarded fish were available for 1987 from the Pikitch study and for 2006-2007 from the West Coast Groundfish Observer Program. Although the West Coast Groundfish Observer Program recorded several length observations of discarded splitnose rockfish in 2003 and 2004, a handful of fish were measured. Length frequency distributions of the discarded fish for both sexes combined were generated the same way as those collected from port samples (Fig. 16). The raw length observations were scaled up to the total weight of discarded fish within a trip and then within the entire fleet by multiplying raw discard length observations by the ratio of total discarded weight to total sampled weight of the discarded fish within a trip and then state. All discarded splitnose rockfish were assumed dead, since they are small in size and live deep.

The annual initial input sample sizes for discard length frequency distributions were calculated using the same method as sample sizes for length frequency distributions of landings (Expressions (1) and (2)). The summary sampling efforts by year, fishery and state used to generate length frequency distributions for trawl discards are given in Table 6.

2.2. Fishery-independent data

In the assessment, the data from four National Marine Fisheries Service (NMFS) surveys were used:

1. The AFSC shelf (triennial) survey (1977-2004)
2. The AFSC slope survey (1997, 1999-2001)
3. The NWFSC shelf-slope survey (2003-2008)
4. The NWFSC slope survey (1999-2002)

Details on latitudinal and depth coverage of these surveys by year are presented in Table 7.

The AFSC triennial survey was conducted every third year between 1977 and 2004 (in 2004 this survey was conducted by the NWFSC). Survey methods are most recently described in Weinberg et al. (2002). Over the years, survey area varied in depth and latitudinal range (Table 7). Prior to 1995, the depth range was limited to 366 m (200 fm); after 1995 the depth coverage expanded to 500 m (275 fm). Because of the large number of "water hauls" in 1977 and 1980, when the trawl footrope failed to establish contact with the bottom (Zimmermann et al. 2001), abundance index estimates for 1977 and 1980 were not used in the assessment. Two configurations of the AFSC triennial survey data were evaluated. The first configuration includes all survey years (1983-2004) in a single abundance index time-series. The data included in this time series are drawn only from those areas and depths covered in all of these surveys: four INPFC areas (Monterey, Eureka, Columbia and U.S. Vancouver) and maximum depth of 366 meters (200 fm). In the other configuration, the survey was divided into two time-series – between 1983 and 1992, and between 1995 and 2004. For the latter time series (≥1995) the latitudinal range included not only four INPFC areas covered by the earlier years, but also part of the Conception area with a southern border of 34 o50' N. latitude. Also, the latter time-series had a depth coverage that extended to 500 meters (275 fm). This configuration not only permits more information from the later surveys to be included in the analysis, but also allows the model to account for differences that may have been associated with the change in survey timing between these two periods. Since both configurations have their advantages, two alternative base models were developed and explored though the sensitivity and likelihood profile analyses.

The AFSC slope survey was initiated in 1984. The survey methods are described in Lauth (2000). Prior to 1997, the survey was conducted in different latitudinal ranges each year (Table 7). In this assessment, only data from survey conducted in 1997, 1999, 2000 and 2001 were used – these years were consistent in latitudinal range (from 34^{o}30' N. latitude to the U.S.-Canadian border) and depth (183-1280 m; 100-700 fm).

The NWFSC shelf-slope survey was conducted annually from 2003 to 2008. Survey methods are described in Keller et al. (2007). This survey ranged from 32°34’ to 48°22’ N. latitude and covered all five INPFC areas included in the scope of the assessment (U.S. Vancouver, Columbia, Eureka, Monterey, Conception). The survey consistently covered depths between 55-1280 m (30 and 700 fm) (Table 5). The NWFSC slope survey was conducted annually from 1999 to 2002 (Keller et al. 2007). The survey was conducted between 34°50’ and 48°07’ N. latitude, encompassing U.S. Vancouver, Columbia, Eureka, Monterey INPFC areas, and a portion of the Conception, and consistently covered depths from 100 to 700 fm (183-1280 m) (Table 7).

2.2.1. Survey indices

Survey indices of abundance for the AFSC triennial and NWFSC shelf-slope and slope surveys were estimated using a generalized linear mixed model (GLMM) approach using a Markov Chain Monte Carlo (MCMC) approach to estimate index uncertainty as described in Helser et al. (2004) and Helser et al. (2007). This allows different survey vessels to be treated as random effects, while also adjusting biomass estimates to depth and latitude, both potentially important factors in the distribution of splitnose rockfish. This GLMM method also handles presence/absence and positive catch data with separate probability functions. Several models were considered and Akaike Information Criteria was ultimately used to select the model for each GLMM. Model selection summaries for the AFSC triennial and NWFSC surveys are provided in Tables 8 and 9, respectively. Residual plots are provided in Fig. 17.

The spatial strata of each index were defined by combination of depth and latitude. Survey data is based on a randomly-stratified survey design with pre-specified strata. We attempted to retain as close as possible strata already recognized by the survey, while balancing the need to inform strata designation by species-specific characteristics. The following three steps were used to update the pre-specified survey strata to incorporate splitnose-specific distribution:

1) Determine the relationship between depth and latitude to catch rate. Depth and latitude strata were defined using a tree regression that minimized the intra-strata variance in catch rates while maximizing the inter-strata variance (Francis 2002). The relationship of catch rate to year, depth, latitude and area swept for AFSC triennial, AFSC slope, NWFSC shelf-slope and NWFSC slope surveys are shown in Figs. 18-21.
2) Establish the relationship between depth and latitude to fish length. Spatial strata relative to fish length were identified using a piecewise regression. The point break can be useful to indicate notable changes in life history (e.g. ontogenetic shifts) that should be considered when defining strata. The relationship of depth and latitude to splitnose rockfish lengths for all four surveys are shown in Figs. 22-23.
3) Compute the number of positive tows in each stratum (defined in steps 1 and 2). This ultimately determines the strata because GLMMs must have non-zero counts in all of the combinations of depth and latitude. We also set the lower counts bound per stratum of at least 4 positive tows in order to run the GLMMs.

Using the above three steps, the spatial strata were defined for each survey, with latitude defined by the INPFC areas. The strata are summarized in Table 10. The abundance indices were calculated by expanding the estimated stratum catch rates by the area of each stratum covered in the survey. Once the individual strata were expanded, the full coast-wide index of abundance by year was calculated (Figs. 24-25). The abundance index for the AFSC slope survey was calculated using a design-based method, in which the average CPUE was calculated for each spatial stratum and then multiplied by the stratum area. The total biomass then was calculated as the sum of the strata biomass estimates.

The survey abundance indices and standard error of the natural log of biomass estimated in this assessment are shown in Tables 11-12.

2.2.2. Survey biological data

Biological data were collected in all surveys. These data included length, weight, sex, age, and maturity data (Table 3). Length observations were available from all surveys, except the NWFSC slope survey. Age compositions were available for the NWFSC shelf-slope survey (2003-2008) and AFSC triennial survey (1977, 1980 and 1989). Weight measurements were available for the NWFSC shelf-slope survey and maturity data for the AFSC slope survey (1997) (Table 3). The length and age data were used to develop length frequency distributions and conditional age-at-length compositions. Weight and length data were used to determine female and male weight-length relationships (Section 2.3.4), and maturity data was used to estimate female maturity parameters (Section 2.3.5).

2.2.2.1.Length frequency distributions

Length frequency distributions were derived by year for three out of four surveys, where data were available. The observed length compositions were expanded to account for differences in catches among tows and spatial strata. To generate coast-wide length frequency distributions the following algorithm was used:

1. For a specific year and survey, length data by sex were acquired at the tow level;
2. For each tow, the raw length observations were expanded to represent the entire tow:
    a. An expansion factor was calculated by dividing the total weight of the tow by the total weight of organisms in this tow measured for length;
    b. The observed length frequencies were multiplied by the expansion factor and then summed up within a spatial stratum.
3. The expanded and summed length frequencies in each spatial stratum were then expanded again to account for differences in catches among strata:
    a. The expansion factor was computed by dividing the total weight of organisms within a stratum by the total weight of organisms in this stratum measured for lengths;
    b. The length frequency distributions within each stratum were multiplied by an expansion factor and then summed up to produce the sex-specific length frequency distributions for the entire survey area.

Spatial (latitudinal and depth) strata used to generate annual length frequency distributions for each survey were consistent with the strata used to compute survey abundance indices (Table 10).

The initial input sample sizes for the survey length frequency distribution data were calculated as a function of both the number of fish samples and number of tows samples using the method developed by Stewart and Miller (Stewart and Miller 2009, pers.comm., Hamel 2008):

$$N_{input} = N_{tows} + 0.0707 N_{fish} \quad \text{when } \frac{N_{fish}}{N_{tows}} < 55 \qquad (3)$$

$$N_{input} = 4.89 N_{tows} \quad \text{when } \frac{N_{fish}}{N_{tows}} \geq 55 \qquad (4)$$

The generated coast-wide length frequency compositions by sex for AFSC triennial, AFSC slope and NWFSC shelf-slope surveys are shown in Figs. 26-28. The summary of sampling efforts by year and survey used to generate length frequency distributions are given in Table 13.

2.2.2.2.Conditional age-at-length compositions

Age observations of the AFSC triennial and NWFSC shelf-slope surveys were used to generate conditional age-at-length distributions by sex and year the same way as it was described for the fishery data (Section 2.1.2.2). Although generated, conditional age-at-length compositions from AFSC triennial survey were not retained for the base model. Our experience with fishery age data demonstrated that splitnose rockfish is very hard species to read, and a reliable ageing error matrix should be developed to help the model deal with ageing imprecision and possible bias. For the AFSC triennial survey no double reads were available and therefore, a reliable ageing error matrix could not be developed. Also, anecdotal evidence (Boehlert 2009, pers. comm.) suggests that the age data from 1977 and 1980 are highly imprecise. In our sensitivity analyses, though, we explored the use of AFSC triennial age data.

Conditional age-at-length distributions from NWFSC shelf-slope are shown in Figs. 29-30. The data was entered separately for females and males to avoid any issues related to a differential occurrence of males and females in the data. For age-at-length distribution, the number of tows with splitnose rockfish was used as initial input sample sizes (Table 14).

2.3. Biological characteristics

Several biological characteristics of splitnose rockfish were either estimated from the available data or obtained from published sources.

2.3.1. Natural mortality

To estimate natural mortality *M*, we explored several methods that relate *M* with different life history parameters, including longevity, growth rate and age-at-maturity (Charnov 1993, Hoenig 1983, Jensen 1996, Rikhter and Efanov 1976, Roff 1986). Hoenig (1983) developed a model that related total mortality to the maximum age of fish. Since Hoenig's analysis was based largely on unexploited fish stocks, total mortality in his model is often assumed to be natural mortality. Based on the Hoenig's method the natural mortality of splitnose rockfish was estimated at 0.048 yr^{-1}. This value was used in the base model, and a likelihood profile analysis was performed to explore how informative the data in model are regarding the value of *M* (Section 4.2).

2.3.2. Growth

Time-invariant growth parameters were fully estimated in the model. External fits to splitnose age-at-length data were made to explore age and growth relationships between gender and

INPFC area. The von Bertalanffy growth function (von Bertalanffy 1938) was used to model this relationship and data sets with multiple age reads used the random effects model of Cope and Punt (2007) to incorporate uncertainty in ageing when fitting the growth model. Females are generally larger than males and individuals of both sexes showed greater lengths with increasing latitude (Figs. 31-32). The available commercial ages are missing the youngest and smallest individuals, necessitating the consideration of alternative theoretical ages at length 0 to describe the age-length relationship (Figs. 33-34). Survey data from the most recent years demonstrated a mean response of smaller, generally faster growing individuals (Fig. 35).

2.3.3. Maturity and fecundity

To estimate the relationship between female size and maturity, the logistic function was used:

$$M\% = \frac{1}{1 + e^{\beta(L - L50\%)}} \tag{5}$$

Where *M*% is the proportion of mature females in the stock, the β coefficient is used as a constant, and *L*50% is the length at 50% maturity.

Maturity information for splitnose rockfish is sparse. Visual assessment of the rockfish external morphology of the gonads to determine maturity states can be challenging, since during non-reproductive periods mature but resting fish can be mistaken for immature fish (Gunderson et al. 1980). Echeverria (1987), while studying maturity of California rockfish, found that 50% maturity in female splitnose rockfish occurs when they are 9 years old. She also estimated the length at first, 50% and 100% female maturity as 18, 19 and 23 cm in total length respectively; however, only three individual females of splitnose rockfish were studied using histological methods. Westrheim (1975) estimated that splitnose rockfish maturity off British Columbia mature somewhat later - both males and females reach 50% maturity at size of 27 cm (Westrheim 1975). To estimate splitnose rockfish maturity parameters in this assessment we used the maturity data collected from the trawl fishery in Oregon and California and the AFSC slope survey (Tables 2-3). Coefficient β was estimated as -0.5683, and *L*50% as 21.84 cm (Fig. 36).

Fecundity (number of eggs) was assumed to be related to female body weight linearly as follows:

$$\Phi / W = a + bW \tag{6}$$

Where Φ is the number of eggs, *W* is female weight in kg, and *a* and *b* are constant coefficients. This linear relationship follows the work of Dick, SWFSC (pers. comm.) who calculated this relationship for several species of rockfish and found the egg and female weight was not proportional. Specifically, for *S. diploproa*, the values of *a* = 237500 and *b* = 74300 were obtained and used in the assessment.

2.3.4. Weight-length relationship

To establish the relationship between weight and length, the following equation was used:

$$W = \alpha(L)^{\beta} \quad (7)$$

Where W is weight (kg), L is fork length (cm) and α and β are coefficients used as constants. The data from NWSFC shelf-f slope survey was used to estimate weight-length parameters by sex. Based on the length and weight observations from 1787 females and 1962 males, α and β were estimated as 0.00002 and 3.0139 for females and 0.00002 and 2.9684 for males (Figs. 37-38).

2.3.5. Ageing error

Age composition data for splitnose rockfish were available from the domestic trawl fishery, and the AFSC triennial and NWFSC shelf-slope surveys. Double reads of ages were available for the domestic trawl fishery and NWFSC shelf-slope survey. Evaluation of the double reads of the trawl fishery age data indicated that differences between readers were too large and inconsistent to provide an informative relationship between age and length (Fig. 39), and, therefore, trawl fishery age-composition data were not included in the base model, but only retained for a sensitivity run. The comparison between readers of the NWFSC shelf-slope age data did not demonstrate erratic bias or variability overwhelming to its inclusion (Fig. 40), and it was, therefore, retained to inform the ageing error matrix in the base model.

Even though only NWFSC shelf-slope survey age data were used in the assessment base model, three ageing error matrices (for trawl fishery, AFSC triennial and NWFSC shelf-slope surveys) were specified to describe the uncertainty in fit to age-at-length data for each of the conditional age-at-length data sets. The ageing error matrix from double read data was generated using the method developed by Punt et al. (2008). This method improves upon former methods characterizing the ageing error matrix by providing an estimate of the biased ages as well as imprecision (given as standard deviations). While this method assumes the first reader is unbiased, it does estimate bias for the second reader as well as imprecision between readers. This method, however, was limited to estimating the ageing error matrix up to the true age of 65, based on the maximum age of our double read samples. The maximum age of 100 for the population dynamics model necessitated deriving the ageing error matrix for age classes >65. This was accomplished by fitting the true age to the estimated bias (age) and/or imprecision (standard deviation) components of the ageing error and extrapolating those relationships out to age 100 (Fig. 41). This was done for the trawl fishery ageing error matrix (matrix 1) and for the NWFSC shelf-slope survey ageing error matrix (matrix 3). For the AFSC triennial survey age composition data, double reads were lacking, and the assumption of no bias and high precision was assigned to the ageing error matrix (matrix 2).

3. Model description

This report describes the latest version of the assessment model that includes changes made during the STAP Panel. The list of these changes along with STAR Panel requests are presented in Appendix 2.

3.1. Assessment program

This assessment model was developed using the Stock Synthesis (SS) modeling program developed by Dr. Richard Methot at the NWFSC (Methot, 2009). The most recent version (version 3.02E), distributed on April 8, 2009 was used.

3.2. Definition of fleets and area

The assessment model treats splitnose rockfish along the continental U.S. west coast from the U.S-Canadian border in the north, to the U.S.-Mexican border in the south as a single stock given no distributional breaks or genetic information suggesting the presence of multiple stocks. Fishery removals are divided into 3 fleets – domestic trawl, foreign trawl and domestic non-trawl. Domestic and foreign trawl fisheries were separated because of the differences in discards: splitnose rockfish are often discarded in domestic trawls because of small size and other market considerations (Rogers 1994b), while large capacity foreign vessels did not discard fish based on size and species, and discard rates were minimal (Rogers 2003). Trawl fleets were separated from non-trawl to reflect differences in selectivities.

3.3. Modeling period

The modeling period begins in 1900, assuming that in 1899 the stock was in an unfished equilibrium condition. Historical records of rockfish catches in the U.S. west coast were available since 1916 from California and since 1927 from Oregon and Washington. The proportion of splitnose rockfish was estimated within OTHER ROCKFISH landings using earliest available rockfish species compositions. Between the first year of the model (1900) and the time when rockfish catches were available, landings were linearly ramped from zero in 1900 up to the reconstructed landed catch level in 1916 for California and 1927 for Oregon and Washington.

3.4. General specifications

This is an age-structured two-sex assessment model. The sex-ratio at birth is 1:1. Females and males have separate growth curves and sex-specific weight-at-length parameters. The model assumes a constant natural mortality of 0.048 yr^{-1} for both sexes. Fecundity is assumed to be non-proportional to female body weight, and the spawning output is expressed in millions of eggs and not in metric tons. The length frequency distributions are presented as twenty eight 2-cm bins ranging between 2 and 56 am. Population length bins are set to be the same as data length bins. Age compositions are summarized in 85 age bins ranging from 1 to 85 years with accumulator age of 100, for which plus-group calculations are applied.

3.5. Likelihood components

In the model, likelihood estimates for the various data components were obtained by comparing expected values from the model with the actual observations from sample data based on "goodness of fit" procedures for log (L). The likelihood components of the model included (1) survey abundance indices, (2) rates of discard, (3) mean size of fish in the discard, (4) fishery and survey length frequency distributions, (5) NWFSC shelf-slope survey age compositions, (6) recruitment deviations and (7) parameter priors.

3.6. Model parameters

In the assessment, there are parameters of four types, including life history parameters, stock-recruitment parameters, selectivity and retention parameters (Table 17). These parameters were either fixed or estimated within the model. Reasonable bounds were specified for all parameters. Symmetric beta priors with a shape parameter value of 0.2 were used for selectivity and retention parameters to prevent them from hitting their bounds. Ageing error was entered in the Stock

Synthesis data file and was not estimated by the model. Survey catchability was estimated for each index of abundance; no prior assumptions were made regarding catchability.

3.6.1. Life history parameters

Life history parameters that were fixed in the model included natural mortality, weight-at-length for males and females, female maturity-at-length and fecundity-at-length. These parameters were either derived from data available or obtained from the literature, as described in Section 2.3.

Time-invariant growth by sex was modeled using the von Bertalanffy model and was fully estimated in the assessment. Stock Synthesis uses the following version of the von Bertalanffy growth model:

$$L_A = L_\infty + (L_1 - L_\infty)e^{-k(A-A_1)} \qquad (8)$$

Where asymptotic length, L_∞, is calculated as:

$$L_\infty = L_1 + \frac{L_2 - L_1}{1 - e^{-k(A_2 - A_1)}} \qquad (9)$$

In these equations, L_A is length (cm) at age A, k is the growth coefficient, L_∞ is asymptotic length, and L_1 and L_2 are the sizes associated with a minimal A_1 and maximum A_2 reference ages. Estimated growth parameters included L_1 and L_2, growth coefficient k, and coefficients of variation in length-at-age for both females and males. Size L_1 was assumed to be equal for both sexes.

3.6.2. Stock-recruitment parameters

In the assessment, the Beverton-Holt model was used to describe the stock-recruitment relationship. The level of virgin recruitment was estimated to assess the magnitude of the initial stock size. Recruitment deviations were estimated for each year between 1960 and 2006, which is the period best informed by the data based on evaluation of the variance of the recruitment deviations. Prior to 1960 and after 2006, recruits were taken deterministically from the stock-recruit curve. The standard deviation of log recruitment (σ_R), used to define offset of the stock recruitment curve when recruitment deviations were estimated, was iteratively fit within the model and then fixed at the resulting level. The standard deviation of log recruitment (σ_R), was iterated until the input value (1 in the base model) was close to the room mean squared error of the estimated recruitment deviations (0.92 in the base model). Steepness of the stock-recruitment curve was fixed at a value of 0.58, a prior for a previously unassessed rockfish developed through meta-analysis by Dr. Martin Dorn (AFSC).

3.6.3. Selectivity parameters

Selectivity parameters used in this assessment were specified as a function of size. Age-based selectivity was set to 1.0 for all ages beginning at age 1. Separate size-based selectivity curves were fit to each fishery and survey, except for the foreign trawl fishery and the NWFSC slope survey, which were assumed to have the same selectivity as the domestic trawl fishery and AFSC slope survey respectively and, therefore, were set to mirror the corresponding selectivity. A double-normal selectivity curve was used in the model. This curve has six parameters, including (1) peak, which is the length at which selectivity is fully selected; (2) width of plateau on the top; (3) width of the ascending part of the curve (4) width of the descending part of the curve; (5) selectivity at first size bin; and (6) selectivity at last size bin.

Peaks (parameter 1) and widths of the ascending part of the curves (parameter 3) were estimated by the model for all fisheries and surveys. The initial selectivity parameters (parameter 5) were fixed so that the smallest bin always had a selectivity of 0. Fishery selectivity curves were allowed to be dome-shaped, but in initial runs they were essentially asymptotic, and therefore, were fixed asymptotic by fixing the selectivity at the last size bin (parameter 6) at a large value. We also fixed the width of plateau on the top and the width of the descending part of the curve at intermediate values since these parameters are redundant when selectivity is fixed asymptotic. Non-trawl fishery selectivity parameters were blocked to allow to reflect changes in selectivity due to regulation, when the use of gillnets was banned from California state waters (within the three mile limit) in 1992.

Slope surveys selectivity curves were assumed to be asymptotic. Splitnose rockfish exhibit a strong gradient of body length/weight with depth, indicating ontogenetic movement of larger fish to deeper waters (Figs. 22-23). Analysis of splitnose catch rates by depth (Figs. 18-21) showed that the maximum depth of the species' distribution was 549 meters, which is consistent with the published data (Love et al. 2002, Boehlert 1980). Slope surveys went deep enough cover the entire depth range of the species, and their selectivities can be assumed to be asymptotic. Fixing the survey selectivity as asymptotic is further justified biologically by the fact that the oldest fish in all of the data (age 93 and age 103) were caught by the survey. To set slope survey selectivity asymptotic, we fixed the selectivity at the last size bin (parameter 6) at a large value. We also fixed the width of plateau on the top and the width of the descending part of the curve at intermediate values since these parameters are redundant when selectivity is fixed asymptotic. The AFSC triennial survey selectivity was not fixed asymptotic since the survey did not cover the entire depth range of the species.

3.6.4. Retention parameters

Retention in Stock Synthesis is defined as a four-parameter logistic function of size. The parameters include inflection, slope, asymptotic retention and male offset to inflection. Male offset was fixed at 0, implying no differences in discards between females and males. All other retention parameters were estimated to reflect the discard of splitnose rockfish based on both size and market consideration (Rogers 1994b).

4. Model selection and evaluation

A variety of alternative model configurations of different levels of complexity were explored in order to realistically describe the population dynamics of splitnose rockfish with a parsimonious model and the best available data.

4.1. Sensitivity analyses

Sensitivity trials allowed the STAT team to evaluate the responsiveness of model outputs to changes in some of the assumptions included in the base models. A number of sensitivity runs were conducted prior to the STAR Panel and several were performed during the STAR Panel.

4.1.1. Sensitivity runs prior to STAR Panel

Prior to the STAR panel, we performed a variety of sensitivity analyses for two possible base case models that differed in configuration of the AFSC triennial survey time series: 1) The AFSC triennial survey was treated as one survey time series (1983-2004), and 2) the AFSC triennial survey was treated as two time series (1983-1992; 1995-2004). Running all sensitivities for both possible base cases demonstrated how model sensitivity plays through both options and allowed the most appropriate model specification to come forth as the base case.

The following 14 trials explore the sensitivity to the omission or inclusion of data sources in each base case:

- Trial 1: Omit the AFSC triennial survey(s).
- Trial 2: Omit the AFSC slope survey.
- Trial 3: Omit the NWFSC shelf-slope survey.
- Trial 4: Omit the NWFSC slope survey.
- Trial 5: Omit the discard rates data.
- Trial 6: Omit the discard mean weight data.
- Trial 7: Omit the domestic trawl fishery length frequency distributions.
- Trial 8: Omit the non-trawl fishery length compositions.
- Trial 9: Omit the AFSC triennial survey(s) length compositions.
- Trial 10: Omit the AFSC slope survey length compositions.
- Trial 11: Omit the NWFSC shelf-slope survey length compositions.
- Trial 12: Include the AFSC triennial survey conditional age-at-length data.
- Trial 13: Use only the NWFSC shelf-slope age data as age compositions.
- Trial 14: Use both the AFSC Triennial survey and NWFSC shelf-slope as age compositions.

The results of these sensitivity analyses are provided in Table 15. Figure 42 demonstrates the relationship of the relative difference between each trial and the base case $\frac{(X_{trial} - X_{base})}{X_{base}}$ for both of the triennial survey treatments. From these plots, one can visualize 1) how different each trial and survey scenario is from the base case (distance from the origin [0,0]) and 2) consistency of trial sensitivity between the two treatments of the AFSC triennial survey (departure from the 1:1 line). Overall, spawning output in the ending year demonstrates the greatest sensitivity among trials, while depletion tends to be the least sensitive. There is a trend in relative difference from the base case between survey AFSC survey treatments along the 1:1 agreement line, with some notable departures. Most noteworthy are trials 7, 12, and 14. These tend to underestimate the scale of spawning biomass and value of depletion relative to the base case (except for trial 14, which results in depletion values greater than the base case). The one AFSC triennial survey time series treatment was also sensitive to the removal of the AFSC triennial length frequency distributions (Trial 9 resulted in lower ending spawning biomass and values of depletion), whereas the treatment with two time series was not. Trial 7 proved the most sensitive data trial overall, dropping the two time series treatment to the target level of $SB_{40\%}$. All other data trials remained above $SB_{40\%}$.

In summary, both base cases demonstrated low sensitivity to a broad range of data use and model specifications. The base case treatment with 1 AFSC survey time series seemed slightly less sensitive. It also maintains catchability coefficients below or near 1 for all. Only a few extreme trials dropped the population below the target reference point of $SB_{40\%}$ and no trials indicated an overfished state. We, therefore, proceeded with using the treatment with 1 AFSC triennial survey time series as the base case.

Prior to the STAR Panel, we explored a number of other sensitivities for both survey treatments and conducted retrospective and profile analyses. Since several specifications of the base case model were changed during the STAR Panel (Appendix 2), we included description of the additional pre-STAR Panel sensitivity runs along with associated Tables and Figures in Appendix 4.

4.1.2. Sensitivity runs during STAR Panel

Sensitivity runs performed during the STAR Panel explored uncertainty in historical catch reconstruction and recruitments. These runs included:

- Use reversed domestic landed catch series between 1901 and 1977 to explore uncertainty in early records and historical reconstruction of splitnose rockfish catches;
- Reduce foreign catch amounts by half to explore uncertainty in reconstructed foreign catches;
- Use estimated domestic catches since 1960 and the average catch of pre-1960 years as the initial catch to assess the extent to which early data affect the results in the more recent period;
- Estimate recruitment deviations between 1960 and 2008 and treat recruitment prior to that deterministically;
- Estimate recruitment deviations between 1960 and 2008 and estimate steepness of the stock-recruitment curve.
- Use Ricker stock-recruitment function, estimate recruitment deviations from 1960 and apply bias correction from 1980;
- Estimate recruitment deviations between 1960 and 2006, the period best informed by the data based on evaluation of the variance of the recruitment deviations, and apply full bias adjustment between1980 and 2002.

These sensitivity runs were conducted for two versions of the model - tuned and not tuned. For the tuned model σ_R was iteratively re-weighed to match the root mean squared error of the estimated recruitment deviations (r.m.s.e.), and effective input sample sizes were re-weighted to match to model derived effective sample sizes when the input sample sizes were greater that the effective ones.

After performing the sensitivity runs mentioned above, a new base case was selected, in which σ_R and input sample sizes of length and age compositions were tuned, recruitment deviations were estimated over the period from 1960 to 2006, and full bias adjustment was applied from 1980 to 2002. This model fits the data better than all other trials, produces reasonable estimates for all parameters, and gives reasonable initial conditions of spawning output and recruitment.

Figure 43 shows estimated spawning output trajectories for the base model and selected sensitivity trials performed after the STAR Panel. Figures 44-45 show estimated recruitment deviations and spawning output trajectories for the base model and retrospective analysis trials where several years of assessment data were removed sequentially (the last five years in succession and also the last 10 years of data) and the mode re-estimated at each stage. Table 16 summarizes initial and ending spawning output, depletion and negative log likelihood for trials presented in Figs. 43-45.

The sensitivity to the assumed base case values of natural mortality (*M*) and recruitment compensation (steepness or *h*) were explored as likelihood profiles. Both of these parameters were inestimable in the base cases, but often prove important considerations for model uncertainty. The data argue for values of both *M* and *h* near those used in base case (Fig. 46). Values for initial and ending spawning output and depletion for natural mortality and steepness likelihood profiles are shown in Fig. 47.

4.2. Conversion criteria

For the base model, the Hessian matrix was positive definite and the maximum gradient component was 0.0000575762. We also assessed convergence of the base model according to its ability to recover similar likelihood estimates when initialized from slightly different starting points. Results from a set of 10 convergence tests showed only minor variability in the objective function and current depletion.

5. Base model results

The base model was able to capture general trends for indices in all surveys, which were either stable or increasing (Figs. 48-51). The estimated biomass in the 2004 AFSC triennial survey appeared to be twice as high as any other estimates in the survey time series. In 2004, the triennial survey was conducted by the NWFSC, not by the AFSC, as in all previous years. Although an effort was made to replicate AFSC protocols as closely as possible, this change may have contributed to a substantial increase in the splitnose rockfish biomass index. Similar increases were observed in the indices for several other stocks during the 2005 and 2007 assessment cycle. Survey catchabilities were estimated to be 0.7, 0.4, 0.73 and 0.48 for AFSC triennial, AFSC slope, NWFSC shelf-slope and NWFC slope surveys respectively (Table 17). The model also fits the discard data well (Fig. 52).

The life history parameters estimated within the model are reasonable and consistent with what we know about the species (Table 17). Both sexes follow the same trajectory in their growth. Males are estimated to grow slightly faster than females, but females reach larger sizes (Fig. 53). Figures 54-58 show weight-at-length relationships by sex, female maturity-at-length, fecundity-at-weight and spawning output-at-length generated based on fixed parameters that were derived from data outside of the model.

The base model fits the length frequency distributions well (Figs. 59, 61, 64, 67, 69, 72, 75, 77, 80, 82, 85, and 87). The quality of fit varies among years and fleets, which reflects the differences in quantity and quality of data. The Pearson residuals, which reflect the noise in the data both within and between years, did not exhibit any strong trends (Figs. 60, 62, 65, 67, 71, 73, 76, 78, 81, 83, 86 and 88). Pearson residuals for the fit to conditional age-at-length data are shown in Figs. 90 and 92.

In the assessment iterative re-weighting was used to develop consistency between the input sample sizes and the effective sample sizes based on model fit for length and age composition samples, attempting to reduce the potential for particular data sources to have a disproportionate effect on total model fit. Observed and effective sample sizes for length frequency observations and conditional age-at-length are shown in Figs. 58, 63, 66, 69, 74, 79, 84, 89 and 91.

Estimated size selectivity curves showed that surveys selected more small fish than fisheries did (Figs. 93-99). The AFSC triennial survey selectivity was estimated as dome-shaped, which is consistent with the fact that the survey did not extend to the deeper waters where the larger fish are generally found. The estimated retention curve (Fig. 93) reflects the discard of both small and large fish, which is consistent with available information about splitnose rockfish discards. The time-series for predicted discards (Fig. 100) and estimated total catch (Table 18, Fig. 101) are also consistent with information about exploitation of splitnose rockfish described in Section 1.3. The time-series of harvest rate for each of the three fisheries (domestic trawl, foreign trawl and domestic non-trawl) are shown in Fig. 102.

Recruitment time-series with 95% confidence interval are shown in Fig. 103. Recruitment deviations were estimated for each year between 1960 and 2006, the period best informed by the data based on evaluation of the variance of the recruitment deviations. Prior to 1960 and after 2006, recruits were taken deterministically from the stock-recruit curve. The input value of the standard deviation of log recruitment, used to define offset of the stock recruitment curve when recruitment deviations were estimated, was one and the r.m.s.e. for that period was 0.92. Estimated recruitment deviations in recent years are consistently higher than those expected from the stock-recruit relationship (Fig. 104) although uncertainty around those estimates is also high (Fig. 103). The uncertainty in recent recruitment deviations was used to define alternative states of nature and develop the decision table.

The time-series of total and summary biomass and spawning output are given in Table 18. Time-series of spawning output is also given in Fig. 105. The biomass showed a small decline prior to 1950, when splitnose rockfish were lightly exploited using mostly non-trawl gear. With the development of the Pacific ocean perch fishery (a species with which splitnose rockfish co-occur) spawning output of splitnose rockfish began to decline and exhibited a sharp drop in 1960s, when foreign trawl fleets targeted Pacific ocean perch in the current U.S. EEZ. In the 1980s and 1990s splitnose rockfish spawning biomass continued to decrease as a result of relatively low recruitment and removal by domestic trawl and non-trawl fisheries, with a large portion of trawl catches being discarded. The spawning biomass reached its minimum size (35.8% of its unexploited level) after large domestic removals of 2780 mt in 1998, when the increased availability of splitnose rockfish led to higher than usual removals. Since 1999 however, the splitnose spawning output is estimated to have increased in response to below-average removals and above-average recruitment during the last decade. This pattern is consistent with flat or increasing trends in recent survey abundance indices. Predicted numbers at age from the base case for females and males are provided in Tables 20 and 21.

6. Model uncertainty

Uncertainty in the model was explored though asymptotic variance estimates and sensitivity analyses. Asymptotic confidence intervals were estimated within the model and reported throughout the assessment for key model parameters and management quantities (Figs. 103, 105, Table 22). Sensitivity analysis allowed evaluation of the responsiveness of model outputs to changes in model assumptions. A variety of sensitivity runs were performed in which base-model data sources were selectively omitted, reconstructed historical catches and, the period over which recruitment deviations were estimated were varied, and alternative assumptions regarding selectivity parameters (asymptotic versus dome-shaped) and female fecundity (proportional versus non-proportional female egg-weight relationship) were explored (Section 4.1).

Also, a retrospective analysis was conducted where we re-ran the model after successively removing data from recent years (the last five years in succession and the last 10 years of data) (Section 4.1). The uncertainty regarding natural mortality and stock-recruitment curve steepness was explored through likelihood profile analysis.

7. Reference points

Unfished spawning stock output for splitnose rockfish was estimated to be 12853 million eggs (95% confidence interval: 9105-16601 million eggs). The management target for splitnose rockfish is defined as 40% of the unfished spawning output ($SB_{40\%}$), which is estimated by the model to be 5141 million eggs (95% confidence interval: 3642-6641 million eggs). The stock is declared overfished if the current spawning output is estimated to be below 25% of unfished level. The MSY-proxy harvest rate for splitnose rockfish is SPR=F50%, which corresponds to an exploitation rate of 0.033. This harvest rate provides an equilibrium yield of 1236 mt at $SB_{40\%}$ (95% confidence interval: 883-1589 mt). The model estimate of maximum sustainable yield (MSY) is 1268 mt (95% confidence interval: 906-1630 mt). The estimated spawning stock output at MSY is 4121 million eggs (95% confidence interval: 2900-5342 million eggs). The exploitation rate corresponding to the estimated SPR_{MSY} of F44% is 0.039. The summary of splitnose rockfish reference points from the base model is shown in Table 23. The equilibrium yield curve developed based on reference point values is shown in Fig. 106.

8. Status of the stock and future projections

The assessment shows that the stock of splitnose rockfish in the U.S. West Coast is currently at 66% of its unexploited level and, therefore, not overfished (Fig. 107-108). Historically, the abundance of splitnose rockfish is estimated to have dropped below $SB_{40\%}$ management target in 1995, after experiencing sharp reductions from the large catches by foreign fishery in mid 1960s and increasing domestic catches in 1980s. However, the spawning stock has been increasing since early 2000s, as a result of above-average recruitment and below average removals over the last decade, and stayed above $SB_{40\%}$ management target since 2003. The assessment identifies two historical periods in which exploitation rates exceeded the current F_{MSY} proxy harvest rate: during the foreign fishery peak in the mid 1960s and in 1998 (Fig. 109).

The model estimates above-average recruitments in the most recent years beginning 1999, which along with below-average catches during the last decade determines a population increase in recent and early forecast years. Uncertainty in recent recruitments (between 2000 and 2006) was used to define alternative states of nature. Three states of nature were defined based on the alternative scenarios for recent recruitment deviations for years between 2000 and 2006. The base scenario uses recent recruitment deviations estimated by the base model of the assessment. The “low” and “high” recruitment scenarios were generated by fixing recruitment deviations between 2000 and 2006 at the limits of the 95% confidence interval of the expected deviations for each year (at the low limit for the "low" scenario; at the high limit for the "high" scenario). Recruitment deviations between 1960 and 1999 were fixed at the base model expectations in both "low" and "high" scenarios (Fig. 110). Stock Synthesis adjusted the fixed recruitment deviations by scaling these deviations to a small value (Fig. 111) to achieve a sum of zero for the entire period (Methot 2009). Table 24 showed 12-year projection of the base, "low" and "high" scenarios under the assumptions that total removals for the next 12 years will stay at the level of the removals 1998, the highest domestic removals, at the average of the last 10 years and level and a 50 % of the last decade average.

9. Regional management consideration

In this assessment splitnose rockfish is modeled as a single coast-wide stock, since no genetic data are currently available to suggest the presence of multiple stocks (Waples et al. 2008). Nevertheless, management decisions on a coast-wide stock need to account for effort concentration, since abundance is higher in some areas such as off central California. Spatial aspects of this coast-wide stock are addressed only though geographical separation of the data sources. A more spatially explicit model will be needed in the future if efforts are to be made to specifically address regional management concerns.

10. Research and data needs

In this assessment, several critical assumptions were made based on limited supporting data and research. There are several research and data needs which, if satisfied could improve the assessment. These research and data needs include:

1) Genetic studies of splitnose rockfish stock structure in the Northeast Pacific ocean;
2) Comprehensive historical reconstruction of splitnose rockfish catches in Oregon and Washington;
3) Age-determination and age-validation studies to develop a consistent set of aging criteria for the species that could help reduce the differences among agers;
4) Histological studies of splitnose rockfish maturity to reliably estimate and reduce uncertainty in female maturity parameters;
5) Further exploration of climate-growth relationships for splitnose rockfish and incorporation of this relationship into the stock assessment model;
6) Studies of the spatial dynamics of splitnose rockfish to better understand distribution and explain increased availability of the species off California in 1998.

It is also very important to continue to monitor discard in order to improve the accuracy of total catch estimates.

Acknowledgements

The authors wholeheartedly thank everyone who contributed to the development of this assessment and provided the data - Rick Methot (NWFSC), Jim Hastie (NWFSC), FRAM assessment team (Ian Stewart, John Wallace, Allan Hicks, Curt Whitmire, Owen Hamel, Stacey Miller), Beth Horness (NWFSC), Brad Stenberg (PacFIN), Mark Karnowski (ODFW), Jack Tagart, Theresa Tsou (WDFW), Steve Ralston (SWFSC), John Field (SWFSC), Eliza Heery (PSMFC), Marlene Bellman (PSMFC), John DeVore (PFMC), David Sampson (OSU), Grant

Thompson (AFSC), Waldo Wakefield (NWFSC), and Sean Matson (OSU). The authors also thank the STAR panel members (Robin Cook, Xi He, Jean-Jacques Maguire, Theresa Tsou, John DeVore, Dan Erickson and Brad Pettinger) for their thorough review of the assessment.

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TABLES

Table 1. Management guidelines, recent trends in landings and estimated total catch for splitnose rockfish.

	South of 40°10' N latitude		North of 40°10' N latitude		Coaswide	
Year	**ABC**	**Total Catch OY**	**ABC**	**Total Catch OY**	**Landings**	**Total catch**
1998	NA	NA	NA	NA	1526	2780
1999	868	868	NA	NA	267	500
2000	820	615	NA	NA	132	245
2001	615	461	NA	NA	110	211
2002	615	461	NA	NA	65	125
2003	615	461	NA	NA	158	320
2004	615	461	NA	NA	182	383
2005	615	461	NA	NA	97	210
2006	615	461	NA	NA	274	610
2007	615	461	NA	NA	68	154
2008	615	461	NA	NA	66	149

Table 2. Summary of recent fishery-dependent data (by state) used in the assessment.

	YEAR																														
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
TRAWL																															
CATCHES																															
Langings																															
CA																															
OR																															
WA																															
Discards																															
CA																															
OR																															
WA																															
BIOLOGICAL DATA																															
Langings																															
Length																															
CA																															
OR																															
WA																															
Age																															
CA																															
OR																															
WA																															
Maturity																															
CA																															
OR																															
WA																															
Discards																															
Length																															
CA																															
OR																															
WA																															
NON-TRAWL																															
CATCHES																															
Langings																															
CA																															
OR																															
WA																															
BIOLOGICAL DATA																															
Length																															
CA																															
OR																															
WA																															

Table 3. Summary of fishery-independent data (by survey) used in the assessment.

	YEAR																									
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ABUNDANCE INDEX																										
AFSC shelf triennial	■			■			■			■			■			■			■			■				
AFSC Slope															■		■	■	■							
NWFSC shelf-slope																					■	■	■	■	■	■
NWFSC slope																	■	■	■	■						
BIOLOGICAL DATA																										
Length																										
AFSC shelf triennial	■			■			■			■			■			■			■			■				
AFSC slope															■		■	■	■							
NWFSC shelf-slope																					■	■	■	■	■	■
NWFSC slope																										
Age																										
AFSC shelf triennial							■																			
AFSC slope																										
NWFSC shelf-slope																					■	■	■	■	■	■
NWFSC slope																										
Maturity																										
AFSC shelf triennial																										
AFSC slope															■											
NWFSC shelf-slope																										
NWFSC slope																										

Table 4. Time-series of reconstructed splitnose rockfish historical landings (in metric tons) for domestic trawl (by state), foreign trawl and non-trawl fisheries.

Year	Trawl CA	Trawl OR	Trawl WA	Foreign Trawl	Non Trawl	Total
1900	0	0	0	0	0	0
1901	0	0	0	0	5	5
1902	1	0	0	0	10	10
1903	1	0	0	0	15	16
1904	1	0	0	0	20	21
1905	2	0	0	0	24	26
1906	2	0	0	0	29	31
1907	2	0	0	0	34	36
1908	3	0	0	0	39	42
1909	3	0	0	0	44	47
1910	3	0	0	0	49	52
1911	3	0	0	0	54	57
1912	4	0	0	0	59	62
1913	4	0	0	0	63	67
1914	4	0	0	0	68	73
1915	5	0	0	0	73	78
1916	5	0	0	0	78	83
1917	7	0	0	0	125	132
1918	9	0	0	0	123	132
1919	6	0	0	0	77	84
1920	6	0	0	0	82	88
1921	5	0	0	0	70	76
1922	4	0	0	0	66	71
1923	4	0	0	0	84	88
1924	2	0	0	0	95	98
1925	2	0	0	0	107	109
1926	6	0	0	0	138	144
1927	9	0.1	0	0	112	121
1928	13	0.1	0	0	101	114
1929	13	0.2	0	0	97	110
1930	16	0.2	0	0	105	122
1931	7	0.2	0	0	139	146
1932	11	0.1	0	0	68	79
1933	12	0.1	0	0	60	72
1934	17	0.1	0	0	48	65
1935	21	0.1	0	0	50	71
1936	24	0.2	0	0	24	48
1937	23	0.3	0	0	19	43
1938	25	0.2	0	0	17	42
1939	24	0.2	0	0	26	50
1940	16	1.1	0	0	30	47
1941	12	2.2	0	0	33	48
1942	4	3.2	0	0	15	22
1943	15	24	1	0	9	48
1944	30	39	3	0	1	72
1945	67	59	6	0	1	133
1946	56	37	2	0	5	100

Table 4 (continued). Time-series of reconstructed splitnose rockfish historical landings (in metric tons) for domestic trawl (by state), foreign trawl and non-trawl fisheries.

Year	Trawl CA	Trawl OR	Trawl WA	Foreign Trawl	Non Trawl	Total
1947	37	23	1	0	7	68
1948	44	16	1	0	19	80
1949	28	16	0	0	23	67
1950	40	47	1	0	24	111
1951	81	41	1	0	24	148
1952	90	42	2	0	15	148
1953	262	22	1	0	36	322
1954	389	43	1	0	25	458
1955	269	45	0	0	26	340
1956	421	59	0	0	34	514
1957	359	54	1	0	27	440
1958	274	61	2	0	11	347
1959	458	39	1	0	12	509
1960	613	63	2	0	11	689
1961	500	52	1	0	12	565
1962	350	65	2	0	9	426
1963	307	39	1	0	14	362
1964	198	20	2	0	14	233
1965	248	53	2	0	17	319
1966	223	88	2	4664	18	4995
1967	176	92	1	5025	19	5313
1968	164	19	1	2778	14	2975
1969	64	32	1	141	6	243
1970	85	17	1	87	7	196
1971	66	21	1	63	8	159
1972	105	8	1	86	11	211
1973	169	34	3	297	18	521
1974	140	10	4	108	44	306
1975	164	0	4	159	36	362
1976	174	5	9	105	42	334
1977	177	54	14	0	37	283
1978	199	78	23	0	58	357
1979	137	82	32	0	72	322
1980	265	95	19	0	22	400
1981	311	128	38	0	84	561
1982	219	128	6	0	66	419
1983	531	96	8	0	63	697
1984	677	118	33	0	59	886
1985	677	224	12	0	111	1024
1986	415	120	11	0	189	735
1987	135	136	19	0	173	462
1988	247	170	5	0	138	560
1989	236	132	11	0	75	453
1990	277	152	7	0	115	551
1991	399	147	17	0	132	695
1992	271	54	5	0	96	425
1993	393	108	2	0	61	563

Table 4 (continued). Time-series of reconstructed splitnose rockfish historical landings (in metric tons) for domestic trawl (by state), foreign trawl and non-trawl fisheries.

Year	Trawl CA	Trawl OR	Trawl WA	Foreign Trawl	Non Trawl	Total
1994	331	130	4	0	19	483
1995	325	68	9	0	41	443
1996	422	44	4	0	7	477
1997	476	81	9	0	8	574
1998	1413	61	3	0	49	1526
1999	231	35	1	0	1	267
2000	101	23	2	0	6	132
2001	99	9	1	0	2	110
2002	57	4	1	0	3	65
2003	151	4	1	0	1	157
2004	170	11	1	0	0	182
2005	86	10	0	0	1	97
2006	269	4	0	0	1	274
2007	61	7	1	0	0	69
2008	61	3	2	0	0	67

Table 5. Splitnose rockfish estimated discard rates used in the assessment to compute total removals by domestic trawl fishery.

Year	Discard rate	CV
1987	0.27	0.5
2002	0.80	0.2
2003	0.46	0.2
2004	0.48	0.2
2005	0.55	0.2
2006	0.55	0.2
2007	0.74	0.2

Table 6. Summary of sampling efforts by year, fishery and state used to generate length frequency distributions for trawl and non-trawl landings, and trawl discards.

	Trawl CA		**Trawl OR**		**Trawl WA**		**Non Trawl**		**Trawl discard**	
Year	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish	N trips	N fish
1978	25	461	0	0	0	0	0	0	0	0
1979	17	321	0	0	0	0	0	0	0	0
1980	18	164	0	0	0	0	0	0	0	0
1981	25	165	0	0	0	0	0	0	0	0
1982	54	474	0	0	0	0	0	0	0	0
1983	146	2070	0	0	0	0	4	21	0	0
1984	188	3613	0	0	0	0	5	34	0	0
1985	217	3551	0	0	0	0	61	452	0	0
1986	116	1361	0	0	0	0	88	849	0	0
1987	74	736	0	0	0	0	67	837	5	60
1988	55	316	0	0	0	0	30	265	0	0
1989	57	434	0	0	0	0	20	84	0	0
1990	53	372	0	0	0	0	33	245	0	0
1991	63	299	0	0	0	0	14	156	0	0
1992	38	350	0	0	0	0	26	128	0	0
1993	59	1439	0	0	0	0	20	319	0	0
1994	48	1046	0	0	0	0	21	179	0	0
1995	48	850	3	63	0	0	20	247	0	0
1996	63	929	7	380	0	0	3	63	0	0
1997	65	1351	1	65	0	0	5	20	0	0
1998	81	2176	1	100	13	150	4	93	0	0
1999	44	1125	0	0	7	18	0	0	0	0
2000	30	457	0	0	12	104	0	0	0	0
2001	24	771	2	84	7	64	0	0	0	0
2002	55	1153	0	0	20	294	3	46	0	0
2003	31	1076	11	140	20	144	0	0	0	0
2004	24	831	11	286	5	42	0	0	0	0
2005	20	467	11	235	3	3	0	0	0	0
2006	38	590	12	179	1	8	0	0	96	573
2007	48	701	39	700	8	78	0	0	146	1031
2008	71	1440	32	304	5	60	0	0	0	0

Table 7. Latitudinal and depth ranges by year of four NMFS surveys used in the assessment.

Survey	Year	Latitudes	Depths (fm)
NWFSC slope	1999	34^o 50'- 48^o 10'	100-700
	2000	34^o 50'- 48^o 07'	100-700
	2001	34^o 50'- 48^o 08'	100-700
	2002	34^o 50'- 48^o 07'	100-700
NWFSC shelf-slope	2003	32^o 34'- 48^o 27'	30-700
	2004	32^o 34'- 48^o 27'	30-700
	2005	32^o 34'- 48^o 27'	30-700
	2006	32^o 34'- 48^o 27'	30-700
	2007	32^o 34'- 48^o 27'	30-700
	2008	32^o 34'- 48^o 27'	30-700
AFSC shelf (triennial)	1977	34^o 00'- Border	50-250
	1980	36^o 48'- 49^o 15'	30-200
	1983	36^o 48'- 49^o 15'	30-200
	1986	36^o 48'- Border	30-200
	1989	34^o 30'- 49^o 40'	30-200
	1992	34^o 30'- 49^o 40'	30-200
	1995	34^o 30'- 49^o 40'	30-275
	1998	34^o 30'- 49^o 40'	30-275
	2001	34^o 30'- 49^o 40'	30-275
	2004	34^o 30'- Border	30-275
AFSC slope	1988	44^o 05'- 45^o 30'	100-700
	1990	40^o 30'- 43^o 00'	100-700
	1991	38^o 20'- 40^o 30'	100-700
	1992	45^o 30'- Border	100-700
	1993	43^o 00'- 45^o 30'	100-700
	1995	40^o 30'- 43^o 00'	100-700
	1996	43^o 00'- Border	100-700
	1997	34^o 30'- Border	100-700
	1999	34^o 30'- Border	100-700
	2000	34^o 30'- Border	100-700
	2001	34^o 30'- Border	100-700

Table 8. Model selection of the generalized linear mixed model (GLMM) for the AFSC triennial survey (bolded values indicate selected model by method).

a) 1983-1992

Error	Model	Df	logLik	AIC	BIC
Zeros					
Binomial	3-Way Interactions	8	-235	**486**	**519**
Binomial	Main Effects only	17	-230	494	564
Binomial	2-Way Interactions	21	-230	502	588
Positives					
Gamma	3-Way Interactions	21	-472	**987**	1066
Gamma	2-Way Interactions	17	-480	995	1059
Gamma	Main Effects only	8	-504	1024	**1055**
Lognormal	3-Way Interactions	21	-673	1388	1467
Lognormal	2-Way Interactions	17	-682	1398	1462
Lognormal	Main Effects only	8	-707	1429	1460

b) 1995-2004

Error	Model	Df	logLik	AIC	BIC
Zeros					
Binomial	Main Effects only	19	-385	**809**	**896**
Binomial	3-Way Interactions	25	-385	821	936
Binomial	2-Way Interactions	8	-407	830	866
Positives					
Gamma	3-Way Interactions	25	-808	**1666**	1771
Gamma	2-Way Interactions	19	-818	1674	1754
Gamma	Main Effects only	8	-843	1701	**1735**
Lognormal	2-Way Interactions	19	-974	1985	2065
Lognormal	3-Way Interactions	25	-970	1990	2095
Lognormal	Main Effects only	8	-1016	2048	2081

c) 1983-2004

Error	Model	Df	logLik	AIC	BIC
Zeros					
Binomial	Main Effect only	12	-370	**765**	**821**
Binomial	2-Way Interactions	29	-364	786	923
Binomial	3-Way Interactions	37	-362	797	971
Positives					
Gamma	3-Way Interactions	37	-987	**2048**	2213
Gamma	2-Way Interactions	29	-996	2050	2179
Gamma	Main Effect only	12	-1037	2099	**2152**
Lognormal	3-Way Interactions	37	-1269	2611	2776
Lognormal	2-Way Interactions	29	-1283	2624	2753
Lognormal	Main Effect only	12	-1330	2684	2738

Table 9. Model selection of the generalized linear mixed-model (GLMM) for the NWFSC surveys (bolded values indicate selected model by method).

a) NWFSC shelf-slope survey

Error	Model	Df	logLik	AIC	BIC
Zeros					
Binomial	Main Effects only	10	-613	**1245**	**1295**
Binomial	2-Way Interactions	27	-601	1256	1391
Binomial	3-Way Interactions	27	-594	1261	1447
Positives					
Gamma	3-Way Interactions	37	-1038	**2149**	2316
Gamma	2-Way Interactions	27	-1067	2189	2310
Gamma	Main Effects only	10	-1119	2258	**2303**
Lognormal	2-Way Interactions	27	-1454	2961	3083
Lognormal	3-Way Interactions	37	-1445	2965	3132
Lognormal	Main Effects only	10	-1515	3051	3096

b) NWFSC slope survey

Error	Model	Df	logLik	AIC	BIC
Zeros					
Binomial	2-Way Interactions	19	-312	**661**	747
Binomial	Main Effects only	8	-324	664	**700**
Binomial	3-Way Interactions	25	-309	668	780
Positives					
Gamma	3-Way Interactions	25	-578	1206	1305
Gamma	2-Way Interactions	19	-590	1217	**1292**
Gamma	Main Effects only	8	-624	1263	1295
Lognormal	3-Way Interactions	25	-793	1637	1735
Lognormal	2-Way Interactions	19	-809	1656	1731
Lognormal	Main Effects only	8	-857	1729	1761

Table 10. Spatial strata used for estimate abundance indices and generate length frequency distributions of the NMFS surveys used in the assessment.

Survey	Latitudinal strata	Depth strata (m)
AFSC triennial survey (1983-2004)	Monterey-Eureka	183-300
		300-366
	Columbia-US Vancouver	183-300
		300-366
AFSC triennial survey (1983-1992)	Monterey-Eureka	183-300
		300-366
	Columbia-US Vancouver	183-300
		300-366
AFSC triennial survey (1995-2004)	Conception	183-300
		300-500
	Monterey-Eureka	183-300
		300-500
	Columbia-US Vancouver	183-300
		300-500
AFSC slope survey	Conception	183-350
		350-549
	Monterey-Eureka	183-350
		350-549
	Columbia-US Vancouver	183-350
		350-549
NWFSC shelf-slope survey	Conception	183-350
		350-549
	Monterey-Eureka	183-350
		350-549
	Columbia-US Vancouver	183-350
		350-549
NWFSC slope survey	Conception	183-350
		350-549
	Monterey-Eureka	183-350
		350-549
	Columbia-US Vancouver	183-350
		350-549

Table 11. Estimated index of abundance (metric tons) and standard error of the natural log of biomass for the AFSC triennial survey. The abundance indices are given for one (1983-2004) and two (1983-1992 and 1995-2004) triennial survey time-series.

	AFSC triennial (1983-2004)		AFSC triennial (1983-1992)		AFSC triannial (1995-2004)	
Year	**Index (mt)**	**SE(log)**	**Index (mt)**	**SE(log)**	**Index (mt)**	**SE(log)**
1983	5206	0.3058	5323	0.1433		
1986	5559	0.3392	5416	0.1774		
1989	6347	0.3183	6411	0.1481		
1992	6052	0.3247	6187	0.1822		
1995	10625	0.3180			14359	0.4731
1998	12084	0.3075			20951	0.4678
2001	11761	0.2902			14290	0.4434
2004	46213	0.3139			55920	0.4628

Table 12. Estimated index of abundance (metric tons) and standard error of the natural log of biomass for the AFSC slope, NWFSC shelf-slope and NWFSC slope surveys.

	AFSC slope		NWFSC shelf-slope		NWFSC slope	
Year	**Index (mt)**	**SE(log)**	**Index (mt)**	**SE(log)**	**Index (mt)**	**SE(log)**
1997	14293	0.4036				
1998						
1999	11190	0.3084			16999	0.1474
2000	27494	0.5722			33231	0.1357
2001	12777	0.2924			14314	0.1950
2002					12446	0.1217
2003			21418	0.3005		
2004			53294	0.2648		
2005			56004	0.2583		
2006			29760	0.2404		
2007			40639	0.2643		
2008			57425	0.3393		

Table 13. Summary of sampling efforts by AFSC triennial, AFSC slope and NWFSC shelf-slope surveys used in the assessment to generate length frequency distributions.

	AFSC triennial		AFSC slope		NWFSC shelf-slope	
Year	N tows	N fish	N tows	N fish	N tows	N fish
1983	35	4106				
1986	7	688				
1989	42	3307				
1992	22	2240				
1995	72	5898				
1997			48	599		
1998	89	5905				
1999			41	541		
2000			47	535		
2001	87	3784	45	555		
2002						
2003					132	6630
2004	87	424			99	5092
2005					126	4467
2006					146	3591
2007					157	3357
2008					151	2914

Table 14. Summary of sampling efforts by NWFSC shelf-slope survey used in the assessment to generate conditional age-at-length compositions.

	NWFSC shelf-slope	
Year	N tows	N fish
2003	192	478
2004	163	396
2005	198	458
2006	191	415
2007	209	431
2008	171	427

Table 15. Pre-STAR Panel sensitivity analyses: Values for the likelihood components and summary statistics related to the current status of the resource for sensitivity trials omitting or including data sources for pre-STAR Panel base cases with a) one triennial survey time-series and b) two triennial survey time-series. Gray boxes indicate data source omitted in the trial. Reproductive output is reported in millions of eggs.

a) One triennial survey time-series

								Trial							
Likelihood Components	Base Case	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Abundance Index															
AFSC triennial	-0.92		-0.42	-1.25	-1.00	-1.73	-0.54	2.21	-2.00	-5.38	0.85	3.66	-0.40	-3.17	-3.24
AFSC slope	-1.78	-1.80		-1.74	-1.78	-1.76	-1.80	-1.84	-1.76	-1.83	-1.84	-1.62	-1.84	-1.82	-1.81
NWFSC shelf slope	-3.32	-3.31	-3.35		-3.31	-3.34	-3.34	-3.40	-3.21	-3.35	-3.37	-3.15	-3.44	-3.16	-3.15
NWFSC slope	-1.11	-0.96	-1.22	-1.09		-1.12	-1.21	-0.69	-0.86	-1.20	-2.08	-2.02	-0.71	-0.75	-0.45
Discard Ratio	-3.71	-2.75	-7.55	-3.70	-3.69		-4.80	-11.82	-6.20	-0.27	-11.05	-10.02	-10.39	3.56	5.52
Mean Body Weight	-12.68	-12.52	-13.53	-12.61	-12.67	-15.92		-18.74	-12.51	-11.94	-15.56	-17.49	-18.09	-11.90	-12.35
Length Comps.															
Domestic trawl	1165.31	1166.03	1153.88	1165.05	1165.44	1154.07	1152.63		1006.21	1171.70	1157.96	1091.89	1197.23	1141.91	1110.84
Non-trawl fishery	543.60	540.25	549.28	543.99	543.80	534.46	548.41	299.00		534.61	539.27	515.05	522.30	544.17	538.93
AFSC triennial	352.05	430.92	333.68	351.53	351.88	355.98	335.54	431.69	345.93		334.29	307.88	597.75	314.90	371.54
AFSC slope	102.26	95.12	105.17	102.17	102.10	104.94	105.11	89.56	93.36	110.08		147.25	100.51	88.42	95.08
NWFSC shelf slope	135.58	126.48	145.02	135.29	135.21	132.98	141.21	107.71	116.86	126.86	170.11		222.85	122.10	126.45
Conditional Ages															
AFSC triennial													1716.89		
NWFSC shelf slope	2018.06	2038.73	2018.19	2019.35	2018.29	2009.21	2018.21	2064.53	2037.00	1971.89	1995.46	1981.90	2374.31		
Age Compositions															
AFSC triennial															127.56
NWFSC shelf slope														1105.22	1126.85
Recruitment penalty	52.49	51.36	52.09	51.92	52.60	48.05	52.50	43.79	53.25	31.28	48.52	36.60	52.37	57.64	48.61
Parameter priors	3.20	2.98	3.35	2.92	3.19	3.28	3.42	2.55	4.35	3.46	3.11	3.63	2.66	3.30	4.03
TOTAL LIKELIHOOD	4349.03	4430.53	4334.58	4351.82	4350.07	4319.10	4345.34	3004.53	3630.43	3925.89	4215.67	4053.55	6752.01	3360.41	3534.39
1900 reproductive output	11956.60	11700.40	11647.70	13215.00	12058.80	10975.30	11375.40	8219.73	12589.30	12273.00	12962.00	11144.60	9136.97	10051.50	8372.76
2009 reproductive output	7001.40	6723.21	6648.42	7662.51	7114.14	7018.94	6567.94	3749.49	7567.08	5026.53	6928.38	5907.28	4885.72	6274.36	5198.40
%Depletion	58.56%	57.46%	57.08%	57.98%	59.00%	63.95%	57.74%	45.62%	60.11%	40.96%	53.45%	53.01%	53.47%	62.42%	62.09%

Table 15 (continued). Pre-STAR Panel sensitivity analyses: Values for the likelihood components and summary statistics related to the current status of the resource for sensitivity trials omitting or including data sources for pre-STAR Panel base cases with a) one triennial survey time-series and b) two triennial survey time-series. Gray boxes indicate data source omitted in the trial. Reproductive output is reported in millions of eggs.

b) Two triennial survey time-series

		Trial													
Likelihood Components	Base Case	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Abundance Index															
AFSC triennial ('80-'92)	-6.02		-6.03	-6.04	-5.36	-6.33	-6.05	-5.02	-6.17	-6.00	-6.21	-6.57	-5.87	-6.10	-6.52
AFSC triennial ('95-'04)	-1.73		-1.74	-1.75	-1.50	-1.76	-1.75	-1.06	-1.88	-1.75	-1.66	-0.65	-0.19	-1.56	-1.44
AFSC slope	-1.83	-1.84		-1.83	-1.84	-1.82	-1.83	-1.83	-1.82	-1.83	-1.83	-1.67	-1.86	-1.82	-1.82
NWFSC shelf slope	-3.38	-3.38	-3.38		-3.41	-3.39	-3.37	-3.41	-3.35	-3.37	-3.41	-3.10	-3.39	-3.23	-3.17
NWFSC slope	-1.21	-1.23	-1.21	-1.21		-1.21	-1.21	-0.94	-0.77	-1.22	-2.28	-2.07	-1.42	-0.89	-0.60
Discard Ratio	-3.87	-4.32	-3.89	-3.84	-11.25		-2.60	-11.55	-4.56	-1.64	-11.06	-10.08	-10.47	4.43	15.90
Mean Body Weight	-12.48	-12.58	-12.47	-12.46	-15.53	-15.85		-18.68	-12.02	-12.11	-15.56	-17.45	-17.59	-11.57	-12.03
Length Comps.															
Domestic trawl	1164.12	1164.91	1164.10	1164.06	1154.30	1148.43	1163.44		1015.00	548.94	1169.95	1093.36	1194.68	1129.29	1121.41
Non-trawl fishery	554.04	553.43	554.07	554.10	563.89	544.29	553.33	304.91		157.72	539.70	514.72	530.01	547.71	532.99
AFSC triennial ('80-'92)	157.04	157.76	157.01	156.99	159.68	158.13	157.20	199.79	168.53		153.84	139.11	287.12	141.91	181.38
AFSC triennial ('95-'04)	93.64	93.54	93.65	93.67	124.12	95.30	94.06	111.66	106.27		93.96	89.67	151.88	98.60	97.83
AFSC slope	113.93	114.09	113.95	113.92	105.24	115.86	114.03	101.95	98.09	111.23		161.99	125.51	101.69	103.99
NWFSC shelf slope	134.06	134.36	134.12	133.95	157.68	132.06	132.44	108.87	106.81	130.71	167.28		269.45	117.81	121.48
Conditional Ages															
AFSC triennial													1711.17		
NWFSC shelf slope	1979.57	1979.35	1979.50	1979.58	2022.08	1974.01	1979.62	1995.10	2010.76	1977.80	1961.82	1956.86	2294.86		
Age Compositions															
AFSC triennial															122.51
NWFSC shelf slope														1092.28	1099.85
Recruitment penalty	33.24	32.69	33.28	33.37	31.83	28.72	33.47	19.72	34.81	32.08	28.33	18.21	35.78	36.54	35.02
Parameter priors	4.13	3.62	4.11	4.03	4.68	4.10	4.11	4.97	4.70	3.31	3.89	4.45	4.67	4.67	3.98
TOTAL LIKELIHOOD	4203.26	4210.39	4205.07	4206.54	4284.59	4170.54	4214.89	2804.46	3514.39	4100.79	4076.75	3936.79	6564.36	3249.74	3410.76
1900 reproductive output	9867.82	9501.01	9916.58	9950.93	9106.68	8953.87	9914.44	7468.27	9779.91	9967.56	11767.80	10462.40	7288.50	8762.23	7653.00
2008 reproductive output	5144.81	4706.90	5195.65	5237.34	4041.48	5265.49	5251.63	2974.48	5704.81	5049.28	5640.05	5664.18	3337.18	4571.21	4811.68
%Depletion	52.14%	49.54%	52.39%	52.63%	44.38%	58.81%	52.97%	39.83%	58.33%	50.66%	47.93%	54.14%	45.79%	52.17%	62.87%

Table 16. Summary of the selected sensitivity trials and retrospective analysis for the base model. Spawning output (SB) is reported in millions of eggs.

	SB_{1900}	SB_{2009}	Depletion	-LogLikelihood
Base model	**12853**	**8426**	**65.55%**	**2308.91**
Base model not tuned	10135	7538	74.37%	3802.92
Foreign catch is halved	11296	7382	65.35%	2371.48
Domestic catch reversed (1901-1977)	10911	6975	63.93%	2338.74
Ricker stock-recruitment curve	12855	6612	51.43%	2343.09
Retrospective analysis				
no 2008	12772	8468	66.31%	2010.11
no 2007-2008	14206	11398	80.23%	1703.61
no 2006-2009	14298	12344	86.33%	1422.71
no 2005-2008	11334	8995	79.37%	1077.48
no 2004-2008	8596	4373	50.87%	792.086
no 1999-2008	5090	1624	31.91%	376.066

Table 17. List of parameter values used in the base model.

Parameter	Value	Min	Max	Fixed	Estimated (phase)	Prior (if any)
Natural Mortality						
Females	0.048			x		
Males	0.048			x		
Growth						
Females						
Size (cm) at age A1	10.3	2	40		x (3)	
Size (cm) at age A2	29.6	2	60		x (3)	
K	0.156	0.05	0.3		x (3)	
CV in size at age A1	0.093	0.05	0.3		x (4)	
CV in size at age A2	0.107	0.05	0.3		x (4)	
Males						
Size (cm) at age A1	10.3					
Size (cm) at age A2	27.3	2	60		x (3)	
K	0.165	0.05	0.3		x (3)	
CV in size at age A1	0.064	0.05	0.3		x (4)	
CV in size at age A2	0.144	0.05	0.3		x (4)	
Biological parameters						
Maturity logistic inflection	21.84			x		
Maturity slope	-0.568			x		
eggs/gm intercept	237500			x		
eggs/gmslope	74300			x		
Weight at length						
Females						
Coefficient	2.00E-05			x		
Exponent	3.0139			x		
Males						
Coefficient	2.00E-05			x		
Exponent	2.9684			x		
Stock-Recruitment						
Ln (R_0)	9.54344	3	15		x (1)	
Steepness	0.58			x		
Survey catchability (Q)						
AFSC triennial survey	0.70436				x (1)	
AFSC slope survey	0.39226				x (1)	
NWFSC shelf-slope survey	0.73115				x (1)	
NWFSC slope survey	0.47878				x (1)	

Table 17 (continued). List of parameter values used in the base model.

Parameter	Value	Min	Max	Fixed	Estimated (phase)	Prior (if any)	Shape parm
Size selectivity parameters dimestic trawl							
Peak	33.28	12	35		x (2)	Symmetric beta	0.2
Top	-2	-6	4	x			
Ascendin slope	5.03	-1	9		x (3)	Symmetric beta	0.2
Descenfin slope	4	-1	9	x			
Selectivity at fist bin	-5	-5	9	x			
Selectivity at last bin	8	-5	9	x			
Retention domestic trawl							
Inflection	26.16	12	35		x (4)	Symmetric beta	0.2
Slope	2.01	0.5	7		x (4)	Symmetric beta	0.2
Asymptotic retention	0.77	0	1		x (4)	Symmetric beta	0.2
Male offset	0	0	1	x			
Size selectivity parameters foreign trawl							
First size bin (mirror to dome	0			x			
Last size bin (mirror to dome:	0			x			
Size selectivity parameters non-trawl							
Peak	36.09	12	55		x (2)	Symmetric beta	0.2
Top	-2	-6	4	x			
Ascendin slope	2.72	-1	9		x (3)	Symmetric beta	0.2
Descenfin slope	4	-1	9	x			
Selectivity at fist bin	-5	-5	9	x			
Selectivity at last bin	8	-5	9	x			
Size selectivity parameters AFSC triennial survey							
Peak	20.59	12	35		x (2)	Symmetric beta	0.2
Top	-4.11	-6	4		x (5)	Symmetric beta	0.2
Ascendin slope	3.40	-1	9		x (3)	Symmetric beta	0.2
Descenfin slope	0.74	-1	9		x (4)	Symmetric beta	0.2
Selectivity at fist bin	-5	-5	9	x			
Selectivity at last bin	-1.51	-5	9		x (2)	Symmetric beta	0.2
Size selectivity parameters AFSC slope survey							
Peak	15.92	12	35		x (2)	Symmetric beta	0.2
Top	-1.5	-6	4	x			
Ascendin slope	1.62	-1	9		x (3)	Symmetric beta	0.2
Descenfin slope	4	-1	9	x			
Selectivity at fist bin	-5	-5	9	x			
Selectivity at last bin	8	-5	9	x			
Size selectivity parameters NWFSC shelf-slope survey							
Peak	15.18	12	35		x (2)	Symmetric beta	0.2
Top	-2	-6	4	x			
Ascendin slope	2.54	-1	9		x (3)	Symmetric beta	0.2
Descenfin slope	4	-1	9	x			
Selectivity at fist bin	-5	-5	9	x			
Selectivity at last bin	8	-5	9	x			
Size selectivity parameters NWFSC slope survey							
First size bin (mirror to AFSC	0			x			
Last size bin (mirror to AFSC	0			x			
Block selectivity non-trawl fishery							
Peak	36.35	12	55		x (4)	Symmetric beta	0.2
Top	-4	-6	4	x			
Ascendin slope	3.99	-1	9		x (4)	Symmetric beta	0.2
Descenfin slope	2.6	-1	9	x			
Selectivity at last bin	8	-5	9	x			

Table 18. Reconstructed landings and estimated total removals of splitnose rockfish by domestic and foreign trawl and non trawl fisheries.

	Lnaded catch (mt)				Total removals (mt)			
Year	Domestic trawl	Foreign trawl	Non trawl	TOTAL	Domestic trawl	Foreign trawl	Non Trawl	TOTAL
1900	0	0	0	0	0	0	0	0
1901	0	0	5	5	0	0	5	5
1902	1	0	10	11	2	0	10	12
1903	1	0	15	16	2	0	15	17
1904	1	0	20	21	2	0	20	22
1905	2	0	24	26	4	0	24	28
1906	2	0	29	31	4	0	29	33
1907	2	0	34	36	4	0	34	38
1908	3	0	39	42	5	0	39	44
1909	3	0	44	47	5	0	44	49
1910	3	0	49	52	5	0	49	54
1911	3	0	54	57	5	0	54	59
1912	4	0	59	63	7	0	59	66
1913	4	0	63	67	7	0	63	70
1914	4	0	68	72	7	0	68	75
1915	5	0	73	78	9	0	73	82
1916	5	0	78	83	9	0	78	87
1917	7	0	125	132	12	0	125	137
1918	9	0	123	132	16	0	123	139
1919	6	0	77	83	11	0	77	88
1920	6	0	82	88	11	0	82	93
1921	5	0	70	75	9	0	70	79
1922	4	0	66	70	7	0	66	73
1923	4	0	84	88	7	0	84	91
1924	2	0	95	97	4	0	95	99
1925	2	0	107	109	4	0	107	111
1926	6	0	138	144	11	0	138	149
1927	9	0	112	121	16	0	112	128
1928	13	0	101	114	23	0	101	124
1929	13	0	97	110	23	0	97	120
1930	16	0	105	121	29	0	105	134
1931	7	0	139	146	12	0	139	151
1932	11	0	68	79	20	0	68	88
1933	12	0	60	72	21	0	60	81
1934	17	0	48	65	30	0	48	78
1935	21	0	50	71	37	0	50	87
1936	24	0	24	48	43	0	24	67
1937	23	0	19	42	41	0	19	60
1938	25	0	17	42	45	0	17	62
1939	24	0	26	50	43	0	26	69
1940	17	0	30	47	30	0	30	60
1941	15	0	33	48	27	0	33	60
1942	7	0	15	22	12	0	15	27
1943	40	0	9	49	71	0	9	80
1944	71	0	1	72	127	0	1	128
1945	132	0	1	133	235	0	1	236
1946	95	0	5	100	169	0	5	174
1947	60	0	7	67	107	0	7	114
1948	60	0	19	79	107	0	19	126
1949	45	0	23	68	80	0	23	103
1950	88	0	24	112	157	0	24	181
1951	124	0	24	148	221	0	24	245
1952	134	0	15	149	239	0	15	254
1953	286	0	36	322	510	0	36	546
1954	433	0	25	458	773	0	25	798

Table 18 (continued). Reconstructed landings and estimated total removals of splitnose rockfish by domestic and foreign trawl and non trawl fisheries.

	Lnaded catch (mt)				Total removals (mt)			
Year	Domestic trawl	Foreign trawl	Non trawl	TOTAL	Domestic trawl	Foreign trawl	Non Trawl	TOTAL
1955	314	0	26	340	561	0	26	587
1956	480	0	34	514	857	0	34	891
1957	413	0	27	440	738	0	27	765
1958	336	0	11	347	601	0	11	612
1959	497	0	12	509	889	0	12	901
1960	678	0	11	689	1213	0	11	1224
1961	553	0	12	565	991	0	12	1003
1962	416	0	9	425	746	0	9	755
1963	348	0	14	362	624	0	14	638
1964	220	0	14	234	395	0	14	409
1965	302	0	17	319	542	0	17	559
1966	313	4664	18	4995	561	4664	18	5243
1967	269	5025	19	5313	483	5025	19	5527
1968	183	2778	14	2975	329	2778	14	3121
1969	96	141	6	243	172	141	6	319
1970	103	87	7	197	184	87	7	278
1971	88	63	8	159	156	63	8	227
1972	114	86	11	211	201	86	11	298
1973	206	297	18	521	362	297	18	677
1974	154	108	44	306	269	108	44	421
1975	167	159	36	362	291	159	36	486
1976	187	105	42	334	324	105	42	471
1977	246	0	37	283	425	0	37	462
1978	299	0	58	357	515	0	58	573
1979	251	0	72	323	431	0	72	503
1980	378	0	22	400	647	0	22	669
1981	477	0	84	561	815	0	84	899
1982	353	0	66	419	603	0	66	669
1983	635	0	63	698	1086	0	63	1149
1984	827	0	59	886	1418	0	59	1477
1985	913	0	111	1024	1572	0	111	1683
1986	546	0	189	735	945	0	189	1134
1987	289	0	173	462	503	0	173	676
1988	422	0	138	560	738	0	138	876
1989	379	0	75	454	666	0	75	741
1990	436	0	115	551	771	0	115	886
1991	563	0	132	695	1003	0	132	1135
1992	330	0	96	426	592	0	96	688
1993	503	0	61	564	909	0	61	970
1994	464	0	19	483	843	0	19	862
1995	401	0	41	442	731	0	41	772
1996	470	0	7	477	859	0	7	866
1997	566	0	8	574	1039	0	8	1047
1998	1477	0	49	1526	2731	0	49	2780
1999	266	0	1	267	499	0	1	500
2000	126	0	6	132	239	0	6	245
2001	108	0	2	110	209	0	2	211
2002	62	0	3	65	122	0	3	125
2003	157	0	1	158	319	0	1	320
2004	182	0	0	182	383	0	0	383
2005	96	0	1	97	209	0	1	210
2006	273	0	1	274	609	0	1	610
2007	68	0	0	68	154	0	0	154
2008	66	0	0	66	149	0	0	149

Table 19. Time-series of estimated total and summary biomass (mt), spawning output (million eggs), depletion, recruitment (1000s fish) and exploitation rate.

Year	Total biomass	Summary biomass	Spawning output	Depletion	Recruirment	Exploitation rate
1900	88699	87584	12853	100.00%	13953	0.0000
1901	88699	87584	12853	100.00%	13953	0.0001
1902	88696	87581	12852	99.99%	13952	0.0001
1903	88688	87573	12851	99.98%	13952	0.0002
1904	88676	87562	12848	99.97%	13952	0.0002
1905	88663	87548	12846	99.95%	13951	0.0003
1906	88645	87530	12842	99.92%	13950	0.0004
1907	88625	87510	12839	99.89%	13950	0.0004
1908	88602	87487	12834	99.86%	13949	0.0005
1909	88575	87460	12829	99.82%	13948	0.0006
1910	88546	87431	12824	99.77%	13947	0.0006
1911	88514	87400	12818	99.73%	13946	0.0007
1912	88481	87366	12811	99.68%	13944	0.0008
1913	88443	87329	12804	99.62%	13943	0.0008
1914	88405	87291	12797	99.57%	13942	0.0009
1915	88364	87250	12789	99.51%	13940	0.0009
1916	88320	87206	12781	99.44%	13938	0.0010
1917	88275	87161	12772	99.38%	13937	0.0016
1918	88197	87083	12758	99.26%	13934	0.0016
1919	88119	87006	12743	99.15%	13931	0.0010
1920	88080	86967	12736	99.09%	13929	0.0011
1921	88038	86925	12728	99.03%	13928	0.0009
1922	88008	86895	12722	98.99%	13927	0.0008
1923	87983	86870	12718	98.95%	13926	0.0010
1924	87947	86834	12711	98.90%	13924	0.0011
1925	87908	86795	12704	98.84%	13923	0.0013
1926	87862	86750	12695	98.77%	13921	0.0017
1927	87792	86679	12682	98.67%	13919	0.0015
1928	87736	86623	12672	98.59%	13916	0.0014
1929	87682	86570	12662	98.51%	13915	0.0014
1930	87633	86521	12653	98.45%	13913	0.0015
1931	87575	86463	12643	98.37%	13911	0.0018
1932	87511	86400	12631	98.27%	13908	0.0010
1933	87490	86379	12627	98.25%	13908	0.0009
1934	87473	86362	12625	98.22%	13907	0.0009
1935	87456	86344	12622	98.21%	13907	0.0010
1936	87431	86320	12618	98.18%	13906	0.0008
1937	87419	86308	12617	98.17%	13906	0.0007
1938	87412	86301	12617	98.17%	13905	0.0007
1939	87402	86291	12616	98.16%	13905	0.0008
1940	87389	86278	12615	98.15%	13905	0.0007
1941	87384	86273	12615	98.15%	13905	0.0007
1942	87381	86270	12614	98.15%	13905	0.0003
1943	87403	86292	12619	98.18%	13906	0.0009
1944	87374	86263	12615	98.15%	13905	0.0015
1945	87300	86189	12604	98.06%	13903	0.0027
1946	87127	86017	12577	97.85%	13897	0.0020
1947	87017	85906	12559	97.72%	13894	0.0013
1948	86966	85855	12551	97.65%	13892	0.0015

Table 19. Time-series of estimated total and summary biomass (mt), spawning output (million eggs), depletion, recruitment (1000s fish) and exploitation rate.

Year	Total biomass	Summary biomass	Spawning output	Depletion	Recruirment	Exploitation rate
1949	86908	85798	12542	97.58%	13890	0.0012
1950	86875	85765	12537	97.54%	13889	0.0021
1951	86771	85662	12520	97.41%	13886	0.0029
1952	86612	85502	12494	97.21%	13880	0.0030
1953	86447	85337	12467	97.00%	13875	0.0064
1954	86023	84914	12398	96.46%	13860	0.0094
1955	85376	84268	12293	95.64%	13838	0.0070
1956	84940	83833	12221	95.08%	13823	0.0106
1957	84239	83134	12106	94.19%	13798	0.0092
1958	83672	82568	12012	93.46%	13778	0.0074
1959	83258	82155	11944	92.93%	13763	0.0110
1960	82593	81491	11834	92.08%	15341	0.0150
1961	81657	80548	11680	90.88%	12581	0.0124
1962	80965	79834	11563	89.96%	10289	0.0095
1963	80485	79370	11485	89.36%	8600	0.0080
1964	80054	79139	11429	88.92%	7438	0.0052
1965	79737	78981	11410	88.77%	6697	0.0071
1966	79151	78509	11369	88.46%	6273	0.0668
1967	74115	73551	10630	82.70%	6040	0.0751
1968	68769	68253	9848	76.62%	5936	0.0457
1969	65604	65114	9415	73.25%	5866	0.0049
1970	64951	64473	9378	72.97%	5710	0.0043
1971	64231	63761	9326	72.56%	5365	0.0036
1972	63464	63004	9259	72.04%	4855	0.0047
1973	62546	62105	9163	71.29%	4286	0.0109
1974	61201	60795	8995	69.98%	3781	0.0069
1975	60032	59667	8852	68.87%	3467	0.0081
1976	58732	58409	8689	67.60%	3469	0.0081
1977	57389	57097	8519	66.28%	4032	0.0081
1978	56008	55726	8341	64.89%	6101	0.0103
1979	54520	54207	8138	63.31%	11063	0.0093
1980	53157	52733	7938	61.76%	5109	0.0127
1981	51732	51121	7704	59.94%	5702	0.0176
1982	50159	49471	7436	57.85%	6248	0.0135
1983	48878	48445	7209	56.09%	7603	0.0237
1984	47239	46757	6922	53.86%	6868	0.0316
1985	45406	44868	6607	51.41%	5923	0.0375
1986	43497	42919	6282	48.88%	11561	0.0264
1987	42234	41678	6059	47.14%	10301	0.0162
1988	41556	40905	5917	46.04%	6824	0.0214
1989	40798	39942	5757	44.80%	9356	0.0186
1990	40235	39514	5631	43.82%	5215	0.0224
1991	39636	39037	5502	42.81%	3651	0.0291
1992	38820	38222	5357	41.68%	6716	0.0180
1993	38396	38007	5294	41.19%	14123	0.0255
1994	37769	37320	5203	40.48%	18675	0.0231
1995	37408	36598	5133	39.94%	6964	0.0211
1996	37312	36109	5074	39.48%	20174	0.0240
1997	37226	36043	5000	38.91%	5713	0.0290

Table 19 (continued). Time-series of estimated total and summary biomass (mt), spawning output (million eggs), depletion, recruitment (1000s fish) and exploitation rate.

Year	Total biomass	Summary biomass	Spawning output	Depletion	Recruirment	Exploitation rate
1998	37198	36294	4913	38.23%	23423	0.0766
1999	35697	34431	4602	35.80%	61319	0.0145
2000	36871	35566	4651	36.19%	35504	0.0069
2001	39177	36217	4763	37.06%	44958	0.0058
2002	42119	38024	4909	38.20%	35903	0.0033
2003	45875	42794	5125	39.87%	22388	0.0075
2004	49911	46722	5404	42.04%	21043	0.0082
2005	54090	51676	5807	45.18%	39992	0.0041
2006	58608	56724	6365	49.52%	52273	0.0108
2007	63145	60729	6972	54.24%	78203	0.0025
2008	68678	64923	7690	59.83%	12440	0.0023
2009	74772	70196	8426	65.55%	12741	N/A

Table 20. Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																				
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1900	6976	6649	6338	6041	5758	5488	5231	4986	4752	4529	4317	4115	3922	3738	3563	3396	3237	3085	2940	2803	2671
1901	6976	6649	6338	6041	5758	5488	5231	4986	4752	4529	4317	4115	3922	3738	3563	3396	3237	3085	2940	2803	2671
1902	6976	6649	6338	6041	5758	5488	5231	4986	4752	4529	4317	4115	3922	3738	3563	3396	3237	3085	2940	2802	2671
1903	6976	6649	6338	6041	5758	5488	5231	4985	4752	4529	4317	4114	3922	3738	3563	3396	3236	3085	2940	2802	2671
1904	6976	6649	6338	6041	5758	5488	5231	4985	4752	4529	4317	4114	3921	3738	3562	3395	3236	3084	2940	2802	2670
1905	6976	6649	6338	6041	5758	5488	5230	4985	4752	4529	4317	4114	3921	3737	3562	3395	3236	3084	2939	2801	2670
1906	6975	6649	6337	6040	5757	5488	5230	4985	4751	4529	4316	4114	3921	3737	3562	3395	3235	3084	2939	2801	2669
1907	6975	6649	6337	6040	5757	5487	5230	4985	4751	4529	4316	4114	3921	3737	3562	3394	3235	3083	2938	2800	2669
1908	6975	6648	6337	6040	5757	5487	5230	4985	4751	4528	4316	4114	3921	3737	3561	3394	3235	3083	2938	2800	2668
1909	6974	6648	6336	6040	5757	5487	5230	4985	4751	4528	4316	4114	3920	3736	3561	3394	3234	3082	2937	2799	2667
1910	6974	6647	6336	6039	5756	5487	5230	4985	4751	4528	4316	4113	3920	3736	3561	3393	3234	3082	2937	2798	2667
1911	6973	6647	6336	6039	5756	5486	5229	4984	4751	4528	4316	4113	3920	3736	3560	3393	3233	3081	2936	2798	2666
1912	6972	6646	6335	6038	5756	5486	5229	4984	4750	4528	4315	4113	3920	3736	3560	3393	3233	3081	2935	2797	2665
1913	6972	6646	6335	6038	5755	5486	5229	4984	4750	4527	4315	4113	3920	3735	3560	3392	3232	3080	2935	2796	2664
1914	6971	6645	6334	6037	5755	5485	5228	4983	4750	4527	4315	4112	3919	3735	3559	3392	3232	3079	2934	2796	2664
1915	6970	6644	6333	6037	5754	5485	5228	4983	4749	4527	4314	4112	3919	3735	3559	3391	3231	3079	2933	2795	2663
1916	6969	6644	6333	6036	5754	5484	5227	4982	4749	4526	4314	4112	3919	3734	3559	3391	3231	3078	2933	2794	2662
1917	6969	6643	6332	6036	5753	5484	5227	4982	4748	4526	4314	4111	3918	3734	3558	3390	3230	3078	2932	2793	2661
1918	6967	6642	6331	6035	5752	5483	5226	4981	4748	4525	4313	4110	3917	3733	3557	3389	3229	3076	2930	2791	2659
1919	6966	6641	6330	6034	5751	5482	5225	4980	4747	4524	4312	4110	3916	3732	3556	3388	3228	3075	2929	2790	2657
1920	6965	6639	6329	6033	5751	5481	5225	4980	4747	4524	4312	4109	3916	3732	3556	3388	3228	3075	2929	2790	2657
1921	6964	6638	6328	6032	5750	5481	5224	4979	4746	4524	4311	4109	3916	3732	3556	3388	3227	3074	2928	2789	2657
1922	6964	6638	6327	6031	5749	5480	5224	4979	4746	4523	4311	4109	3916	3731	3556	3388	3227	3074	2929	2789	2657
1923	6963	6637	6326	6030	5748	5479	5223	4978	4745	4523	4311	4108	3915	3731	3555	3388	3228	3075	2929	2790	2657
1924	6962	6637	6326	6030	5747	5478	5222	4978	4745	4522	4310	4108	3915	3731	3555	3387	3227	3074	2929	2789	2657
1925	6962	6636	6325	6029	5747	5478	5221	4977	4744	4522	4310	4108	3915	3731	3555	3387	3227	3074	2928	2789	2656
1926	6961	6635	6325	6029	5746	5477	5221	4976	4744	4522	4310	4107	3914	3730	3554	3387	3226	3074	2928	2789	2656
1927	6959	6635	6324	6028	5746	5476	5220	4975	4742	4521	4309	4107	3914	3729	3553	3386	3225	3072	2926	2787	2654
1928	6958	6633	6323	6027	5745	5476	5219	4975	4742	4519	4308	4106	3913	3729	3553	3385	3224	3071	2925	2786	2653
1929	6957	6632	6322	6026	5744	5475	5218	4974	4740	4518	4306	4105	3912	3728	3552	3384	3224	3071	2925	2785	2652
1930	6957	6631	6321	6025	5744	5474	5218	4973	4740	4517	4305	4103	3911	3727	3551	3383	3223	3070	2924	2785	2652
1931	6956	6631	6320	6024	5742	5474	5217	4972	4739	4516	4304	4102	3909	3725	3550	3382	3222	3069	2923	2784	2651
1932	6954	6630	6319	6024	5742	5473	5216	4972	4738	4516	4304	4101	3908	3724	3549	3381	3221	3068	2922	2782	2649
1933	6954	6628	6319	6023	5741	5472	5216	4971	4738	4516	4303	4101	3908	3724	3548	3381	3221	3068	2922	2783	2650
1934	6954	6628	6318	6022	5740	5471	5215	4970	4738	4515	4303	4101	3908	3723	3548	3380	3221	3068	2922	2783	2650
1935	6953	6628	6317	6021	5739	5471	5214	4970	4736	4514	4302	4100	3907	3723	3547	3380	3220	3068	2922	2783	2650
1936	6953	6628	6317	6021	5738	5470	5213	4969	4735	4513	4301	4099	3906	3722	3546	3379	3219	3067	2922	2783	2650
1937	6953	6627	6317	6021	5738	5469	5212	4968	4734	4512	4300	4098	3905	3721	3546	3378	3219	3066	2921	2783	2650
1938	6953	6627	6316	6020	5738	5468	5211	4967	4734	4511	4299	4097	3904	3720	3545	3378	3218	3066	2921	2782	2650
1939	6953	6627	6316	6020	5738	5468	5211	4966	4733	4510	4298	4096	3903	3719	3544	3377	3217	3065	2920	2782	2650
1940	6953	6627	6316	6020	5737	5468	5211	4966	4732	4510	4297	4095	3902	3718	3543	3376	3217	3065	2920	2781	2650
1941	6953	6627	6316	6020	5737	5468	5211	4966	4732	4509	4297	4095	3902	3718	3542	3376	3216	3064	2919	2781	2649
1942	6953	6627	6316	6020	5737	5468	5211	4966	4732	4509	4297	4094	3901	3717	3542	3375	3216	3064	2919	2781	2649
1943	6953	6627	6316	6020	5738	5468	5211	4966	4733	4510	4297	4095	3902	3718	3543	3375	3216	3064	2920	2781	2650
1944	6953	6627	6316	6020	5737	5468	5211	4965	4732	4509	4296	4093	3900	3716	3541	3374	3214	3063	2918	2780	2649
1945	6952	6627	6316	6019	5736	5466	5209	4963	4729	4505	4293	4090	3897	3712	3537	3370	3211	3059	2915	2777	2646
1946	6949	6626	6316	6019	5735	5464	5205	4958	4723	4499	4286	4083	3889	3705	3529	3363	3204	3052	2908	2770	2639
1947	6947	6623	6315	6019	5735	5463	5204	4956	4721	4496	4282	4079	3885	3700	3525	3358	3199	3047	2903	2766	2635
1948	6946	6621	6312	6018	5735	5464	5205	4957	4721	4496	4281	4077	3883	3699	3523	3355	3196	3045	2901	2763	2632
1949	6945	6621	6311	6016	5735	5465	5206	4958	4722	4496	4281	4077	3882	3697	3521	3353	3194	3042	2898	2761	2630
1950	6945	6620	6310	6014	5733	5465	5207	4960	4723	4497	4282	4077	3882	3697	3520	3353	3193	3041	2896	2759	2628
1951	6943	6619	6309	6013	5731	5462	5205	4959	4722	4496	4281	4076	3880	3694	3517	3349	3189	3037	2893	2755	2624
1952	6940	6618	6308	6012	5729	5459	5201	4955	4719	4494	4277	4072	3876	3690	3512	3344	3184	3032	2887	2749	2618
1953	6938	6615	6307	6011	5728	5457	5198	4951	4716	4490	4274	4068	3872	3685	3507	3339	3178	3026	2881	2743	2612
1954	6930	6612	6304	6008	5724	5451	5190	4940	4703	4477	4261	4054	3857	3670	3492	3323	3163	3010	2865	2728	2597
1955	6919	6606	6300	6003	5718	5443	5178	4926	4685	4456	4239	4032	3834	3647	3468	3299	3139	2986	2842	2705	2575

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1900	2546	2427	2313	2205	2101	2003	1909	1819	1734	1653	1575	1502	1431	1364	1300	1239	1181	1126	1073	1023
1901	2546	2427	2313	2205	2101	2003	1909	1819	1734	1653	1575	1502	1431	1364	1300	1239	1181	1126	1073	1023
1902	2546	2427	2313	2204	2101	2003	1909	1819	1734	1653	1575	1502	1431	1364	1300	1239	1181	1126	1073	1023
1903	2546	2426	2313	2204	2101	2002	1909	1819	1734	1653	1575	1501	1431	1364	1300	1239	1181	1126	1073	1023
1904	2545	2426	2312	2204	2100	2002	1908	1819	1733	1652	1575	1501	1431	1364	1300	1239	1181	1125	1073	1022
1905	2545	2425	2312	2203	2100	2001	1908	1818	1733	1652	1574	1501	1430	1363	1299	1238	1180	1125	1072	1022
1906	2544	2425	2311	2203	2099	2001	1907	1818	1732	1651	1574	1500	1430	1363	1299	1238	1180	1125	1072	1022
1907	2544	2424	2310	2202	2099	2000	1906	1817	1732	1650	1573	1499	1429	1362	1298	1237	1179	1124	1071	1021
1908	2543	2423	2310	2201	2098	1999	1906	1816	1731	1650	1572	1499	1428	1361	1298	1237	1179	1123	1071	1021
1909	2542	2423	2309	2200	2097	1998	1905	1815	1730	1649	1571	1498	1428	1361	1297	1236	1178	1123	1070	1020
1910	2541	2422	2308	2199	2096	1997	1904	1814	1729	1648	1571	1497	1427	1360	1296	1235	1177	1122	1069	1019
1911	2540	2421	2307	2198	2095	1996	1903	1813	1728	1647	1569	1496	1426	1359	1295	1234	1176	1121	1069	1019
1912	2540	2420	2306	2197	2094	1995	1901	1812	1727	1646	1568	1495	1425	1358	1294	1233	1175	1120	1068	1018
1913	2539	2419	2305	2196	2093	1994	1900	1811	1726	1644	1567	1494	1423	1357	1293	1232	1174	1119	1067	1017
1914	2538	2418	2304	2195	2091	1993	1899	1810	1724	1643	1566	1492	1422	1355	1292	1231	1173	1118	1066	1016
1915	2537	2417	2303	2194	2090	1992	1898	1808	1723	1642	1565	1491	1421	1354	1291	1230	1172	1117	1065	1015
1916	2536	2416	2302	2193	2089	1990	1896	1807	1722	1641	1563	1490	1420	1353	1289	1229	1171	1116	1064	1014
1917	2535	2415	2301	2192	2088	1989	1895	1805	1720	1639	1562	1488	1418	1351	1288	1227	1170	1115	1062	1012
1918	2533	2413	2298	2189	2085	1987	1893	1803	1718	1637	1559	1486	1416	1349	1286	1225	1168	1113	1060	1011
1919	2531	2411	2296	2187	2083	1984	1890	1801	1715	1634	1557	1483	1413	1347	1283	1223	1165	1111	1058	1009
1920	2531	2410	2296	2186	2082	1983	1889	1800	1714	1633	1556	1482	1412	1346	1282	1222	1164	1109	1057	1008
1921	2530	2410	2295	2186	2082	1983	1888	1799	1713	1632	1555	1481	1411	1344	1281	1220	1163	1108	1056	1006
1922	2530	2410	2295	2185	2081	1982	1888	1798	1713	1631	1554	1480	1410	1343	1280	1220	1162	1107	1055	1005
1923	2530	2410	2295	2185	2081	1982	1887	1798	1712	1631	1553	1480	1409	1343	1279	1219	1161	1106	1054	1005
1924	2530	2409	2294	2185	2081	1981	1887	1797	1711	1630	1552	1479	1408	1342	1278	1218	1160	1105	1053	1004
1925	2530	2409	2294	2184	2080	1981	1886	1796	1710	1629	1551	1478	1407	1341	1277	1217	1159	1104	1052	1002
1926	2529	2408	2293	2184	2079	1980	1885	1795	1709	1628	1550	1476	1406	1339	1276	1215	1158	1103	1051	1001
1927	2528	2407	2292	2182	2078	1978	1884	1794	1708	1626	1549	1475	1404	1338	1274	1213	1156	1101	1049	999
1928	2527	2406	2291	2181	2077	1977	1883	1792	1707	1625	1547	1473	1403	1336	1273	1212	1154	1100	1048	998
1929	2526	2405	2290	2180	2076	1976	1882	1791	1706	1624	1546	1472	1402	1335	1271	1211	1153	1098	1046	997
1930	2525	2404	2289	2180	2075	1976	1881	1791	1705	1623	1545	1471	1401	1334	1270	1210	1152	1097	1045	996
1931	2524	2403	2288	2179	2074	1975	1880	1790	1704	1622	1544	1470	1400	1333	1269	1209	1151	1096	1044	994
1932	2523	2402	2287	2177	2073	1973	1879	1788	1702	1621	1543	1469	1398	1331	1268	1207	1149	1095	1042	993
1933	2523	2402	2287	2177	2073	1973	1879	1788	1703	1621	1543	1469	1398	1331	1267	1207	1149	1094	1042	992
1934	2523	2403	2288	2178	2073	1974	1879	1789	1703	1621	1543	1469	1398	1331	1267	1207	1149	1094	1042	992
1935	2524	2403	2288	2178	2074	1974	1879	1789	1703	1621	1543	1469	1399	1331	1268	1207	1149	1094	1042	992
1936	2524	2403	2288	2178	2074	1974	1880	1789	1703	1622	1544	1469	1399	1331	1268	1207	1149	1094	1041	992
1937	2524	2404	2289	2179	2075	1975	1880	1790	1704	1622	1544	1470	1399	1332	1268	1207	1149	1094	1042	992
1938	2525	2404	2289	2180	2075	1976	1881	1791	1705	1623	1545	1471	1400	1333	1269	1208	1150	1094	1042	992
1939	2524	2404	2290	2180	2076	1977	1882	1792	1706	1624	1546	1471	1401	1333	1269	1208	1150	1095	1042	992
1940	2524	2404	2290	2181	2076	1977	1882	1792	1706	1624	1546	1472	1401	1334	1270	1209	1150	1095	1043	992
1941	2524	2404	2290	2181	2077	1978	1883	1793	1707	1625	1547	1473	1402	1334	1270	1209	1151	1096	1043	993
1942	2524	2404	2290	2181	2077	1978	1884	1793	1707	1626	1547	1473	1402	1335	1271	1210	1151	1096	1043	993
1943	2524	2405	2291	2182	2078	1979	1885	1795	1709	1627	1549	1474	1404	1336	1272	1211	1153	1097	1044	994
1944	2523	2404	2290	2181	2077	1979	1885	1795	1709	1627	1549	1475	1404	1336	1272	1211	1153	1097	1045	994
1945	2521	2401	2287	2179	2075	1977	1883	1793	1708	1626	1548	1474	1403	1336	1272	1211	1152	1097	1044	994
1946	2514	2395	2282	2174	2071	1972	1879	1789	1704	1623	1545	1471	1401	1333	1269	1208	1150	1095	1042	992
1947	2510	2391	2278	2170	2067	1969	1876	1787	1702	1621	1543	1469	1399	1332	1268	1207	1149	1094	1041	991
1948	2508	2389	2276	2168	2066	1968	1874	1785	1700	1620	1542	1469	1399	1332	1268	1207	1149	1094	1041	991
1949	2505	2387	2274	2166	2063	1966	1872	1783	1699	1618	1541	1468	1398	1331	1267	1206	1148	1093	1041	991
1950	2504	2385	2272	2164	2062	1964	1871	1782	1698	1617	1540	1467	1397	1330	1267	1206	1148	1093	1041	991
1951	2500	2381	2268	2161	2058	1961	1868	1779	1695	1614	1538	1464	1395	1328	1265	1204	1147	1092	1039	989
1952	2494	2375	2262	2155	2053	1956	1863	1775	1690	1610	1534	1461	1391	1325	1262	1202	1144	1089	1037	987
1953	2488	2369	2257	2150	2048	1950	1858	1770	1686	1606	1530	1457	1388	1322	1259	1199	1142	1087	1035	985
1954	2473	2355	2243	2136	2035	1938	1846	1759	1675	1596	1520	1448	1379	1313	1251	1191	1135	1080	1029	979
1955	2451	2334	2222	2116	2015	1919	1828	1741	1659	1580	1505	1434	1365	1301	1239	1180	1124	1070	1019	970

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1900	975	929	886	844	805	767	731	697	664	633	603	575	548	522	498	475	452	431	411	392
1901	975	929	886	844	805	767	731	697	664	633	603	575	548	522	498	475	452	431	411	392
1902	975	929	886	844	805	767	731	697	664	633	603	575	548	522	498	474	452	431	411	392
1903	975	929	885	844	804	767	731	696	664	633	603	575	548	522	498	474	452	431	411	392
1904	974	929	885	844	804	766	731	696	664	633	603	575	548	522	498	474	452	431	411	391
1905	974	928	885	843	804	766	730	696	663	632	603	574	548	522	497	474	452	431	411	391
1906	974	928	885	843	804	766	730	696	663	632	603	574	547	522	497	474	452	431	410	391
1907	973	928	884	843	803	766	730	696	663	632	602	574	547	521	497	474	452	430	410	391
1908	973	927	884	842	803	765	729	695	663	632	602	574	547	521	497	473	451	430	410	391
1909	972	927	883	842	802	765	729	695	662	631	602	573	546	521	496	473	451	430	410	391
1910	971	926	883	841	802	764	728	694	662	631	601	573	546	520	496	473	451	430	409	390
1911	971	925	882	841	801	764	728	694	661	630	601	572	546	520	496	472	450	429	409	390
1912	970	924	881	840	800	763	727	693	661	630	600	572	545	520	495	472	450	429	409	390
1913	969	924	880	839	800	762	726	692	660	629	600	571	545	519	495	472	450	428	408	389
1914	968	923	879	838	799	761	726	692	659	628	599	571	544	519	494	471	449	428	408	389
1915	967	922	879	837	798	761	725	691	659	628	598	570	544	518	494	471	449	428	408	388
1916	966	921	878	836	797	760	724	690	658	627	598	570	543	517	493	470	448	427	407	388
1917	965	920	876	835	796	759	723	689	657	626	597	569	542	517	493	469	447	427	407	387
1918	963	918	875	834	795	757	722	688	656	625	596	568	541	516	492	469	447	426	406	387
1919	961	916	873	832	793	756	720	687	654	624	595	567	540	515	491	468	446	425	405	386
1920	960	915	872	831	792	755	720	686	654	623	594	566	539	514	490	467	445	424	404	385
1921	959	914	871	830	791	754	719	685	653	622	593	565	539	513	489	466	445	424	404	385
1922	958	913	870	829	790	753	718	684	652	621	592	565	538	513	489	466	444	423	403	384
1923	957	912	869	828	790	752	717	683	651	621	592	564	538	512	488	465	444	423	403	384
1924	956	911	868	828	789	752	716	683	651	620	591	563	537	512	488	465	443	422	402	384
1925	955	910	867	826	788	751	715	682	650	619	590	562	536	511	487	464	442	422	402	383
1926	954	909	866	825	786	749	714	681	649	618	589	562	535	510	486	463	442	421	401	382
1927	952	907	864	824	785	748	713	679	647	617	588	560	534	509	485	462	441	420	400	382
1928	951	906	863	822	784	747	712	678	646	616	587	559	533	508	484	462	440	419	400	381
1929	950	905	862	821	782	746	710	677	645	615	586	558	532	507	483	461	439	419	399	380
1930	948	903	861	820	781	745	709	676	644	614	585	558	531	506	483	460	438	418	398	380
1931	947	902	859	819	780	743	708	675	643	613	584	557	530	505	482	459	438	417	397	379
1932	946	901	858	817	779	742	707	674	642	612	583	555	529	504	481	458	437	416	397	378
1933	945	900	857	817	778	741	706	673	641	611	582	555	529	504	480	458	436	416	396	378
1934	945	900	857	816	778	741	706	672	641	610	582	554	528	503	480	457	436	415	396	377
1935	944	899	857	816	777	740	705	672	640	610	581	554	528	503	479	457	435	415	395	377
1936	944	899	856	816	777	740	705	671	640	609	581	553	527	502	479	456	435	414	395	376
1937	944	899	856	815	777	740	705	671	639	609	580	553	527	502	478	456	434	414	395	376
1938	944	899	856	815	777	740	704	671	639	609	580	553	527	502	478	456	434	414	394	376
1939	945	899	856	815	777	740	704	671	639	609	580	552	526	502	478	455	434	413	394	375
1940	945	900	856	815	777	739	704	671	639	609	580	552	526	501	478	455	434	413	394	375
1941	945	900	857	816	777	740	704	671	639	608	580	552	526	501	477	455	433	413	393	375
1942	946	900	857	816	777	740	704	671	639	608	579	552	526	501	477	455	433	413	393	375
1943	946	901	858	816	777	740	705	671	639	609	580	552	526	501	477	455	433	413	393	375
1944	947	901	858	817	777	740	705	671	639	608	579	552	526	501	477	454	433	412	393	374
1945	946	901	857	816	777	740	704	671	638	608	579	551	525	500	476	454	432	412	392	374
1946	945	899	856	815	776	738	703	669	637	607	578	550	524	499	475	453	431	411	391	373
1947	944	898	855	814	775	738	702	668	636	606	577	549	523	498	475	452	430	410	391	372
1948	943	898	855	814	775	737	702	668	636	606	577	549	523	498	474	452	430	410	390	372
1949	943	898	855	813	774	737	702	668	636	605	576	549	522	498	474	451	430	409	390	371
1950	943	898	854	813	774	737	702	668	636	605	576	549	522	497	474	451	429	409	390	371
1951	942	897	854	812	773	736	701	667	635	604	575	548	522	497	473	450	429	408	389	370
1952	940	895	852	811	772	735	699	666	634	603	574	547	520	496	472	449	428	407	388	369
1953	938	893	850	809	770	733	698	664	632	602	573	546	519	494	471	448	427	406	387	369
1954	932	888	845	804	766	729	694	661	629	598	570	542	516	491	468	445	424	404	385	366
1955	924	879	837	797	759	722	687	654	623	593	564	537	511	487	464	441	420	400	381	363

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1900	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1901	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1902	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1903	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1904	373	356	339	323	308	293	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1905	373	355	339	323	308	293	280	267	254	242	231	220	210	200	190	182	173	165	157	150
1906	373	355	339	323	308	293	280	266	254	242	231	220	210	200	190	181	173	165	157	150
1907	373	355	339	323	308	293	279	266	254	242	231	220	209	200	190	181	173	165	157	150
1908	372	355	338	322	307	293	279	266	254	242	230	220	209	200	190	181	173	165	157	150
1909	372	355	338	322	307	293	279	266	254	242	230	220	209	199	190	181	173	165	157	150
1910	372	355	338	322	307	293	279	266	253	241	230	219	209	199	190	181	173	164	157	149
1911	372	354	338	322	307	292	279	266	253	241	230	219	209	199	190	181	172	164	157	149
1912	371	354	337	322	306	292	278	265	253	241	230	219	209	199	190	181	172	164	157	149
1913	371	354	337	321	306	292	278	265	253	241	230	219	209	199	189	181	172	164	156	149
1914	371	353	337	321	306	292	278	265	252	241	229	219	208	199	189	180	172	164	156	149
1915	370	353	336	321	306	291	278	265	252	240	229	218	208	198	189	180	172	164	156	149
1916	370	352	336	320	305	291	277	264	252	240	229	218	208	198	189	180	172	164	156	149
1917	369	352	335	320	305	291	277	264	252	240	229	218	208	198	189	180	171	163	156	148
1918	369	351	335	319	304	290	276	263	251	239	228	217	207	197	188	179	171	163	155	148
1919	368	351	334	318	304	289	276	263	251	239	228	217	207	197	188	179	171	163	155	148
1920	367	350	334	318	303	289	275	263	250	238	227	217	207	197	188	179	170	162	155	148
1921	367	350	333	318	303	289	275	262	250	238	227	216	206	197	187	179	170	162	155	147
1922	366	349	333	317	302	288	275	262	250	238	227	216	206	196	187	178	170	162	154	147
1923	366	349	333	317	302	288	274	262	249	238	227	216	206	196	187	178	170	162	154	147
1924	366	348	332	317	302	288	274	261	249	237	226	216	205	196	187	178	170	162	154	147
1925	365	348	332	316	301	287	274	261	249	237	226	215	205	196	186	178	169	161	154	147
1926	364	347	331	316	301	287	273	260	248	237	226	215	205	195	186	177	169	161	154	146
1927	364	347	330	315	300	286	273	260	248	236	225	214	204	195	186	177	169	161	153	146
1928	363	346	330	314	300	286	272	259	247	236	225	214	204	194	185	177	168	161	153	146
1929	362	345	329	314	299	285	272	259	247	235	224	214	204	194	185	176	168	160	153	146
1930	362	345	329	313	299	285	271	258	246	235	224	213	203	194	185	176	168	160	152	145
1931	361	344	328	313	298	284	271	258	246	234	223	213	203	193	184	176	167	160	152	145
1932	360	343	327	312	297	283	270	257	245	234	223	212	202	193	184	175	167	159	152	145
1933	360	343	327	312	297	283	270	257	245	234	223	212	202	193	184	175	167	159	152	145
1934	359	343	327	311	297	283	269	257	245	233	222	212	202	193	184	175	167	159	151	144
1935	359	342	326	311	296	282	269	257	244	233	222	212	202	192	183	175	167	159	151	144
1936	359	342	326	310	296	282	269	256	244	233	222	211	202	192	183	174	166	159	151	144
1937	358	342	326	310	296	282	269	256	244	233	222	211	201	192	183	174	166	158	151	144
1938	358	341	325	310	295	282	268	256	244	232	221	211	201	192	183	174	166	158	151	144
1939	358	341	325	310	295	281	268	256	244	232	221	211	201	192	183	174	166	158	151	144
1940	358	341	325	310	295	281	268	255	243	232	221	211	201	191	182	174	166	158	151	144
1941	357	341	325	309	295	281	268	255	243	232	221	211	201	191	182	174	166	158	150	143
1942	357	340	324	309	295	281	268	255	243	232	221	210	201	191	182	174	165	158	150	143
1943	357	340	324	309	294	281	267	255	243	232	221	210	200	191	182	174	165	158	150	143
1944	357	340	324	309	294	280	267	255	243	231	220	210	200	191	182	173	165	157	150	143
1945	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150	143
1946	355	339	323	307	293	279	266	253	242	230	219	209	199	190	181	173	164	157	149	142
1947	355	338	322	307	292	279	265	253	241	230	219	209	199	190	181	172	164	156	149	142
1948	354	337	322	306	292	278	265	253	241	229	219	208	199	189	180	172	164	156	149	142
1949	354	337	321	306	292	278	265	252	240	229	218	208	198	189	180	172	164	156	149	142
1950	353	337	321	306	291	277	264	252	240	229	218	208	198	189	180	171	163	156	148	141
1951	353	336	320	305	291	277	264	251	240	228	218	207	198	188	179	171	163	155	148	141
1952	352	335	319	304	290	276	263	251	239	228	217	207	197	188	179	170	162	155	148	141
1953	351	334	318	303	289	275	262	250	238	227	216	206	196	187	178	170	162	154	147	140
1954	349	332	316	301	287	273	261	248	236	225	215	205	195	186	177	169	161	153	146	139
1955	345	329	313	298	284	271	258	246	234	223	213	202	193	184	175	167	159	152	145	138

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1900	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1901	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1902	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1903	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1904	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1224
1905	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1224
1906	143	136	130	124	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1224
1907	143	136	130	124	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1223
1908	143	136	130	123	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1222
1909	143	136	129	123	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1222
1910	142	136	129	123	118	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1221
1911	142	136	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1220
1912	142	136	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1219
1913	142	135	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1218
1914	142	135	129	123	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	1216
1915	142	135	129	123	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	1215
1916	142	135	129	123	117	111	106	101	96	92	88	84	80	76	72	69	66	63	60	1214
1917	141	135	128	122	117	111	106	101	96	92	87	83	79	76	72	69	66	63	60	1212
1918	141	135	128	122	116	111	106	101	96	92	87	83	79	76	72	69	65	62	59	1210
1919	141	134	128	122	116	111	106	101	96	91	87	83	79	75	72	69	65	62	59	1207
1920	141	134	128	122	116	111	105	101	96	91	87	83	79	75	72	68	65	62	59	1206
1921	140	134	128	122	116	110	105	100	96	91	87	83	79	75	72	68	65	62	59	1204
1922	140	134	127	121	116	110	105	100	96	91	87	83	79	75	72	68	65	62	59	1203
1923	140	134	127	121	116	110	105	100	95	91	87	83	79	75	72	68	65	62	59	1201
1924	140	133	127	121	116	110	105	100	95	91	87	83	79	75	71	68	65	62	59	1200
1925	140	133	127	121	115	110	105	100	95	91	86	82	79	75	71	68	65	62	59	1198
1926	140	133	127	121	115	110	105	100	95	91	86	82	78	75	71	68	65	62	59	1196
1927	139	133	126	121	115	110	104	100	95	90	86	82	78	75	71	68	65	62	59	1193
1928	139	132	126	120	115	109	104	99	95	90	86	82	78	74	71	68	64	61	59	1191
1929	139	132	126	120	114	109	104	99	94	90	86	82	78	74	71	68	64	61	58	1189
1930	138	132	126	120	114	109	104	99	94	90	86	82	78	74	71	67	64	61	58	1187
1931	138	132	126	120	114	109	104	99	94	90	86	82	78	74	71	67	64	61	58	1185
1932	138	131	125	119	114	108	103	99	94	90	85	81	78	74	70	67	64	61	58	1182
1933	138	131	125	119	114	108	103	98	94	89	85	81	77	74	70	67	64	61	58	1181
1934	138	131	125	119	114	108	103	98	94	89	85	81	77	74	70	67	64	61	58	1179
1935	137	131	125	119	113	108	103	98	94	89	85	81	77	74	70	67	64	61	58	1178
1936	137	131	125	119	113	108	103	98	93	89	85	81	77	74	70	67	64	61	58	1177
1937	137	131	125	119	113	108	103	98	93	89	85	81	77	73	70	67	64	61	58	1175
1938	137	131	124	119	113	108	103	98	93	89	85	81	77	73	70	67	64	61	58	1174
1939	137	130	124	119	113	108	103	98	93	89	85	81	77	73	70	67	64	61	58	1174
1940	137	130	124	118	113	108	103	98	93	89	85	81	77	73	70	67	63	60	58	1172
1941	137	130	124	118	113	108	102	98	93	89	85	81	77	73	70	67	63	60	58	1171
1942	137	130	124	118	113	107	102	98	93	89	84	81	77	73	70	66	63	60	58	1170
1943	137	130	124	118	113	107	102	98	93	89	84	81	77	73	70	66	63	60	58	1170
1944	136	130	124	118	113	107	102	97	93	89	84	80	77	73	70	66	63	60	57	1169
1945	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	57	1167
1946	136	129	123	118	112	107	102	97	92	88	84	80	76	73	69	66	63	60	57	1163
1947	135	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	57	1161
1948	135	129	123	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	57	1159
1949	135	129	123	117	111	106	101	96	92	88	84	80	76	72	69	66	63	60	57	1157
1950	135	128	122	117	111	106	101	96	92	88	83	80	76	72	69	66	63	60	57	1155
1951	135	128	122	116	111	106	101	96	92	87	83	79	76	72	69	65	62	59	57	1153
1952	134	128	122	116	111	105	101	96	91	87	83	79	75	72	68	65	62	59	56	1149
1953	134	127	121	116	110	105	100	95	91	87	83	79	75	72	68	65	62	59	56	1145
1954	133	126	121	115	109	104	99	95	90	86	82	78	75	71	68	65	62	59	56	1137
1955	131	125	119	114	108	103	98	94	89	85	81	77	74	70	67	64	61	58	55	1125

Table 19 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																				
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1956	6912	6595	6294	6001	5716	5441	5176	4921	4677	4446	4227	4019	3821	3633	3454	3284	3123	2971	2826	2689	2559
1957	6899	6588	6283	5994	5711	5434	5167	4910	4663	4429	4206	3996	3797	3608	3429	3259	3098	2946	2801	2665	2535
1958	6889	6576	6277	5984	5705	5431	5162	4904	4656	4419	4194	3981	3780	3590	3411	3240	3079	2926	2781	2645	2515
1959	6882	6566	6266	5979	5697	5427	5163	4904	4656	4417	4190	3974	3770	3579	3399	3228	3066	2913	2768	2631	2501
1960	7670	6559	6256	5967	5689	5415	5153	4896	4646	4406	4177	3959	3753	3559	3377	3205	3043	2890	2745	2608	2479
1961	6290	7311	6248	5955	5673	5401	5134	4878	4628	4385	4154	3934	3726	3529	3345	3172	3010	2857	2712	2576	2447
1962	5144	5995	6965	5949	5664	5390	5126	4865	4617	4376	4142	3921	3710	3512	3325	3150	2986	2833	2688	2552	2423
1963	4300	4903	5712	6633	5661	5386	5121	4864	4613	4374	4142	3919	3707	3507	3318	3141	2975	2819	2674	2537	2408
1964	3719	4098	4672	5441	6314	5385	5119	4863	4616	4374	4145	3923	3710	3508	3318	3138	2970	2812	2665	2528	2398
1965	3348	3545	3905	4451	5181	6010	5124	4868	4622	4385	4154	3935	3723	3520	3328	3147	2976	2816	2666	2527	2396
1966	3136	3191	3378	3720	4238	4930	5714	4868	4622	4386	4159	3938	3729	3527	3333	3151	2979	2816	2665	2523	2390
1967	3020	2989	3034	3200	3507	3971	4587	5279	4467	4215	3977	3754	3541	3341	3152	2973	2805	2647	2500	2363	2235
1968	2968	2878	2841	2872	3013	3280	3684	4221	4821	4050	3798	3565	3350	3148	2962	2787	2623	2471	2329	2196	2074
1969	2933	2829	2738	2697	2718	2839	3075	3437	3921	4459	3732	3489	3267	3063	2873	2699	2537	2385	2244	2114	1993
1970	2855	2796	2696	2609	2568	2587	2701	2925	3267	3726	4235	3544	3312	3100	2906	2726	2560	2406	2262	2128	2005
1971	2682	2721	2664	2568	2485	2445	2462	2570	2781	3106	3540	4023	3366	3145	2943	2759	2587	2430	2283	2146	2020
1972	2428	2557	2593	2539	2447	2367	2328	2343	2444	2645	2953	3365	3824	3198	2988	2796	2621	2457	2308	2168	2038
1973	2143	2314	2436	2471	2418	2329	2252	2214	2228	2323	2513	2805	3195	3630	3035	2835	2653	2486	2331	2189	2057
1974	1890	2042	2204	2320	2351	2298	2212	2136	2098	2109	2197	2375	2649	3017	3426	2864	2674	2502	2344	2197	2063
1975	1734	1802	1946	2100	2209	2237	2186	2102	2029	1992	2001	2084	2252	2511	2859	3245	2712	2532	2369	2219	2080
1976	1734	1652	1717	1854	1999	2101	2127	2076	1995	1925	1888	1896	1974	2132	2377	2705	3070	2565	2395	2239	2098
1977	2016	1653	1574	1635	1765	1902	1998	2020	1971	1893	1825	1790	1796	1869	2018	2249	2559	2904	2426	2264	2117
1978	3051	1922	1575	1500	1557	1679	1808	1898	1918	1870	1795	1729	1695	1701	1769	1910	2128	2420	2746	2294	2141
1979	5531	2908	1831	1500	1427	1480	1595	1716	1800	1817	1770	1698	1635	1602	1607	1671	1803	2009	2284	2591	2164
1980	2555	5272	2770	1744	1428	1358	1407	1515	1629	1707	1722	1677	1608	1548	1516	1520	1580	1704	1898	2158	2447
1981	2851	2435	5023	2638	1659	1357	1288	1334	1434	1540	1613	1626	1582	1516	1459	1428	1431	1488	1604	1786	2031
1982	3124	2717	2320	4780	2508	1575	1286	1219	1260	1353	1452	1518	1529	1487	1424	1369	1340	1342	1394	1503	1673
1983	3801	2978	2589	2209	4547	2383	1495	1219	1155	1192	1279	1371	1432	1442	1401	1341	1289	1261	1263	1312	1414
1984	3434	3623	2836	2462	2098	4310	2254	1410	1148	1085	1118	1198	1282	1338	1346	1307	1250	1201	1174	1175	1220
1985	2962	3273	3449	2695	2336	1984	4065	2119	1322	1073	1012	1041	1113	1189	1240	1246	1209	1155	1109	1084	1084
1986	5781	2823	3115	3277	2555	2207	1868	3813	1981	1232	997	938	963	1028	1097	1142	1146	1111	1061	1018	994
1987	5150	5510	2688	2963	3112	2421	2087	1763	3590	1861	1155	934	877	899	959	1022	1063	1067	1033	986	945
1988	3412	4909	5248	2559	2818	2957	2298	1978	1668	3395	1758	1091	881	827	847	902	961	999	1002	970	925
1989	4678	3252	4675	4994	2432	2673	2800	2172	1866	1572	3193	1651	1023	826	774	792	844	898	933	935	905
1990	2608	4459	3098	4449	4747	2308	2533	2649	2051	1760	1480	3003	1552	961	774	726	742	790	841	873	875
1991	1826	2485	4246	2947	4227	4501	2184	2392	2497	1930	1653	1388	2814	1452	898	723	677	693	737	784	814
1992	3357	1740	2366	4037	2797	4002	4250	2057	2247	2339	1804	1543	1294	2618	1350	834	671	628	641	682	725
1993	7065	3200	1657	2252	3838	2655	3793	4021	1943	2119	2203	1697	1449	1214	2455	1265	781	628	587	600	637
1994	9334	6734	3047	1576	2138	3636	2509	3574	3780	1822	1983	2058	1583	1350	1130	2283	1175	725	583	545	556
1995	3483	8897	6412	2898	1497	2026	3437	2366	3363	3549	1707	1855	1923	1477	1259	1053	2126	1094	674	542	506
1996	10088	3320	8473	6101	2753	1419	1917	3245	2229	3163	3332	1601	1737	1799	1381	1176	982	1983	1020	629	505
1997	2856	9615	3161	8059	5792	2608	1341	1807	3051	2091	2962	3115	1494	1620	1676	1285	1094	914	1843	947	584
1998	11708	2722	9154	3005	7645	5480	2460	1261	1694	2853	1951	2757	2895	1387	1502	1552	1189	1012	844	1703	875
1999	30667	11159	2586	8664	2828	7142	5078	2260	1149	1533	2564	1743	2452	2565	1225	1323	1364	1043	886	738	1487
2000	17745	29230	10630	2462	8238	2685	6771	4806	2136	1085	1445	2415	1640	2306	2410	1150	1242	1280	979	831	693
2001	22482	16913	27852	10125	2344	7838	2553	6432	4563	2027	1029	1369	2288	1553	2183	2281	1088	1175	1211	926	786
2002	17955	21428	16117	26533	9641	2230	7454	2426	6110	4332	1923	976	1298	2168	1472	2068	2161	1031	1113	1147	877
2003	11196	17114	20421	15357	25275	9181	2123	7094	2308	5811	4118	1828	927	1234	2060	1399	1965	2053	979	1057	1089
2004	10522	10672	16307	19450	14617	24039	8725	2016	6730	2188	5505	3899	1730	877	1167	1948	1322	1857	1940	925	998
2005	20008	10029	10168	15529	18510	13899	22836	8280	1911	6375	2071	5207	3687	1635	829	1102	1839	1248	1753	1831	873
2006	26161	19071	9557	9687	14790	17621	13225	21718	7871	1816	6055	1967	4943	3499	1551	786	1045	1744	1184	1662	1736
2007	39113	24935	18168	9099	9214	14051	16719	12531	20552	7440	1715	5713	1854	4658	3295	1460	740	983	1641	1113	1563
2008	6220	37280	23764	17312	8668	8776	13378	15913	11924	19551	7076	1631	5431	1763	4427	3132	1388	703	934	1559	1058
2009	6370	5929	35530	22645	16493	8257	8356	12736	15145	11345	18598	6730	1551	5164	1676	4209	2977	1319	668	888	1482

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1956	2436	2319	2208	2102	2002	1906	1816	1729	1647	1569	1494	1423	1356	1291	1230	1172	1116	1063	1012	964
1957	2412	2296	2185	2080	1980	1886	1796	1710	1629	1551	1478	1408	1341	1277	1216	1158	1103	1051	1001	953
1958	2393	2277	2167	2062	1963	1869	1779	1694	1614	1537	1464	1394	1328	1265	1205	1147	1093	1041	991	944
1959	2379	2263	2153	2048	1950	1856	1767	1682	1602	1525	1453	1384	1318	1255	1196	1139	1085	1033	984	937
1960	2356	2241	2131	2027	1929	1836	1747	1664	1584	1508	1436	1368	1303	1241	1182	1126	1072	1021	973	926
1961	2325	2210	2101	1998	1901	1809	1721	1638	1559	1485	1414	1346	1282	1221	1163	1108	1055	1005	957	911
1962	2301	2186	2078	1976	1879	1787	1700	1618	1540	1466	1396	1329	1265	1205	1148	1093	1041	992	944	899
1963	2286	2171	2063	1960	1864	1772	1686	1604	1526	1452	1382	1316	1253	1193	1136	1082	1031	982	935	891
1964	2276	2160	2051	1949	1852	1761	1674	1592	1515	1442	1372	1306	1243	1184	1127	1073	1022	974	927	883
1965	2273	2157	2047	1944	1847	1755	1669	1587	1509	1436	1366	1300	1238	1178	1122	1068	1017	969	923	879
1966	2267	2150	2040	1936	1839	1747	1660	1578	1500	1427	1358	1292	1229	1170	1114	1061	1010	962	916	872
1967	2116	2006	1902	1804	1711	1625	1543	1466	1393	1324	1260	1198	1140	1085	1033	983	936	891	849	808
1968	1960	1855	1757	1665	1578	1497	1421	1349	1281	1218	1157	1101	1047	996	948	902	859	817	778	741
1969	1881	1777	1681	1592	1508	1429	1355	1286	1221	1160	1102	1047	996	947	901	857	816	777	739	704
1970	1890	1783	1685	1594	1509	1429	1355	1285	1219	1158	1099	1045	993	944	898	854	813	773	736	701
1971	1902	1793	1692	1598	1512	1431	1356	1285	1219	1157	1098	1043	991	942	896	852	810	771	734	698
1972	1918	1806	1702	1607	1518	1435	1359	1288	1220	1157	1098	1043	990	941	894	850	809	769	732	697
1973	1933	1819	1713	1614	1524	1439	1361	1289	1221	1157	1097	1041	989	939	892	848	806	767	729	694
1974	1938	1822	1714	1614	1521	1435	1356	1282	1214	1150	1090	1034	981	931	884	840	798	759	722	687
1975	1953	1834	1724	1621	1527	1439	1358	1283	1213	1148	1088	1031	978	928	881	836	795	755	718	683
1976	1966	1845	1733	1629	1532	1443	1360	1283	1212	1146	1085	1028	974	924	876	832	790	751	713	678
1977	1983	1858	1744	1638	1539	1448	1363	1285	1212	1145	1083	1025	971	920	873	828	786	746	709	674
1978	2001	1874	1756	1649	1548	1455	1368	1288	1214	1145	1082	1023	968	917	869	824	782	743	705	670
1979	2019	1888	1768	1656	1554	1460	1371	1290	1214	1144	1080	1020	964	913	865	819	777	737	700	665
1980	2044	1907	1782	1669	1563	1467	1378	1294	1217	1146	1080	1019	962	910	861	816	773	733	696	660
1981	2303	1923	1794	1676	1569	1470	1380	1296	1217	1145	1078	1015	958	905	855	810	767	727	689	654
1982	1902	2156	1800	1679	1569	1469	1376	1291	1212	1138	1071	1008	950	896	846	800	757	717	680	645
1983	1573	1788	2027	1692	1578	1474	1380	1292	1213	1139	1070	1006	947	892	841	795	751	711	674	638
1984	1315	1463	1662	1884	1572	1466	1370	1282	1201	1127	1058	993	934	879	828	782	738	698	661	626
1985	1126	1213	1349	1532	1736	1449	1351	1262	1181	1106	1037	974	915	860	810	763	719	679	642	608
1986	994	1032	1111	1235	1403	1589	1326	1236	1154	1080	1011	949	891	836	786	740	697	658	621	587
1987	923	922	957	1030	1145	1300	1472	1228	1145	1069	1000	936	878	825	774	728	685	645	609	575
1988	887	865	865	897	965	1073	1218	1379	1150	1072	1001	937	877	822	772	725	682	641	604	570
1989	863	827	807	806	835	899	999	1134	1284	1071	998	932	872	816	765	718	675	634	597	562
1990	846	807	773	754	753	781	840	933	1059	1199	1000	932	870	814	762	715	671	630	592	557
1991	815	788	751	719	701	700	726	781	868	984	1115	929	866	809	756	708	664	623	585	550
1992	752	753	728	693	664	647	646	670	720	800	908	1028	857	799	746	697	653	612	575	539
1993	677	703	703	680	648	620	604	604	625	673	747	848	960	800	746	696	651	609	572	536
1994	591	628	651	651	630	600	574	560	559	579	623	692	785	888	741	690	644	603	564	529
1995	517	549	583	605	605	585	557	533	520	519	537	578	642	728	825	687	640	598	559	523
1996	472	481	511	543	563	563	544	518	496	484	483	500	538	597	678	767	640	596	556	520
1997	469	438	447	474	504	523	523	505	481	460	449	448	464	499	554	629	712	593	553	516
1998	539	433	404	412	438	465	482	482	466	443	424	414	413	428	460	511	579	656	547	509
1999	764	470	377	352	359	381	404	419	419	405	386	369	359	359	372	400	444	503	570	475
2000	1395	716	441	354	330	337	357	379	393	393	379	361	346	337	336	348	375	416	472	534
2001	655	1319	677	417	334	312	318	338	358	372	371	359	342	327	318	318	329	354	393	446
2002	744	620	1249	641	395	317	295	301	320	339	352	352	340	323	309	301	301	312	335	372
2003	833	707	589	1186	609	375	301	281	286	303	322	334	334	322	307	294	286	286	296	318
2004	1029	786	667	556	1120	575	354	284	265	270	287	304	315	315	304	290	277	270	270	279
2005	942	970	742	630	525	1057	542	334	268	250	255	270	287	297	297	287	273	262	255	254
2006	828	893	920	703	597	498	1002	514	316	254	237	242	256	272	282	282	272	259	248	242
2007	1632	778	840	865	661	561	468	941	483	297	239	223	227	241	256	265	265	256	244	233
2008	1485	1551	739	798	822	628	533	444	894	459	283	227	211	216	229	243	252	252	243	231
2009	1005	1411	1474	703	758	781	597	507	422	850	436	268	215	201	205	217	231	239	239	231

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1956	918	874	832	792	754	717	683	650	619	589	561	534	508	484	460	438	417	397	378	360
1957	908	864	823	783	746	710	676	643	612	583	555	528	503	479	456	434	413	393	374	356
1958	899	856	815	776	739	703	670	637	607	578	550	523	498	474	451	430	409	389	371	353
1959	892	850	809	771	734	698	665	633	603	574	546	520	495	471	448	427	406	387	368	350
1960	882	840	800	762	725	691	658	626	596	567	540	514	489	466	443	422	402	382	364	347
1961	868	827	787	750	714	680	647	616	587	558	532	506	482	459	436	415	395	376	358	341
1962	857	816	777	740	705	671	639	608	579	551	525	500	476	453	431	410	391	372	354	337
1963	848	808	769	733	698	665	633	603	574	546	520	495	471	449	427	406	387	368	351	334
1964	841	801	763	727	692	659	628	598	569	542	516	491	468	445	424	403	384	365	348	331
1965	837	797	759	723	689	656	625	595	566	539	513	489	465	443	422	401	382	364	346	330
1966	831	791	754	718	684	651	620	591	563	536	510	486	462	440	419	399	380	361	344	327
1967	770	733	698	665	633	603	574	547	521	496	472	450	428	408	388	369	352	335	319	303
1968	706	672	640	610	581	553	527	502	478	455	433	412	393	374	356	339	323	307	292	278
1969	670	638	608	579	551	525	500	476	454	432	411	392	373	355	338	322	307	292	278	264
1970	667	635	605	576	549	523	498	474	452	430	410	390	371	354	337	321	305	291	277	263
1971	665	633	603	574	547	521	496	472	450	428	408	388	370	352	335	319	304	290	276	262
1972	663	631	601	572	545	519	494	471	448	427	407	387	369	351	335	319	303	289	275	262
1973	660	629	598	570	543	517	492	469	446	425	405	386	367	350	333	317	302	288	274	261
1974	654	622	592	564	537	511	487	463	441	420	400	381	363	346	329	314	299	284	271	258
1975	650	618	588	560	533	508	483	460	438	417	398	379	361	343	327	311	297	283	269	256
1976	645	614	584	556	529	504	479	457	435	414	394	376	358	341	324	309	294	280	267	254
1977	641	609	580	552	525	500	476	453	431	411	391	373	355	338	322	306	292	278	265	252
1978	637	605	576	548	521	496	472	449	428	407	388	370	352	335	319	304	290	276	263	250
1979	631	600	571	543	516	491	467	445	424	403	384	366	348	332	316	301	286	273	260	247
1980	627	596	566	538	512	487	463	441	420	400	380	362	345	329	313	298	284	270	257	245
1981	621	590	560	532	506	481	458	436	415	395	376	358	341	324	309	294	280	267	254	242
1982	612	580	551	524	498	473	450	428	407	388	369	351	334	318	303	289	275	262	249	238
1983	605	574	545	518	492	468	445	423	402	383	364	347	330	314	299	285	271	258	246	234
1984	593	562	533	506	481	457	434	413	393	373	355	338	322	306	292	278	265	252	240	228
1985	576	546	518	491	466	443	420	400	380	361	344	327	311	296	282	269	256	243	232	221
1986	556	527	499	473	449	426	405	384	365	347	330	314	299	285	271	258	245	234	223	212
1987	544	515	487	462	438	415	394	374	356	338	321	306	291	277	263	251	239	227	216	206
1988	538	509	482	456	432	410	389	369	350	333	316	301	286	272	259	246	235	223	213	202
1989	530	501	473	448	424	402	381	362	343	326	310	294	280	266	253	241	229	218	208	198
1990	525	495	467	442	418	396	375	356	338	321	304	289	275	261	249	236	225	214	204	194
1991	518	488	460	434	411	389	368	349	331	314	298	283	269	255	243	231	220	209	199	189
1992	507	477	450	424	400	379	358	339	322	305	289	275	261	248	235	224	213	202	193	183
1993	504	473	446	420	396	374	353	334	317	300	285	270	256	243	231	220	209	199	189	180
1994	496	466	438	412	388	366	346	327	309	293	278	263	250	237	225	214	203	193	184	175
1995	491	461	433	407	383	360	340	321	303	287	272	258	244	232	220	209	199	189	179	171
1996	487	457	429	402	378	356	335	316	299	282	267	253	240	227	216	205	194	185	176	167
1997	483	452	424	398	373	351	330	311	293	277	262	248	235	222	211	200	190	180	171	163
1998	476	445	416	390	366	344	323	304	287	270	255	241	228	216	205	194	184	175	166	158
1999	443	413	386	362	339	318	299	281	264	249	235	222	210	198	188	178	169	160	152	144
2000	445	415	387	362	339	318	298	280	263	248	233	220	208	196	186	176	167	158	150	142
2001	505	421	392	366	342	320	300	282	265	249	234	221	208	196	186	176	166	158	150	142
2002	422	478	398	371	346	324	303	284	267	251	236	222	209	197	186	176	166	158	149	142
2003	353	401	454	378	352	329	308	288	270	253	238	224	210	198	187	177	167	158	150	142
2004	300	334	379	428	357	333	311	291	272	255	239	225	211	199	187	177	167	158	149	141
2005	264	283	315	357	404	337	314	293	274	256	240	226	212	199	187	177	167	157	149	141
2006	241	250	269	298	338	383	319	297	278	260	243	228	214	201	189	178	167	158	149	141
2007	227	227	235	252	280	318	360	300	280	261	244	228	214	201	189	177	167	157	148	140
2008	221	216	215	223	240	266	302	342	285	266	248	232	217	203	191	179	169	159	149	141
2009	220	210	205	205	212	228	253	287	325	271	252	236	220	206	193	181	170	160	151	142

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1956	343	327	311	296	282	269	256	244	232	221	211	201	191	182	174	166	158	150	143	137
1957	339	323	308	293	279	266	253	241	230	219	208	199	189	180	172	164	156	149	142	135
1958	336	320	305	290	276	263	251	239	227	217	206	197	187	179	170	162	154	147	140	134
1959	334	318	302	288	274	261	249	237	226	215	205	195	186	177	169	161	153	146	139	133
1960	330	314	299	285	271	258	246	234	223	212	202	193	184	175	167	159	151	144	137	131
1961	325	309	294	280	267	254	242	230	219	209	199	190	181	172	164	156	149	142	135	129
1962	321	305	291	277	263	251	239	227	217	206	196	187	178	170	162	154	147	140	133	127
1963	318	302	288	274	261	248	237	225	214	204	195	185	176	168	160	153	145	139	132	126
1964	315	300	286	272	259	246	235	223	213	203	193	184	175	167	159	151	144	137	131	125
1965	314	299	284	271	258	245	234	222	212	202	192	183	174	166	158	150	143	137	130	124
1966	312	297	282	269	256	244	232	221	210	200	191	182	173	165	157	149	142	136	129	123
1967	289	275	262	249	237	226	215	205	195	185	177	168	160	152	145	138	132	125	120	114
1968	265	252	240	228	217	207	197	188	179	170	162	154	147	140	133	127	121	115	110	104
1969	252	240	228	217	207	197	187	178	170	162	154	146	139	133	126	120	115	109	104	99
1970	251	239	227	216	206	196	186	177	169	161	153	146	139	132	126	120	114	109	104	99
1971	250	238	226	215	205	195	186	177	168	160	153	145	138	132	125	119	114	108	103	98
1972	249	237	226	215	205	195	185	176	168	160	152	145	138	131	125	119	113	108	103	98
1973	248	236	225	214	204	194	185	176	167	159	152	144	137	131	124	119	113	107	102	97
1974	245	234	222	212	202	192	183	174	165	158	150	143	136	129	123	117	112	106	101	96
1975	244	232	221	210	200	191	181	173	164	157	149	142	135	129	122	116	111	106	101	96
1976	242	230	219	209	199	189	180	171	163	155	148	141	134	128	121	116	110	105	100	95
1977	240	229	218	207	197	188	179	170	162	154	147	140	133	127	120	115	109	104	99	94
1978	238	227	216	206	196	186	177	169	161	153	146	139	132	126	120	114	108	103	98	93
1979	236	224	214	203	194	184	176	167	159	151	144	137	131	124	118	113	107	102	97	93
1980	233	222	212	202	192	183	174	166	158	150	143	136	129	123	117	112	106	101	96	92
1981	230	220	209	199	190	180	172	164	156	148	141	134	128	122	116	110	105	100	95	91
1982	226	216	205	195	186	177	169	161	153	146	139	132	126	120	114	108	103	98	93	89
1983	223	213	202	193	184	175	166	159	151	144	137	130	124	118	112	107	102	97	92	88
1984	218	207	197	188	179	170	162	155	147	140	133	127	121	115	110	104	99	94	90	86
1985	210	200	191	182	173	165	157	149	142	135	129	123	117	111	106	101	96	91	87	83
1986	202	192	183	174	166	158	151	143	137	130	124	118	112	107	102	97	92	88	84	80
1987	196	187	178	169	161	154	146	139	133	126	120	115	109	104	99	94	90	85	81	77
1988	193	184	175	167	159	151	144	137	130	124	118	113	107	102	97	93	88	84	80	76
1989	188	179	171	163	155	148	141	134	127	121	116	110	105	100	95	90	86	82	78	74
1990	185	176	167	159	152	145	138	131	125	119	113	108	103	98	93	89	84	80	77	73
1991	180	172	163	156	148	141	134	128	122	116	111	105	100	95	91	87	82	78	75	71
1992	174	166	158	151	143	137	130	124	118	112	107	102	97	92	88	84	80	76	72	69
1993	171	163	155	148	141	134	127	121	116	110	105	100	95	91	86	82	78	74	71	67
1994	166	158	151	143	137	130	124	118	112	107	102	97	92	88	84	80	76	72	69	66
1995	162	154	147	140	133	127	121	115	109	104	99	95	90	86	82	78	74	71	67	64
1996	159	151	144	137	130	124	118	112	107	102	97	92	88	84	80	76	72	69	66	62
1997	155	147	140	133	127	121	115	109	104	99	94	90	86	82	78	74	70	67	64	61
1998	150	143	136	129	123	117	111	106	101	96	91	87	83	79	75	72	68	65	62	59
1999	137	130	124	118	112	107	101	97	92	88	83	79	76	72	69	65	62	59	56	54
2000	135	129	122	116	110	105	100	95	91	86	82	78	74	71	67	64	61	58	56	53
2001	135	128	121	115	110	104	99	94	90	86	81	78	74	70	67	64	61	58	55	52
2002	134	127	121	115	109	104	99	94	89	85	81	77	73	70	67	63	60	58	55	52
2003	134	128	121	115	109	104	99	94	89	85	81	77	73	70	66	63	60	57	55	52
2004	134	127	120	114	109	103	98	93	89	84	80	76	73	69	66	63	60	57	54	52
2005	133	126	120	114	108	102	97	92	88	84	79	76	72	68	65	62	59	56	54	51
2006	133	126	120	113	108	102	97	92	88	83	79	75	72	68	65	62	59	56	53	51
2007	132	125	119	112	107	101	96	91	87	82	78	74	71	67	64	61	58	55	53	50
2008	133	126	119	113	107	101	96	91	87	82	78	74	71	67	64	61	58	55	53	50
2009	134	126	120	113	107	102	96	91	87	82	78	74	71	67	64	61	58	55	52	50

Table 20 (continued). Female numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1956	130	124	118	113	107	102	98	93	89	85	81	77	73	70	67	63	60	58	55	1116
1957	129	123	117	111	106	101	96	92	88	84	80	76	72	69	66	63	60	57	54	1103
1958	127	121	116	110	105	100	95	91	87	83	79	75	72	68	65	62	59	56	54	1091
1959	126	120	115	109	104	99	95	90	86	82	78	74	71	68	64	61	59	56	53	1082
1960	125	119	113	108	103	98	94	89	85	81	77	74	70	67	64	61	58	55	53	1069
1961	123	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	57	54	52	1051
1962	121	115	110	105	100	95	91	86	82	79	75	71	68	65	62	59	56	53	51	1037
1963	120	114	109	104	99	94	90	86	82	78	74	71	67	64	61	58	56	53	50	1026
1964	119	113	108	103	98	93	89	85	81	77	73	70	67	64	61	58	55	52	50	1016
1965	118	113	107	102	97	93	88	84	80	77	73	70	66	63	60	57	55	52	50	1010
1966	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	57	54	52	49	1002
1967	109	103	99	94	89	85	81	77	74	70	67	64	61	58	55	53	50	48	46	928
1968	99	95	90	86	82	78	74	71	68	64	61	59	56	53	51	48	46	44	42	850
1969	94	90	86	82	78	74	71	67	64	61	58	56	53	50	48	46	44	42	40	806
1970	94	89	85	81	77	74	70	67	64	61	58	55	53	50	48	46	43	41	39	802
1971	94	89	85	81	77	73	70	67	64	61	58	55	52	50	48	45	43	41	39	798
1972	93	89	85	81	77	73	70	66	63	60	57	55	52	50	47	45	43	41	39	795
1973	93	88	84	80	76	73	69	66	63	60	57	54	52	49	47	45	43	41	39	791
1974	92	87	83	79	76	72	69	65	62	59	57	54	51	49	47	44	42	40	38	781
1975	91	87	83	79	75	71	68	65	62	59	56	53	51	49	46	44	42	40	38	775
1976	90	86	82	78	74	71	67	64	61	58	56	53	50	48	46	44	42	40	38	769
1977	90	85	81	77	74	70	67	64	61	58	55	53	50	48	45	43	41	39	37	762
1978	89	85	81	77	73	70	66	63	60	57	55	52	50	47	45	43	41	39	37	755
1979	88	84	80	76	72	69	66	63	60	57	54	52	49	47	45	42	40	39	37	747
1980	87	83	79	75	72	68	65	62	59	56	54	51	49	46	44	42	40	38	36	739
1981	86	82	78	74	71	67	64	61	58	55	53	50	48	46	44	41	40	38	36	729
1982	85	81	77	73	70	66	63	60	57	54	52	49	47	45	43	41	39	37	35	715
1983	84	80	76	72	69	65	62	59	56	54	51	49	46	44	42	40	38	36	35	705
1984	81	78	74	70	67	64	61	58	55	52	50	48	45	43	41	39	37	36	34	687
1985	79	75	71	68	65	62	59	56	53	51	48	46	44	42	40	38	36	34	33	663
1986	76	72	69	65	62	59	56	54	51	49	46	44	42	40	38	36	35	33	31	636
1987	74	70	67	63	60	58	55	52	50	47	45	43	41	39	37	35	34	32	30	618
1988	72	69	66	62	59	57	54	51	49	46	44	42	40	38	36	35	33	31	30	607
1989	71	67	64	61	58	55	53	50	48	45	43	41	39	37	36	34	32	31	29	592
1990	69	66	63	60	57	54	52	49	47	44	42	40	38	37	35	33	32	30	29	580
1991	68	64	61	58	56	53	50	48	46	43	41	39	37	36	34	32	31	29	28	566
1992	66	62	59	57	54	51	49	46	44	42	40	38	36	35	33	31	30	28	27	547
1993	64	61	58	55	53	50	48	46	43	41	39	37	36	34	32	31	29	28	27	536
1994	62	59	57	54	51	49	46	44	42	40	38	36	35	33	31	30	28	27	26	520
1995	61	58	55	53	50	48	45	43	41	39	37	35	34	32	31	29	28	26	25	507
1996	59	57	54	51	49	47	44	42	40	38	36	35	33	31	30	28	27	26	25	495
1997	58	55	53	50	48	45	43	41	39	37	35	34	32	31	29	28	26	25	24	482
1998	56	53	51	48	46	44	42	40	38	36	34	33	31	30	28	27	26	24	23	466
1999	51	49	46	44	42	40	38	36	35	33	31	30	28	27	26	24	23	22	21	425
2000	50	48	46	43	41	39	38	36	34	32	31	29	28	27	25	24	23	22	21	418
2001	50	48	45	43	41	39	37	35	34	32	31	29	28	26	25	24	23	22	21	415
2002	50	47	45	43	41	39	37	35	34	32	30	29	28	26	25	24	23	22	21	412
2003	50	47	45	43	41	39	37	35	33	32	30	29	28	26	25	24	23	21	20	411
2004	49	47	45	42	40	38	37	35	33	32	30	29	27	26	25	24	22	21	20	407
2005	49	46	44	42	40	38	36	35	33	31	30	28	27	26	24	23	22	21	20	403
2006	48	46	44	42	40	38	36	34	33	31	30	28	27	26	24	23	22	21	20	401
2007	48	45	43	41	39	37	36	34	32	31	29	28	27	25	24	23	22	21	20	396
2008	48	45	43	41	39	37	36	34	32	31	29	28	27	25	24	23	22	21	20	395
2009	48	45	43	41	39	37	35	34	32	31	29	28	26	25	24	23	22	21	20	394

Table 21. Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																				
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1900	6976	6649	6338	6041	5758	5488	5231	4986	4752	4529	4317	4115	3922	3738	3563	3396	3237	3085	2940	2803	2671
1901	6976	6649	6338	6041	5758	5488	5231	4986	4752	4529	4317	4115	3922	3738	3563	3396	3237	3085	2940	2803	2671
1902	6976	6649	6338	6041	5758	5488	5231	4986	4752	4529	4317	4115	3922	3738	3563	3396	3237	3085	2940	2803	2671
1903	6976	6649	6338	6041	5758	5488	5231	4985	4752	4529	4317	4114	3922	3738	3563	3396	3236	3085	2940	2802	2671
1904	6976	6649	6338	6041	5758	5488	5231	4985	4752	4529	4317	4114	3922	3738	3562	3395	3236	3085	2940	2802	2671
1905	6976	6649	6338	6041	5758	5488	5230	4985	4752	4529	4317	4114	3921	3738	3562	3395	3236	3084	2940	2802	2670
1906	6975	6649	6337	6040	5757	5488	5230	4985	4752	4529	4317	4114	3921	3737	3562	3395	3236	3084	2939	2801	2670
1907	6975	6649	6337	6040	5757	5487	5230	4985	4751	4529	4316	4114	3921	3737	3562	3395	3236	3084	2939	2801	2670
1908	6975	6648	6337	6040	5757	5487	5230	4985	4751	4529	4316	4114	3921	3737	3562	3395	3235	3083	2939	2801	2669
1909	6974	6648	6336	6040	5757	5487	5230	4985	4751	4528	4316	4114	3921	3737	3561	3394	3235	3083	2938	2800	2669
1910	6974	6647	6336	6039	5756	5487	5230	4985	4751	4528	4316	4113	3920	3737	3561	3394	3235	3083	2938	2800	2668
1911	6973	6647	6336	6039	5756	5486	5229	4984	4751	4528	4316	4113	3920	3736	3561	3394	3234	3082	2937	2799	2668
1912	6972	6646	6335	6038	5756	5486	5229	4984	4751	4528	4316	4113	3920	3736	3561	3393	3234	3082	2937	2799	2667
1913	6972	6646	6335	6038	5755	5486	5229	4984	4750	4528	4315	4113	3920	3736	3560	3393	3233	3081	2936	2798	2667
1914	6971	6645	6334	6037	5755	5485	5228	4983	4750	4527	4315	4113	3920	3736	3560	3393	3233	3081	2936	2798	2666
1915	6970	6644	6333	6037	5754	5485	5228	4983	4749	4527	4315	4112	3919	3735	3560	3392	3233	3081	2936	2797	2666
1916	6969	6644	6333	6036	5754	5484	5227	4983	4749	4526	4314	4112	3919	3735	3559	3392	3232	3080	2935	2797	2665
1917	6969	6643	6332	6036	5753	5484	5227	4982	4749	4526	4314	4112	3919	3735	3559	3392	3232	3080	2935	2796	2664
1918	6967	6642	6331	6035	5752	5483	5226	4981	4748	4525	4313	4111	3918	3734	3558	3391	3231	3079	2933	2795	2663
1919	6966	6641	6330	6034	5751	5482	5225	4981	4747	4525	4312	4110	3917	3733	3557	3390	3230	3078	2932	2794	2662
1920	6965	6639	6329	6033	5751	5482	5225	4980	4747	4524	4312	4110	3917	3733	3557	3390	3230	3077	2932	2794	2662
1921	6964	6638	6328	6032	5750	5481	5224	4979	4746	4524	4312	4109	3916	3732	3557	3389	3230	3077	2932	2793	2661
1922	6964	6638	6327	6031	5749	5480	5224	4979	4746	4523	4311	4109	3916	3732	3557	3389	3230	3077	2932	2793	2661
1923	6963	6637	6326	6030	5748	5479	5223	4979	4745	4523	4311	4109	3916	3732	3557	3389	3229	3077	2932	2793	2661
1924	6962	6637	6326	6030	5747	5478	5222	4978	4745	4523	4311	4108	3916	3732	3556	3389	3229	3077	2932	2793	2661
1925	6962	6636	6325	6029	5747	5478	5221	4977	4745	4522	4310	4108	3915	3731	3556	3389	3229	3077	2931	2793	2661
1926	6961	6635	6325	6029	5746	5477	5221	4976	4744	4522	4310	4108	3915	3731	3556	3388	3229	3076	2931	2793	2660
1927	6959	6635	6324	6028	5746	5476	5220	4975	4742	4521	4309	4107	3914	3730	3555	3387	3228	3075	2930	2792	2659
1928	6958	6633	6323	6027	5745	5476	5219	4975	4742	4519	4308	4106	3914	3730	3554	3387	3227	3075	2929	2791	2659
1929	6957	6632	6322	6026	5744	5475	5219	4974	4741	4518	4307	4105	3913	3729	3553	3386	3226	3074	2929	2790	2658
1930	6957	6631	6321	6025	5744	5474	5218	4973	4740	4518	4306	4104	3911	3728	3553	3385	3225	3073	2928	2789	2657
1931	6956	6631	6320	6024	5742	5474	5217	4972	4739	4517	4305	4103	3910	3727	3552	3384	3225	3072	2927	2788	2656
1932	6954	6630	6319	6024	5742	5473	5217	4972	4739	4516	4304	4102	3909	3726	3551	3383	3224	3071	2926	2788	2655
1933	6954	6628	6319	6023	5741	5472	5216	4972	4738	4516	4304	4102	3909	3725	3550	3383	3224	3071	2926	2788	2655
1934	6954	6628	6318	6022	5740	5471	5215	4971	4738	4515	4303	4101	3908	3725	3549	3382	3223	3071	2926	2787	2655
1935	6953	6628	6317	6021	5740	5471	5214	4970	4737	4515	4303	4101	3908	3724	3549	3382	3222	3070	2926	2787	2655
1936	6953	6628	6317	6021	5738	5470	5213	4969	4736	4514	4302	4100	3907	3723	3548	3381	3221	3069	2925	2787	2655
1937	6953	6627	6317	6021	5738	5469	5213	4968	4735	4513	4301	4099	3906	3722	3547	3380	3221	3069	2924	2786	2655
1938	6953	6627	6316	6020	5738	5469	5212	4967	4734	4512	4300	4098	3905	3722	3546	3379	3220	3068	2924	2786	2654
1939	6953	6627	6316	6020	5738	5468	5211	4966	4733	4511	4299	4097	3904	3721	3546	3379	3219	3068	2923	2785	2654
1940	6953	6627	6316	6020	5737	5468	5211	4966	4732	4510	4298	4096	3903	3720	3545	3378	3219	3067	2922	2784	2653
1941	6953	6627	6316	6020	5737	5468	5211	4966	4732	4510	4298	4096	3903	3719	3544	3377	3218	3066	2922	2784	2653
1942	6953	6627	6316	6020	5738	5468	5211	4966	4733	4510	4297	4095	3903	3719	3544	3377	3218	3066	2922	2784	2652
1943	6953	6627	6316	6020	5738	5468	5212	4967	4733	4510	4298	4096	3903	3719	3544	3377	3218	3066	2922	2784	2653
1944	6953	6627	6316	6020	5737	5468	5211	4966	4732	4509	4297	4094	3901	3718	3542	3375	3216	3065	2921	2783	2651
1945	6952	6627	6316	6019	5736	5466	5209	4964	4730	4507	4294	4091	3898	3714	3539	3372	3213	3062	2917	2780	2649
1946	6949	6626	6316	6019	5735	5464	5206	4960	4725	4501	4288	4085	3892	3708	3532	3366	3207	3055	2911	2774	2643
1947	6947	6623	6315	6019	5735	5464	5205	4958	4723	4498	4285	4082	3888	3704	3528	3361	3203	3051	2907	2770	2639
1948	6946	6621	6312	6018	5735	5465	5206	4958	4723	4498	4284	4080	3887	3702	3527	3359	3200	3049	2905	2768	2637
1949	6945	6621	6311	6016	5735	5465	5207	4959	4723	4498	4284	4080	3886	3701	3525	3358	3198	3047	2903	2765	2635
1950	6945	6620	6310	6015	5733	5465	5207	4961	4724	4499	4285	4080	3886	3701	3525	3357	3198	3046	2901	2764	2633
1951	6943	6619	6309	6013	5731	5462	5206	4960	4724	4498	4284	4079	3884	3698	3522	3354	3195	3043	2898	2760	2630
1952	6940	6618	6308	6012	5729	5459	5202	4957	4721	4496	4281	4076	3880	3694	3518	3349	3190	3038	2893	2756	2625
1953	6938	6615	6307	6011	5728	5457	5199	4952	4718	4493	4278	4072	3877	3690	3513	3345	3185	3033	2888	2750	2620
1954	6930	6612	6304	6008	5724	5452	5192	4943	4707	4482	4266	4061	3864	3678	3500	3332	3172	3019	2875	2737	2607
1955	6919	6606	6300	6003	5719	5445	5182	4930	4691	4463	4247	4041	3844	3657	3480	3311	3151	2999	2854	2717	2587

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1900	2546	2427	2313	2205	2101	2003	1909	1819	1734	1653	1575	1502	1431	1364	1300	1239	1181	1126	1073	1023
1901	2546	2427	2313	2205	2101	2003	1909	1819	1734	1653	1575	1502	1431	1364	1300	1239	1181	1126	1073	1023
1902	2546	2427	2313	2205	2101	2003	1909	1819	1734	1653	1575	1502	1431	1364	1300	1239	1181	1126	1073	1023
1903	2546	2426	2313	2204	2101	2003	1909	1819	1734	1653	1575	1501	1431	1364	1300	1239	1181	1126	1073	1023
1904	2546	2426	2312	2204	2101	2002	1908	1819	1734	1652	1575	1501	1431	1364	1300	1239	1181	1126	1073	1023
1905	2545	2426	2312	2204	2100	2002	1908	1819	1733	1652	1575	1501	1431	1364	1300	1239	1181	1125	1073	1022
1906	2545	2426	2312	2203	2100	2002	1908	1818	1733	1652	1574	1501	1430	1363	1299	1238	1180	1125	1072	1022
1907	2544	2425	2311	2203	2100	2001	1907	1818	1733	1651	1574	1500	1430	1363	1299	1238	1180	1125	1072	1022
1908	2544	2425	2311	2202	2099	2001	1907	1817	1732	1651	1574	1500	1430	1362	1299	1238	1180	1124	1072	1022
1909	2543	2424	2310	2202	2099	2000	1906	1817	1732	1650	1573	1499	1429	1362	1298	1237	1179	1124	1071	1021
1910	2543	2424	2310	2201	2098	1999	1906	1816	1731	1650	1572	1499	1428	1361	1298	1237	1179	1124	1071	1021
1911	2542	2423	2309	2201	2097	1999	1905	1816	1730	1649	1572	1498	1428	1361	1297	1236	1178	1123	1070	1020
1912	2542	2422	2308	2200	2097	1998	1904	1815	1730	1649	1571	1497	1427	1360	1297	1236	1178	1123	1070	1020
1913	2541	2422	2308	2199	2096	1997	1904	1814	1729	1648	1570	1497	1427	1360	1296	1235	1177	1122	1069	1019
1914	2541	2421	2307	2199	2095	1997	1903	1813	1728	1647	1570	1496	1426	1359	1295	1234	1177	1121	1069	1019
1915	2540	2420	2306	2198	2094	1996	1902	1813	1727	1646	1569	1495	1425	1358	1294	1234	1176	1121	1068	1018
1916	2539	2420	2306	2197	2094	1995	1901	1812	1727	1645	1568	1494	1424	1357	1294	1233	1175	1120	1067	1017
1917	2539	2419	2305	2196	2093	1994	1900	1811	1726	1644	1567	1494	1423	1357	1293	1232	1174	1119	1067	1017
1918	2537	2418	2304	2195	2091	1993	1899	1809	1724	1643	1566	1492	1422	1355	1291	1231	1173	1118	1066	1016
1919	2536	2416	2302	2193	2090	1991	1897	1808	1723	1642	1564	1491	1421	1354	1290	1230	1172	1117	1064	1014
1920	2536	2416	2302	2193	2089	1991	1897	1807	1722	1641	1563	1490	1420	1353	1289	1229	1171	1116	1064	1014
1921	2535	2415	2301	2192	2089	1990	1896	1806	1721	1640	1563	1489	1419	1352	1289	1228	1170	1115	1063	1013
1922	2535	2415	2301	2192	2088	1990	1896	1806	1721	1640	1562	1489	1418	1352	1288	1227	1170	1115	1062	1012
1923	2535	2415	2301	2192	2088	1989	1895	1806	1720	1639	1562	1488	1418	1351	1287	1227	1169	1114	1062	1012
1924	2535	2415	2301	2192	2088	1989	1895	1805	1720	1639	1561	1487	1417	1350	1287	1226	1168	1114	1061	1011
1925	2535	2415	2300	2191	2088	1989	1894	1805	1719	1638	1561	1487	1417	1350	1286	1226	1168	1113	1060	1011
1926	2535	2414	2300	2191	2087	1988	1894	1804	1719	1637	1560	1486	1416	1349	1285	1225	1167	1112	1060	1010
1927	2534	2413	2299	2190	2086	1987	1893	1803	1718	1636	1559	1485	1415	1348	1284	1224	1166	1111	1059	1009
1928	2533	2413	2298	2189	2085	1986	1892	1802	1717	1636	1558	1484	1414	1347	1283	1223	1165	1110	1058	1008
1929	2532	2412	2298	2189	2085	1986	1891	1802	1716	1635	1557	1483	1413	1346	1283	1222	1164	1109	1057	1007
1930	2531	2411	2297	2188	2084	1985	1891	1801	1716	1634	1557	1483	1412	1346	1282	1221	1163	1109	1056	1006
1931	2530	2410	2296	2187	2083	1984	1890	1800	1715	1633	1556	1482	1412	1345	1281	1220	1163	1108	1055	1006
1932	2530	2410	2295	2186	2082	1983	1889	1799	1714	1632	1555	1481	1411	1344	1280	1219	1162	1107	1054	1005
1933	2530	2410	2295	2186	2082	1983	1889	1799	1714	1632	1555	1481	1411	1344	1280	1219	1161	1106	1054	1004
1934	2530	2410	2295	2186	2082	1983	1889	1799	1714	1632	1555	1481	1411	1344	1280	1219	1161	1106	1054	1004
1935	2529	2410	2295	2186	2082	1983	1889	1799	1714	1632	1555	1481	1411	1343	1280	1219	1161	1106	1054	1004
1936	2529	2409	2295	2186	2082	1983	1889	1799	1714	1632	1555	1481	1410	1343	1279	1219	1161	1106	1053	1003
1937	2529	2409	2295	2186	2082	1983	1889	1799	1714	1632	1555	1481	1410	1343	1279	1219	1161	1106	1053	1003
1938	2529	2409	2295	2186	2082	1983	1889	1800	1714	1633	1555	1481	1411	1343	1280	1219	1161	1106	1053	1003
1939	2528	2409	2295	2186	2082	1984	1889	1800	1714	1633	1555	1481	1411	1344	1280	1219	1161	1106	1053	1003
1940	2528	2408	2295	2186	2082	1984	1889	1800	1714	1633	1555	1481	1411	1344	1280	1219	1161	1106	1053	1003
1941	2527	2408	2294	2186	2082	1984	1890	1800	1714	1633	1555	1481	1411	1344	1280	1219	1161	1106	1053	1003
1942	2527	2408	2294	2186	2082	1984	1890	1800	1715	1633	1556	1482	1411	1344	1280	1219	1161	1106	1053	1003
1943	2527	2408	2294	2186	2083	1984	1890	1801	1715	1634	1556	1482	1412	1345	1281	1220	1162	1107	1054	1004
1944	2526	2407	2293	2185	2082	1983	1890	1800	1715	1633	1556	1482	1412	1344	1281	1220	1162	1106	1054	1004
1945	2524	2405	2291	2183	2080	1981	1888	1799	1713	1632	1555	1481	1411	1343	1280	1219	1161	1106	1053	1003
1946	2518	2399	2286	2178	2075	1977	1884	1795	1710	1629	1552	1478	1408	1341	1277	1216	1159	1104	1051	1001
1947	2515	2396	2283	2175	2072	1974	1881	1792	1707	1627	1550	1476	1406	1339	1276	1215	1157	1102	1050	1000
1948	2512	2394	2281	2173	2070	1973	1879	1791	1706	1625	1549	1475	1405	1338	1275	1214	1157	1102	1049	999
1949	2510	2392	2279	2171	2069	1971	1878	1789	1704	1624	1547	1474	1404	1337	1274	1213	1156	1101	1049	999
1950	2509	2390	2277	2170	2067	1970	1877	1788	1703	1623	1546	1473	1403	1337	1273	1213	1155	1100	1048	998
1951	2505	2387	2274	2166	2064	1967	1874	1785	1701	1620	1544	1471	1401	1335	1272	1211	1154	1099	1047	997
1952	2500	2382	2269	2162	2060	1962	1870	1781	1697	1617	1540	1468	1398	1332	1269	1209	1152	1097	1045	995
1953	2495	2377	2264	2157	2055	1958	1865	1777	1693	1613	1537	1464	1395	1329	1266	1206	1149	1094	1043	993
1954	2483	2364	2252	2145	2044	1947	1855	1767	1684	1604	1528	1456	1387	1321	1259	1199	1143	1089	1037	988
1955	2464	2346	2234	2128	2027	1931	1840	1752	1670	1591	1515	1444	1375	1310	1248	1189	1133	1079	1028	979

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1900	975	929	886	844	805	767	731	697	664	633	603	575	548	522	498	475	452	431	411	392
1901	975	929	886	844	805	767	731	697	664	633	603	575	548	522	498	475	452	431	411	392
1902	975	929	886	844	805	767	731	697	664	633	603	575	548	522	498	474	452	431	411	392
1903	975	929	886	844	804	767	731	697	664	633	603	575	548	522	498	474	452	431	411	392
1904	975	929	885	844	804	767	731	696	664	633	603	575	548	522	498	474	452	431	411	392
1905	974	929	885	844	804	766	731	696	664	633	603	575	548	522	498	474	452	431	411	391
1906	974	929	885	844	804	766	730	696	664	632	603	575	548	522	498	474	452	431	411	391
1907	974	928	885	843	804	766	730	696	663	632	603	574	547	522	497	474	452	431	410	391
1908	974	928	884	843	804	766	730	696	663	632	602	574	547	522	497	474	452	431	410	391
1909	973	928	884	843	803	766	730	696	663	632	602	574	547	521	497	474	452	430	410	391
1910	973	927	884	842	803	765	729	695	663	632	602	574	547	521	497	474	451	430	410	391
1911	972	927	883	842	803	765	729	695	662	631	602	574	547	521	497	473	451	430	410	391
1912	972	926	883	842	802	765	729	695	662	631	601	573	546	521	496	473	451	430	410	390
1913	971	926	883	841	802	764	728	694	662	631	601	573	546	520	496	473	451	430	409	390
1914	971	925	882	841	801	764	728	694	661	630	601	573	546	520	496	473	450	429	409	390
1915	970	925	881	840	801	763	727	693	661	630	600	572	545	520	495	472	450	429	409	390
1916	970	924	881	840	800	763	727	693	660	629	600	572	545	519	495	472	450	429	409	389
1917	969	924	880	839	800	762	726	692	660	629	599	571	545	519	495	472	449	428	408	389
1918	968	923	879	838	799	761	726	692	659	628	599	571	544	518	494	471	449	428	408	389
1919	967	921	878	837	798	760	725	691	658	628	598	570	543	518	494	470	448	427	407	388
1920	966	921	878	836	797	760	724	690	658	627	598	570	543	517	493	470	448	427	407	388
1921	965	920	877	836	797	759	724	690	657	627	597	569	543	517	493	470	448	427	407	388
1922	965	920	876	835	796	759	723	689	657	626	597	569	542	517	493	469	447	426	406	387
1923	964	919	876	835	796	758	723	689	657	626	596	568	542	516	492	469	447	426	406	387
1924	964	918	875	834	795	758	722	688	656	625	596	568	541	516	492	469	447	426	406	387
1925	963	918	875	834	795	757	722	688	656	625	596	568	541	516	491	468	446	426	406	387
1926	962	917	874	833	794	757	721	687	655	624	595	567	541	515	491	468	446	425	405	386
1927	961	916	873	832	793	756	720	686	654	624	594	566	540	515	490	467	446	425	405	386
1928	960	915	872	831	792	755	720	686	654	623	594	566	539	514	490	467	445	424	404	385
1929	960	914	871	830	791	754	719	685	653	622	593	565	539	513	489	466	445	424	404	385
1930	959	914	871	830	791	754	718	684	652	622	592	565	538	513	489	466	444	423	403	385
1931	958	913	870	829	790	753	717	684	652	621	592	564	538	512	488	465	444	423	403	384
1932	957	912	869	828	789	752	717	683	651	620	591	563	537	512	488	465	443	422	402	384
1933	957	912	869	828	789	752	716	682	650	620	591	563	537	511	487	464	443	422	402	383
1934	956	911	868	827	788	751	716	682	650	619	590	563	536	511	487	464	442	422	402	383
1935	956	911	868	827	788	751	715	682	650	619	590	562	536	511	487	464	442	421	402	383
1936	956	911	868	827	788	750	715	681	649	619	590	562	535	510	486	464	442	421	401	382
1937	956	910	867	826	787	750	715	681	649	618	589	562	535	510	486	463	441	421	401	382
1938	956	910	867	826	787	750	715	681	649	618	589	561	535	510	486	463	441	421	401	382
1939	956	910	867	826	787	750	714	681	649	618	589	561	535	510	486	463	441	420	401	382
1940	956	910	867	826	787	750	714	680	648	618	589	561	534	509	485	462	441	420	400	382
1941	956	910	867	826	787	750	714	680	648	618	588	561	534	509	485	462	441	420	400	381
1942	956	910	867	826	787	749	714	680	648	617	588	560	534	509	485	462	440	420	400	381
1943	956	911	867	826	787	750	714	680	648	617	588	561	534	509	485	462	440	420	400	381
1944	956	911	867	826	787	749	714	680	648	617	588	560	534	509	485	462	440	419	400	381
1945	955	910	867	825	786	749	713	680	647	617	587	560	533	508	484	461	440	419	399	380
1946	953	908	865	824	785	747	712	678	646	615	586	558	532	507	483	460	438	418	398	379
1947	952	907	864	823	784	746	711	677	645	615	585	558	531	506	482	459	438	417	397	379
1948	952	907	863	822	783	746	711	677	645	614	585	557	531	506	482	459	437	417	397	378
1949	951	906	863	822	783	746	710	676	644	614	585	557	530	505	481	459	437	416	397	378
1950	951	906	863	822	783	745	710	676	644	613	584	557	530	505	481	458	437	416	396	378
1951	950	905	862	821	782	744	709	675	643	613	583	556	529	504	480	458	436	415	396	377
1952	948	903	860	819	780	743	708	674	642	611	582	555	528	503	479	457	435	414	395	376
1953	946	901	858	817	778	741	706	673	641	610	581	553	527	502	478	456	434	413	394	375
1954	941	896	853	813	774	737	702	669	637	607	578	551	524	499	476	453	432	411	392	373
1955	933	889	846	806	768	731	697	663	632	602	573	546	520	495	472	449	428	408	388	370

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1900	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1901	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1902	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1903	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1904	373	356	339	323	308	294	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1905	373	356	339	323	308	293	280	267	254	242	231	220	210	200	191	182	173	165	157	150
1906	373	356	339	323	308	293	280	267	254	242	231	220	210	200	190	182	173	165	157	150
1907	373	355	339	323	308	293	280	266	254	242	231	220	210	200	190	182	173	165	157	150
1908	373	355	339	323	308	293	280	266	254	242	231	220	210	200	190	181	173	165	157	150
1909	373	355	339	323	308	293	279	266	254	242	231	220	209	200	190	181	173	165	157	150
1910	372	355	338	323	307	293	279	266	254	242	230	220	209	200	190	181	173	165	157	150
1911	372	355	338	322	307	293	279	266	254	242	230	220	209	199	190	181	173	165	157	150
1912	372	355	338	322	307	293	279	266	253	242	230	219	209	199	190	181	173	165	157	149
1913	372	354	338	322	307	293	279	266	253	241	230	219	209	199	190	181	173	164	157	149
1914	372	354	338	322	307	292	279	266	253	241	230	219	209	199	190	181	172	164	157	149
1915	371	354	337	322	307	292	279	265	253	241	230	219	209	199	190	181	172	164	157	149
1916	371	354	337	321	306	292	278	265	253	241	230	219	209	199	190	181	172	164	156	149
1917	371	354	337	321	306	292	278	265	253	241	230	219	209	199	189	181	172	164	156	149
1918	371	353	337	321	306	291	278	265	252	241	229	219	208	199	189	180	172	164	156	149
1919	370	353	336	320	305	291	277	264	252	240	229	218	208	198	189	180	172	164	156	149
1920	370	352	336	320	305	291	277	264	252	240	229	218	208	198	189	180	172	164	156	149
1921	370	352	336	320	305	291	277	264	252	240	229	218	208	198	189	180	171	163	156	148
1922	369	352	335	320	305	290	277	264	252	240	228	218	208	198	189	180	171	163	156	148
1923	369	352	335	320	305	290	277	264	251	240	228	218	207	198	188	180	171	163	156	148
1924	369	351	335	319	304	290	276	264	251	239	228	217	207	198	188	179	171	163	155	148
1925	368	351	335	319	304	290	276	263	251	239	228	217	207	197	188	179	171	163	155	148
1926	368	351	334	319	304	290	276	263	251	239	228	217	207	197	188	179	171	163	155	148
1927	368	350	334	318	303	289	276	263	250	239	227	217	207	197	188	179	171	163	155	148
1928	367	350	334	318	303	289	275	262	250	238	227	217	206	197	188	179	170	162	155	148
1929	367	350	333	318	303	289	275	262	250	238	227	216	206	197	187	179	170	162	155	147
1930	366	349	333	317	302	288	275	262	250	238	227	216	206	196	187	178	170	162	154	147
1931	366	349	333	317	302	288	274	262	249	238	226	216	206	196	187	178	170	162	154	147
1932	366	348	332	317	302	288	274	261	249	237	226	216	205	196	187	178	170	162	154	147
1933	365	348	332	316	301	287	274	261	249	237	226	215	205	196	187	178	169	162	154	147
1934	365	348	332	316	301	287	274	261	249	237	226	215	205	196	186	178	169	161	154	147
1935	365	348	331	316	301	287	273	261	248	237	226	215	205	195	186	178	169	161	154	147
1936	365	347	331	316	301	287	273	260	248	237	226	215	205	195	186	177	169	161	154	146
1937	364	347	331	315	301	287	273	260	248	236	225	215	205	195	186	177	169	161	153	146
1938	364	347	331	315	300	286	273	260	248	236	225	215	205	195	186	177	169	161	153	146
1939	364	347	331	315	300	286	273	260	248	236	225	215	204	195	186	177	169	161	153	146
1940	364	347	330	315	300	286	273	260	248	236	225	214	204	195	186	177	169	161	153	146
1941	363	346	330	315	300	286	272	260	247	236	225	214	204	195	186	177	169	161	153	146
1942	363	346	330	314	300	286	272	259	247	236	225	214	204	195	185	177	168	161	153	146
1943	363	346	330	314	300	286	272	259	247	236	225	214	204	194	185	177	168	161	153	146
1944	363	346	330	314	299	285	272	259	247	235	224	214	204	194	185	177	168	160	153	146
1945	362	345	329	314	299	285	272	259	247	235	224	214	204	194	185	176	168	160	153	145
1946	362	345	328	313	298	284	271	258	246	235	224	213	203	194	184	176	168	160	152	145
1947	361	344	328	312	298	284	270	258	246	234	223	213	203	193	184	175	167	159	152	145
1948	361	344	327	312	297	283	270	257	245	234	223	212	202	193	184	175	167	159	152	145
1949	360	343	327	312	297	283	270	257	245	234	223	212	202	193	184	175	167	159	152	144
1950	360	343	327	311	297	283	269	257	245	233	222	212	202	192	183	175	167	159	151	144
1951	359	342	326	311	296	282	269	256	244	233	222	211	202	192	183	175	166	159	151	144
1952	358	342	325	310	295	282	268	256	244	232	221	211	201	192	183	174	166	158	151	144
1953	358	341	325	309	295	281	268	255	243	232	221	210	200	191	182	174	165	158	150	143
1954	356	339	323	308	293	279	266	254	242	230	219	209	199	190	181	173	164	157	149	142
1955	353	336	320	305	290	277	264	251	239	228	217	207	198	188	179	171	163	155	148	141

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1900	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1901	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1902	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1903	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1904	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1225
1905	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1224
1906	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	70	66	63	60	1224
1907	143	136	130	124	118	112	107	102	97	93	88	84	80	77	73	69	66	63	60	1224
1908	143	136	130	124	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1223
1909	143	136	130	124	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1223
1910	143	136	130	123	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1222
1911	143	136	130	123	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1222
1912	142	136	129	123	118	112	107	102	97	93	88	84	80	76	73	69	66	63	60	1221
1913	142	136	129	123	118	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1221
1914	142	136	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1220
1915	142	136	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1219
1916	142	135	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	1218
1917	142	135	129	123	117	112	106	101	97	92	88	84	80	76	73	69	66	63	60	1217
1918	142	135	129	123	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	1216
1919	142	135	129	123	117	111	106	101	97	92	88	84	80	76	72	69	66	63	60	1215
1920	142	135	129	123	117	111	106	101	96	92	88	84	80	76	72	69	66	63	60	1214
1921	141	135	129	123	117	111	106	101	96	92	88	83	80	76	72	69	66	63	60	1213
1922	141	135	128	122	117	111	106	101	96	92	87	83	79	76	72	69	66	63	60	1212
1923	141	135	128	122	117	111	106	101	96	92	87	83	79	76	72	69	66	62	60	1211
1924	141	135	128	122	117	111	106	101	96	92	87	83	79	76	72	69	66	62	60	1210
1925	141	134	128	122	116	111	106	101	96	92	87	83	79	76	72	69	65	62	59	1209
1926	141	134	128	122	116	111	106	101	96	92	87	83	79	76	72	69	65	62	59	1208
1927	141	134	128	122	116	111	106	101	96	91	87	83	79	75	72	69	65	62	59	1207
1928	141	134	128	122	116	111	105	100	96	91	87	83	79	75	72	68	65	62	59	1205
1929	140	134	128	122	116	110	105	100	96	91	87	83	79	75	72	68	65	62	59	1204
1930	140	134	127	121	116	110	105	100	96	91	87	83	79	75	72	68	65	62	59	1203
1931	140	134	127	121	116	110	105	100	95	91	87	83	79	75	72	68	65	62	59	1201
1932	140	133	127	121	116	110	105	100	95	91	87	83	79	75	71	68	65	62	59	1200
1933	140	133	127	121	115	110	105	100	95	91	87	82	79	75	71	68	65	62	59	1199
1934	140	133	127	121	115	110	105	100	95	91	86	82	79	75	71	68	65	62	59	1198
1935	140	133	127	121	115	110	105	100	95	91	86	82	79	75	71	68	65	62	59	1197
1936	140	133	127	121	115	110	105	100	95	91	86	82	78	75	71	68	65	62	59	1196
1937	139	133	127	121	115	110	105	100	95	91	86	82	78	75	71	68	65	62	59	1195
1938	139	133	127	121	115	110	104	100	95	90	86	82	78	75	71	68	65	62	59	1194
1939	139	133	127	121	115	110	104	100	95	90	86	82	78	75	71	68	65	62	59	1194
1940	139	133	126	121	115	109	104	99	95	90	86	82	78	75	71	68	65	62	59	1193
1941	139	133	126	120	115	109	104	99	95	90	86	82	78	75	71	68	65	62	59	1192
1942	139	132	126	120	115	109	104	99	95	90	86	82	78	74	71	68	64	61	59	1192
1943	139	132	126	120	115	109	104	99	95	90	86	82	78	74	71	68	64	61	59	1191
1944	139	132	126	120	115	109	104	99	95	90	86	82	78	74	71	68	64	61	59	1190
1945	139	132	126	120	114	109	104	99	94	90	86	82	78	74	71	67	64	61	58	1189
1946	138	132	126	120	114	109	104	99	94	90	86	82	78	74	71	67	64	61	58	1185
1947	138	132	125	120	114	109	103	99	94	90	85	81	78	74	70	67	64	61	58	1183
1948	138	131	125	119	114	108	103	99	94	89	85	81	77	74	70	67	64	61	58	1182
1949	138	131	125	119	114	108	103	98	94	89	85	81	77	74	70	67	64	61	58	1180
1950	138	131	125	119	113	108	103	98	94	89	85	81	77	74	70	67	64	61	58	1179
1951	137	131	125	119	113	108	103	98	93	89	85	81	77	74	70	67	64	61	58	1176
1952	137	130	124	119	113	108	103	98	93	89	85	81	77	73	70	67	64	61	58	1173
1953	137	130	124	118	113	107	102	98	93	89	84	81	77	73	70	66	63	60	58	1170
1954	136	129	123	117	112	107	102	97	92	88	84	80	76	73	69	66	63	60	57	1163
1955	134	128	122	116	111	106	101	96	92	87	83	79	76	72	69	65	62	59	57	1152

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																				
Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1956	6912	6595	6294	6002	5716	5442	5179	4925	4684	4454	4236	4030	3833	3645	3467	3298	3138	2985	2841	2704	2574
1957	6899	6588	6283	5994	5712	5436	5171	4916	4671	4439	4218	4009	3812	3624	3446	3276	3116	2964	2819	2683	2553
1958	6889	6576	6277	5984	5706	5433	5167	4911	4665	4430	4207	3996	3797	3608	3430	3260	3099	2946	2802	2665	2536
1959	6882	6566	6266	5979	5698	5429	5166	4910	4664	4428	4203	3990	3788	3598	3419	3249	3088	2935	2790	2653	2524
1960	7670	6559	6256	5967	5690	5417	5157	4903	4655	4418	4192	3977	3773	3581	3400	3230	3068	2915	2770	2633	2504
1961	6290	7311	6248	5955	5675	5405	5139	4886	4639	4400	4172	3955	3749	3555	3372	3200	3039	2886	2742	2605	2476
1962	5144	5995	6965	5949	5666	5394	5131	4874	4629	4391	4161	3943	3736	3539	3355	3181	3018	2865	2721	2584	2455
1963	4300	4903	5712	6633	5662	5389	5126	4873	4625	4389	4161	3941	3732	3535	3348	3173	3008	2853	2708	2571	2442
1964	3719	4098	4672	5441	6315	5387	5124	4870	4626	4388	4163	3944	3735	3536	3348	3170	3003	2847	2700	2563	2433
1965	3348	3545	3905	4451	5182	6012	5127	4874	4630	4397	4170	3954	3746	3546	3356	3177	3008	2850	2701	2562	2432
1966	3136	3191	3378	3720	4238	4931	5718	4873	4630	4396	4173	3955	3750	3551	3361	3181	3011	2850	2700	2558	2426
1967	3020	2989	3034	3201	3511	3978	4602	5304	4494	4247	4015	3796	3586	3390	3203	3026	2859	2703	2556	2419	2291
1968	2968	2878	2841	2874	3017	3289	3703	4254	4871	4103	3858	3631	3420	3221	3037	2863	2700	2547	2405	2272	2148
1969	2933	2829	2739	2698	2721	2846	3091	3465	3965	4524	3799	3563	3345	3145	2957	2785	2623	2471	2330	2198	2076
1970	2855	2796	2696	2609	2569	2590	2709	2940	3295	3769	4299	3609	3384	3177	2986	2808	2644	2490	2345	2211	2086
1971	2682	2721	2664	2568	2485	2447	2466	2577	2797	3133	3583	4086	3430	3215	3018	2836	2666	2510	2364	2227	2099
1972	2428	2557	2593	2539	2447	2367	2330	2347	2453	2660	2980	3407	3885	3260	3056	2868	2695	2534	2385	2246	2116
1973	2143	2314	2436	2471	2418	2330	2253	2216	2232	2332	2529	2831	3237	3690	3096	2902	2723	2559	2405	2264	2132
1974	1890	2042	2204	2320	2351	2299	2213	2138	2102	2115	2208	2393	2678	3060	3487	2925	2741	2572	2416	2271	2138
1975	1734	1802	1946	2100	2209	2238	2187	2104	2032	1996	2008	2096	2270	2540	2902	3307	2773	2598	2437	2290	2152
1976	1734	1652	1717	1854	1999	2102	2128	2078	1999	1929	1894	1904	1987	2152	2407	2749	3131	2626	2460	2307	2167
1977	2016	1653	1574	1635	1765	1903	1999	2023	1974	1897	1830	1796	1805	1883	2039	2280	2604	2965	2486	2329	2184
1978	3051	1922	1575	1500	1557	1679	1809	1900	1921	1874	1800	1736	1703	1711	1784	1931	2159	2465	2808	2354	2204
1979	5531	2908	1831	1500	1427	1481	1596	1718	1803	1822	1776	1705	1643	1612	1619	1687	1826	2041	2330	2653	2224
1980	2555	5272	2770	1744	1428	1358	1408	1517	1631	1711	1728	1684	1616	1557	1526	1533	1597	1728	1932	2205	2510
1981	2851	2435	5023	2638	1659	1358	1290	1336	1437	1545	1618	1633	1591	1526	1470	1440	1446	1506	1630	1821	2078
1982	3124	2717	2320	4781	2508	1576	1288	1222	1264	1358	1458	1526	1539	1498	1436	1382	1354	1359	1416	1531	1711
1983	3801	2978	2589	2209	4549	2384	1496	1221	1158	1196	1285	1378	1442	1454	1414	1355	1304	1277	1281	1334	1443
1984	3434	3623	2836	2463	2098	4314	2257	1414	1152	1090	1125	1206	1293	1351	1361	1323	1267	1219	1193	1197	1246
1985	2962	3273	3450	2696	2337	1987	4073	2126	1328	1080	1019	1050	1125	1204	1257	1265	1229	1176	1131	1107	1110
1986	5781	2823	3115	3278	2556	2210	1873	3829	1992	1241	1007	949	976	1043	1116	1164	1170	1136	1086	1044	1021
1987	5150	5510	2688	2963	3114	2424	2092	1769	3611	1876	1167	945	890	914	977	1043	1088	1093	1060	1014	974
1988	3412	4909	5248	2559	2819	2960	2302	1984	1677	3418	1774	1103	893	840	862	921	983	1025	1029	998	954
1989	4678	3252	4675	4994	2433	2676	2805	2178	1874	1582	3221	1670	1037	839	789	809	864	922	960	964	935
1990	2608	4459	3098	4450	4748	2310	2537	2655	2059	1770	1492	3035	1572	976	789	741	760	811	865	901	904
1991	1826	2485	4246	2947	4228	4505	2188	2399	2507	1941	1666	1403	2851	1475	915	739	694	712	759	809	842
1992	3357	1740	2366	4038	2798	4006	4259	2063	2257	2354	1820	1560	1311	2662	1376	853	688	646	662	706	752
1993	7065	3200	1657	2252	3840	2657	3799	4033	1951	2132	2221	1715	1468	1234	2502	1293	801	646	606	621	662
1994	9334	6734	3047	1576	2139	3639	2513	3586	3798	1834	2000	2081	1605	1373	1152	2335	1206	747	602	565	578
1995	3483	8897	6412	2898	1497	2028	3444	2373	3379	3573	1723	1877	1950	1502	1284	1077	2182	1126	697	562	527
1996	10088	3320	8473	6101	2754	1421	1921	3256	2240	3184	3362	1619	1762	1829	1408	1203	1008	2042	1054	652	525
1997	2856	9615	3161	8060	5795	2611	1344	1813	3067	2106	2989	3152	1516	1648	1709	1315	1123	941	1904	982	608
1998	11708	2722	9155	3005	7649	5487	2466	1266	1704	2875	1970	2792	2940	1412	1534	1589	1222	1043	873	1767	911
1999	30667	11159	2587	8668	2832	7161	5101	2276	1161	1552	2606	1777	2508	2632	1261	1366	1413	1085	924	773	1563
2000	17745	29230	10630	2462	8243	2690	6794	4833	2154	1097	1466	2458	1675	2363	2479	1187	1286	1329	1020	869	727
2001	22482	16913	27853	10126	2344	7844	2558	6457	4590	2045	1041	1390	2330	1588	2239	2348	1124	1218	1259	966	823
2002	17955	21428	16117	26534	9642	2231	7462	2432	6136	4360	1941	988	1319	2211	1506	2124	2227	1066	1154	1193	916
2003	11196	17114	20421	15357	25277	9183	2125	7103	2314	5837	4147	1846	939	1254	2101	1432	2018	2116	1013	1097	1134
2004	10522	10672	16307	19450	14619	24047	8730	2018	6742	2195	5534	3930	1749	889	1187	1989	1355	1909	2002	958	1037
2005	20008	10029	10168	15530	18513	13904	22852	8289	1915	6392	2080	5241	3720	1655	841	1123	1880	1281	1805	1892	905
2006	26161	19071	9557	9687	14792	17626	13233	21739	7883	1820	6074	1976	4978	3533	1571	799	1066	1785	1215	1713	1795
2007	39113	24935	18168	9100	9216	14058	16733	12548	20592	7459	1721	5739	1866	4698	3332	1482	753	1004	1682	1145	1613
2008	6220	37280	23764	17312	8669	8778	13386	15930	11942	19594	7096	1637	5458	1774	4467	3168	1409	716	955	1599	1089
2009	6370	5929	35530	22645	16494	8258	8360	12745	15163	11366	18645	6751	1557	5192	1688	4248	3013	1339	681	908	1520

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1956	2451	2333	2222	2116	2015	1920	1829	1742	1659	1581	1506	1435	1367	1302	1241	1182	1126	1073	1022	974
1957	2430	2313	2202	2097	1997	1902	1812	1726	1644	1566	1492	1421	1354	1290	1229	1171	1115	1062	1012	964
1958	2413	2297	2186	2081	1982	1887	1797	1712	1630	1553	1479	1409	1343	1279	1219	1161	1106	1054	1004	956
1959	2401	2284	2174	2069	1970	1876	1786	1701	1620	1543	1470	1400	1334	1271	1211	1153	1099	1047	997	950
1960	2381	2265	2155	2051	1952	1858	1769	1685	1604	1528	1455	1386	1321	1258	1199	1142	1088	1036	987	940
1961	2354	2238	2129	2025	1927	1834	1746	1662	1583	1507	1436	1367	1302	1241	1182	1126	1073	1022	973	927
1962	2333	2218	2109	2006	1908	1816	1728	1645	1566	1491	1420	1352	1288	1227	1168	1113	1060	1010	962	917
1963	2320	2204	2095	1992	1895	1802	1715	1632	1554	1479	1408	1341	1277	1216	1159	1104	1051	1002	954	909
1964	2311	2195	2085	1982	1885	1792	1705	1622	1544	1470	1399	1332	1268	1208	1150	1096	1044	994	947	902
1965	2308	2192	2082	1978	1880	1788	1700	1617	1539	1464	1394	1327	1263	1203	1146	1091	1039	990	943	898
1966	2303	2186	2076	1971	1873	1780	1692	1610	1531	1457	1386	1320	1256	1196	1139	1085	1033	984	937	893
1967	2171	2059	1954	1855	1761	1673	1589	1511	1437	1366	1300	1237	1177	1121	1067	1016	967	921	878	836
1968	2033	1926	1826	1731	1643	1559	1481	1407	1337	1271	1209	1150	1094	1041	991	944	898	856	815	776
1969	1962	1856	1757	1666	1579	1498	1422	1350	1283	1219	1159	1102	1048	997	949	903	860	819	780	742
1970	1970	1862	1761	1667	1580	1499	1422	1349	1281	1217	1156	1099	1045	994	946	900	857	816	777	740
1971	1981	1870	1767	1672	1583	1500	1423	1350	1281	1216	1155	1098	1044	992	944	898	855	813	774	737
1972	1995	1882	1777	1679	1588	1504	1425	1351	1282	1217	1155	1097	1043	991	943	897	853	812	773	736
1973	2008	1893	1786	1686	1593	1507	1427	1353	1282	1217	1155	1096	1041	990	941	895	851	810	770	733
1974	2013	1895	1787	1685	1591	1504	1422	1347	1276	1210	1148	1089	1034	982	934	888	844	803	764	727
1975	2025	1907	1796	1692	1597	1507	1424	1347	1275	1209	1146	1087	1032	980	931	884	841	799	760	723
1976	2037	1917	1804	1699	1601	1511	1426	1347	1274	1207	1144	1084	1029	976	927	880	837	795	756	719
1977	2052	1928	1814	1708	1608	1515	1429	1349	1275	1206	1142	1082	1026	973	923	877	833	791	752	715
1978	2067	1942	1824	1717	1616	1522	1434	1353	1277	1206	1141	1080	1024	971	921	874	830	788	749	712
1979	2083	1953	1834	1723	1622	1526	1437	1354	1277	1206	1139	1078	1020	967	917	869	825	783	744	707
1980	2104	1970	1847	1735	1629	1533	1443	1359	1280	1208	1140	1077	1019	964	914	866	822	780	741	703
1981	2366	1983	1856	1741	1634	1535	1445	1360	1280	1206	1138	1074	1015	960	909	861	816	774	735	698
1982	1952	2221	1861	1742	1634	1534	1441	1356	1276	1201	1132	1067	1008	952	900	852	808	766	726	689
1983	1612	1839	2093	1754	1641	1539	1445	1357	1277	1201	1131	1066	1005	949	896	848	803	761	721	684
1984	1347	1505	1716	1953	1636	1531	1435	1348	1266	1191	1121	1055	994	937	885	836	790	748	709	672
1985	1155	1248	1394	1590	1808	1515	1418	1329	1247	1172	1102	1037	976	920	867	819	774	732	693	656
1986	1023	1065	1150	1284	1464	1666	1395	1306	1224	1149	1079	1015	955	899	847	798	754	712	673	637
1987	952	954	992	1072	1196	1364	1551	1299	1216	1139	1069	1004	944	889	837	788	743	701	663	627
1988	916	896	897	933	1008	1125	1283	1459	1221	1143	1071	1005	944	888	835	786	741	698	659	623
1989	893	858	838	840	873	943	1052	1199	1364	1142	1068	1001	940	882	830	781	735	692	653	616
1990	877	838	804	786	787	818	884	986	1124	1278	1070	1001	938	880	827	777	732	689	649	612
1991	845	819	783	751	734	735	764	825	921	1049	1193	999	935	876	822	772	726	683	643	606
1992	783	785	761	727	697	681	682	709	766	854	973	1107	927	867	812	762	716	673	633	596
1993	705	734	736	713	681	653	638	639	664	717	800	912	1037	868	812	761	714	670	630	593
1994	616	656	683	685	663	633	608	594	594	618	667	744	848	964	807	755	707	664	623	586
1995	539	574	612	637	638	618	590	566	553	554	576	622	693	790	898	752	703	659	618	581
1996	492	504	537	572	595	596	578	551	529	517	517	538	580	647	738	839	702	657	615	578
1997	490	459	470	500	533	554	555	538	514	493	481	482	501	540	603	687	781	654	612	573
1998	564	454	425	435	463	494	513	515	498	476	456	446	446	464	501	558	636	723	606	566
1999	806	498	401	375	384	409	435	452	454	439	419	402	393	393	408	441	492	560	637	533
2000	1470	757	468	377	353	361	384	409	425	426	413	394	378	369	369	384	414	462	526	598
2001	688	1391	717	443	357	334	342	364	387	402	403	390	373	357	349	349	363	392	437	498
2002	780	652	1319	679	420	338	316	324	344	367	381	382	370	353	339	331	331	344	371	414
2003	870	741	620	1253	645	399	321	301	307	327	348	362	363	351	335	322	314	314	327	353
2004	1072	823	701	586	1185	610	377	304	284	291	309	329	342	343	332	317	304	297	297	309
2005	980	1013	777	662	554	1119	576	356	287	268	275	292	311	323	324	314	300	287	281	281
2006	859	930	961	738	628	525	1062	547	338	272	255	261	277	295	307	308	298	284	273	266
2007	1691	809	876	905	694	591	495	1000	515	318	256	240	245	261	278	289	290	280	268	257
2008	1534	1607	769	833	861	660	562	470	950	489	302	243	228	233	248	264	275	275	266	254
2009	1035	1458	1528	731	792	818	628	534	447	903	465	287	231	217	222	236	251	261	262	253

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1956	927	883	841	801	763	727	692	660	628	598	570	543	517	492	469	447	425	405	386	368
1957	919	875	833	794	756	720	686	653	622	593	564	538	512	488	465	442	421	401	382	364
1958	911	868	827	787	750	714	680	648	617	588	560	533	508	484	461	439	418	398	379	361
1959	905	862	821	782	745	710	676	644	613	584	556	530	505	481	458	436	415	396	377	359
1960	896	854	813	775	738	703	669	638	607	578	551	525	500	476	453	432	411	392	373	355
1961	883	842	802	764	728	693	660	629	599	570	543	518	493	469	447	426	406	386	368	350
1962	873	832	793	755	719	685	653	622	592	564	537	512	487	464	442	421	401	382	364	347
1963	866	825	786	749	713	679	647	617	587	559	533	507	483	460	438	418	398	379	361	344
1964	860	819	780	743	708	675	643	612	583	555	529	504	480	457	435	415	395	376	358	341
1965	856	815	777	740	705	672	640	609	581	553	527	502	478	455	434	413	393	375	357	340
1966	850	810	772	735	700	667	636	606	577	550	524	499	475	452	431	410	391	372	355	338
1967	796	759	723	688	656	625	595	567	540	515	490	467	445	424	403	384	366	349	332	316
1968	739	704	671	639	609	580	552	526	501	478	455	433	413	393	374	357	340	324	308	294
1969	707	674	642	611	582	555	528	503	479	457	435	415	395	376	358	341	325	310	295	281
1970	704	671	639	609	580	552	526	501	477	455	433	413	393	375	357	340	324	308	294	280
1971	702	669	637	607	578	550	524	499	476	453	432	411	392	373	356	339	323	307	293	279
1972	700	667	635	605	576	549	523	498	474	452	431	410	391	372	355	338	322	306	292	278
1973	698	665	633	603	574	547	521	496	473	450	429	409	389	371	353	337	321	305	291	277
1974	692	659	627	597	569	542	516	491	468	446	425	405	385	367	350	333	317	302	288	274
1975	688	655	624	594	565	539	513	489	465	443	422	402	383	365	348	331	316	301	286	273
1976	684	651	620	590	562	535	509	485	462	440	419	399	381	362	345	329	313	299	284	271
1977	680	647	616	586	558	531	506	482	459	437	416	397	378	360	343	327	311	296	282	269
1978	677	644	613	583	555	528	503	479	456	434	414	394	375	358	341	324	309	294	280	267
1979	672	639	608	578	550	524	499	475	452	431	410	391	372	354	338	322	306	292	278	265
1980	668	635	604	575	547	520	495	471	449	427	407	388	369	352	335	319	304	290	276	263
1981	663	630	599	569	541	515	490	466	444	423	403	383	365	348	331	316	301	286	273	260
1982	654	622	591	561	534	508	483	460	438	417	397	378	360	343	326	311	296	282	269	256
1983	649	616	585	556	529	503	478	455	433	412	392	373	356	339	323	307	293	279	266	253
1984	638	605	575	546	519	493	469	446	424	404	384	366	348	332	316	301	286	273	260	248
1985	622	590	560	532	505	480	456	434	413	392	373	355	338	322	307	292	278	265	252	240
1986	604	573	543	515	489	465	442	420	399	380	361	344	327	311	297	282	269	256	244	232
1987	593	562	533	505	480	455	433	411	391	371	353	336	320	304	290	276	263	250	238	227
1988	589	557	528	501	475	451	428	406	386	367	349	332	316	301	286	272	259	247	235	224
1989	582	550	521	494	468	444	421	400	380	361	343	326	310	295	281	267	255	242	231	220
1990	577	545	516	488	463	439	416	395	375	356	338	321	306	291	277	263	251	238	227	216
1991	571	539	509	481	456	432	409	388	368	350	332	316	300	285	271	258	246	234	223	212
1992	561	529	500	472	446	423	400	380	360	342	324	308	293	278	265	252	239	228	217	206
1993	558	526	496	468	442	418	396	375	356	337	320	304	289	274	261	248	236	224	213	203
1994	551	519	489	461	435	411	389	368	349	330	313	297	282	268	255	242	230	219	208	198
1995	546	514	484	456	430	405	383	362	343	325	308	292	277	263	250	237	226	215	204	194
1996	542	510	480	451	425	401	378	358	338	320	303	288	273	259	246	233	222	211	200	191
1997	538	505	475	447	420	396	373	352	333	315	298	282	268	254	241	229	217	206	196	187
1998	531	498	467	440	414	389	367	346	326	308	292	276	261	248	235	223	212	201	191	182
1999	499	467	438	412	387	364	343	323	304	287	271	257	243	230	218	207	196	186	177	168
2000	501	468	439	412	387	364	342	322	303	286	270	255	241	228	216	205	194	184	175	166
2001	566	474	443	415	390	366	344	324	305	287	271	255	241	228	216	205	194	184	175	166
2002	472	537	449	420	394	369	347	326	307	289	272	256	242	229	216	205	194	184	174	165
2003	393	448	510	427	399	374	351	329	310	291	274	258	244	230	217	205	194	184	175	166
2004	334	372	424	482	403	377	353	332	311	293	276	259	244	230	217	205	194	184	174	165
2005	292	315	351	400	455	381	356	334	313	294	277	260	245	231	218	205	194	183	174	164
2006	266	277	299	333	380	432	361	338	317	297	279	262	247	232	219	206	195	184	174	165
2007	251	251	261	281	314	358	406	340	318	298	280	263	247	232	219	206	194	183	173	164
2008	244	238	238	248	267	298	340	386	323	302	283	266	250	235	221	208	196	185	174	165
2009	242	232	226	227	235	254	284	323	367	307	288	269	253	237	223	210	198	186	176	166

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1956	350	334	318	303	289	275	262	250	238	227	216	206	196	187	178	170	162	154	147	140
1957	347	331	315	300	286	272	259	247	236	225	214	204	194	185	176	168	160	153	146	139
1958	344	328	312	298	283	270	257	245	234	223	212	202	193	184	175	167	159	151	144	138
1959	342	326	310	296	282	268	256	243	232	221	211	201	191	182	174	166	158	150	143	137
1960	338	322	307	293	279	266	253	241	230	219	208	199	189	180	172	164	156	149	142	135
1961	334	318	303	289	275	262	249	238	226	216	206	196	187	178	169	161	154	147	140	133
1962	330	314	299	285	272	259	247	235	224	213	203	194	184	176	167	160	152	145	138	132
1963	327	312	297	283	269	257	244	233	222	211	201	192	183	174	166	158	151	144	137	130
1964	325	310	295	281	267	255	243	231	220	210	200	190	181	173	165	157	150	143	136	129
1965	324	308	294	280	266	254	242	230	219	209	199	190	181	172	164	156	149	142	135	129
1966	322	306	292	278	265	252	240	229	218	208	198	188	179	171	163	155	148	141	134	128
1967	301	287	273	260	248	236	225	214	204	194	185	176	168	160	152	145	138	132	126	120
1968	280	266	254	242	230	219	209	199	189	180	172	164	156	149	142	135	128	122	117	111
1969	267	255	243	231	220	210	200	190	181	173	164	157	149	142	135	129	123	117	112	106
1970	266	254	242	230	219	209	199	189	180	172	164	156	149	141	135	128	122	117	111	106
1971	266	253	241	229	219	208	198	189	180	171	163	155	148	141	134	128	122	116	111	105
1972	265	252	240	229	218	208	198	188	179	171	163	155	148	141	134	128	122	116	110	105
1973	264	251	239	228	217	207	197	188	179	170	162	154	147	140	133	127	121	115	110	105
1974	261	249	237	226	215	205	195	186	177	169	161	153	146	139	132	126	120	114	109	104
1975	260	247	236	225	214	204	194	185	176	168	160	152	145	138	131	125	119	114	108	103
1976	258	246	234	223	212	202	193	184	175	166	159	151	144	137	130	124	118	113	107	102
1977	256	244	233	222	211	201	191	182	174	165	157	150	143	136	130	123	118	112	107	102
1978	255	243	231	220	210	200	190	181	172	164	156	149	142	135	129	123	117	111	106	101
1979	252	240	229	218	208	198	188	180	171	163	155	148	141	134	128	122	116	110	105	100
1980	250	239	227	216	206	196	187	178	170	162	154	147	140	133	127	121	115	109	104	99
1981	248	236	225	214	204	194	185	176	168	160	152	145	138	132	125	119	114	108	103	98
1982	244	232	221	211	201	191	182	174	165	157	150	143	136	130	123	118	112	107	102	97
1983	241	230	219	208	198	189	180	172	163	156	148	141	134	128	122	116	111	105	100	96
1984	236	225	214	204	194	185	176	168	160	152	145	138	132	125	119	114	108	103	98	94
1985	229	218	208	198	189	180	171	163	155	148	141	134	128	122	116	110	105	100	95	91
1986	221	211	201	191	182	174	165	158	150	143	136	130	124	118	112	107	102	97	92	88
1987	216	206	196	187	178	170	162	154	147	140	133	127	121	115	110	104	99	95	90	86
1988	213	203	194	184	176	167	159	152	145	138	131	125	119	113	108	103	98	93	89	85
1989	209	199	190	181	172	164	156	149	142	135	129	123	117	111	106	101	96	92	87	83
1990	206	196	187	178	169	161	154	147	140	133	127	121	115	110	104	99	95	90	86	82
1991	202	192	183	174	166	158	151	144	137	130	124	118	113	107	102	97	93	88	84	80
1992	197	187	178	170	162	154	147	140	133	127	121	115	110	104	99	95	90	86	82	78
1993	193	184	175	167	159	151	144	137	131	125	119	113	108	103	98	93	89	85	81	77
1994	189	180	171	163	155	148	141	134	128	122	116	110	105	100	95	91	87	83	79	75
1995	185	176	167	159	152	145	138	131	125	119	113	108	103	98	93	89	85	81	77	73
1996	181	173	164	156	149	142	135	129	122	117	111	106	101	96	91	87	83	79	75	72
1997	177	169	161	153	146	139	132	126	120	114	109	103	99	94	89	85	81	77	74	70
1998	173	164	156	149	142	135	128	122	116	111	106	101	96	91	87	83	79	75	72	68
1999	160	152	145	138	131	125	119	113	108	102	98	93	89	84	80	77	73	69	66	63
2000	158	150	143	136	129	123	117	111	106	101	96	92	87	83	79	75	72	68	65	62
2001	157	150	142	135	129	122	116	111	105	100	96	91	87	83	79	75	71	68	65	62
2002	157	149	142	135	128	122	116	110	105	100	95	91	86	82	78	75	71	68	64	61
2003	157	149	142	135	128	122	116	110	105	100	95	90	86	82	78	74	71	67	64	61
2004	157	149	141	134	127	121	115	109	104	99	94	90	85	81	78	74	70	67	64	61
2005	156	148	140	133	127	120	114	109	103	98	94	89	85	81	77	73	70	66	63	60
2006	156	148	140	133	126	120	114	108	103	98	93	89	85	80	77	73	69	66	63	60
2007	155	147	139	132	125	119	113	107	102	97	92	88	84	80	76	72	69	65	62	59
2008	156	147	140	132	126	119	113	107	102	97	92	88	83	79	76	72	69	65	62	59
2009	157	148	140	133	126	119	113	108	102	97	92	88	83	79	76	72	68	65	62	59

Table 21 (continued). Male numbers-at-age of splitnose rockfish estimated by the base model.

	Age (years)																			
Year	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1956	134	127	121	116	110	105	100	95	91	87	83	79	75	72	68	65	62	59	56	1145
1957	132	126	120	114	109	104	99	94	90	86	82	78	74	71	68	64	61	58	56	1133
1958	131	125	119	113	108	103	98	94	89	85	81	77	74	70	67	64	61	58	55	1123
1959	130	124	118	113	107	102	98	93	89	84	81	77	73	70	66	63	60	58	55	1115
1960	129	123	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	57	54	1104
1961	127	121	115	110	105	100	95	91	86	82	79	75	71	68	65	62	59	56	53	1088
1962	125	120	114	109	104	99	94	90	85	81	78	74	70	67	64	61	58	55	53	1075
1963	124	118	113	108	103	98	93	89	85	81	77	73	70	67	63	60	58	55	52	1065
1964	123	118	112	107	102	97	92	88	84	80	76	73	69	66	63	60	57	55	52	1057
1965	123	117	112	106	101	97	92	88	84	80	76	72	69	66	63	60	57	54	52	1051
1966	122	116	111	106	101	96	91	87	83	79	75	72	68	65	62	59	57	54	51	1044
1967	114	109	104	99	94	90	86	81	78	74	71	67	64	61	58	55	53	50	48	977
1968	106	101	96	92	87	83	79	76	72	69	65	62	59	57	54	51	49	47	45	906
1969	101	96	92	88	84	80	76	72	69	66	63	60	57	54	52	49	47	45	43	867
1970	101	96	92	87	83	79	76	72	69	65	62	59	57	54	51	49	47	44	42	862
1971	100	96	91	87	83	79	75	72	68	65	62	59	56	54	51	49	46	44	42	859
1972	100	95	91	87	83	79	75	71	68	65	62	59	56	54	51	49	46	44	42	856
1973	100	95	91	86	82	78	75	71	68	65	62	59	56	53	51	48	46	44	42	852
1974	99	94	90	85	81	78	74	70	67	64	61	58	55	53	50	48	46	44	41	844
1975	98	94	89	85	81	77	73	70	67	64	61	58	55	52	50	48	45	43	41	838
1976	97	93	88	84	80	77	73	69	66	63	60	57	55	52	50	47	45	43	41	832
1977	97	92	88	84	80	76	72	69	66	63	60	57	54	52	49	47	45	43	41	826
1978	96	92	87	83	79	75	72	68	65	62	59	56	54	51	49	47	44	42	40	820
1979	95	91	86	82	78	75	71	68	65	62	59	56	53	51	48	46	44	42	40	812
1980	95	90	86	82	78	74	71	67	64	61	58	56	53	50	48	46	44	42	40	805
1981	94	89	85	81	77	73	70	67	63	60	58	55	52	50	47	45	43	41	39	796
1982	92	88	84	80	76	72	69	66	62	60	57	54	51	49	47	45	42	40	39	783
1983	91	87	83	79	75	71	68	65	62	59	56	53	51	48	46	44	42	40	38	774
1984	89	85	81	77	73	70	67	63	60	58	55	52	50	47	45	43	41	39	37	757
1985	87	82	79	75	71	68	65	62	59	56	53	51	48	46	44	42	40	38	36	735
1986	84	80	76	72	69	66	62	60	57	54	51	49	47	44	42	40	38	37	35	710
1987	82	78	74	71	67	64	61	58	55	53	50	48	46	43	41	39	38	36	34	693
1988	81	77	73	70	66	63	60	57	55	52	50	47	45	43	41	39	37	35	34	683
1989	79	75	72	68	65	62	59	56	54	51	49	46	44	42	40	38	36	35	33	670
1990	78	74	71	67	64	61	58	55	53	50	48	46	43	41	39	38	36	34	32	659
1991	76	73	69	66	63	60	57	54	52	49	47	45	43	41	39	37	35	33	32	645
1992	74	71	67	64	61	58	55	53	50	48	46	43	41	39	38	36	34	32	31	628
1993	73	70	66	63	60	57	55	52	49	47	45	43	41	39	37	35	34	32	30	617
1994	71	68	65	62	59	56	53	51	48	46	44	42	40	38	36	34	33	31	30	602
1995	70	66	63	60	57	55	52	50	47	45	43	41	39	37	35	34	32	30	29	588
1996	68	65	62	59	56	54	51	49	46	44	42	40	38	36	35	33	31	30	28	576
1997	67	64	61	58	55	52	50	48	45	43	41	39	37	35	34	32	31	29	28	563
1998	65	62	59	56	53	51	49	46	44	42	40	38	36	34	33	31	30	28	27	547
1999	60	57	54	52	49	47	45	43	41	39	37	35	33	32	30	29	28	26	25	506
2000	59	56	54	51	49	46	44	42	40	38	36	35	33	31	30	29	27	26	25	498
2001	59	56	53	51	48	46	44	42	40	38	36	34	33	31	30	28	27	26	24	495
2002	59	56	53	51	48	46	44	42	40	38	36	34	33	31	30	28	27	26	24	492
2003	58	56	53	50	48	46	44	42	40	38	36	34	33	31	30	28	27	26	24	491
2004	58	55	53	50	48	45	43	41	39	37	36	34	32	31	29	28	27	25	24	487
2005	57	55	52	50	47	45	43	41	39	37	35	34	32	31	29	28	26	25	24	483
2006	57	54	52	49	47	45	43	41	39	37	35	34	32	30	29	28	26	25	24	481
2007	57	54	51	49	47	44	42	40	38	37	35	33	32	30	29	27	26	25	24	475
2008	56	54	51	49	46	44	42	40	38	36	35	33	31	30	29	27	26	25	24	474
2009	56	54	51	49	46	44	42	40	38	36	35	33	31	30	29	27	26	25	23	473

Table 22. Summary of recent trends in splitnose rockfish stock status and exploitation estimated by the base assessment model.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Landings (mt)	132	110	65	158	182	97	274	68	66	NA
Estimated Discards (mt)	113	101	60	162	201	113	336	86	83	NA
Estimated Total Catch (mt)	245	211	125	320	383	210	610	154	149	316
ABC (mt) south of 40°10' N lat	820	615	615	615	615	615	615	615	615	615
OY * (if different from ABC) (mt) south of 40°10' N lat	615	461	461	461	461	461	461	461	461	461
ABC (mt) north of 40°10' N lat										
OY * (if different from ABC) (mt) north of 40°10' N lat										
SPR	83.66%	86.02%	91.56%	81.58%	79.74%	88.68%	74.14%	92.69%	93.45%	87.96%
Exploitation Rate (total catch/summary biomass)	0.0069	0.0058	0.0033	0.0075	0.0082	0.0041	0.0108	0.0025	0.0023	NA
Summary Age 4+ Biomass (B) (mt)	35566	36217	38024	42794	46722	51676	56724	60729	64923	70196
Spawning Stock Output (SB) (million eggs)	4651	4763	4909	5125	5404	5807	6365	6972	7690	8426
Uncertainty in Spawning Stock Output estimate	2372-6931	2430-7096	2508-7311	2627-7623	2770-8038	2975-8639	3273-9457	3574-10370	3960-11420	4357-12494
Recruitment at age 0	35504	44958	35903	22388	21043	39992	52273	78203	12440	12741
Uncertainty in Recruitment estimate	14008-57000	20992-68924	16308-55498	8681-36095	6965-35121	14406-65578	11335-93211	0-186159	0-37683	0-38585
Depletion (SB/SB_0)	36.19%	37.06%	38.20%	39.87%	42.04%	45.18%	49.52%	54.24%	59.83%	65.55%
Uncertainty in Depletion estimate									46.68%-72.98%	51.22%-79.89%

Table 23. Summary of splitnose rockfish reference points from the base model.

	Point estimate	95% confidence interval
Unfished Spawning Stock Output (SB_0) (million eggs)	12853	9105-16601
Unfished Summary Age 4+ Biomass (B_0) (mt)	87584	NA
Unfished Recruitment (R_0) at age 0	13953	9874-18031
Reference points based on SB $_{40\%}$		
MSY Proxy Spawning Stock Output ($SB_{40\%}$) (million eggs)	5141	3642-6641
SPR resulting in $SB_{40\%}$ ($SPR_{SB40\%}$)	50.86%	50.86%-50.86%
Exploitation rate resulting in $SB_{40\%}$	3.18%	NA
Yield with $SPR_{SB40\%}$ at $SB_{40\%}$ (mt)	1236	883-1589
Reference points based on SPR proxy for MSY		
Spawning Stock Output at SPR (SB_{SPR}) (million eggs)	5006	3546-6466
$SPR_{MSY\text{-}proxy}$	50%	
Exploitation rate corresponding to SPR	3.28%	NA
Yield with $SPR_{MSY\text{-}proxy}$ at SB_{SPR} (mt)	1244	888-1599
Reference points based on estimated MSY values		
Spawning Stock Output at MSY (SB_{MSY}) (million eggs)	4121	2900-5342
SPR_{MSY}	44.36%	43.90%-44.83%
Exploitation Rate corresponding to SPR_{MSY}	3.98%	NA
MSY (mt)	1268	906-1630

Table 24. 12-year projections for alternative states of nature defined based on the alternative scenarios for recent recruitment deviations (2000-2006), with "low" and "high" scenarios corresponding to the high and low limits of the 95% confidence interval around the base model recruitment deviations for the same period.

			Low recent recruitments		Base Case		High recent recruitments	
Forecast	Year	Total removals (mt)	Spawning output (million eggs)	Depletion	Spawning output (million eggs)	Depletion	Spawning output (million eggs)	Depletion
	2009	2,780	7,432	62%	8,426	66%	8,177	66%
	2010	2,780	7,601	64%	8,825	69%	8,785	71%
	2011	2,780	7,754	65%	9,261	72%	9,503	76%
	2012	2,780	7,906	66%	9,750	76%	10,342	83%
1998 removals	2013	2,780	8,062	67%	10,275	80%	11,256	91%
	2014	2,780	8,190	68%	10,765	84%	12,124	98%
	2015	2,780	8,263	69%	11,154	87%	12,845	103%
	2016	2,780	8,268	69%	11,416	89%	13,376	108%
	2017	2,780	8,208	69%	11,552	90%	13,719	110%
	2018	2,780	8,094	68%	11,581	90%	13,898	112%
	2019	2,780	7,936	66%	11,520	90%	13,941	112%
	2020	2,780	7,745	65%	11,391	89%	13,875	112%
	2009	291	7,432	62%	8,426	66%	8,177	66%
	2010	291	7,935	66%	9,153	71%	9,107	73%
	2011	291	8,436	71%	9,929	77%	10,159	82%
	2012	291	8,943	75%	10,768	84%	11,344	91%
Average removals	2013	291	9,461	79%	11,653	91%	12,615	101%
of the last 10 years	2014	291	9,956	83%	12,509	97%	13,848	111%
	2015	291	10,396	87%	13,268	103%	14,940	120%
	2016	291	10,766	90%	13,897	108%	15,842	127%
	2017	291	11,065	93%	14,395	112%	16,551	133%
	2018	291	11,300	94%	14,775	115%	17,086	137%
	2019	291	11,480	96%	15,054	117%	17,472	141%
	2020	291	11,615	97%	15,250	119%	17,734	143%
	2009	145	7,432	62%	8,426	66%	8,177	66%
	2010	145	7,955	67%	9,172	71%	9,126	73%
	2011	145	8,475	71%	9,968	78%	10,198	82%
	2012	145	9,004	75%	10,827	84%	11,403	92%
50%	2013	145	9,543	80%	11,733	91%	12,694	102%
of average removals	2014	145	10,060	84%	12,611	98%	13,949	112%
of the last 10 years	2015	145	10,522	88%	13,392	104%	15,063	121%
	2016	145	10,913	91%	14,043	109%	15,986	129%
	2017	145	11,233	94%	14,562	113%	16,717	134%
	2018	145	11,488	96%	14,963	116%	17,273	139%
	2019	145	11,688	98%	15,262	119%	17,679	142%
	2020	145	11,842	99%	15,476	120%	17,961	144%

FIGURES

Figure 1. Photograph of splitnose rockfish, *Sebastes diploproa* (from Milton Love lab website at http://www.lovelab.id.ucsb.edu)

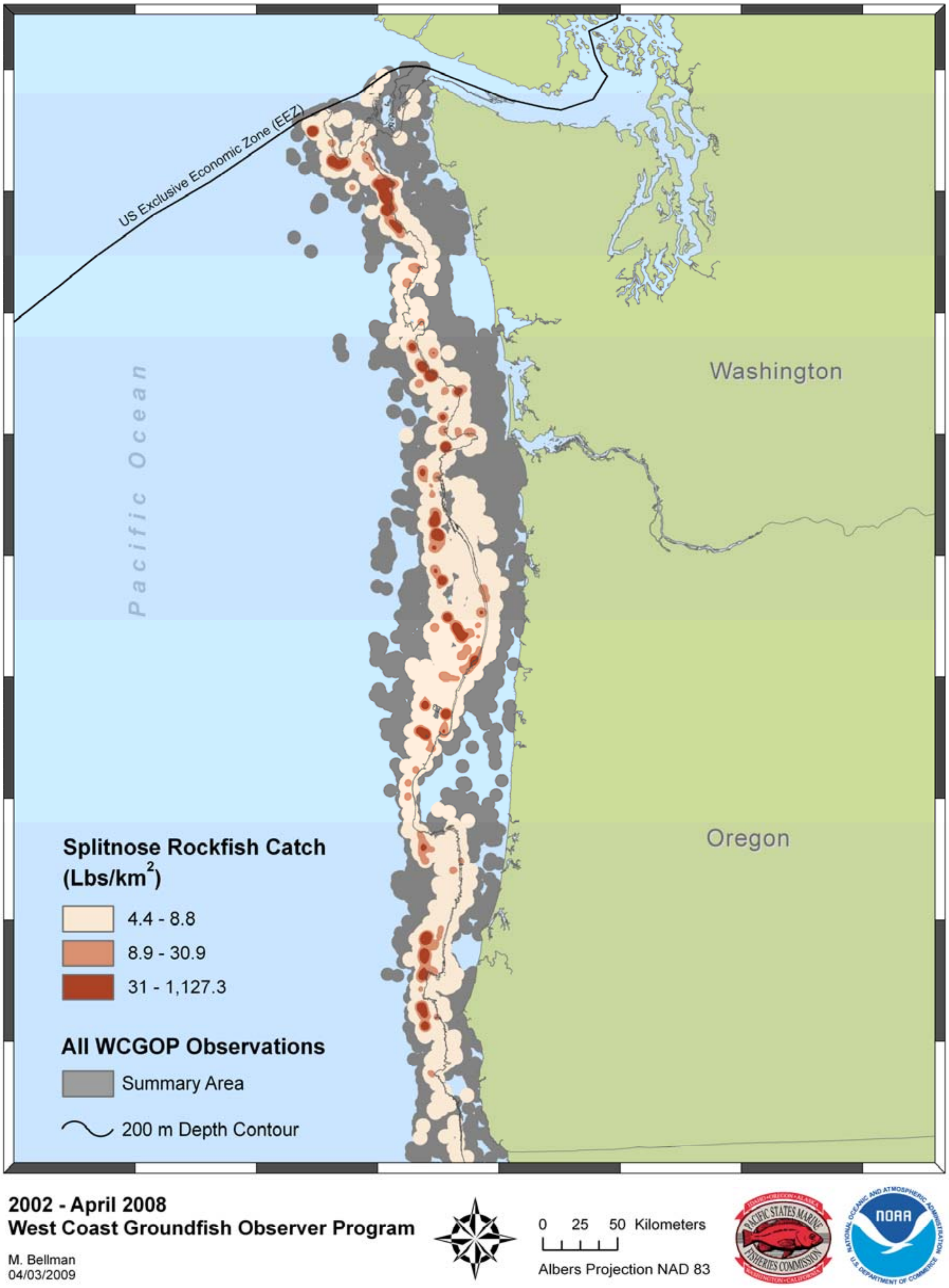


Figure 2. Spatial distribution of splitnose rockfish catch (lbs/km^2) observed by the West Coast Groundfish Observer Program from 2002 – April 2008 and the summary area of all observed fishing events off of Washington and Oregon.

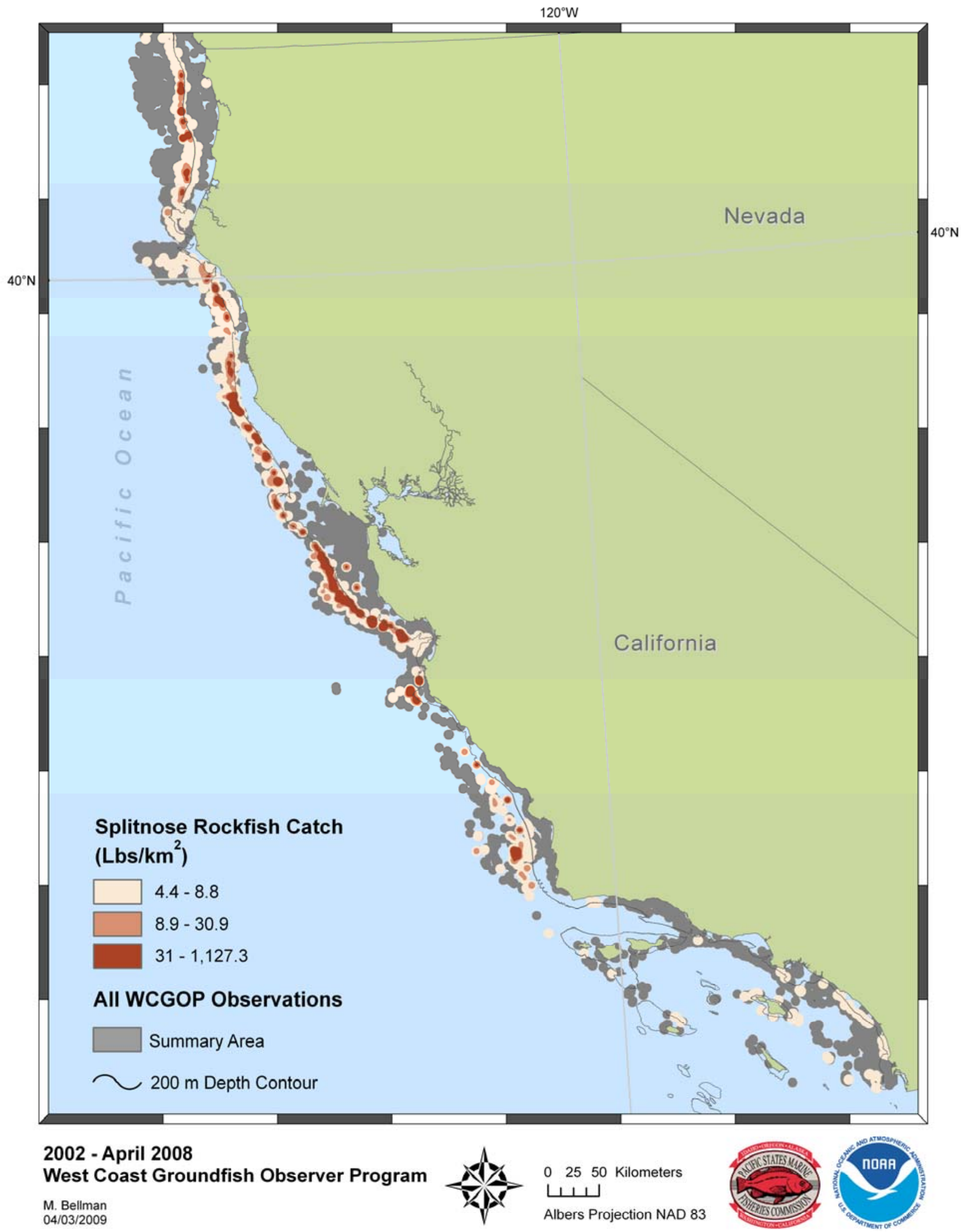


Figure 2 (continued). Spatial distribution of splitnose rockfish catch (lbs/km^2) observed by the West Coast Groundfish Observer Program from 2002 – April 2008 and the summary area of all observed fishing events off of California.

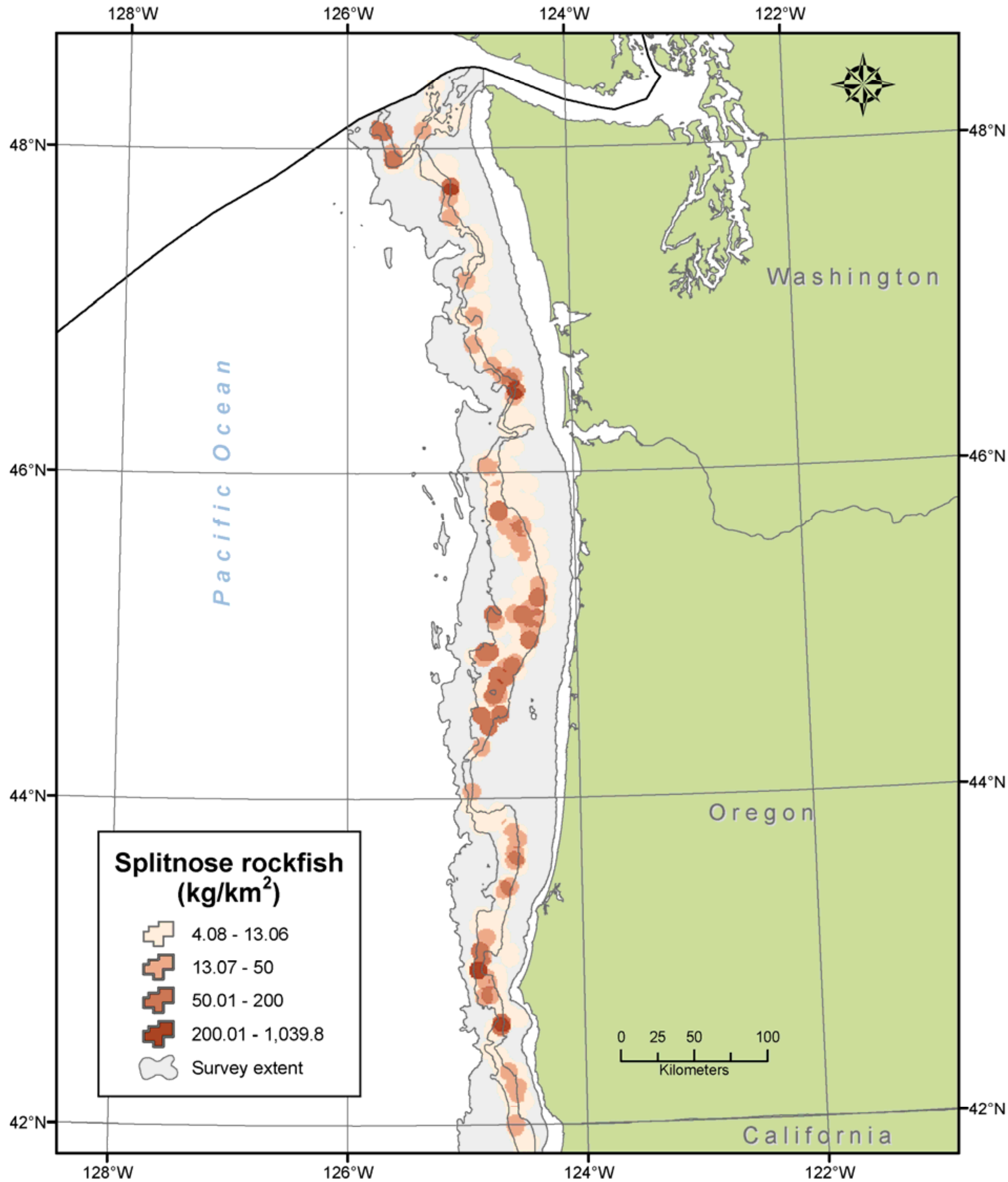


Figure 3. Density of splitnose rockfish (*Sebastes diploproa*) catch during NWFSC Groundfish Survey (2003-2008). Three main survey strata are defined by the 30-, 100-, 300- and 700-fathom isobaths.

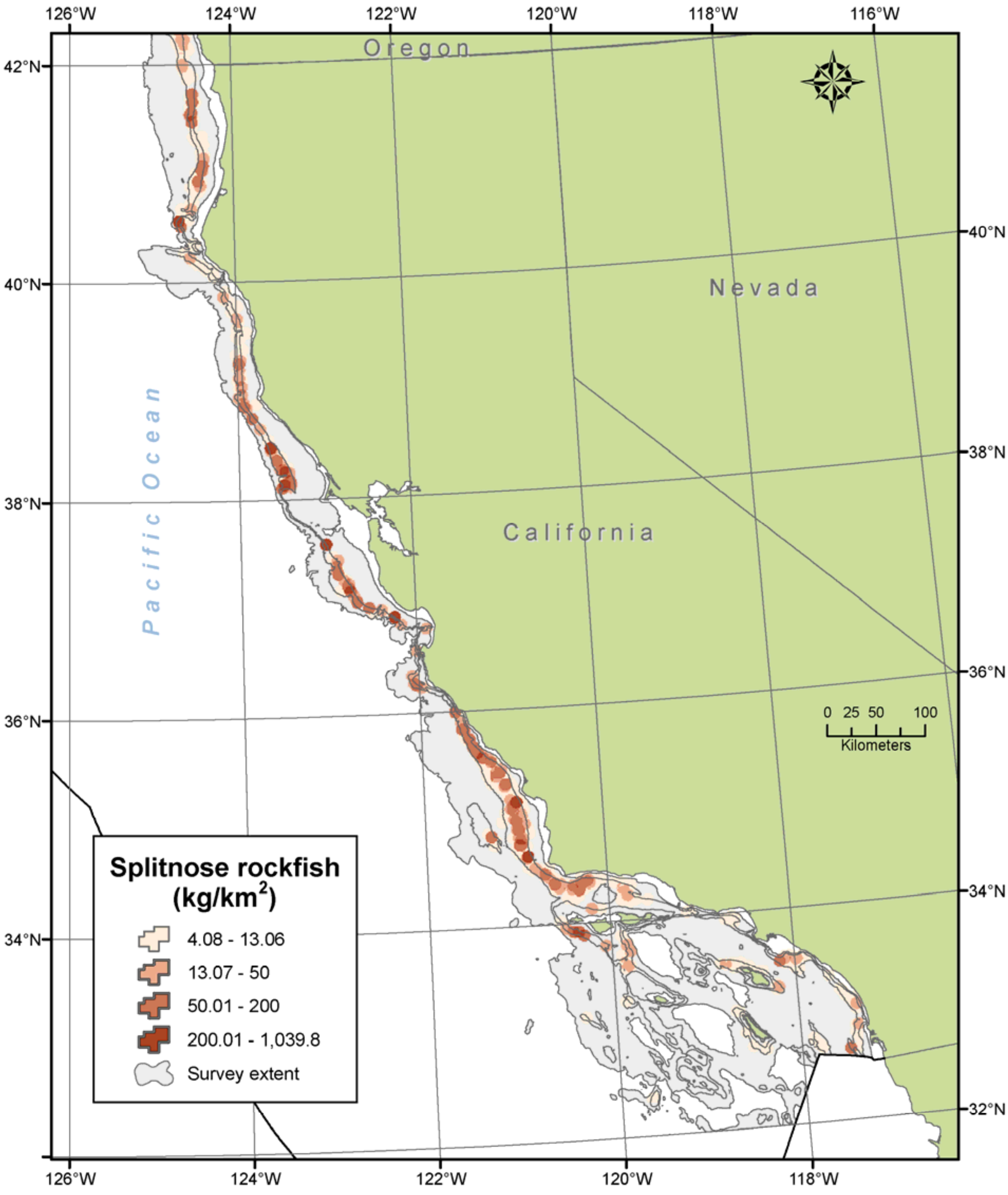


Figure 3 (continued). Density of splitnose rockfish (*Sebastes diploproa*) catch during NWFSC Groundfish Survey (2003-2008). Three main survey strata are defined by the 30-, 100-, 300- and 700-fathom isobaths.

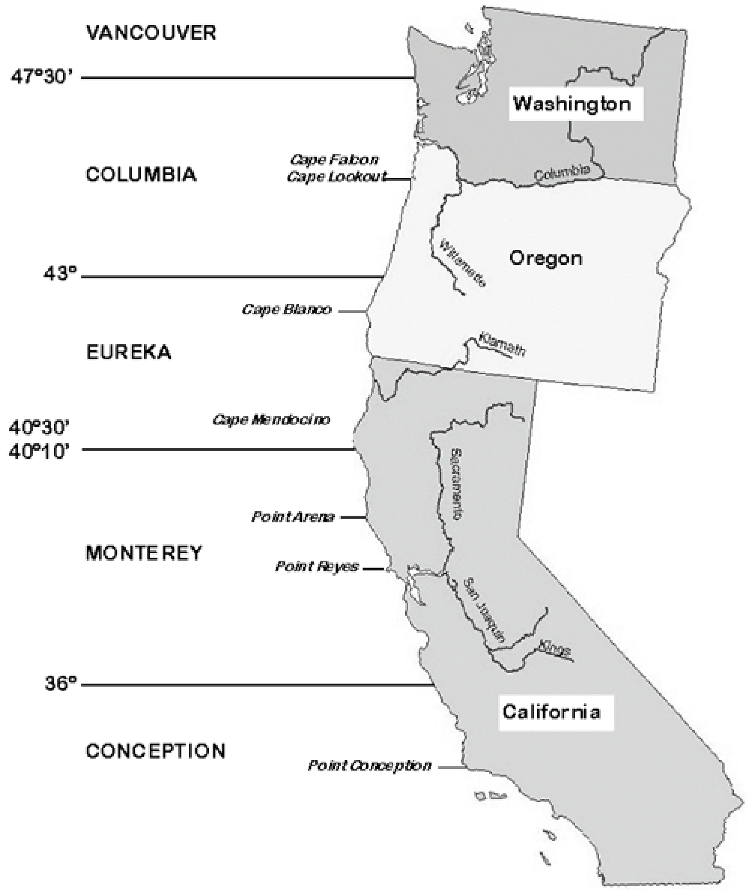


Figure 4. Map of the assessment area by states and International North Pacific Fisheries Commission (INPFC) areas.

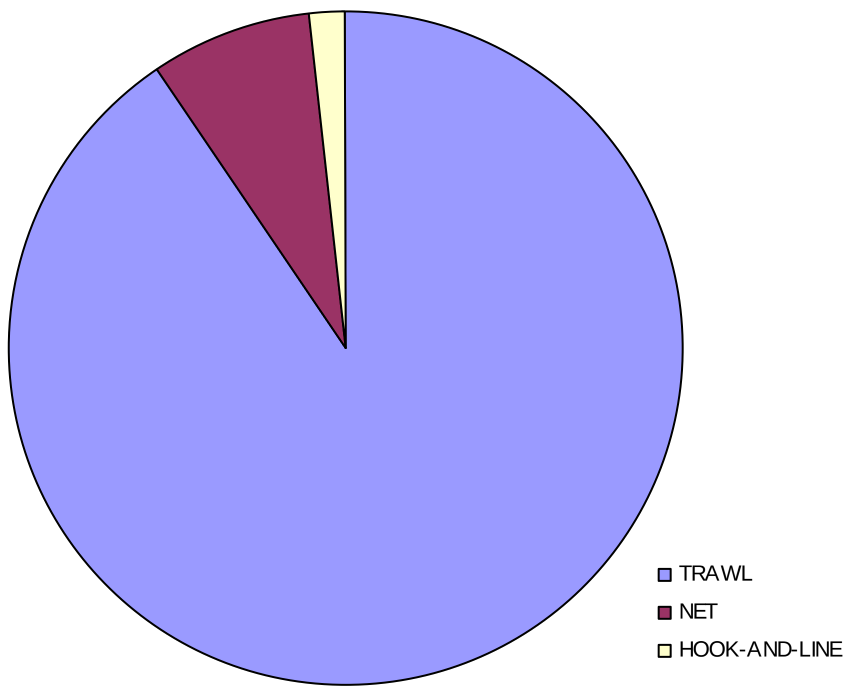


Figure 5. Averaged recent landings (1981-2008) of splitnose rockfish by gear.

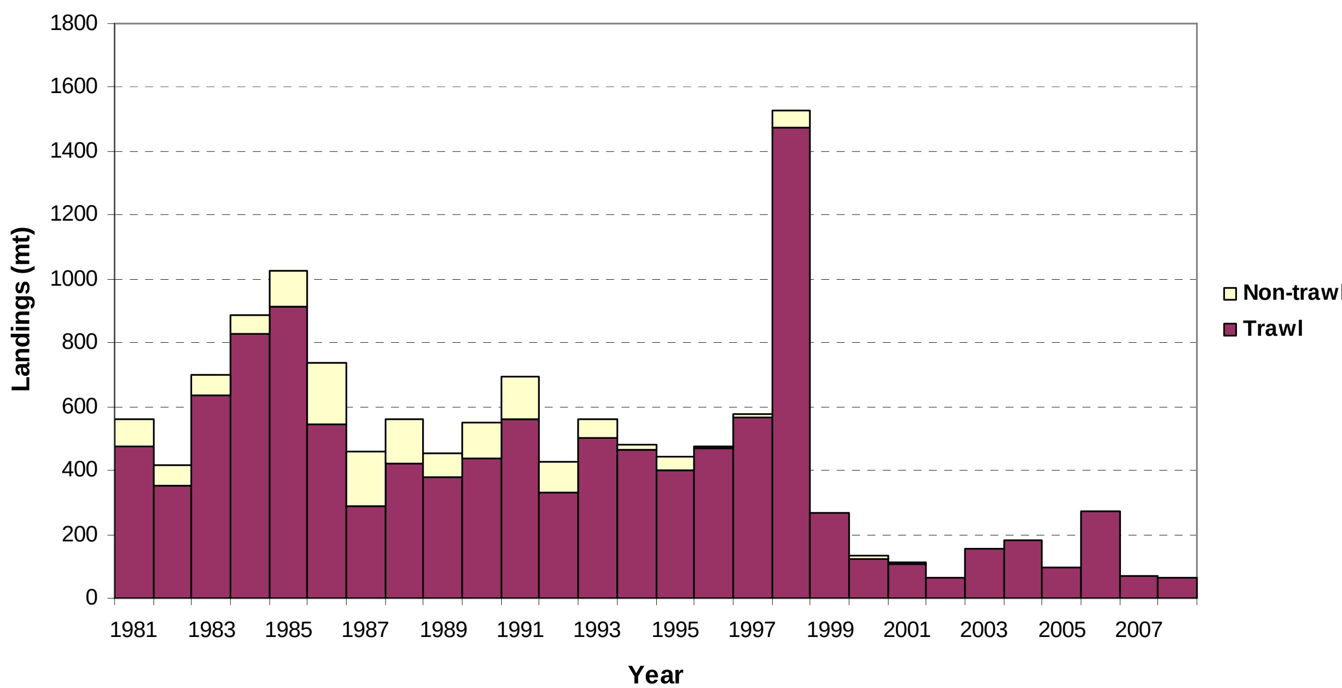


Figure 6. Recent landings of splitnose rockfish by trawl and non-trawl fisheries.

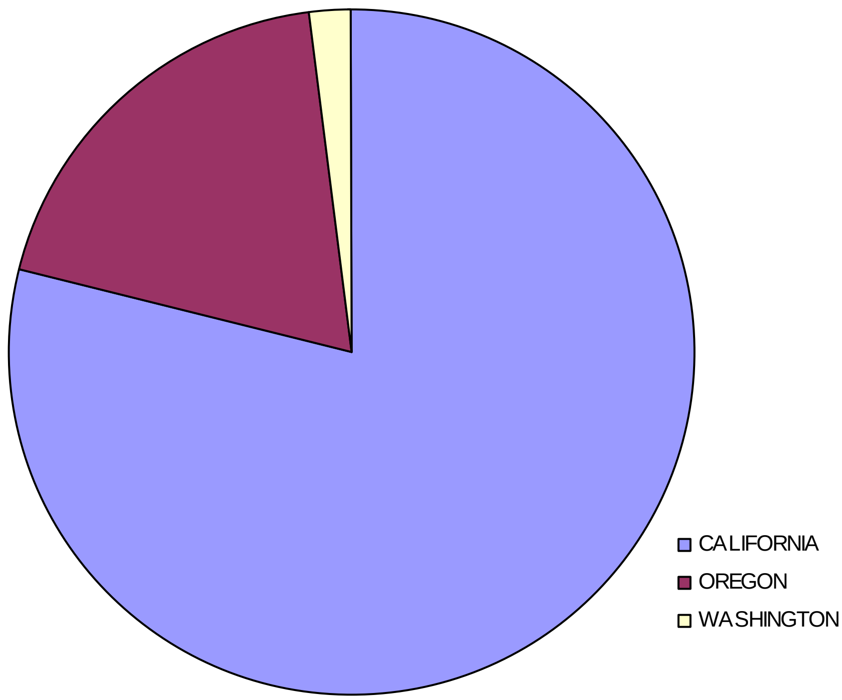


Figure 7. Averaged recent landings (1981-2008) of splitnose rockfish by state.

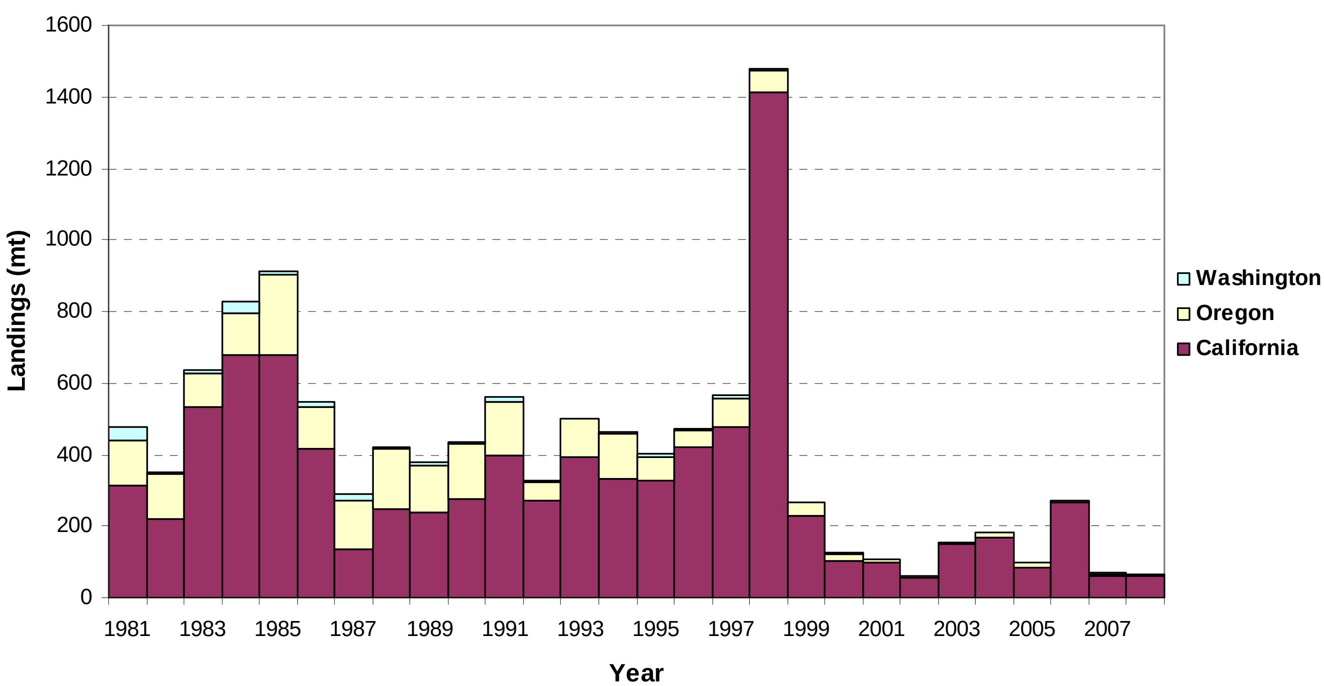


Figure 8. Recent trawl fishery landings of splitnose rockfish by state.

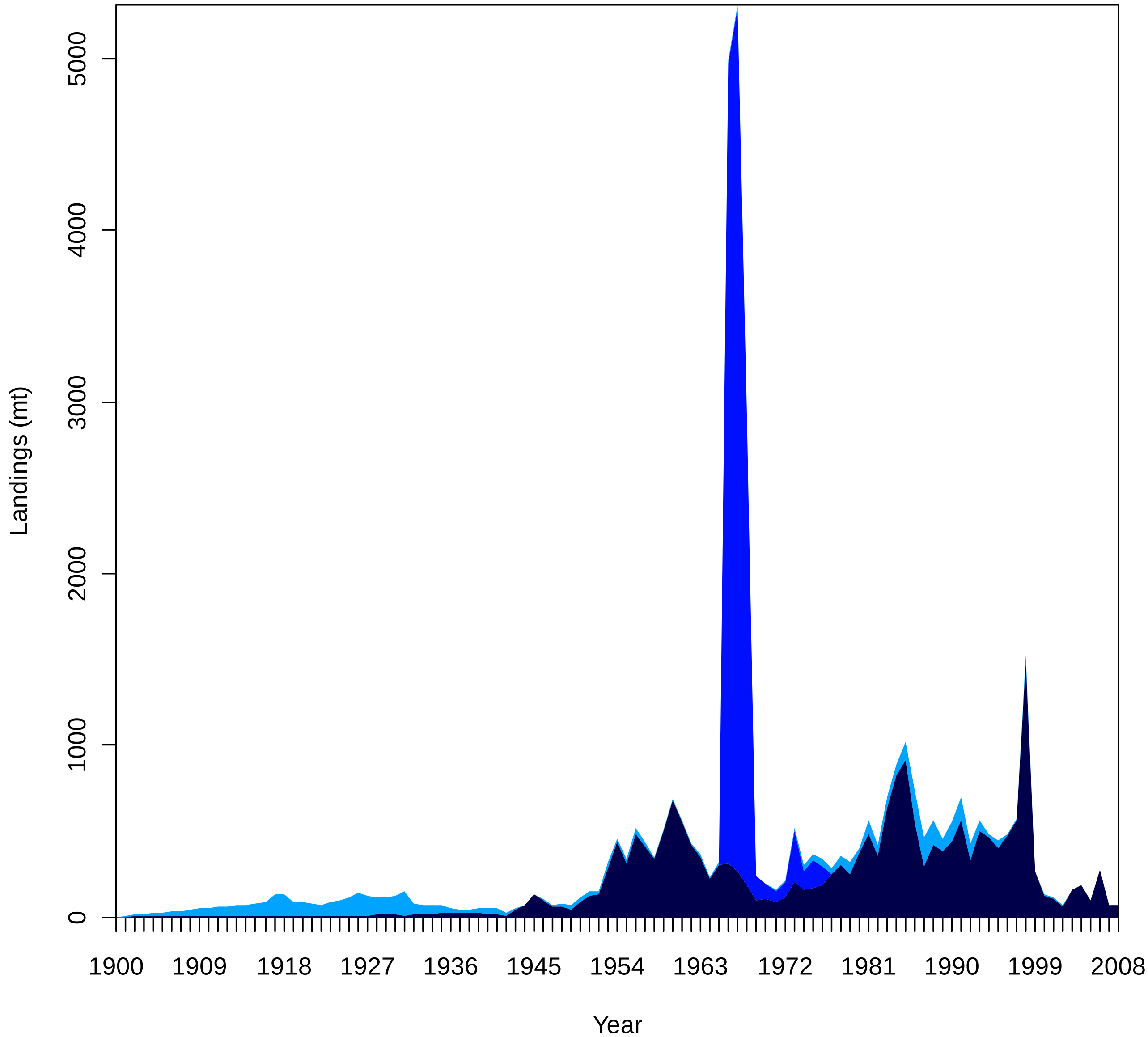


Figure 9. Time-series of historical landings of splitnose rockfish by domestic trawl (dark blue), foreign trawl (mid blue) and non-trawl (light blue) commercial fisheries.

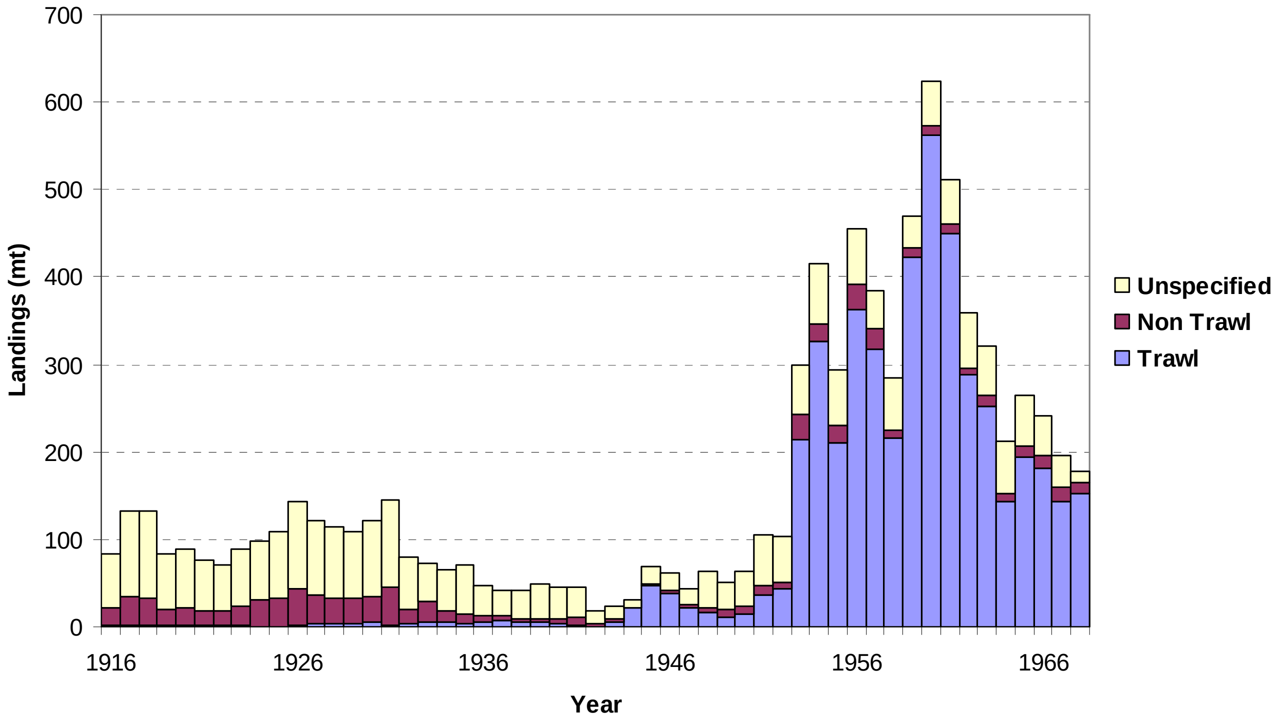


Figure 10. California reconstructed historical catches of splitnose rockfish by gear category.

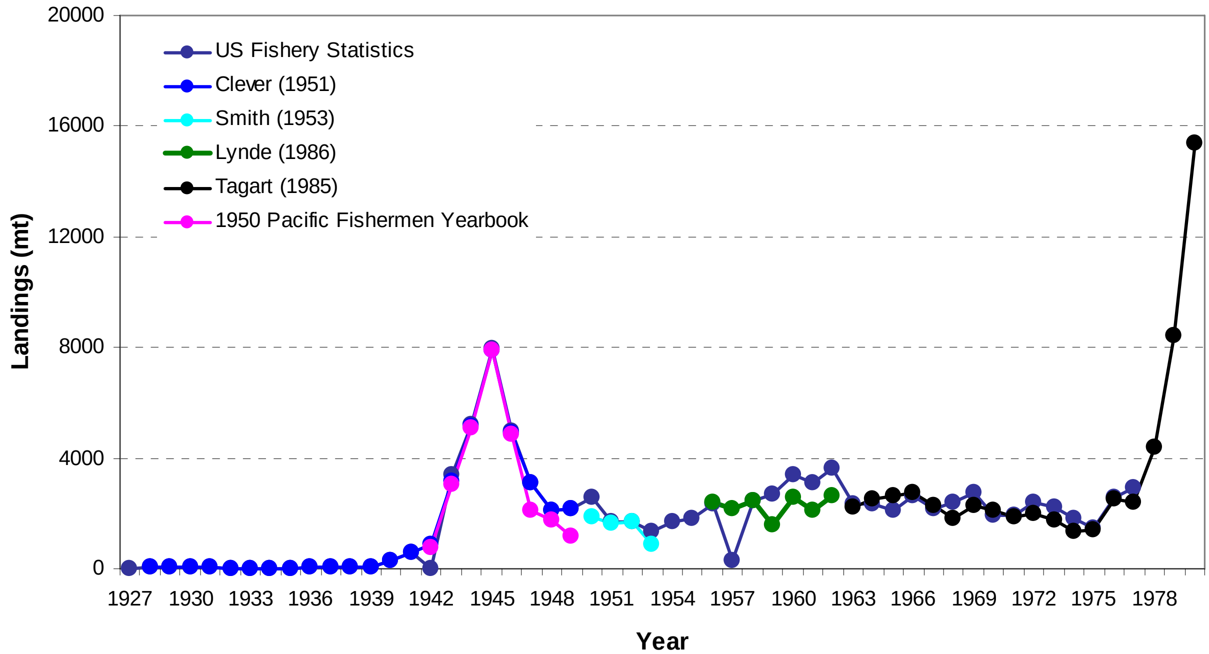


Figure 11. Time-series of historical landings of OTHER ROCKFISH market category in Oregon reported by different sources.

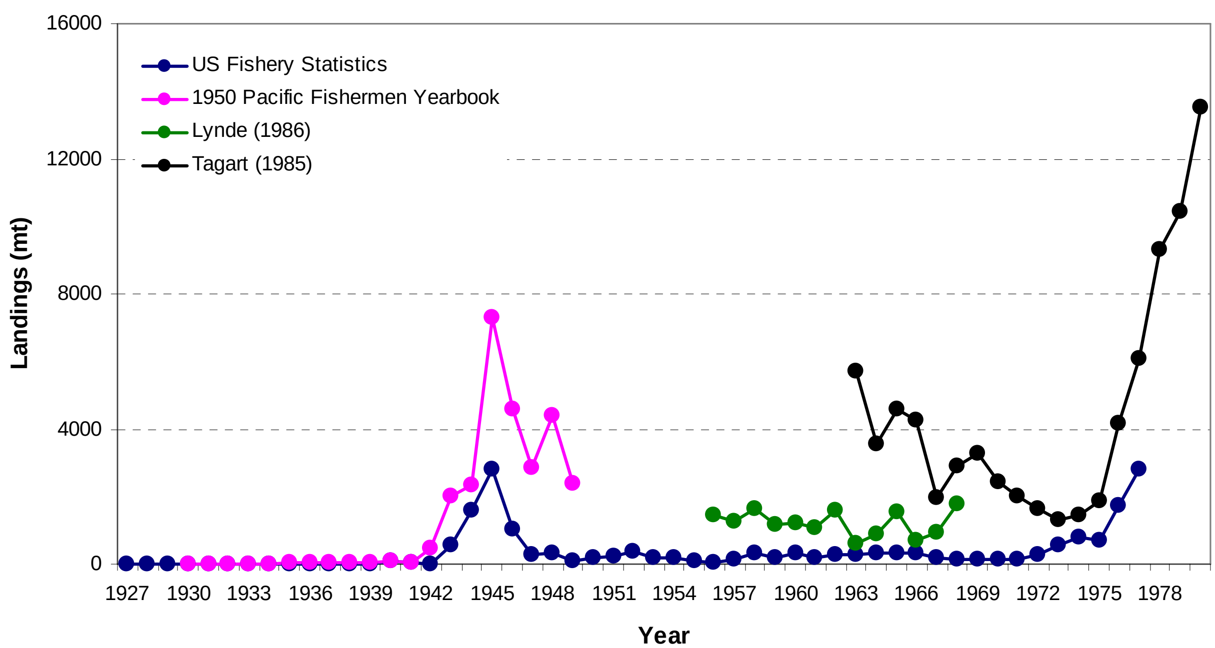
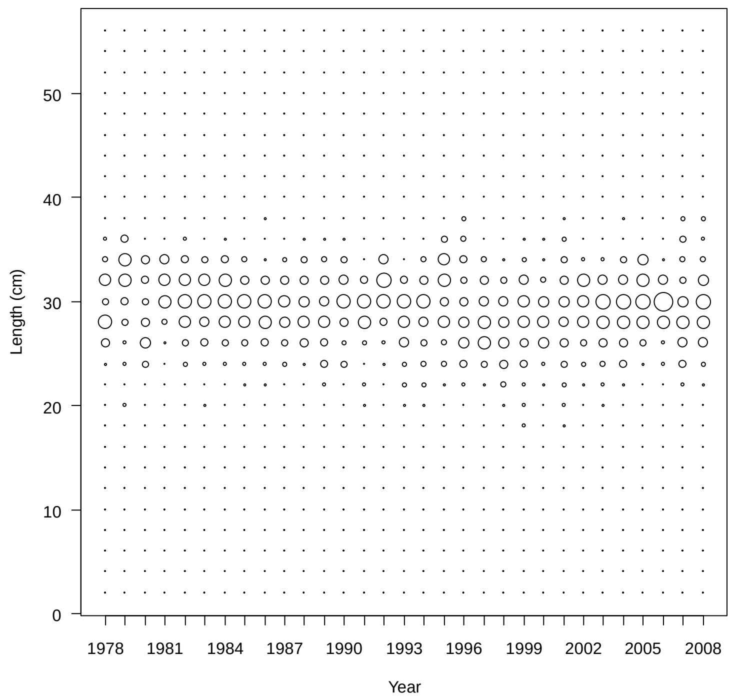


Figure 12. Time-series of historical landings of OTHER ROCKFISH market category in Washington reported by different sources.



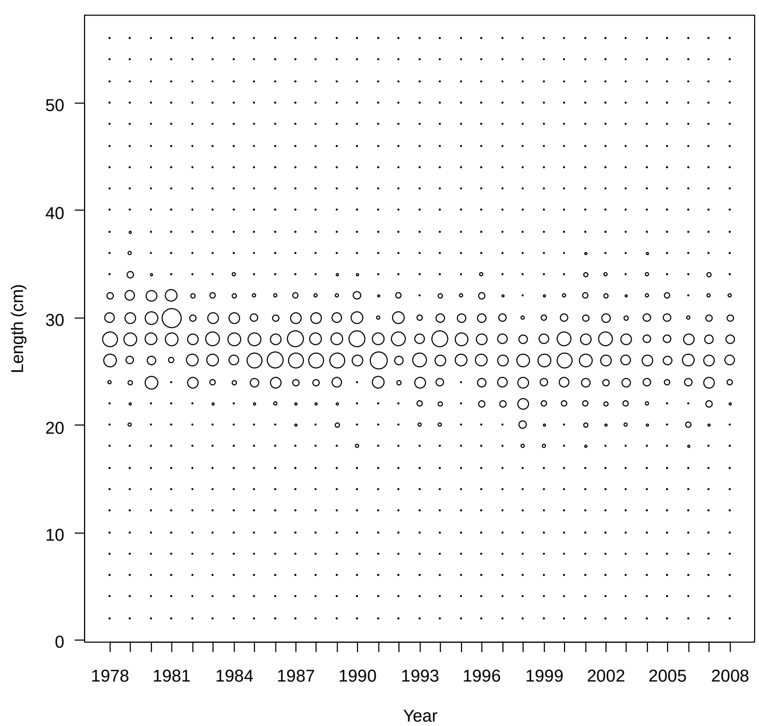


Figure 13. Length frequency distributions for female (top panel) and male (bottom panel) splitnose rockfish from domestic trawl fishery.

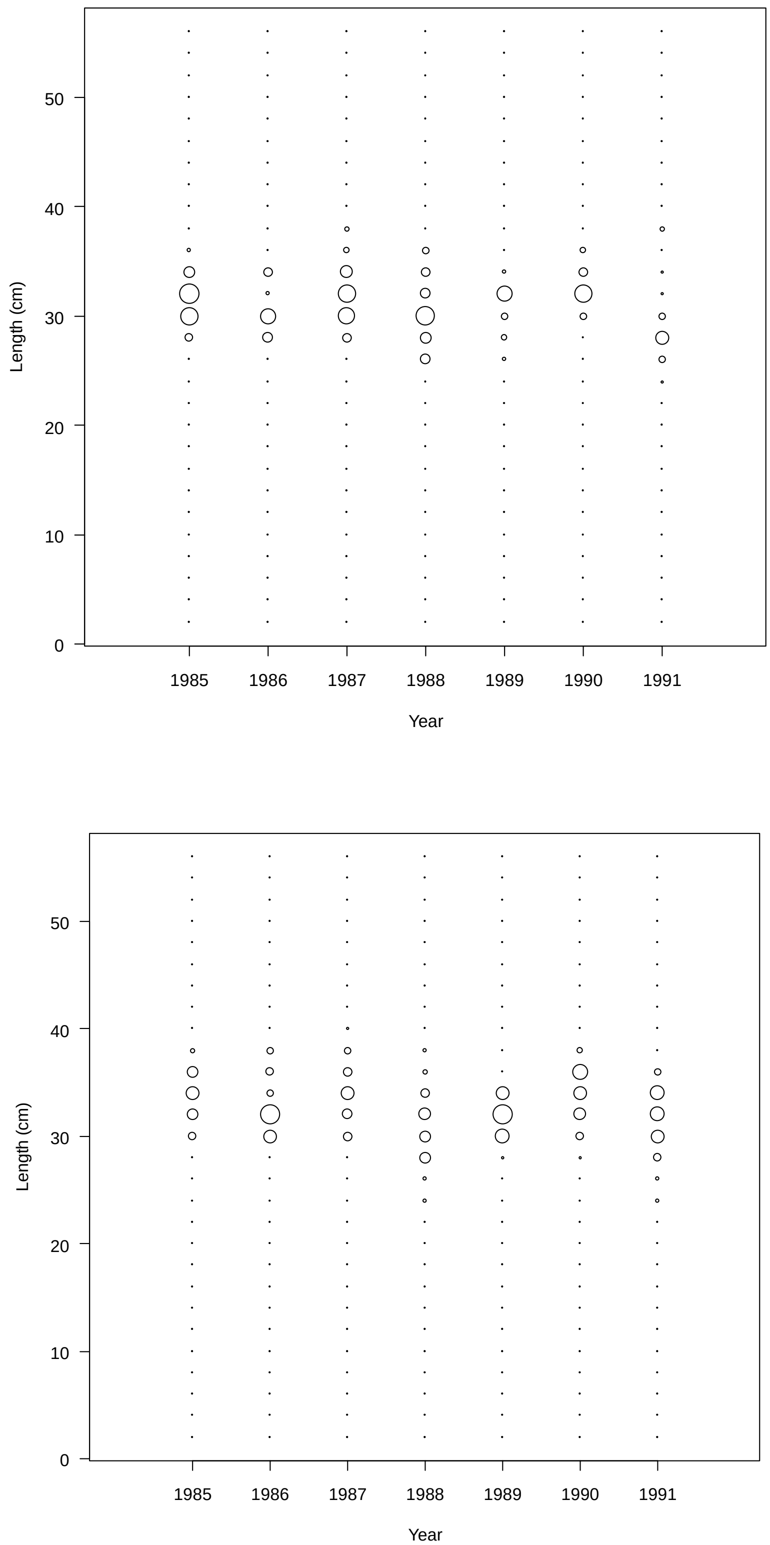


Figure 14. Length frequency distributions for female (top panel) and male (bottom panel) splitnose rockfish from non trawl fishery.

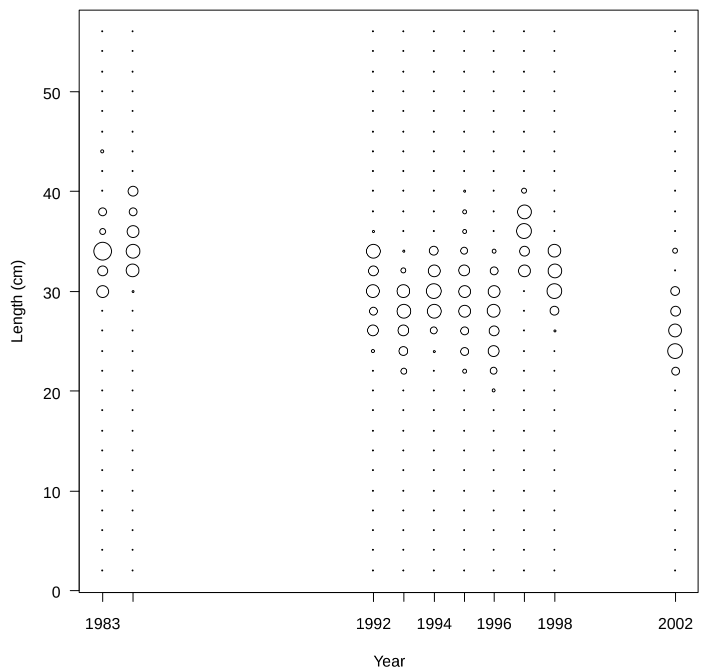


Figure 15. Length frequency distributions for splitnose rockfish (both sexes combined) from non trawl fishery.

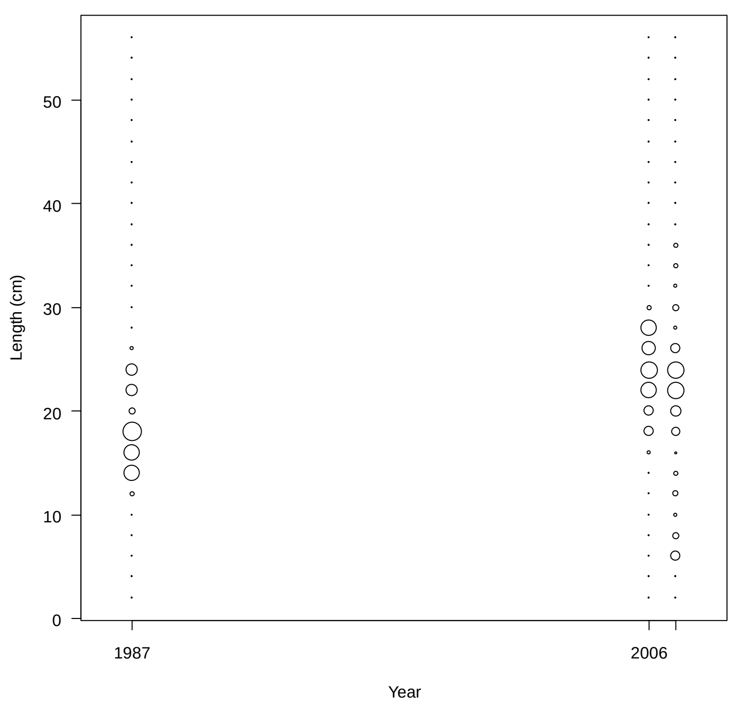


Figure 16. Length frequency distributions (both sexes combined) for discarded splitnose rockfish from trawl fishery.

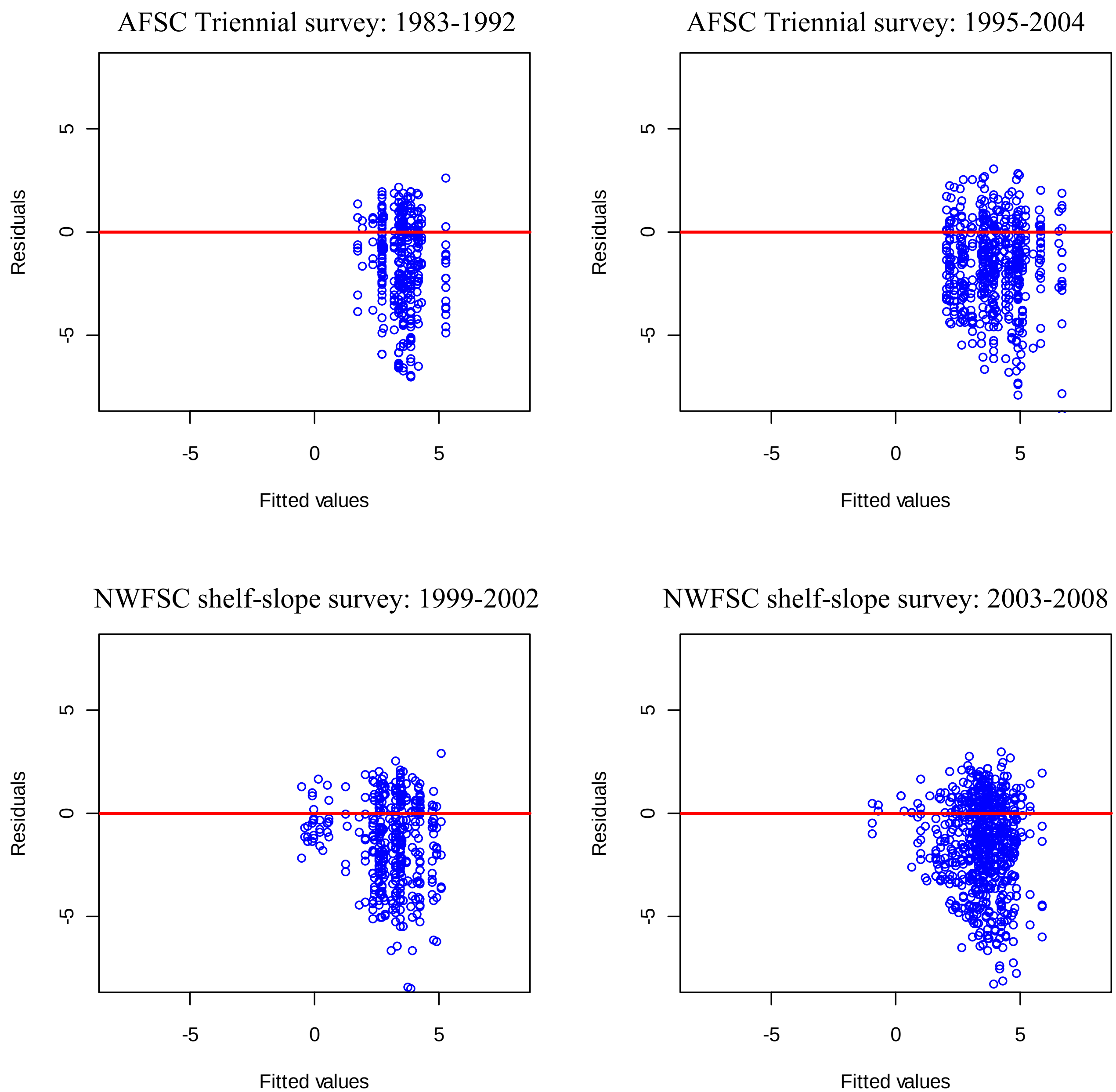


Figure 17. Residual plots of positive data for each survey.

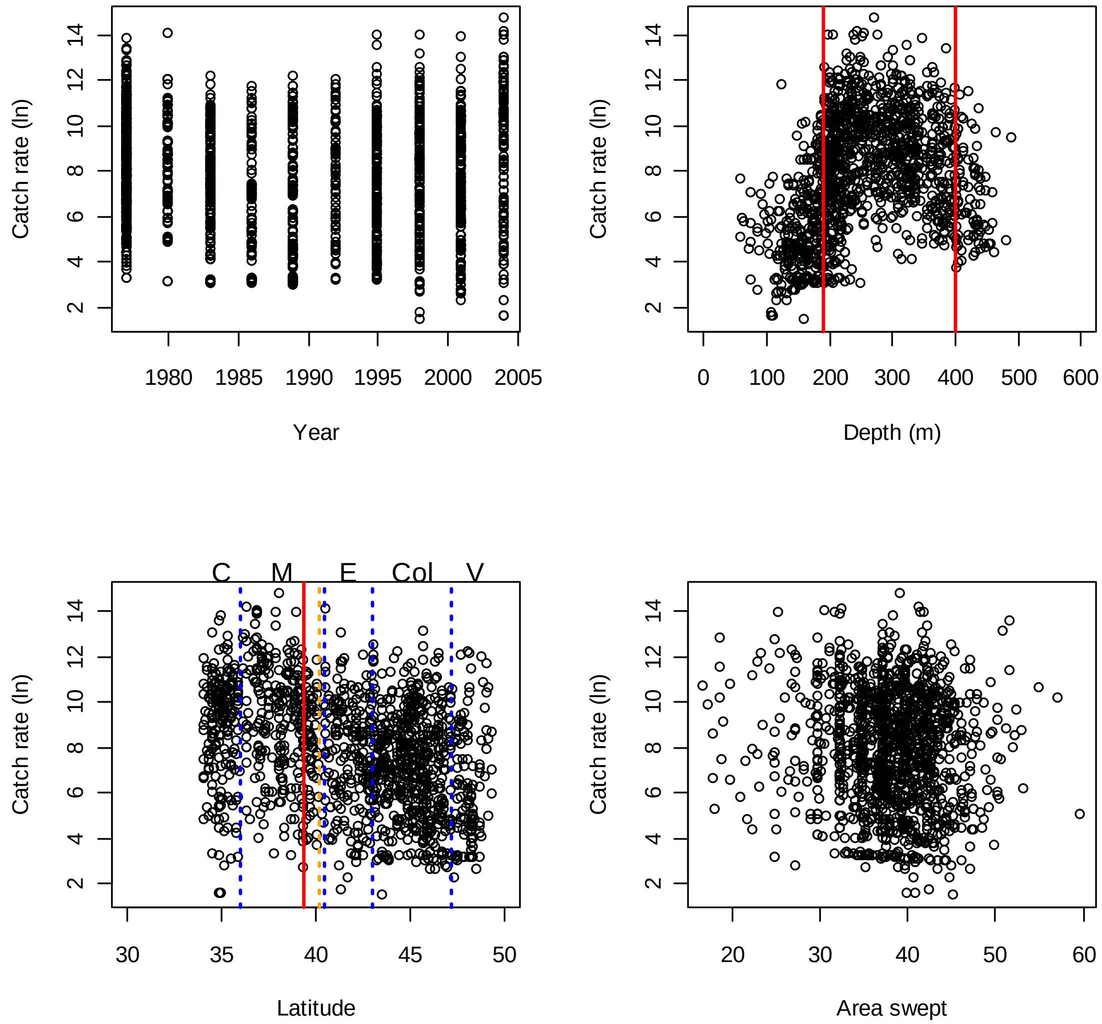


Figure 18. Relationship of catch rate to year, depth, latitude and area swept for the AFSC triennial survey. Red lines indicated suggested strata based on a tree regression. Orange line in the latitude plot indicates the north/south management line. Blue vertical lines in the same plot indicate the INPFC area boundaries. C = Conception; M = Monterey; E= Eureka; Col= Columbia; V= Vancouver.

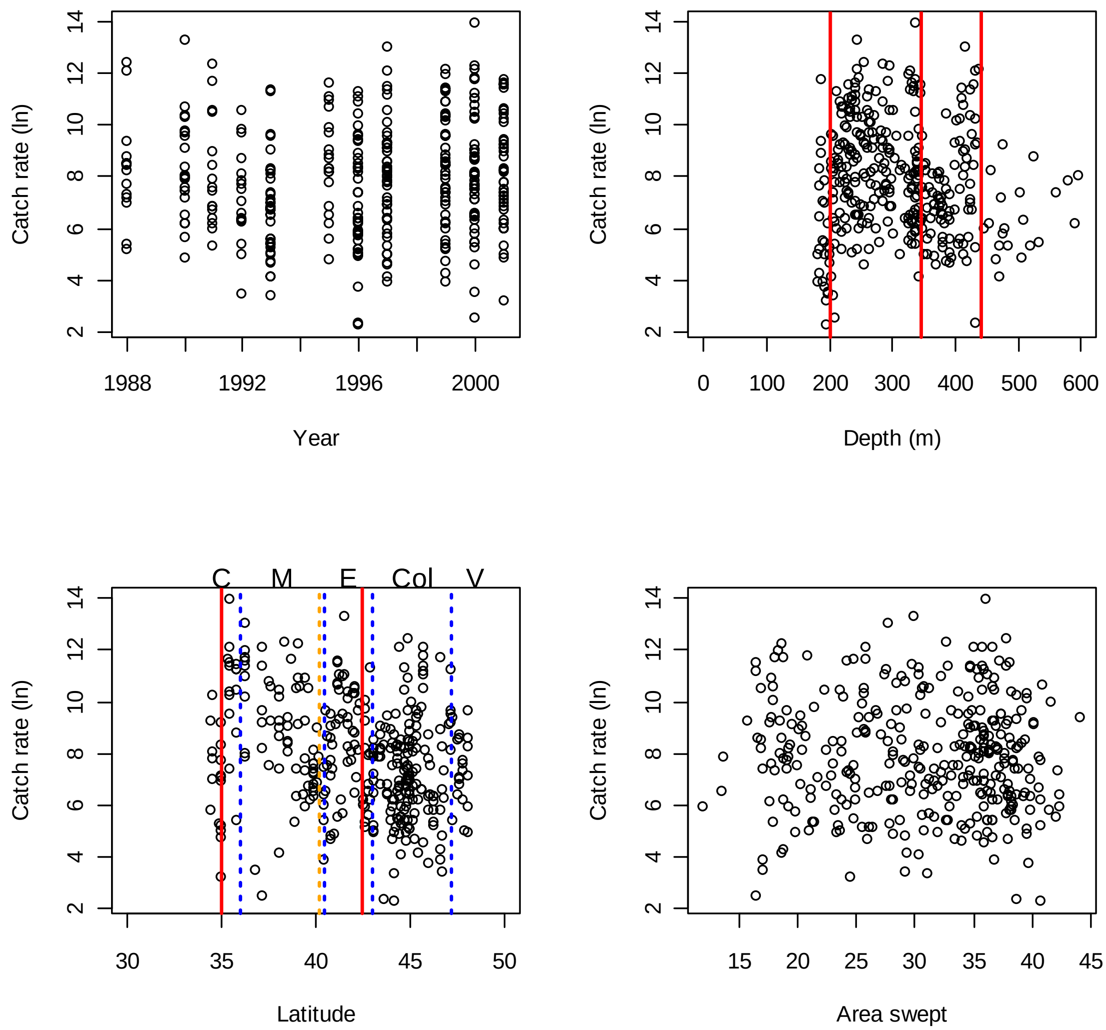


Figure 19. Relationship of catch rate to year, depth, latitude and area swept for the Alaska Fisheries Science Center slope survey. Red lines indicated suggested strata based on a tree regression. Orange line in the latitude plot indicates the north/south management line. Blue vertical lines in the same plot indicate the INPFC area boundaries. C = Conception; M = Monterey; E= Eureka; Col= Columbia; V= Vancouver.

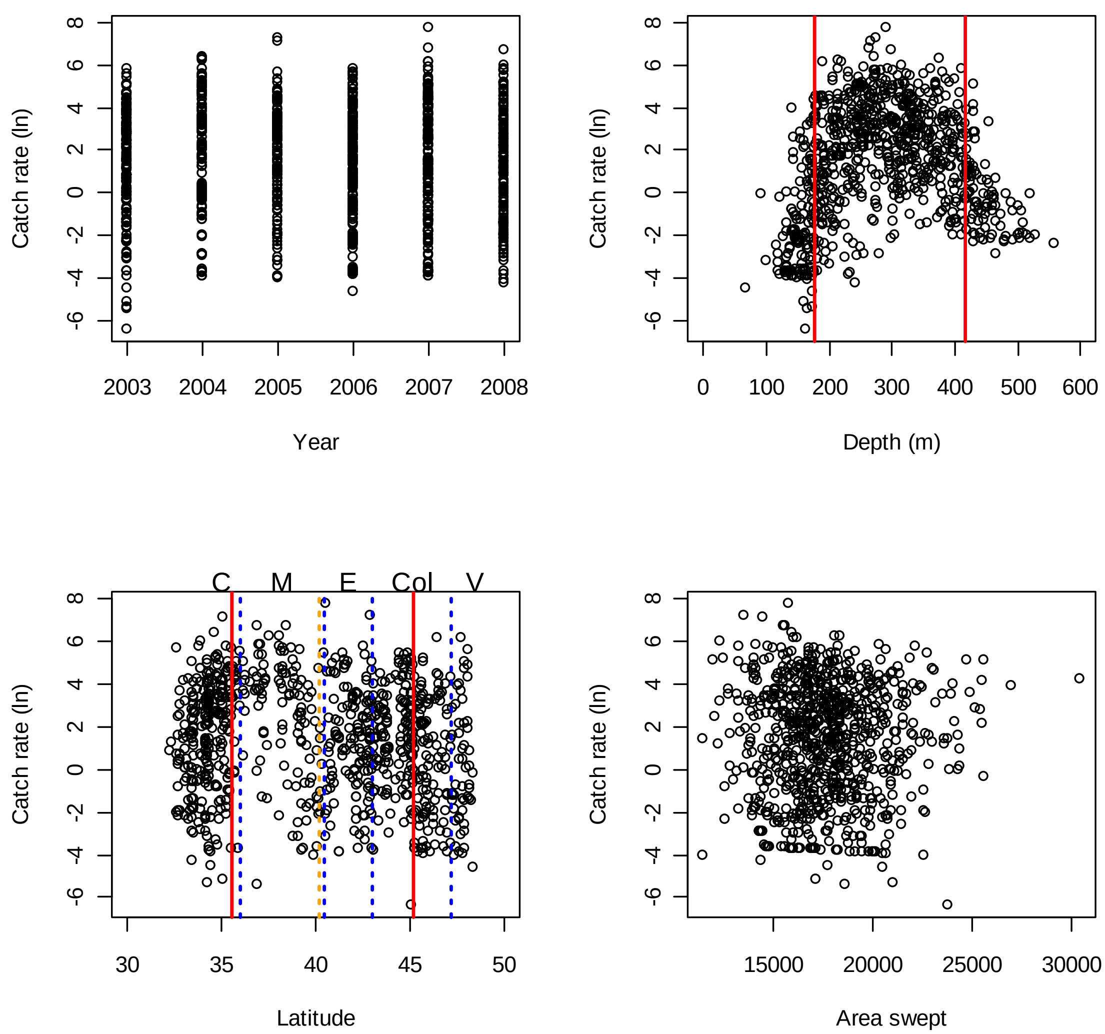


Figure 20. Relationship of catch rate to year, depth, latitude and area swept for the NWFSC shelf-slope survey. Red lines indicated suggested strata based on a tree regression. Orange line in the latitude plot indicates the north/south management line. Blue vertical lines in the same plot indicate the INPFC area boundaries. C = Conception; M = Monterey; E= Eureka; Col= Columbia; V= Vancouver.

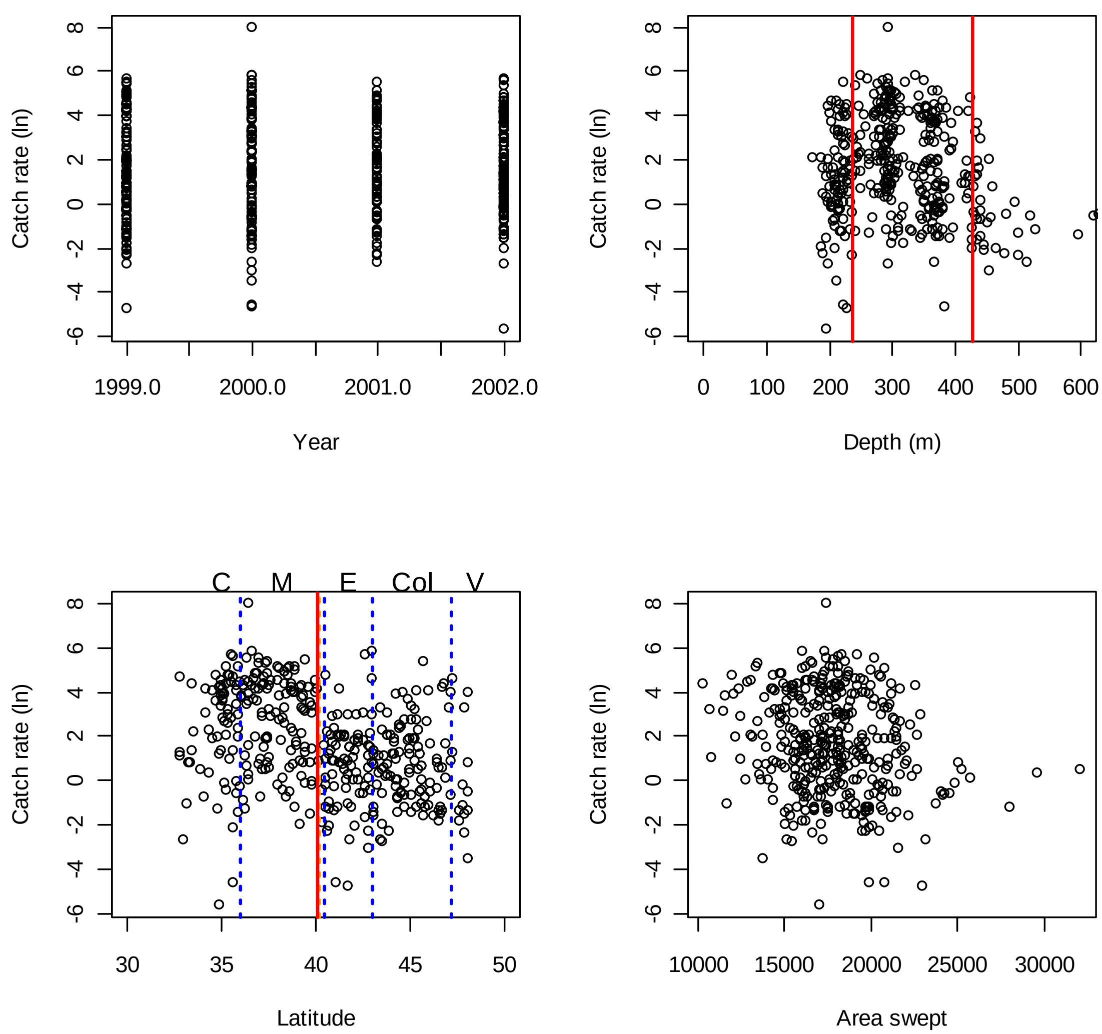


Figure 21. Relationship of catch rate to year, depth, latitude and area swept for the NWFSC slope survey. Red lines indicated suggested strata based on a tree regression. Blue vertical lines in the same plot indicate the INPFC area boundaries. C = Conception; M = Monterey; E= Eureka; Col= Columbia; V= Vancouver.

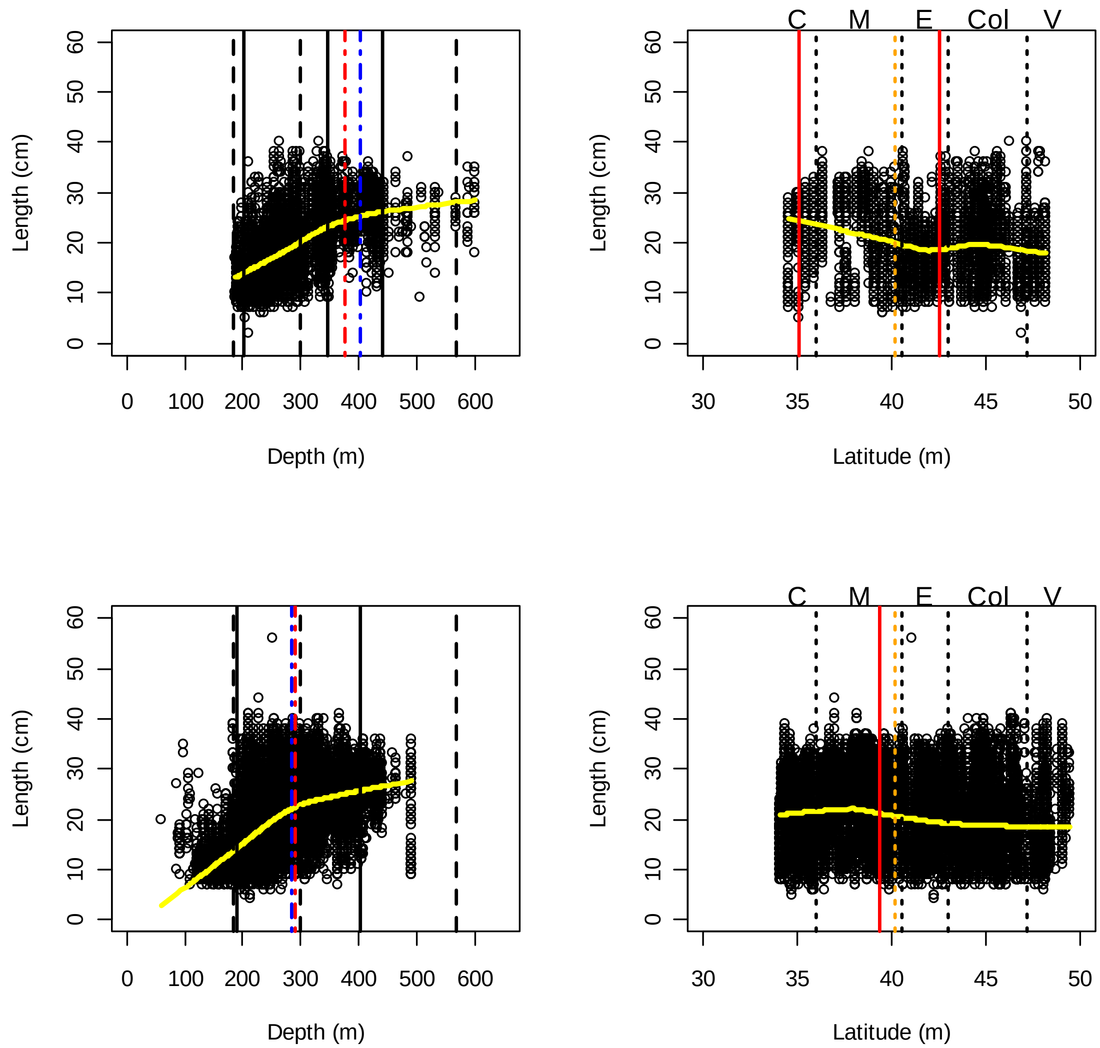


Figure 22. Relationship of depth (left panels) and latitude (right panels) to splitnose rockfish lengths for the Alaska Fisheries Science Center slope (top panels) and triennial survey (bottom panels). Yellow fit line is the lowess polynomial fit. Solid lines indicated suggested strata based on a piecewise regression. Black broken lines in the depth plot indicate the depth strata from Helser et al. 2007. Orange line is the latitude plots indicate the north/south management line. Black broken vertical lines in the latitude plots indicate the INPFC area boundaries. C = Conception; M = Monterey; E= Eureka; Col= Columbia; V= Vancouver.

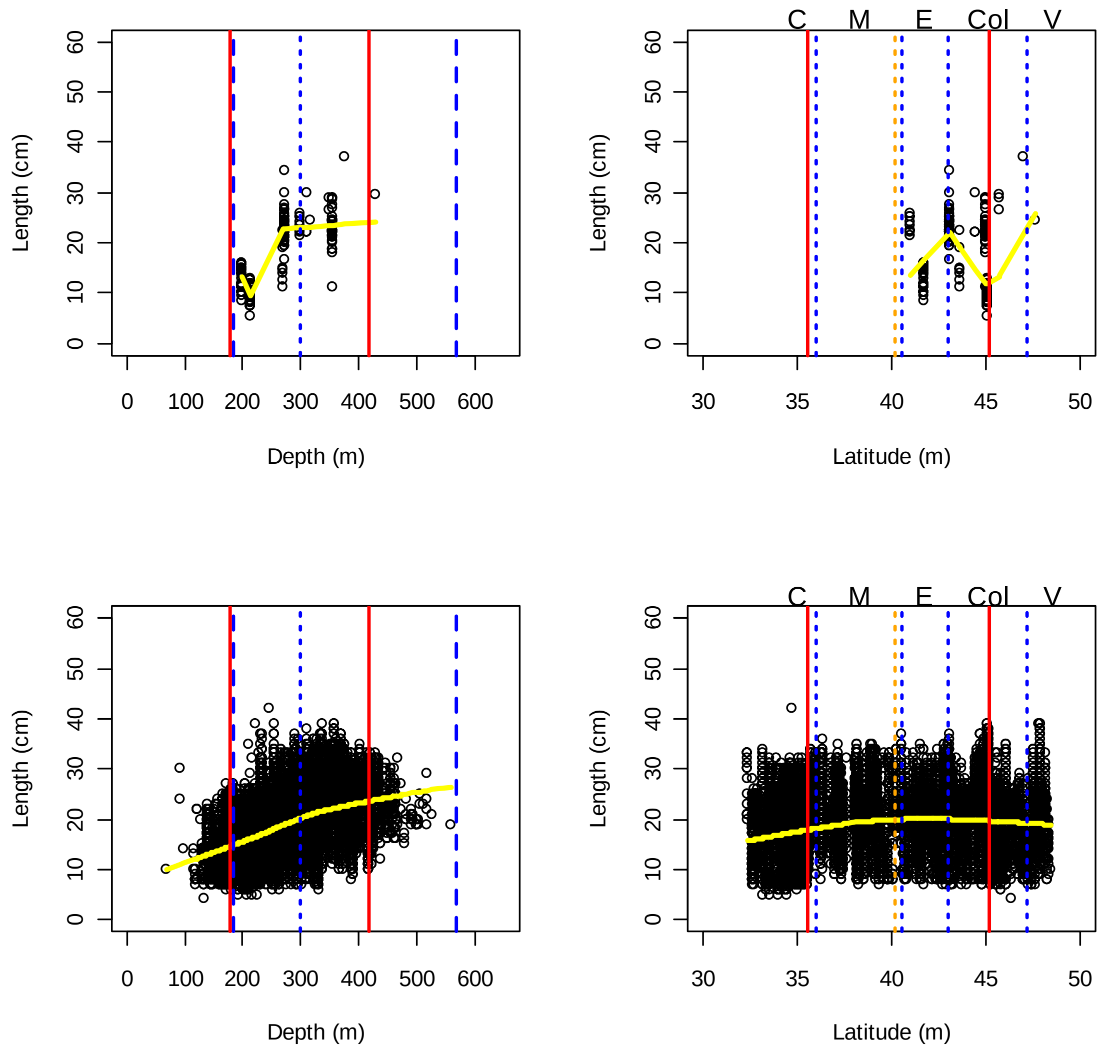


Figure 23. Relationship of depth (left panels) and latitude (right panels) to splitnose rockfish lengths for the NWFSC slope (top panels) and NWFSC shelf-slope survey (bottom panels). Yellow fit line is the lowess polynomial fit. Red lines indicated suggested strata based on a piecewise regression. Blue lines in the depth plot indicate the depth strata from Helser et al. 2007. Orange line in the latitude plot indicates the north/south management line. Blue vertical lines indicate the INPFC area boundaries. C = Conception; M = Monterey; E= Eureka; Col= Columbia; V= Vancouver.

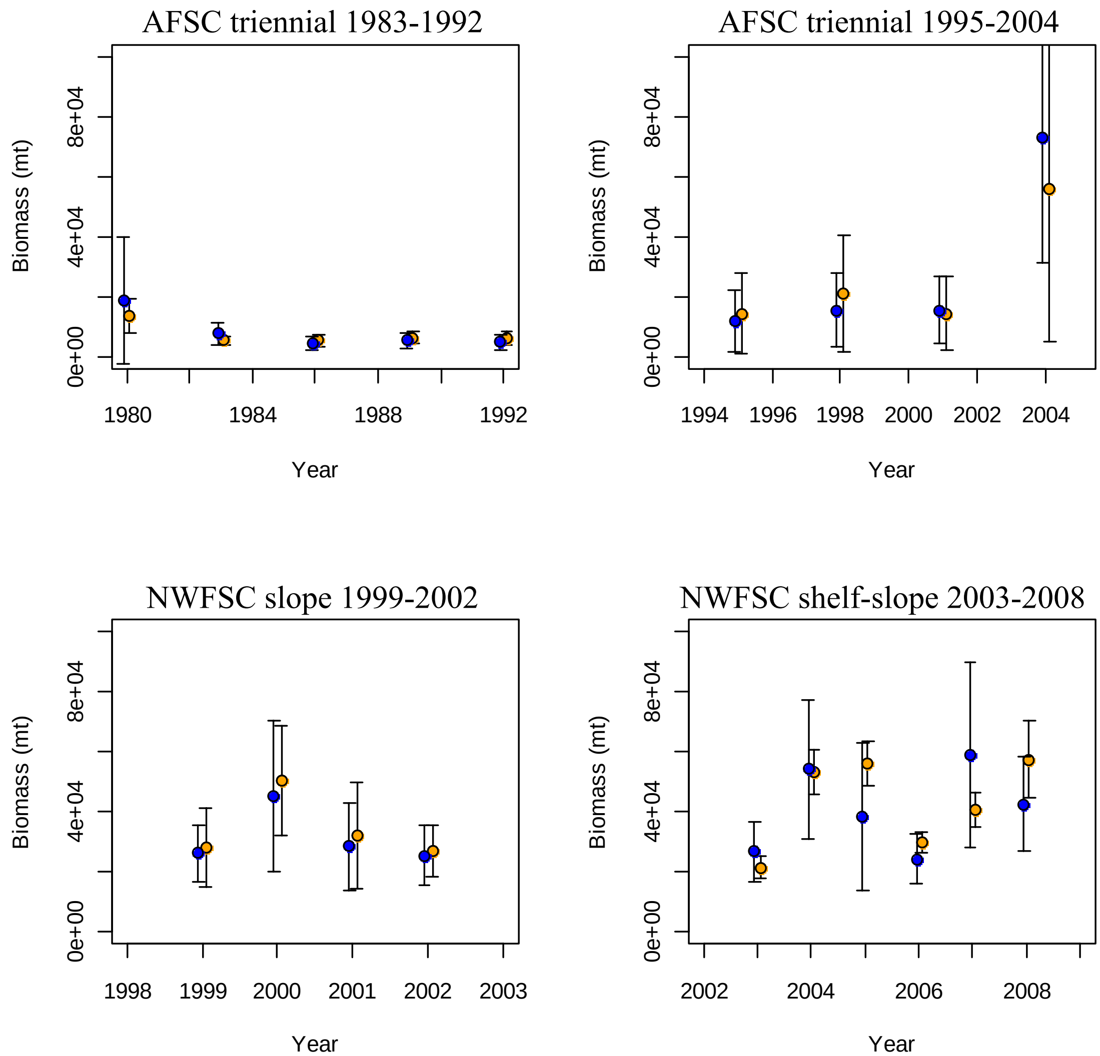


Figure 24. Splitnose rockfish biomass for each survey based on the GLMM (light orange circles) and design based estimates (dark blue circles).

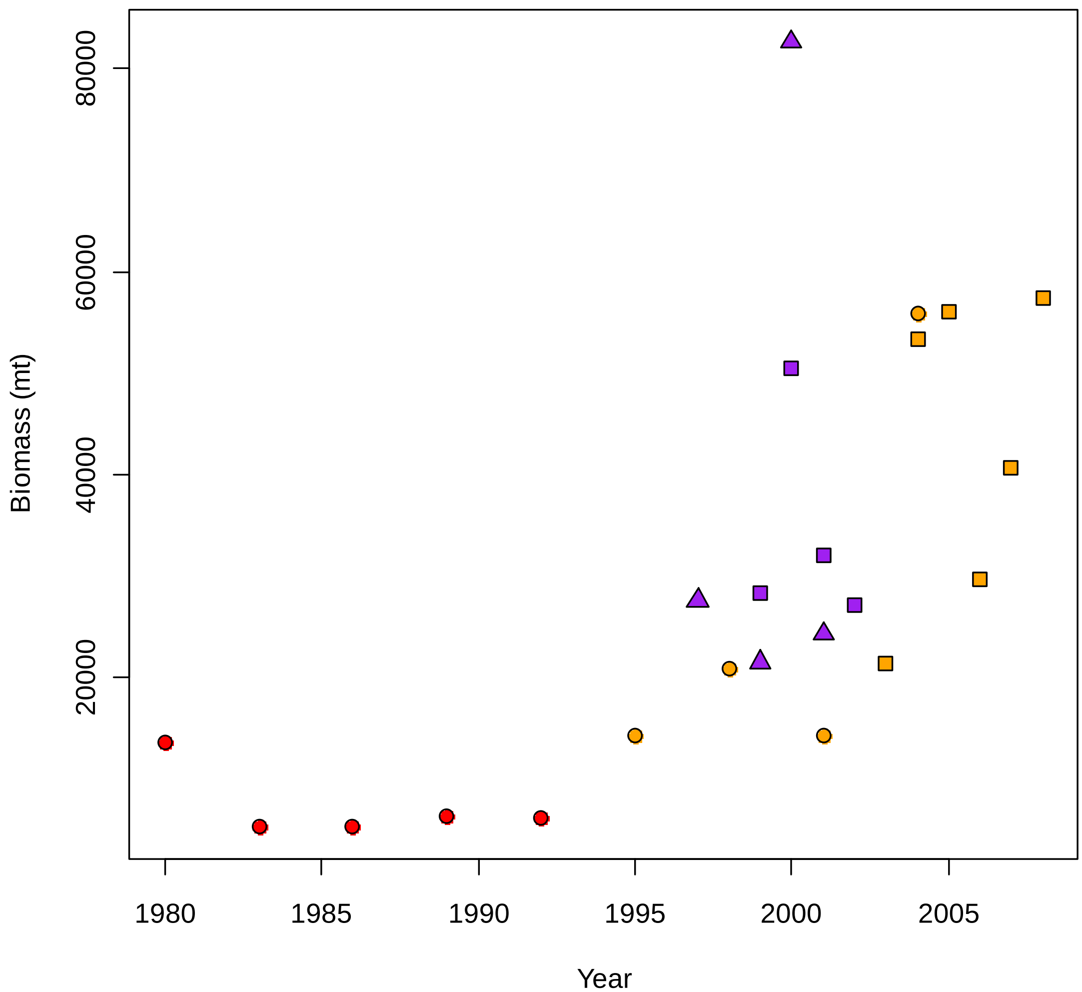


Figure 25. A composite biomass trajectory for each of the survey-based estimates of splitnose abundance. Circles represent AFSC triennial survey, triangles represent AFSC slope survey, and squares correspond to NWFSC surveys with purple (dark) squares representing NWFSC slope survey and orange (light) squares - NWFSC shelf-slope survey.

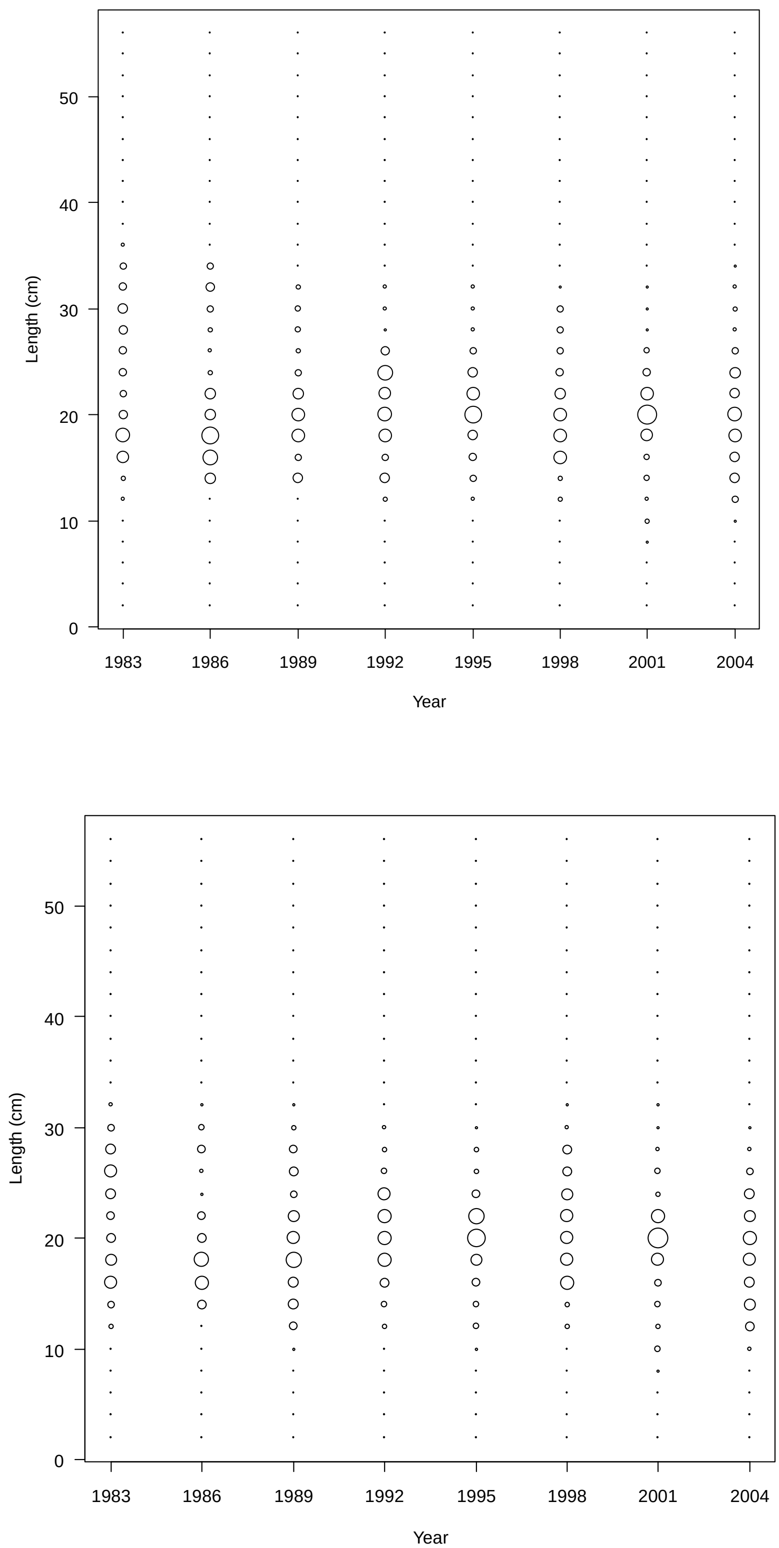


Figure 26. Length frequency distributions for female (top panel) and male (bottom panel) splitnose rockfish from AFSC triennial survey.

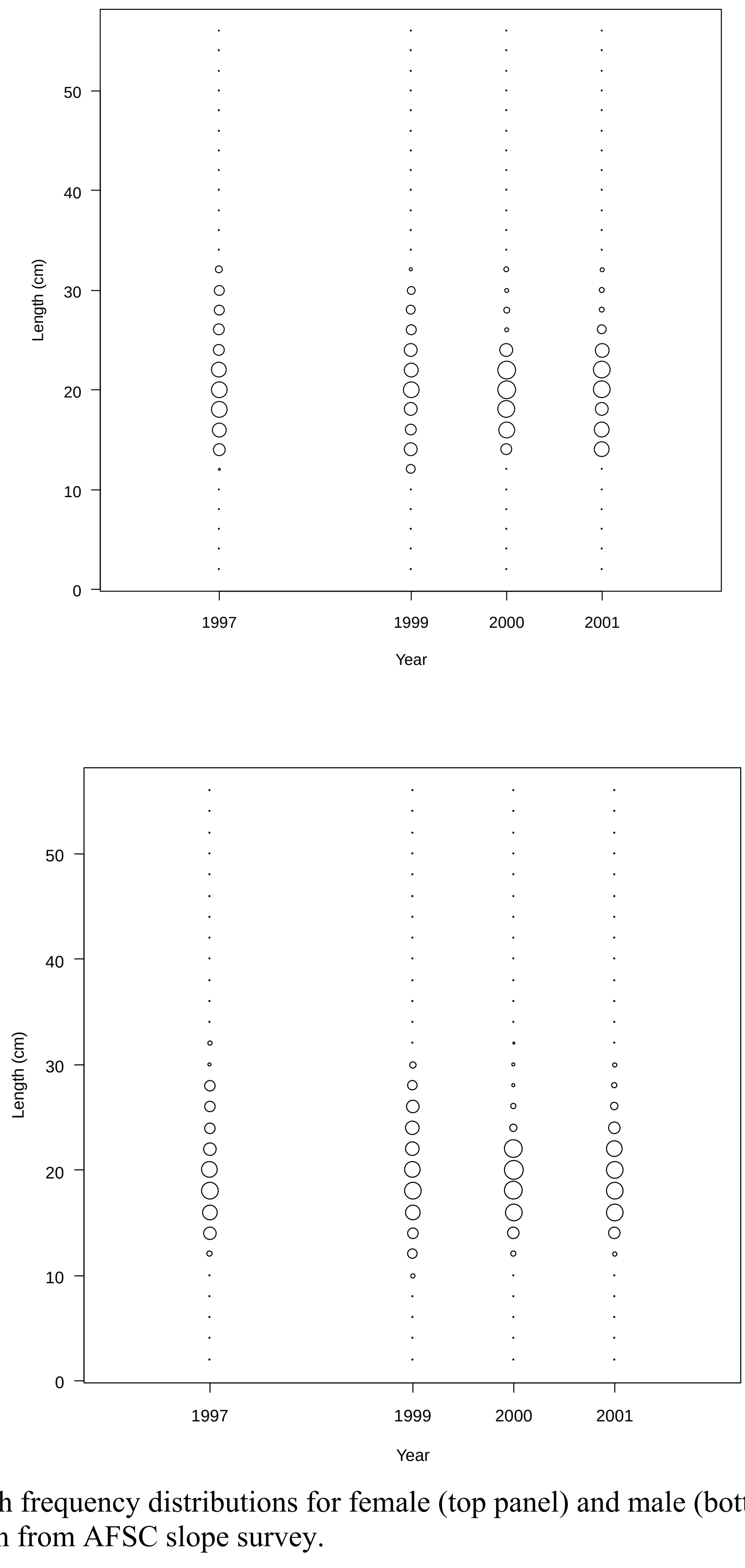


Figure 27. Length frequency distributions for female (top panel) and male (bottom panel) splitnose rockfish from AFSC slope survey.

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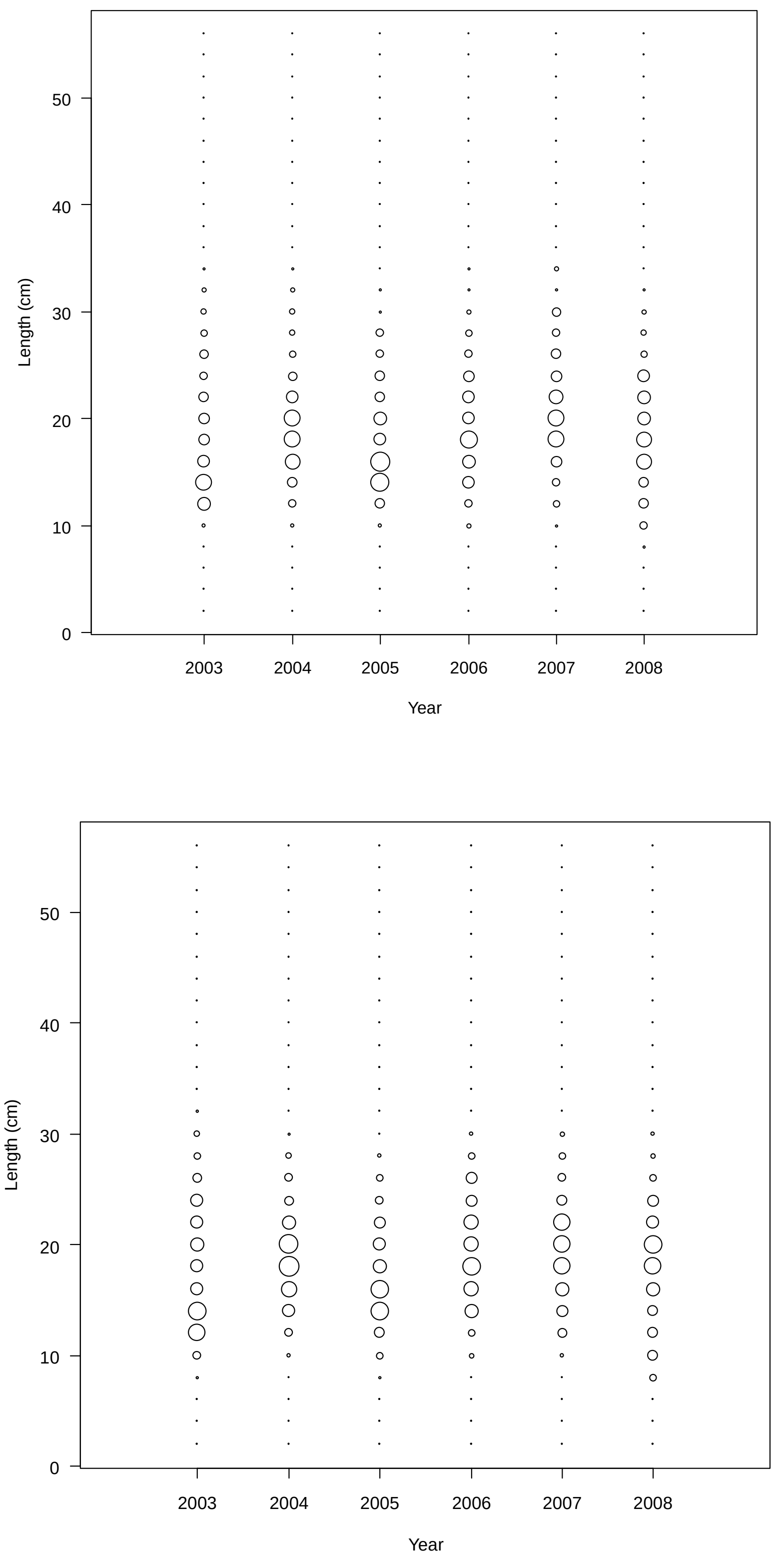

Figure 28. Length frequency distributions for female (top panel) and male (bottom panel) splitnose rockfish from NWFSC shelf-slope survey.

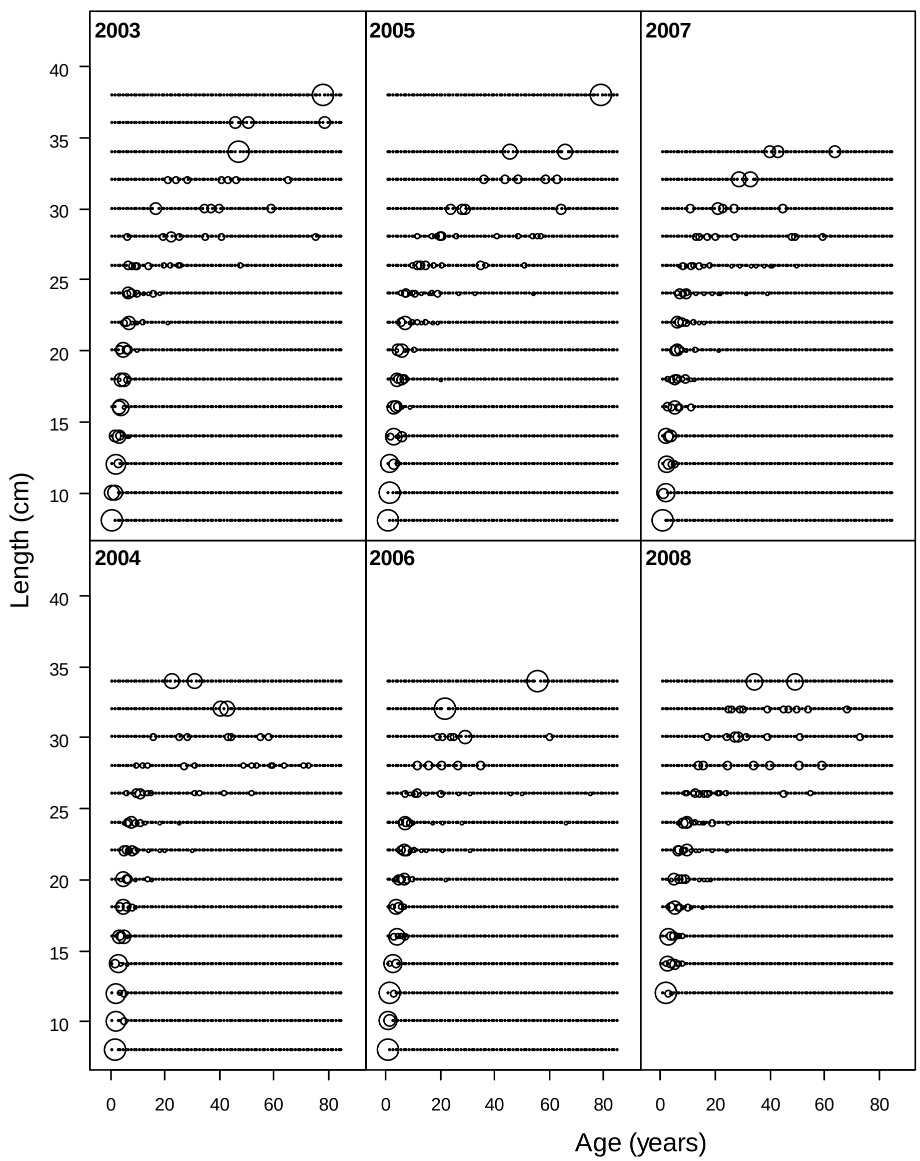

Figure 29. Conditional age-at-length distribution for female splitnose rockfish from the NWFSC shelf-slope survey.

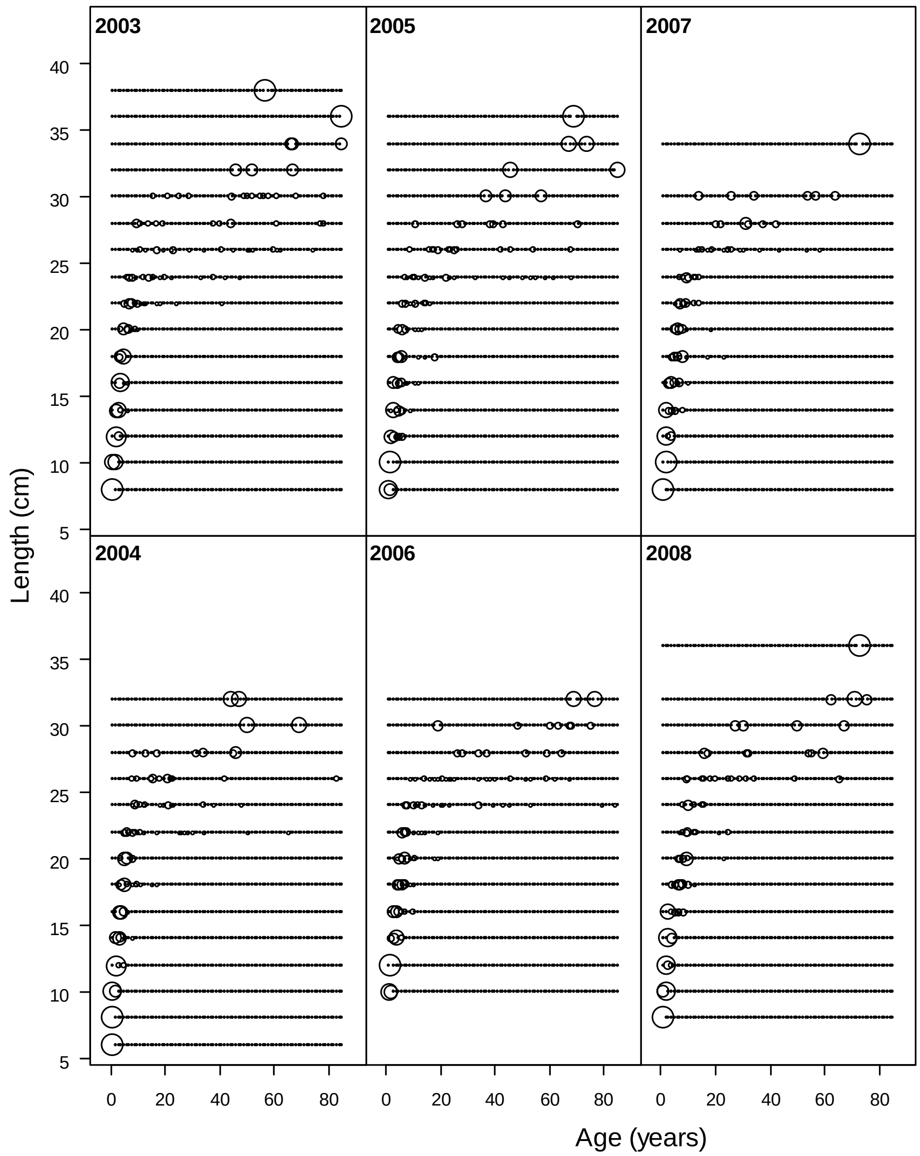

Figure 30. Conditional age-at-length distribution for male splitnose rockfish from the NWFSC shelf-slope survey.

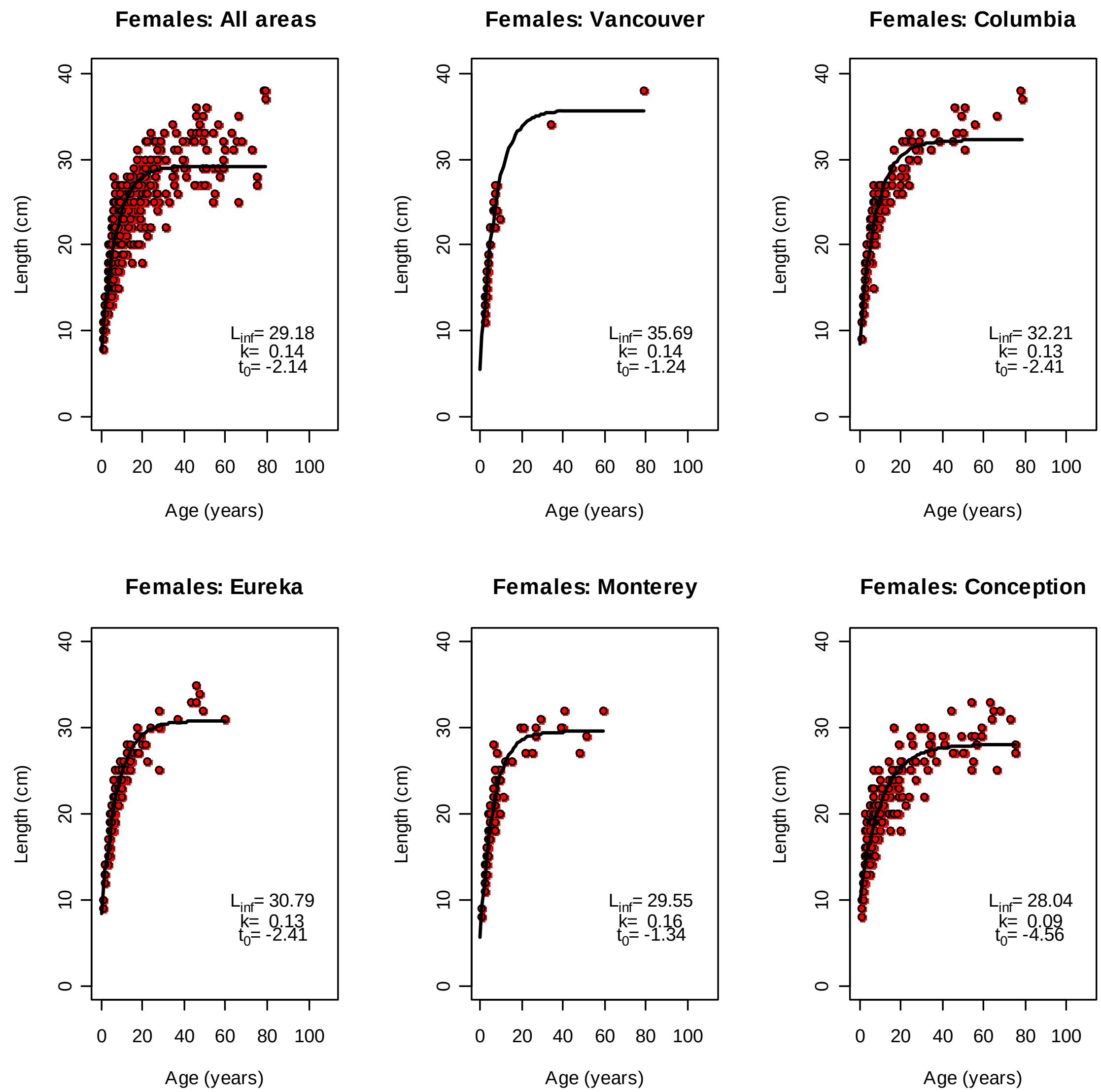

Figure 31. Female splitnose rockfish age-at-length plots from the NWFSC survey data (2003-2008) for the combined and separate INPFC areas.

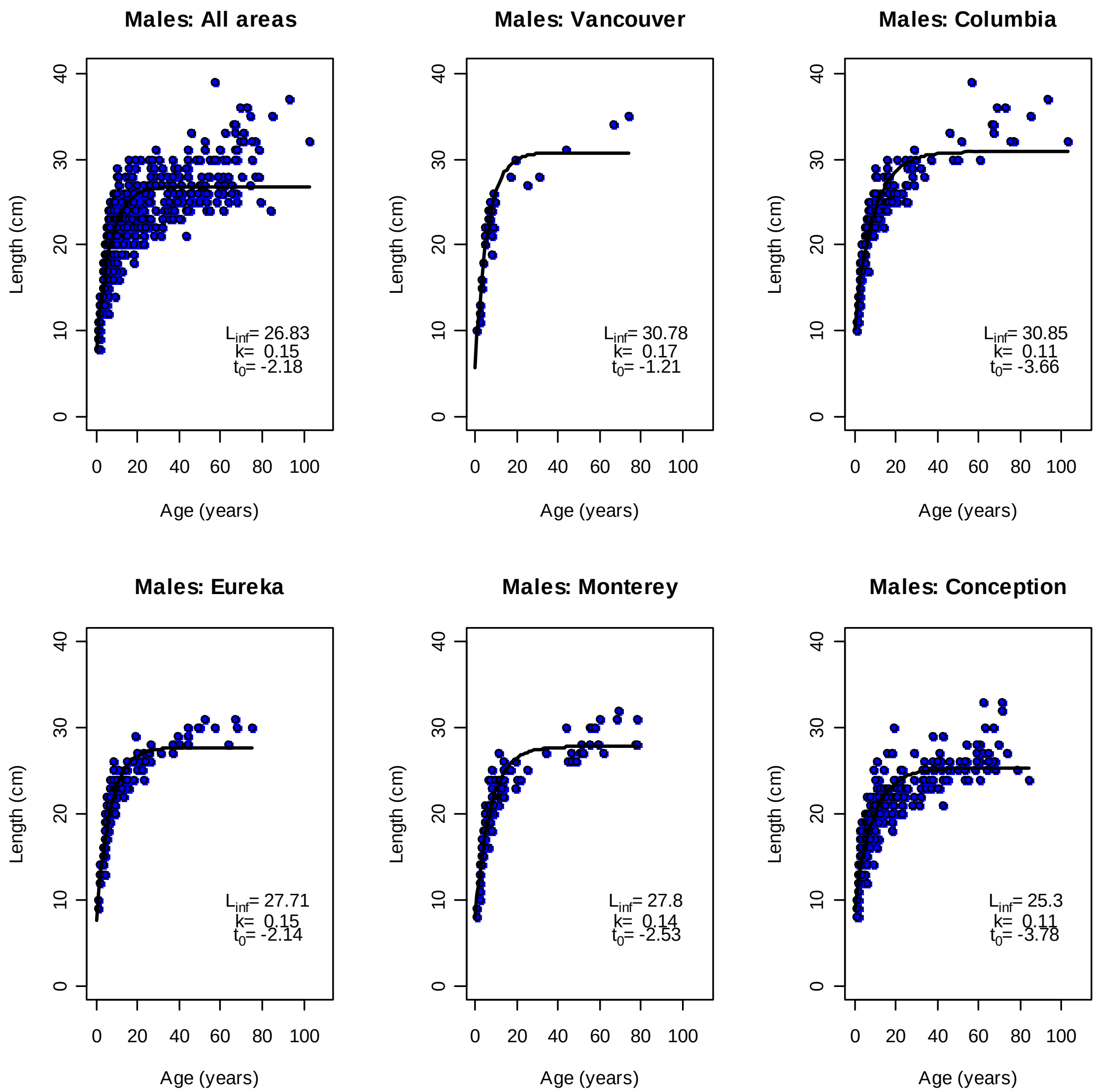

Figure 32. Male splitnose rockfish age-at-length plots from the NWFSC survey data (2003-2008) for the combined and separate INPFC areas.

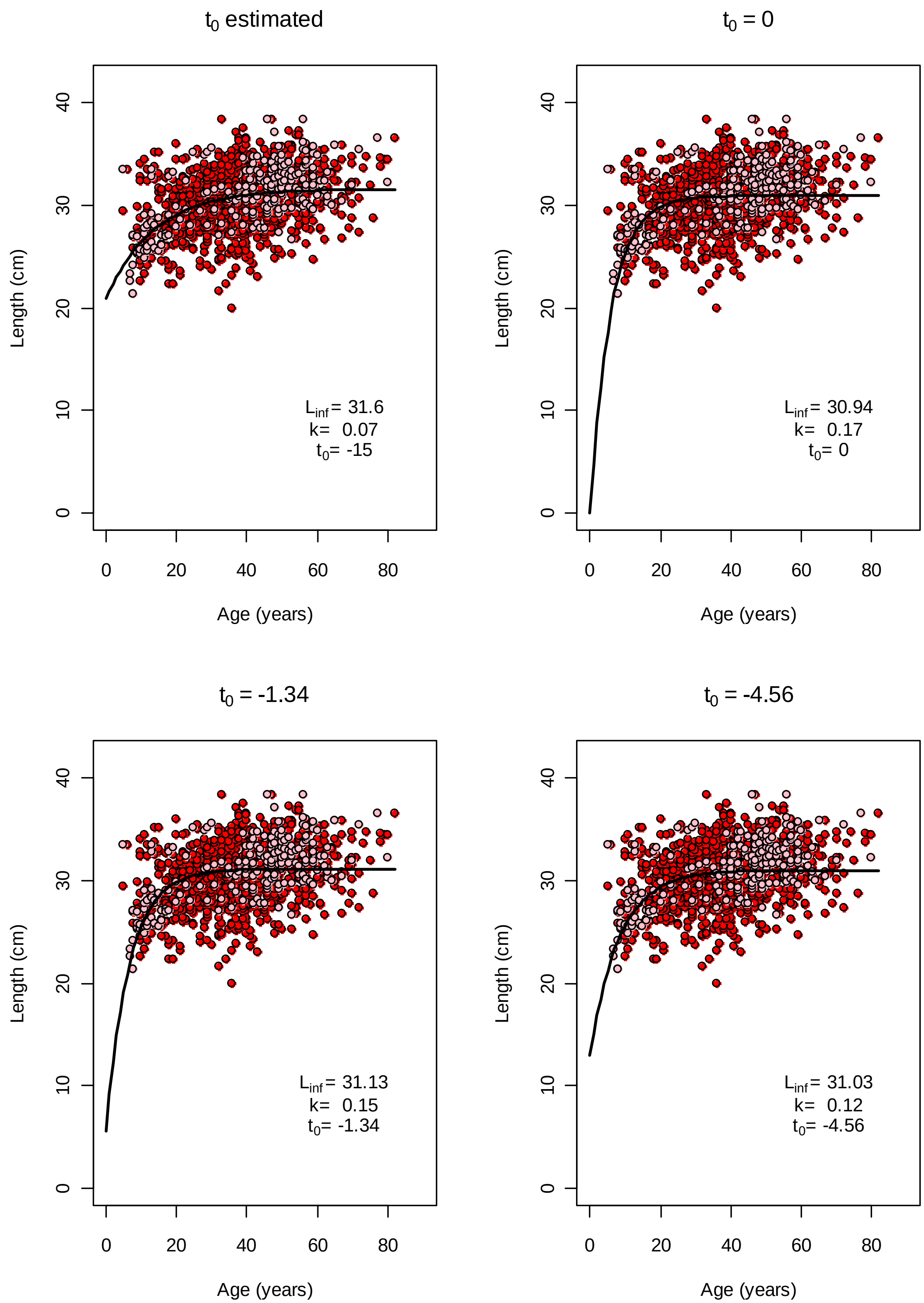

Figure 33. Female splitnose rockfish age-at-length plots incorporating reader ageing error for different assumptions of t_0. Samples obtained from the California commercial fishery (1980-1989). Dark red dots are age reader 1 and light pink dots are age reader 2.

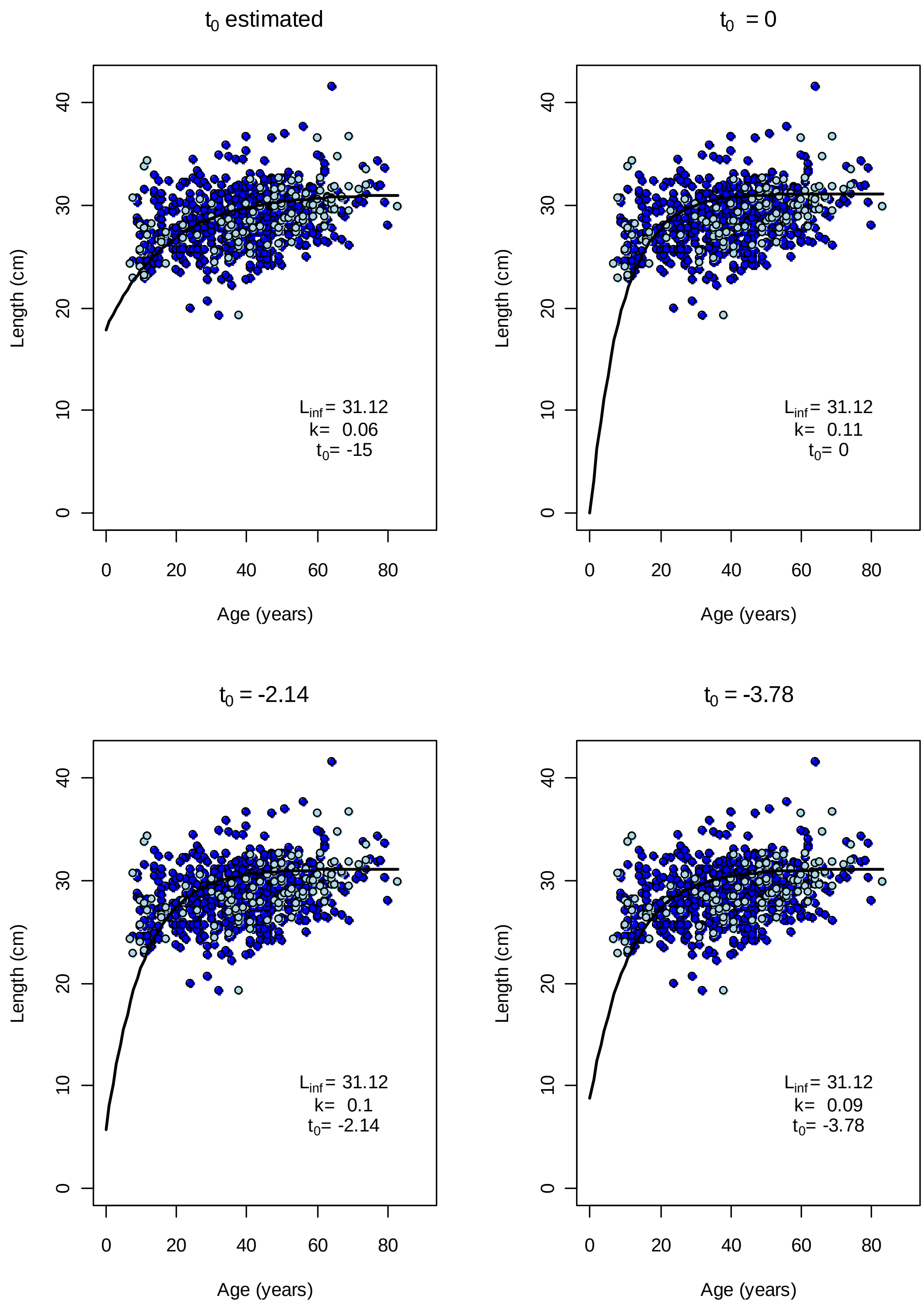

Figure 34. Male splitnose rockfish age-at-length plots incorporating reader ageing error for different assumptions of t_0. Samples obtained from the California commercial fishery (1980-1989). Dark blue dots are age reader 1 and light blue dots are age reader 2.

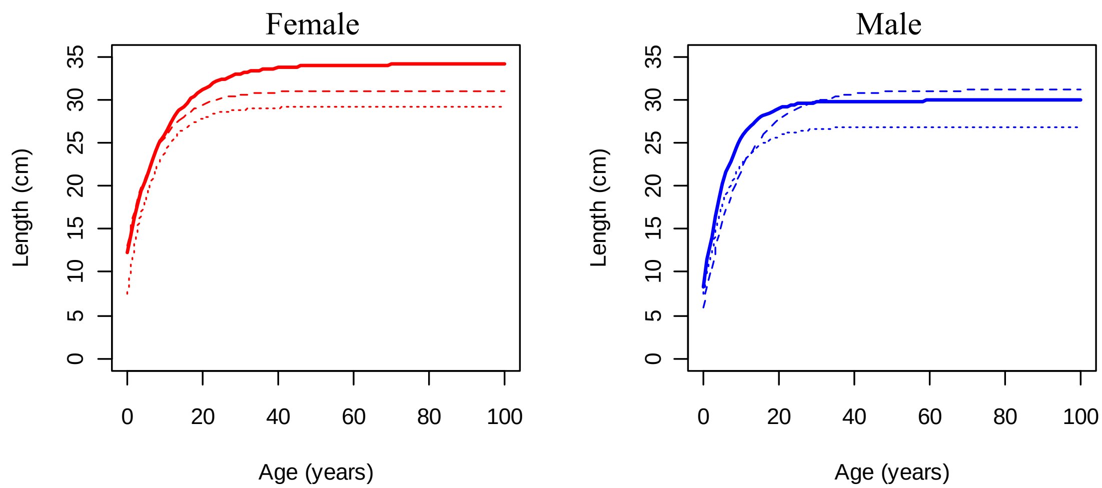

Figure 35. Estimated growth curves for female and male splitnose from Love et al. 2002 (solid line), the NWFSC survey (dotted line), and the California commercial data (broken line).

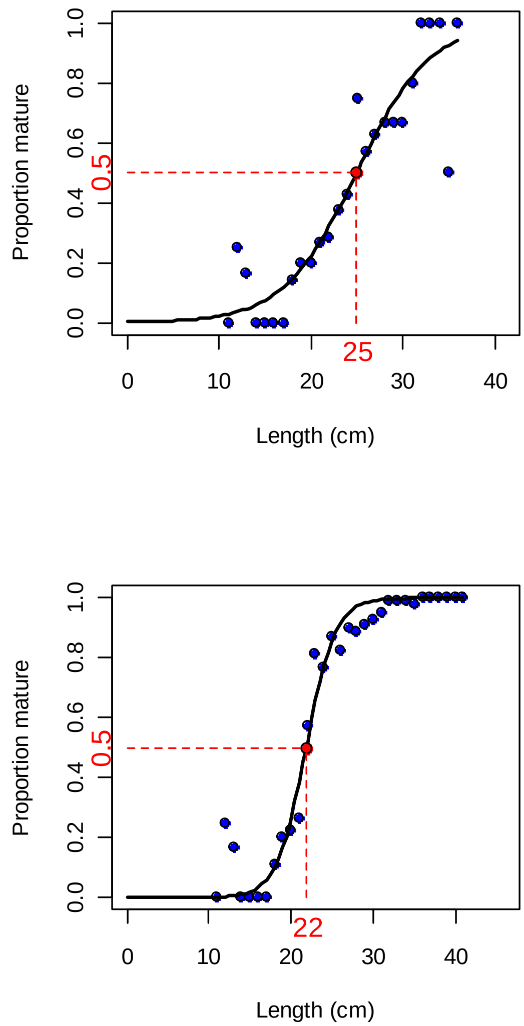

Figure 36. Maturity estimates of splitnose rockfish from the Alaska Fisheries Science Center (AFSC) slope survey (top left panel) and biological sampling from fisheries data (top right panel). Bottom left panel combined all data into one estimate of maturity.

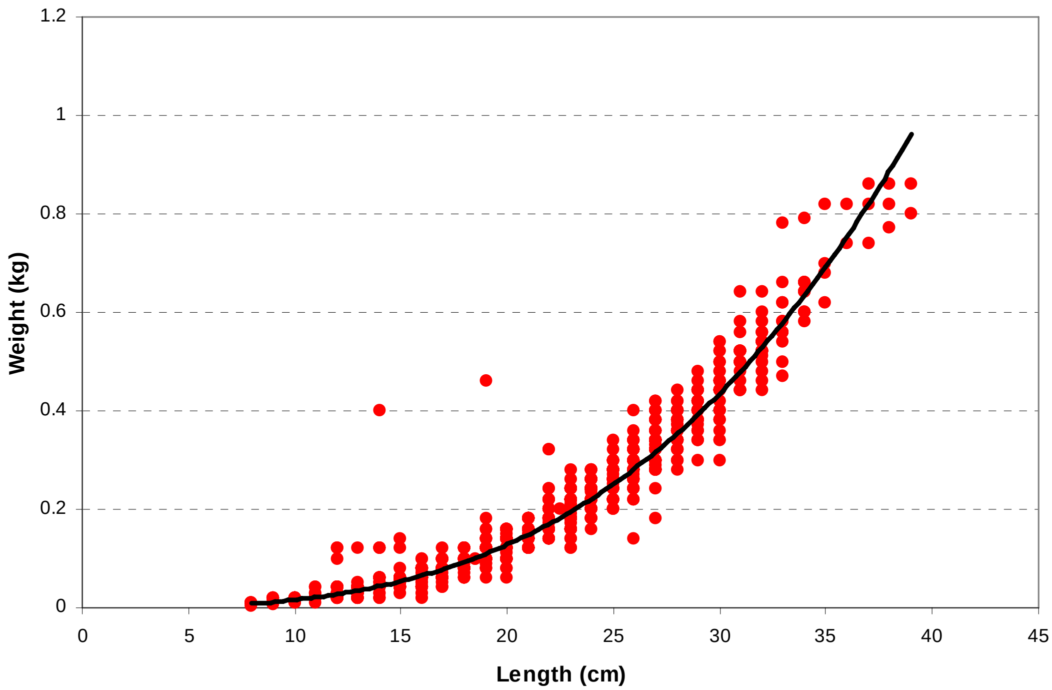

Figure 37. Weight-length relations estimated for female splitnose rockfish based on NWSFC shelf-slope survey data.

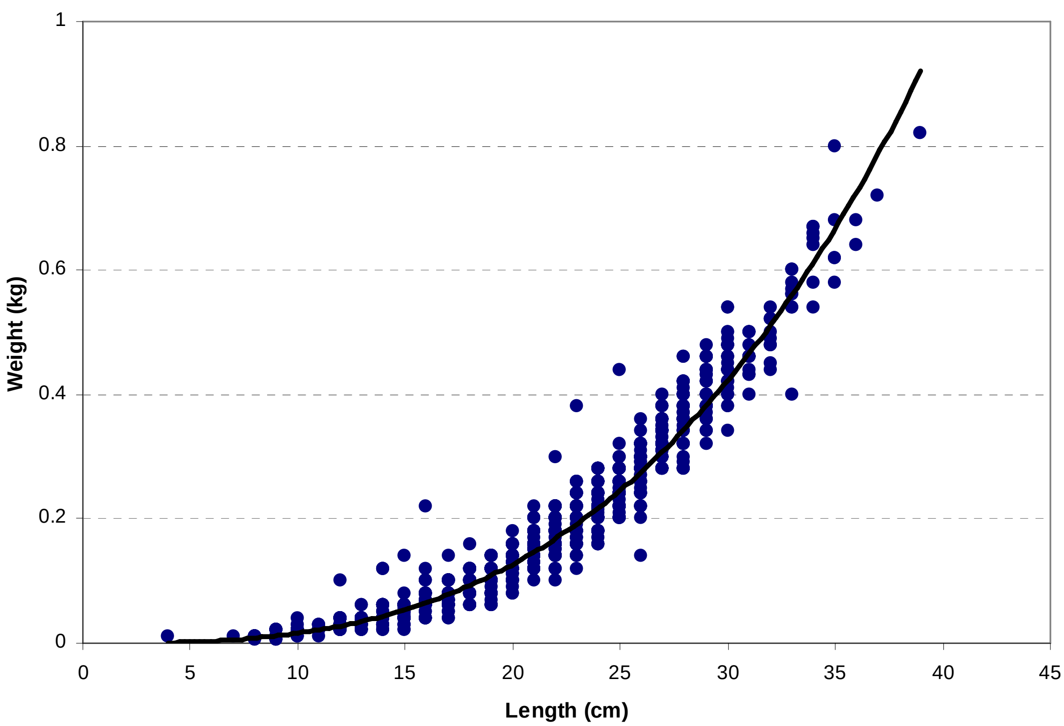

Figure 38. Weight-length relations estimated for the male splitnose rockfish based on NWSFC shelf-slope survey data.

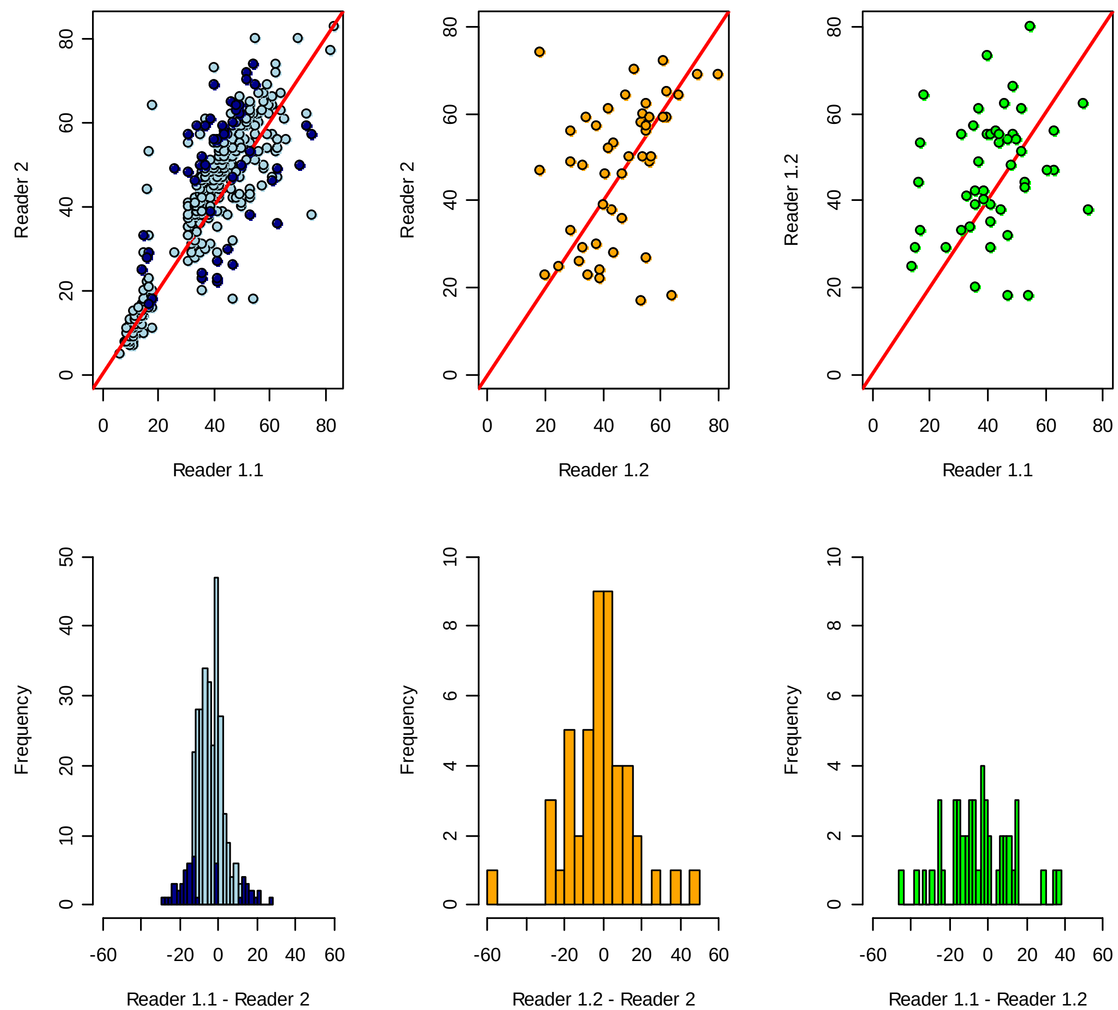

Figure 39. Comparison of age reads between Readers 1.1, 1.2, and 2 corresponding to ageing error matrix 1. Reader 1.1 and 1.2 are the same reader, but at two different time periods. Top panels are 1:1 plots with the red solid line indicating perfect agreement; bottom panels are histograms of the age read differences between each reader. Dark points and bars in the left panels correspond to the 50 re-read otoliths compared in the middle and right panels.

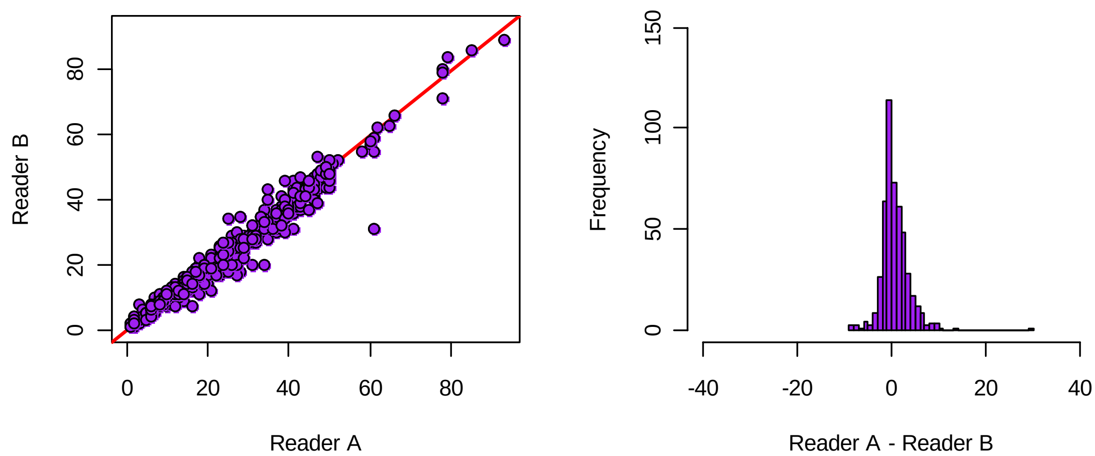

Figure 40. Comparison of age reads between Readers A and B corresponding to ageing error matrix 3. Left panel is the 1:1 plots with the red solid line indicating perfect agreement; right panel is a histogram of the age read differences between each reader.

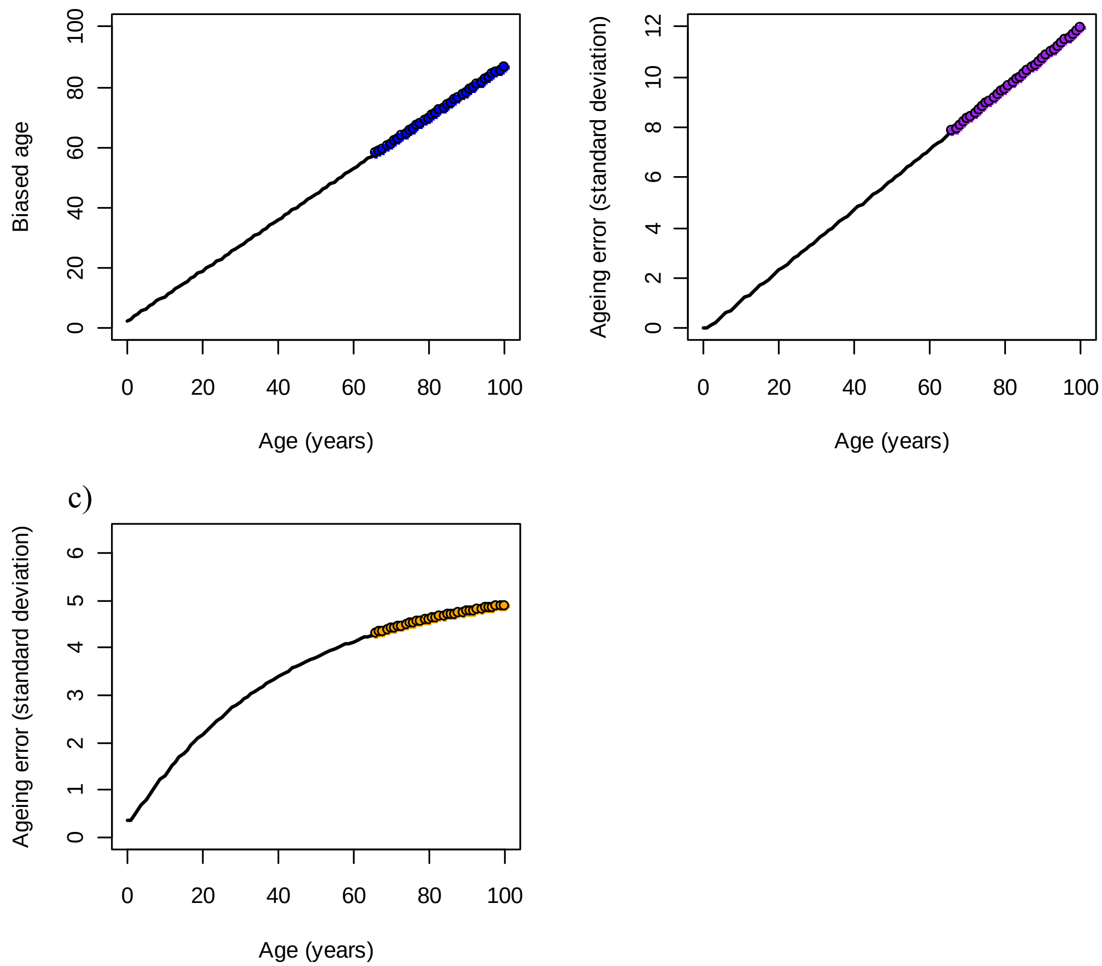

Figure 41. Relationship between true age and ageing error (a and c) and biased age (b) used to define the ageing error matrix input for SS3. Top panels refer to ageing error matrix 1; bottom panel refers to ageing error matrix 2. Solid lines indicate the relationship derived using the method of Punt et al. 2008 up to age 65. Estimates beyond age 65 (colored points) were derived by fitting a linear (a and b) or asymptotic (c) model as determined by the solid line relationships.

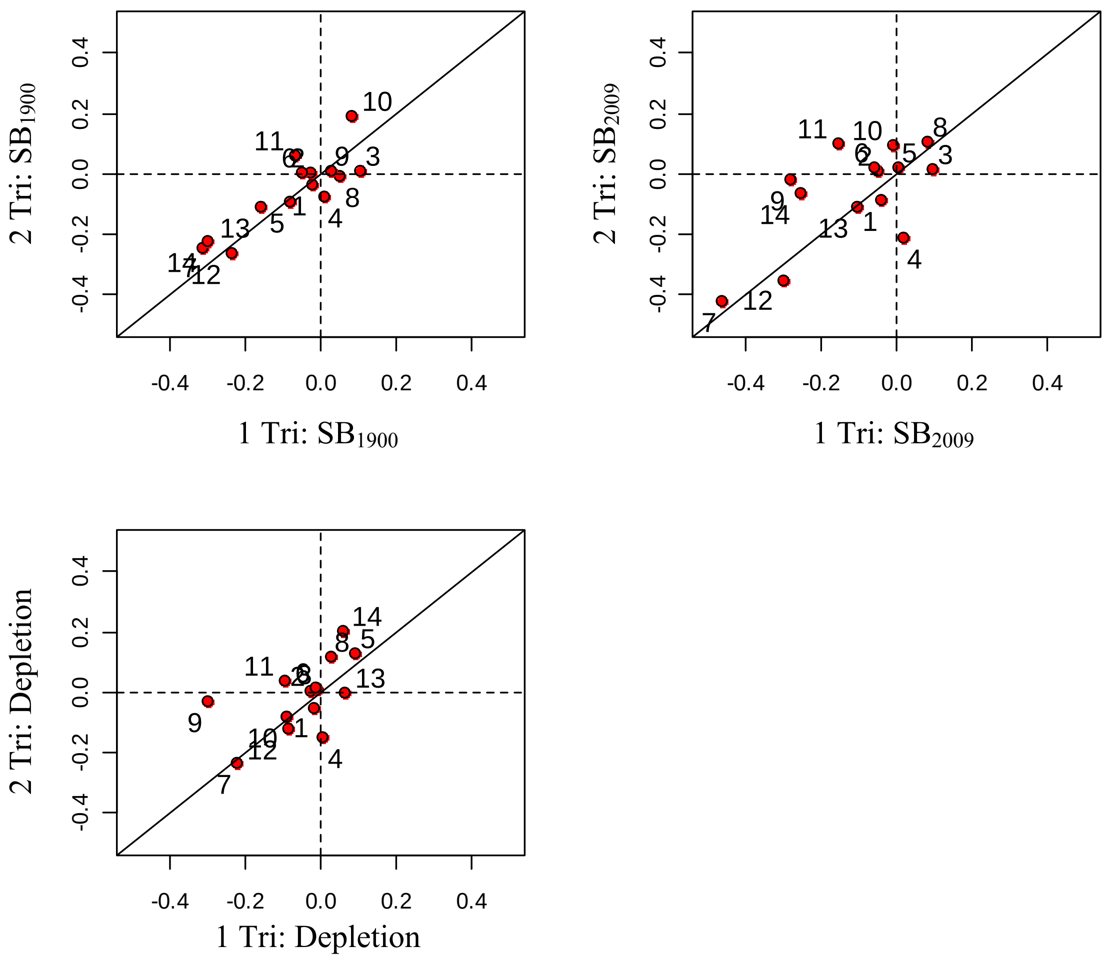

Figure 42. Pre-STAR Panel sensitivity analyses: Relative difference between the pre-STAR Panel base case and sensitivity trials (points) for spawning biomass and depletion values compared between the pre-STAR Panel base case with one triennial survey series (1 Tri) and the pre-STAR Panel base case with two triennial survey time series (2 Tri) for each data sensitivity trial. Trials are indicated by their corresponding number (see text for details). Solid line indicates the 1:1 relationship. Intersection of the broken line is the point the base case and sensitivity trials are equivalent.

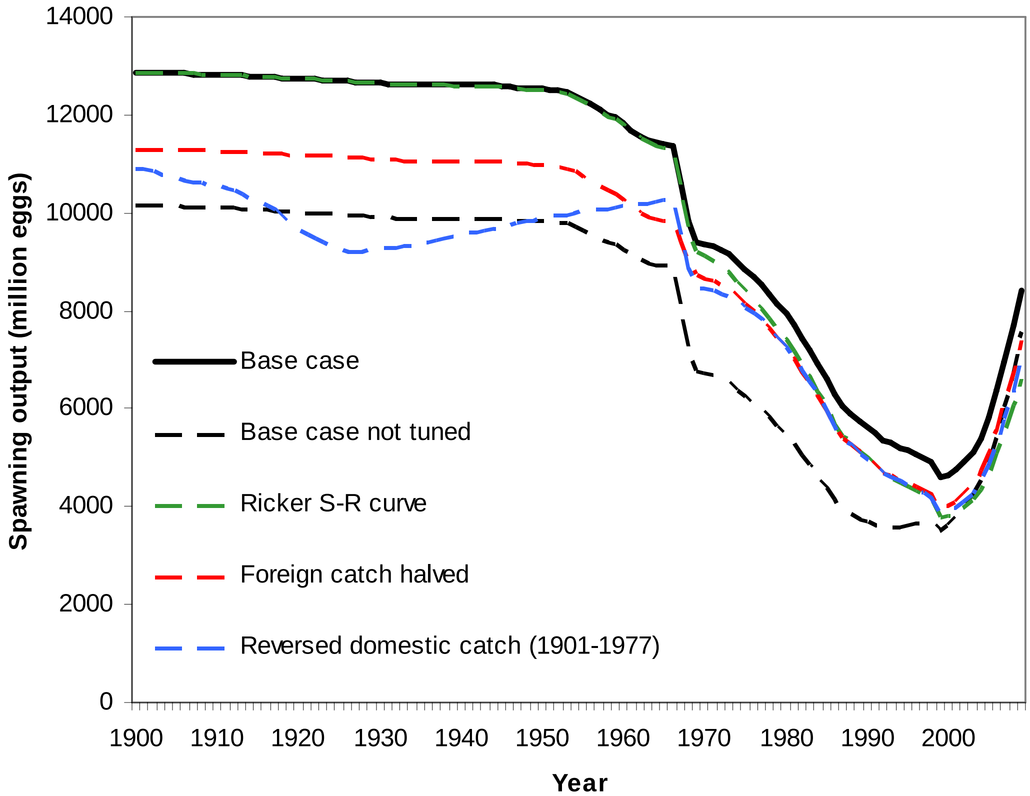

Figure 43. Spawning output trajectories for the base case and selected sensitivity trials.

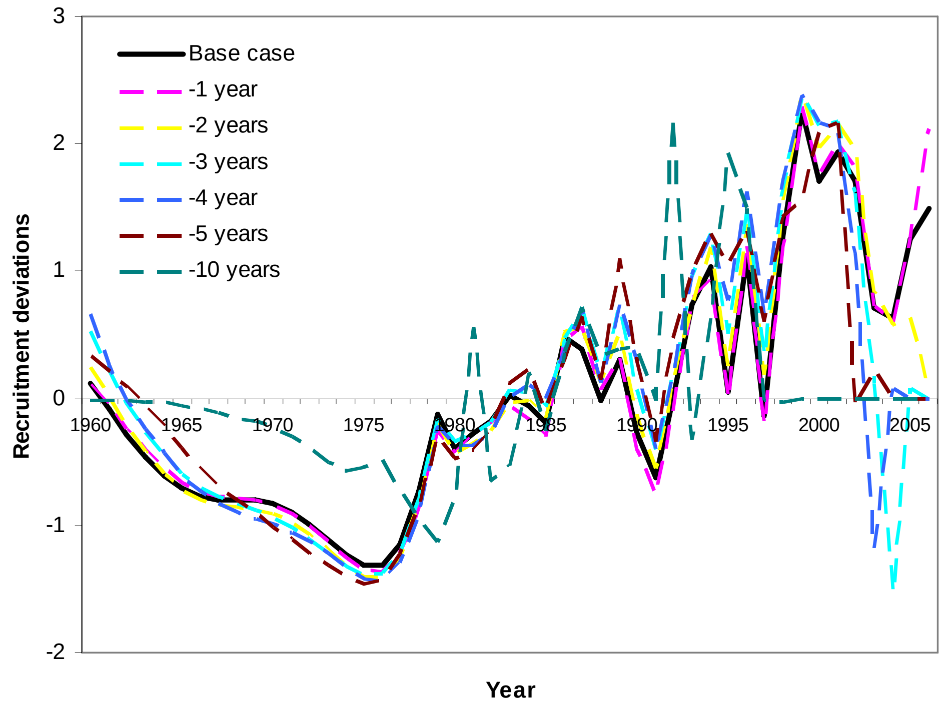

Figure 44. Recruitment deviations estimated by the base case and retrospective analysis trials.

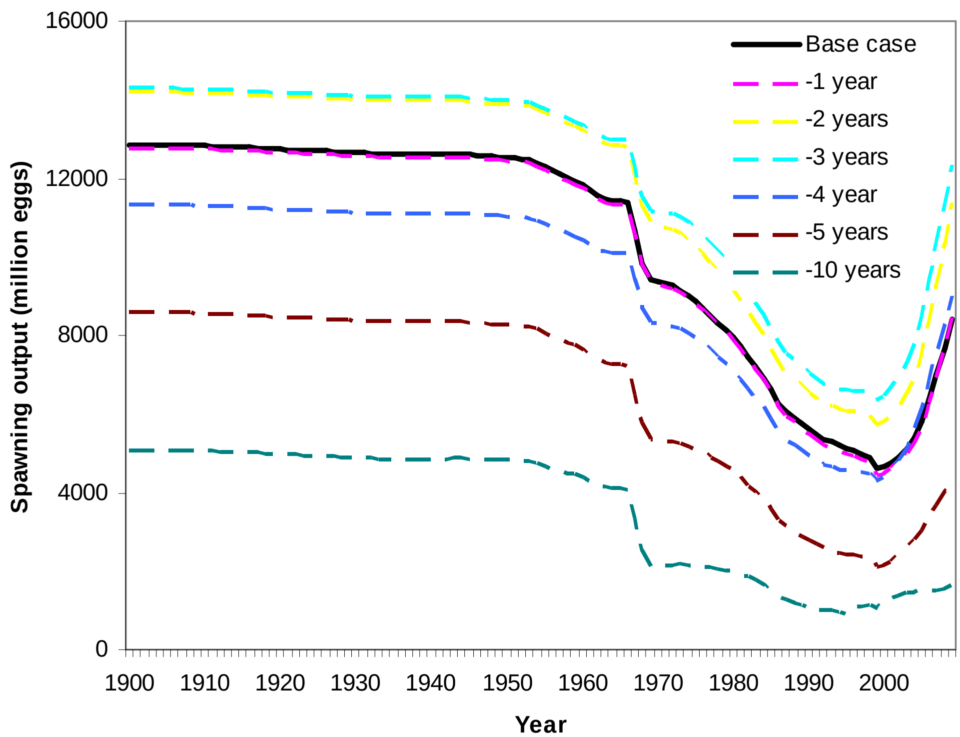

Figure 45. Spawning output trajectories estimated by the base case and retrospective analysis trials.

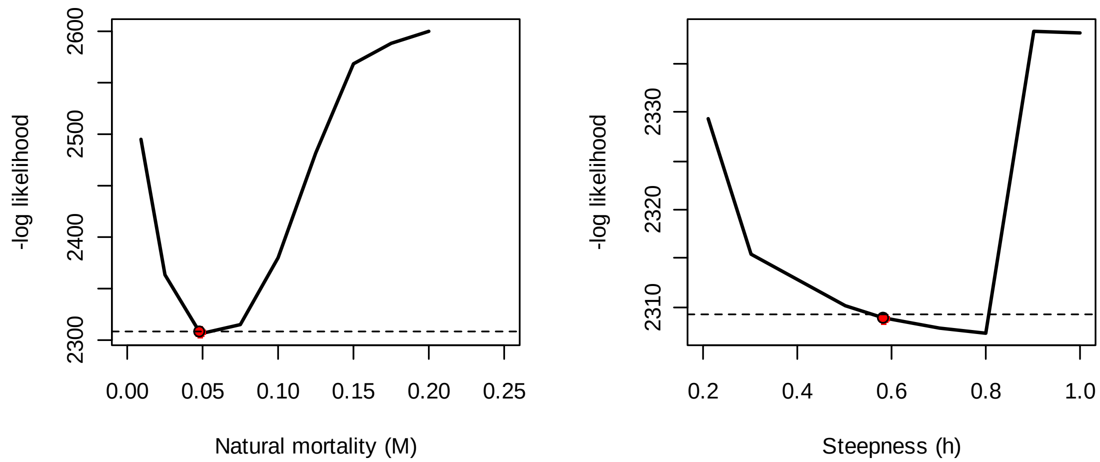

Figure 46. Likelihood profiles for natural mortality (left) and steepness (right) for the base case. Horizontal broken line indicates the 95% confidence interval.

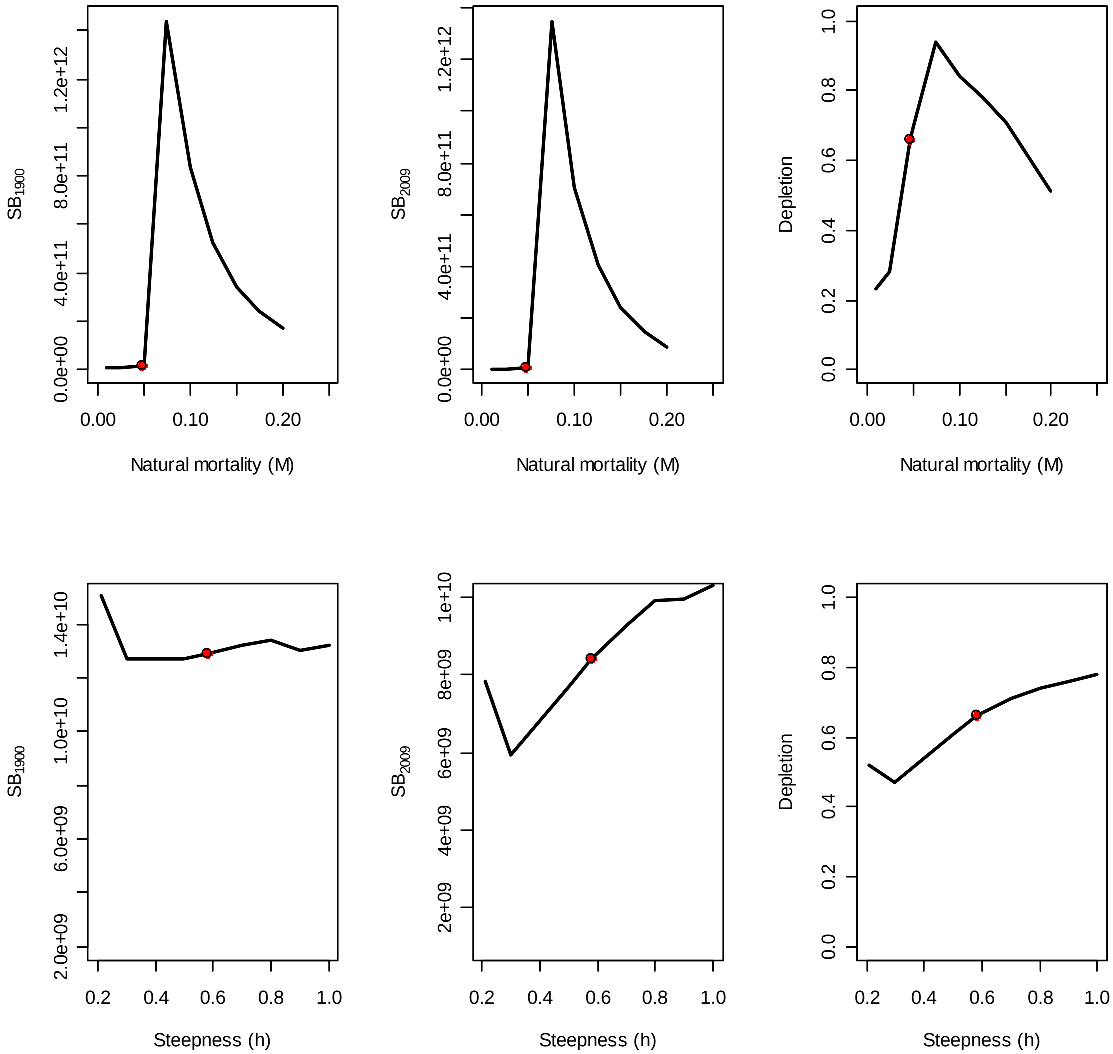

Figure 47. Values for initial spawning biomass (SB_{1900}; left panels), ending spawning output (SB_{2009}; center panels) and depletion (right panels) for natural mortality (top panels) and recruitment compensation (steepness; bottom panels) likelihood profiles. Base case values are indicated by red points.

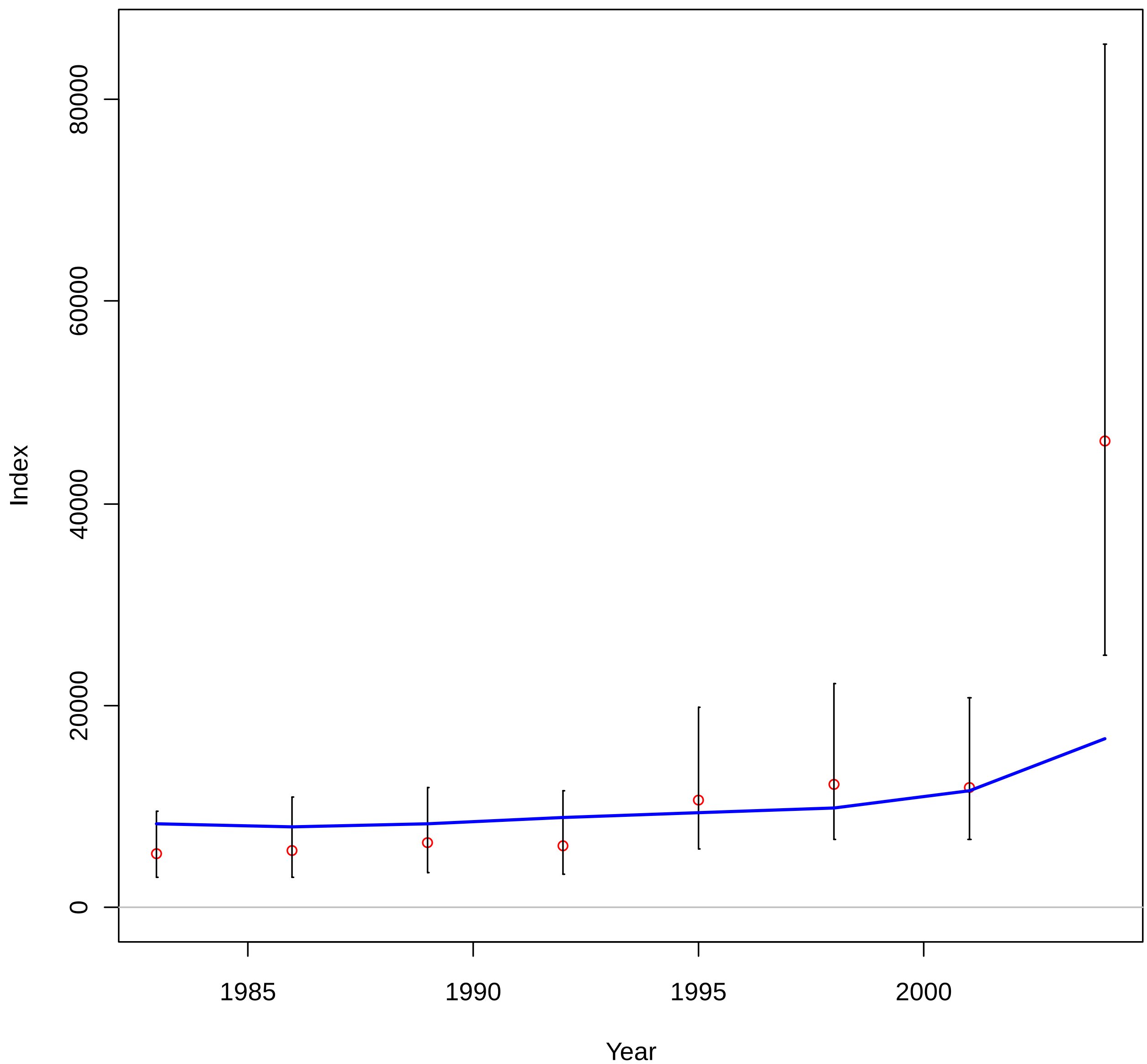

Figure 48. Observed and expected values of biomass index (mt) for the AFSC triennial survey.

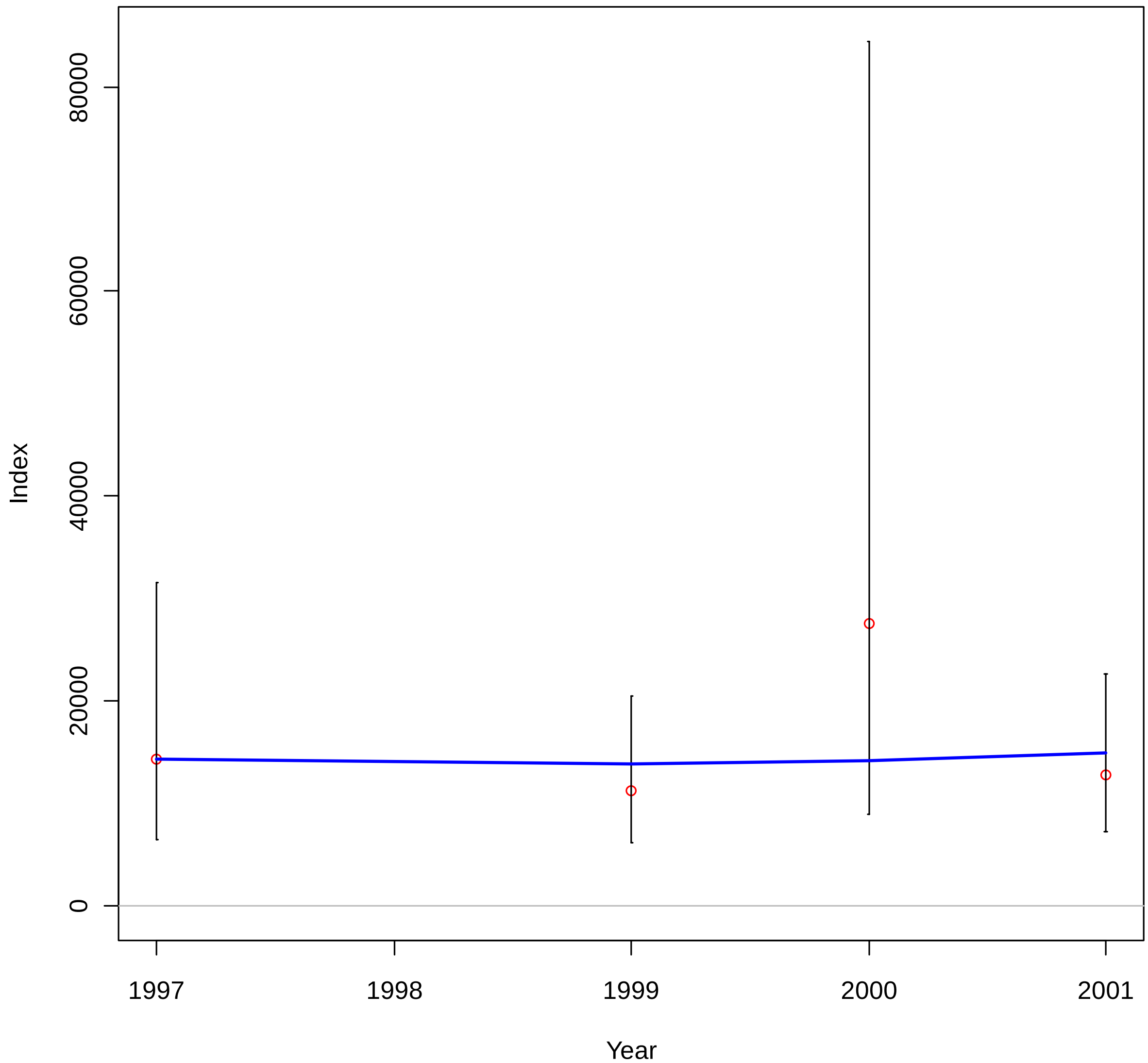

Figure 49. Observed and expected values of biomass index (mt) for the AFSC slope survey.

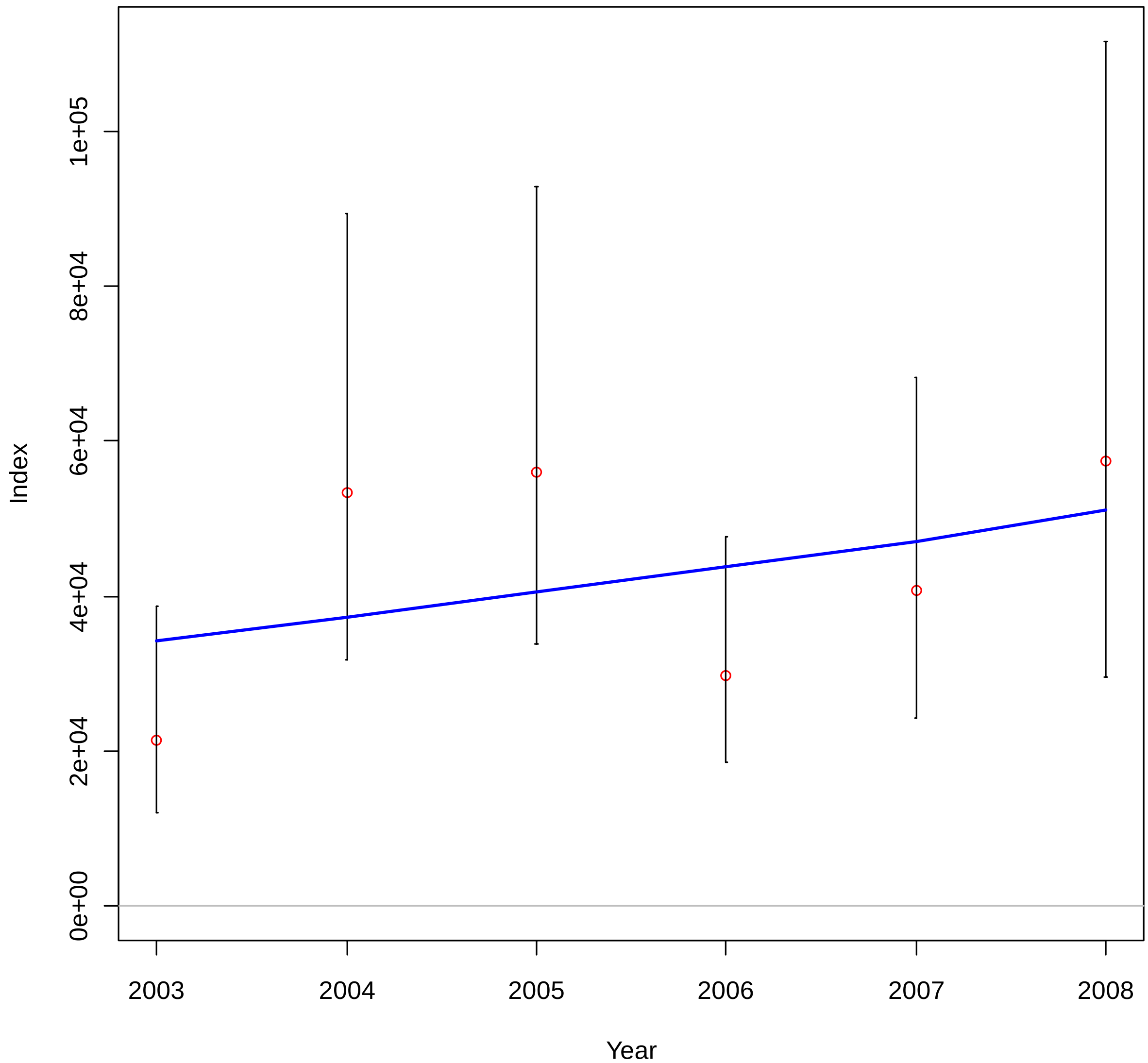

Figure 50. Observed and expected values of biomass index (mt) for the NWFSC shelf-slope survey.

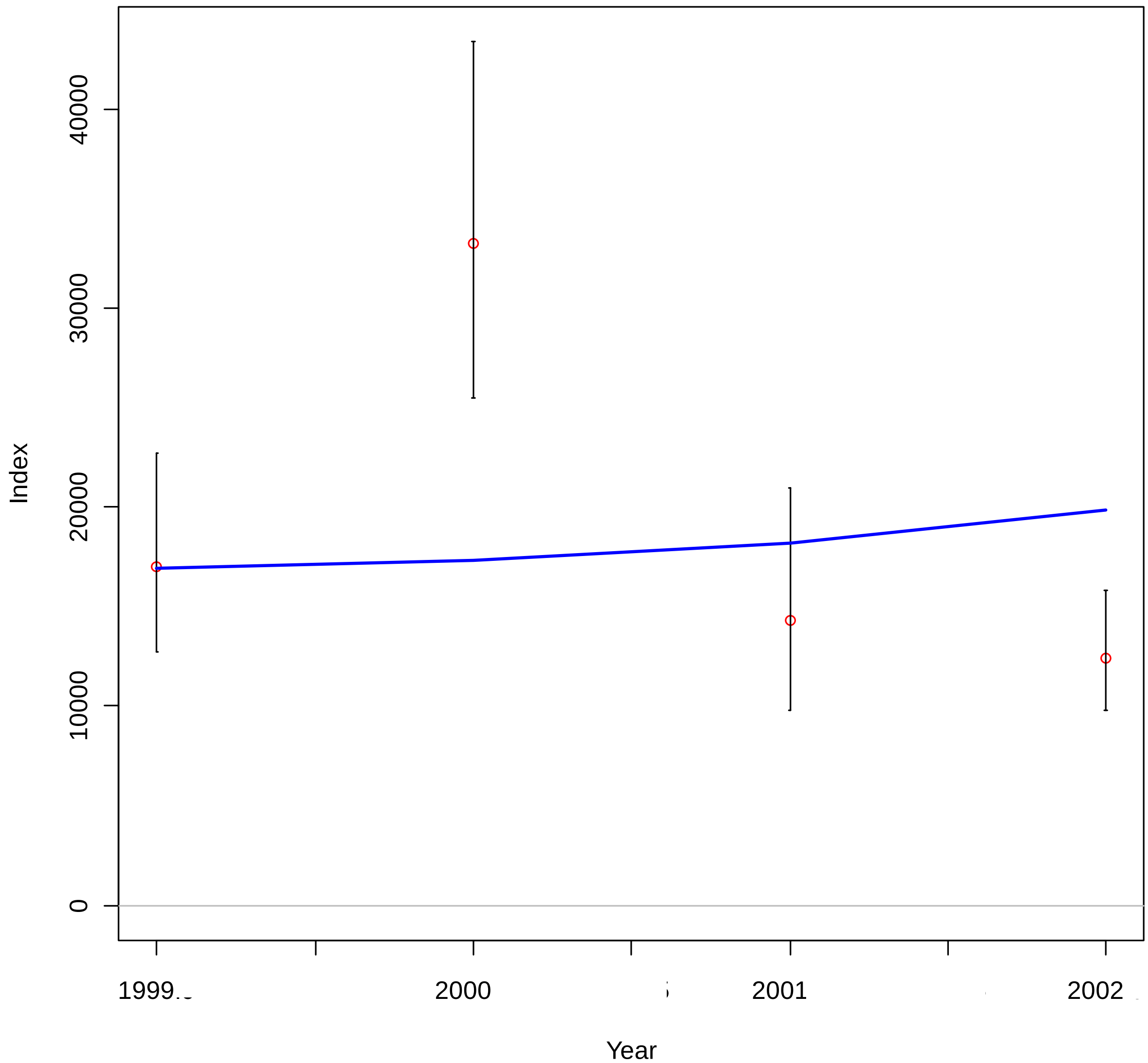

Figure 51. Observed and expected values of biomass index (mt) for the NWFSC slope survey.

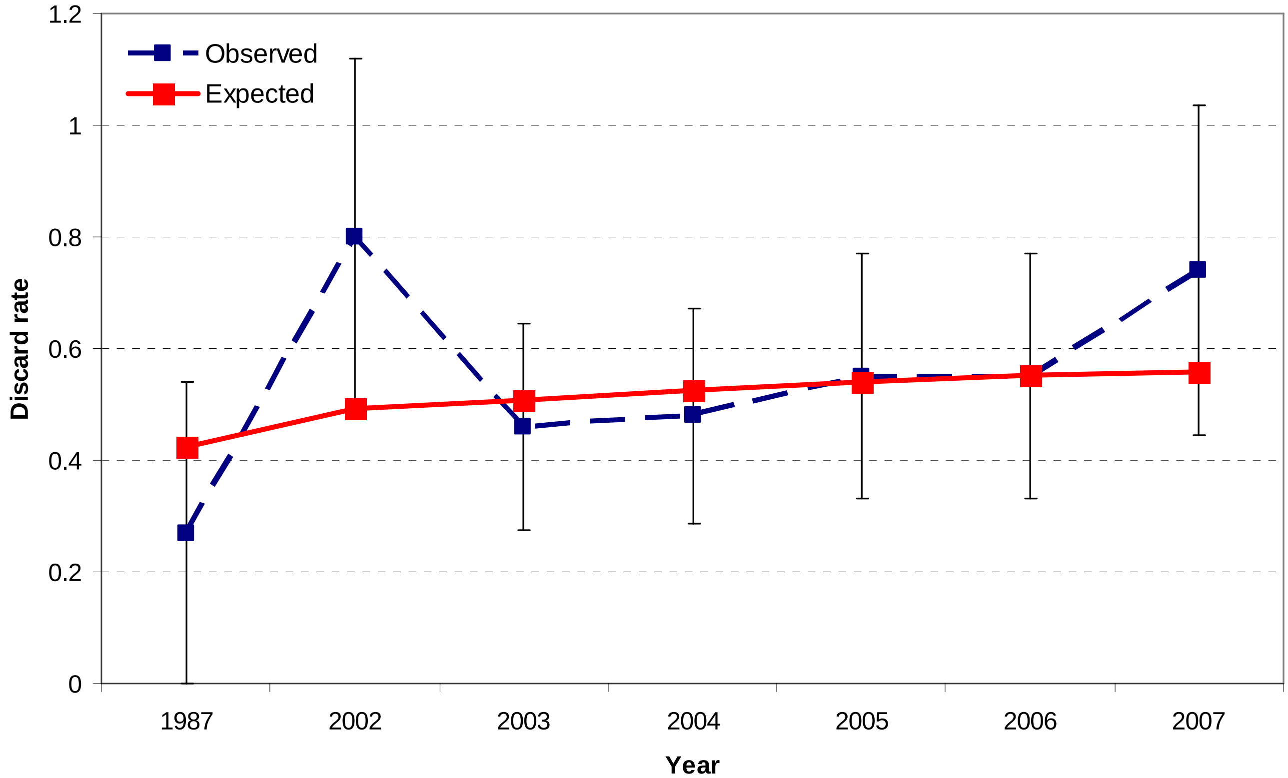

Figure 52. Observed and expected values of discard rates for the domestic trawl fishery

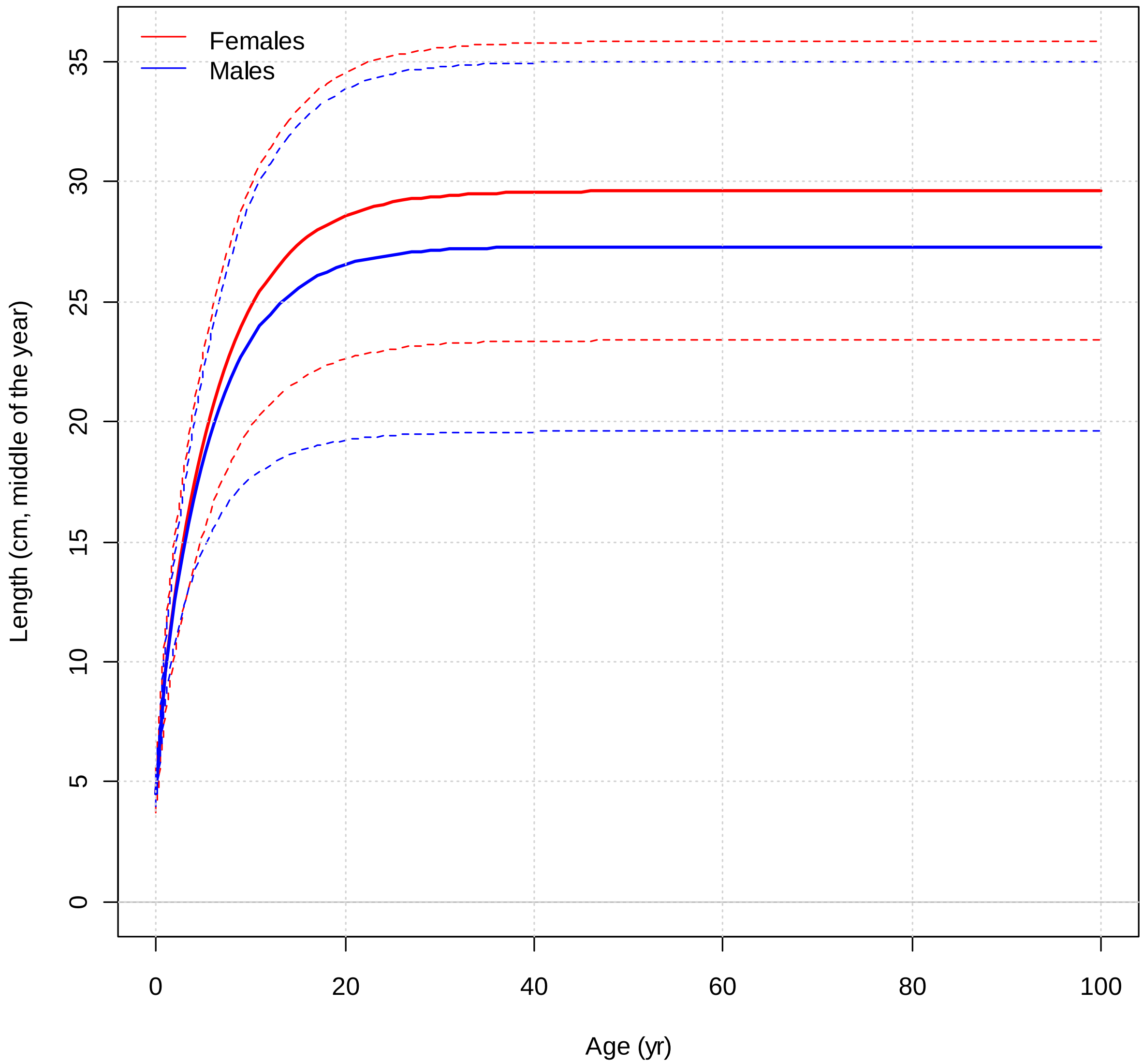

Figure 53. Growth curves for females (upper solid line) and males (lower solid line) estimated by the base model with 95% confidence interval.

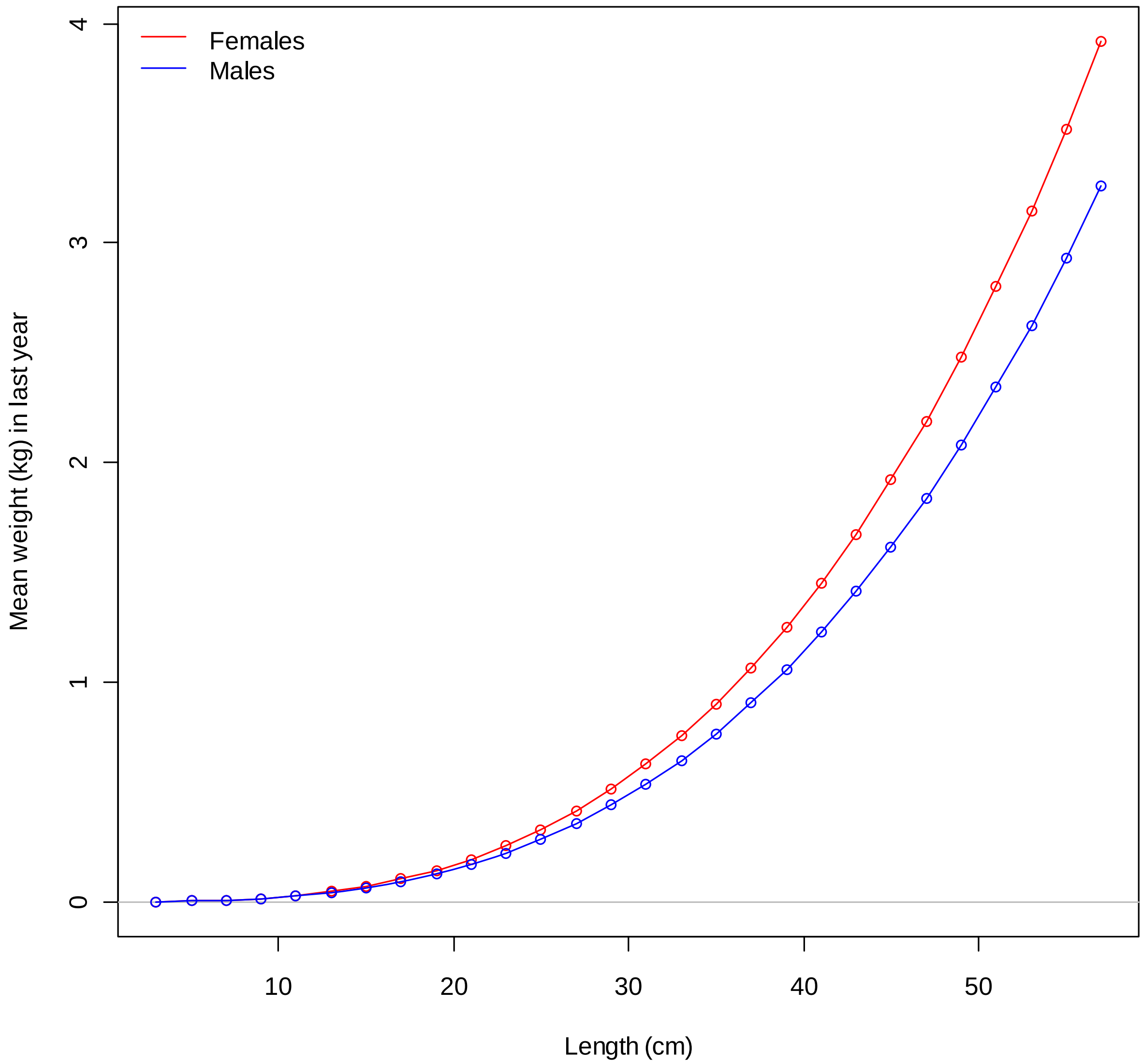

Figure 54. Weight-at-length relationship by sex used in the base model.

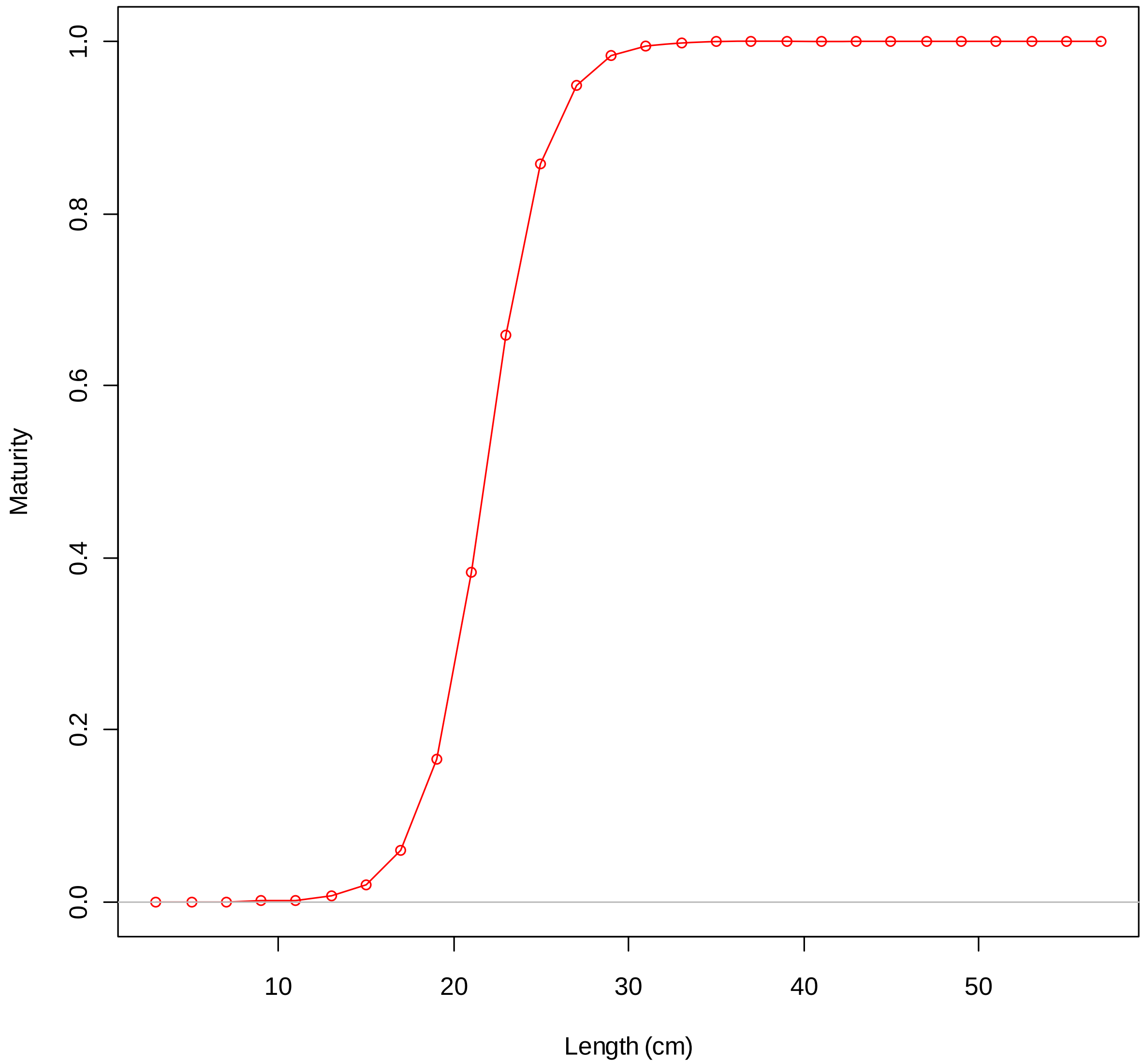

Figure 55. Female-maturity-at-length relationship used in the base model.

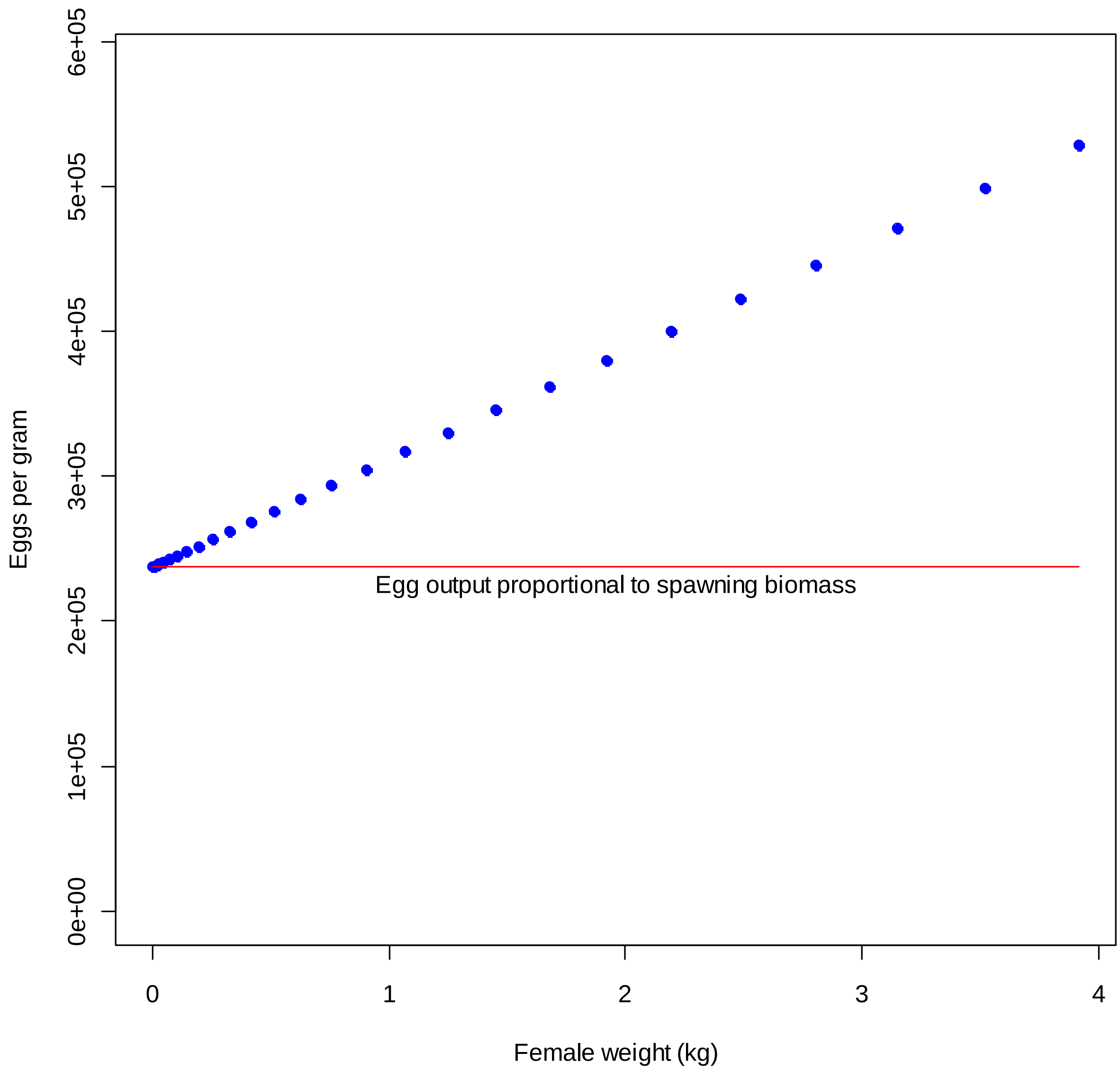

Figure 56. Female fecundity-at-weight relationship used in the base model.

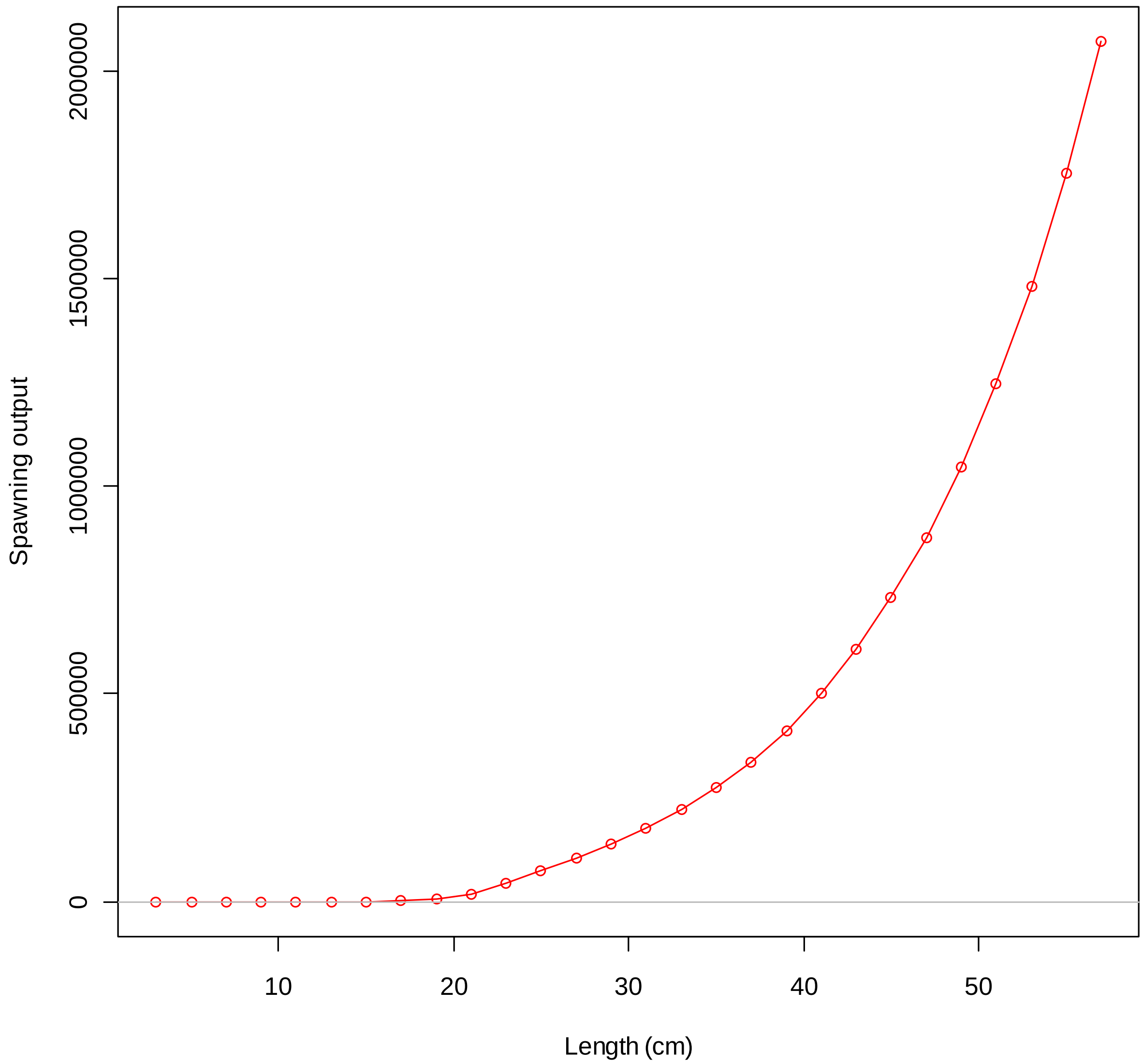

Figure 57. Spawning output-at-length relationship used in the base model.

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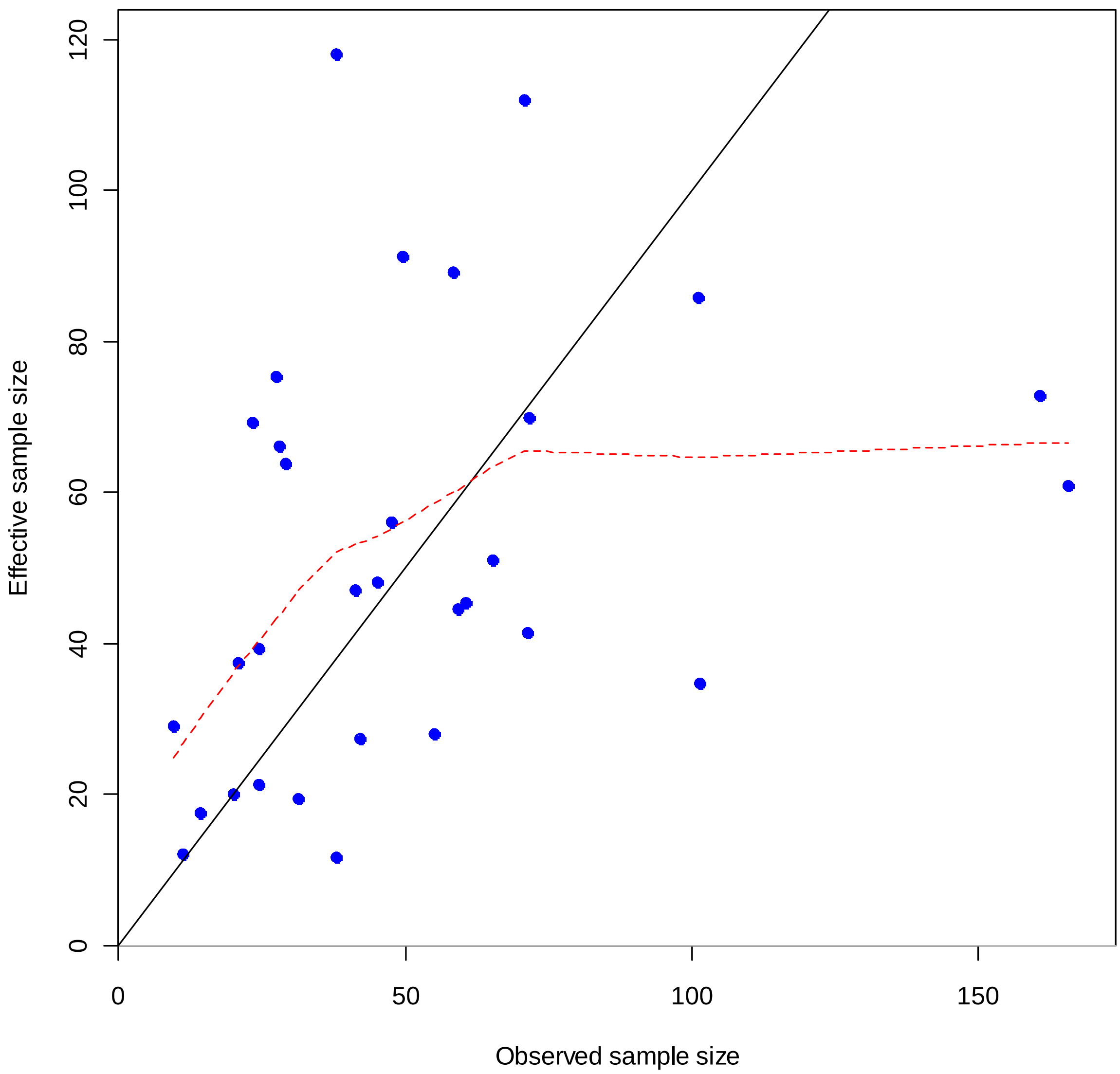

Figure 58. Observed and effective sample sizes for the sex-specific trawl fishery length-frequency observations.

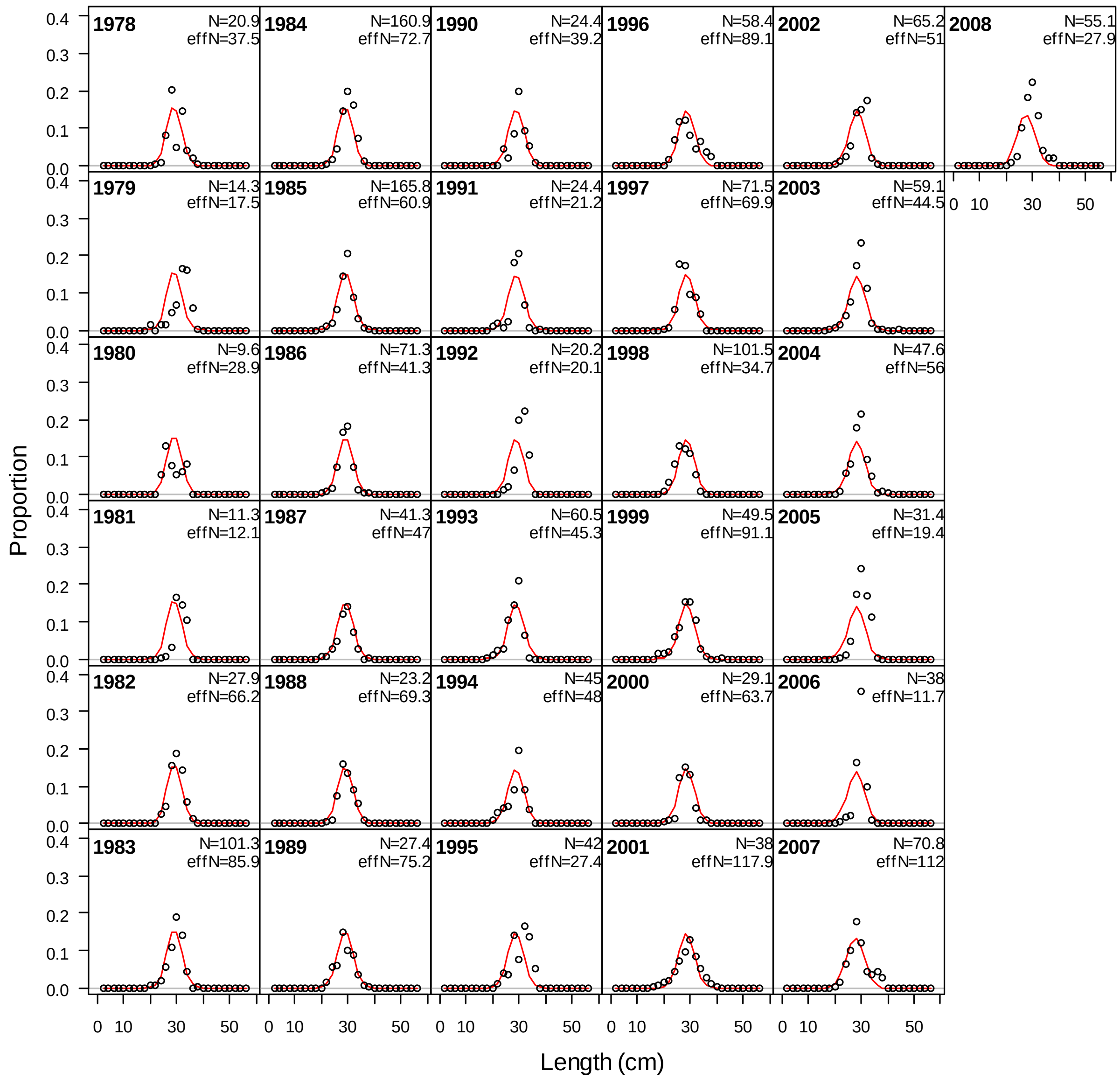

Figure 59. Fit to length-frequency distributions of the female splitnose rockfish for the domestic trawl fishery.

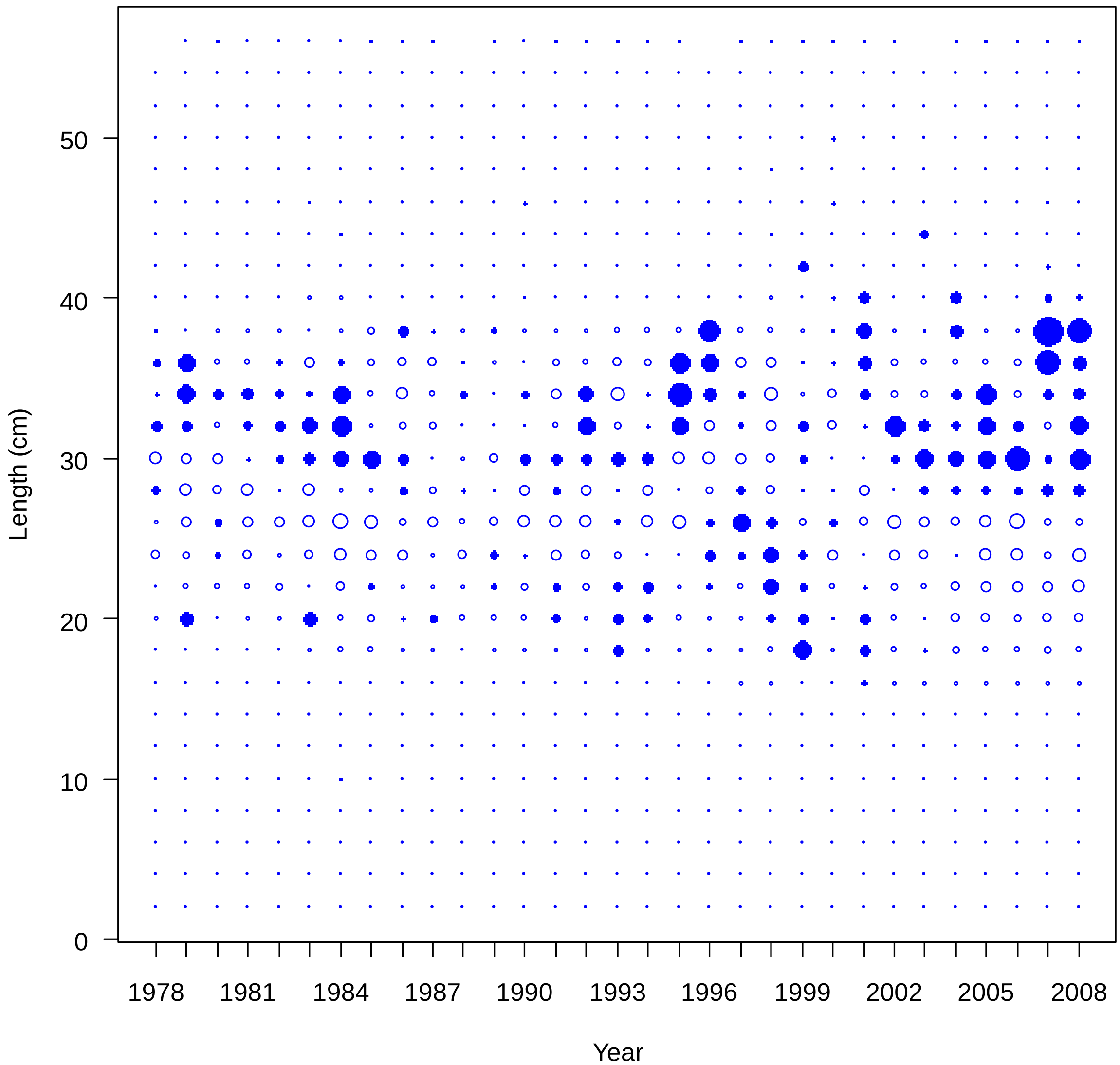

Figure 60. Pearson residuals for the fit of the female length-frequency distributions for the domestic trawl fishery.

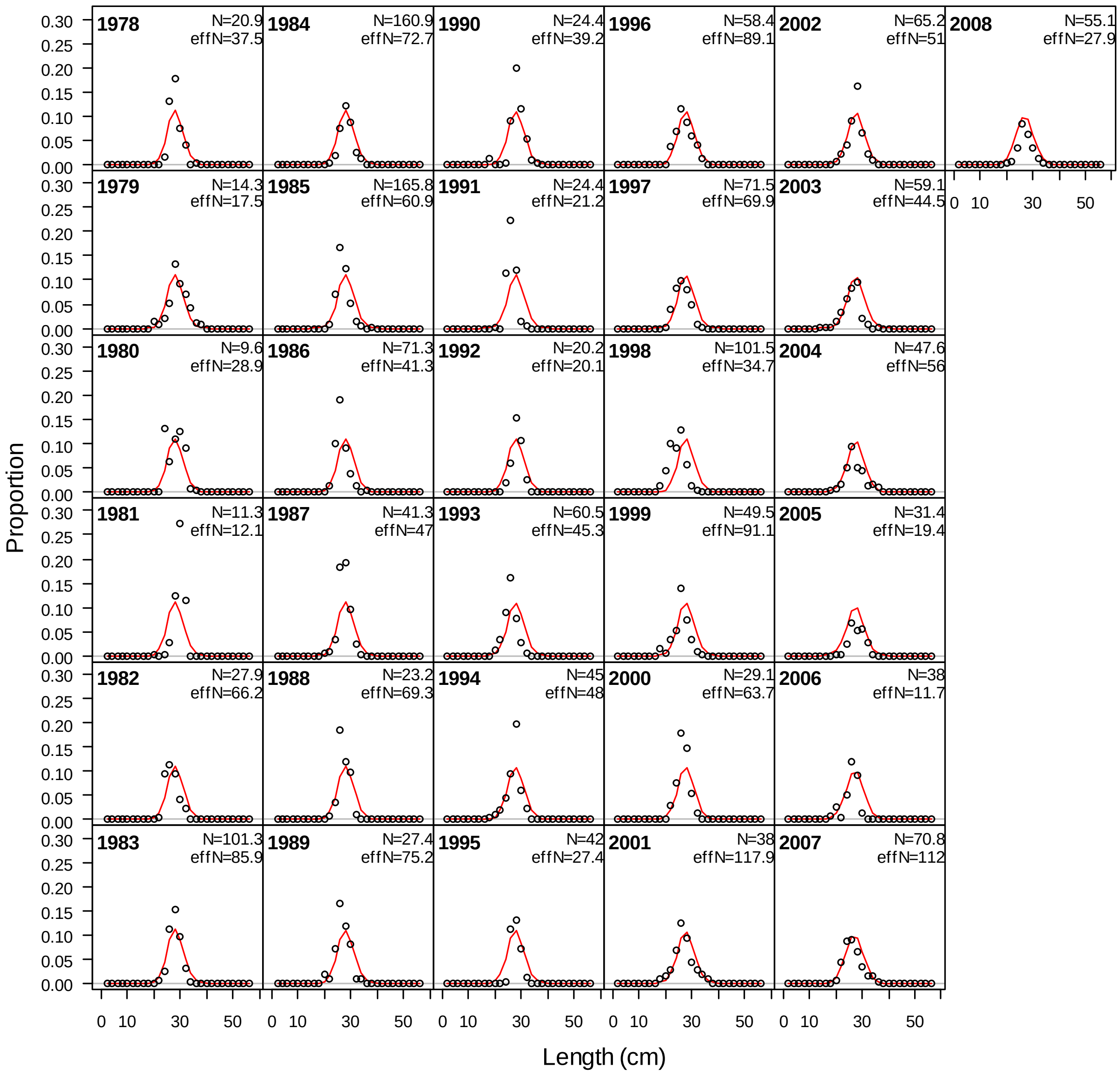

Figure 61. Fit to length-frequency distributions of the male splitnose rockfish for the domestic trawl fishery.

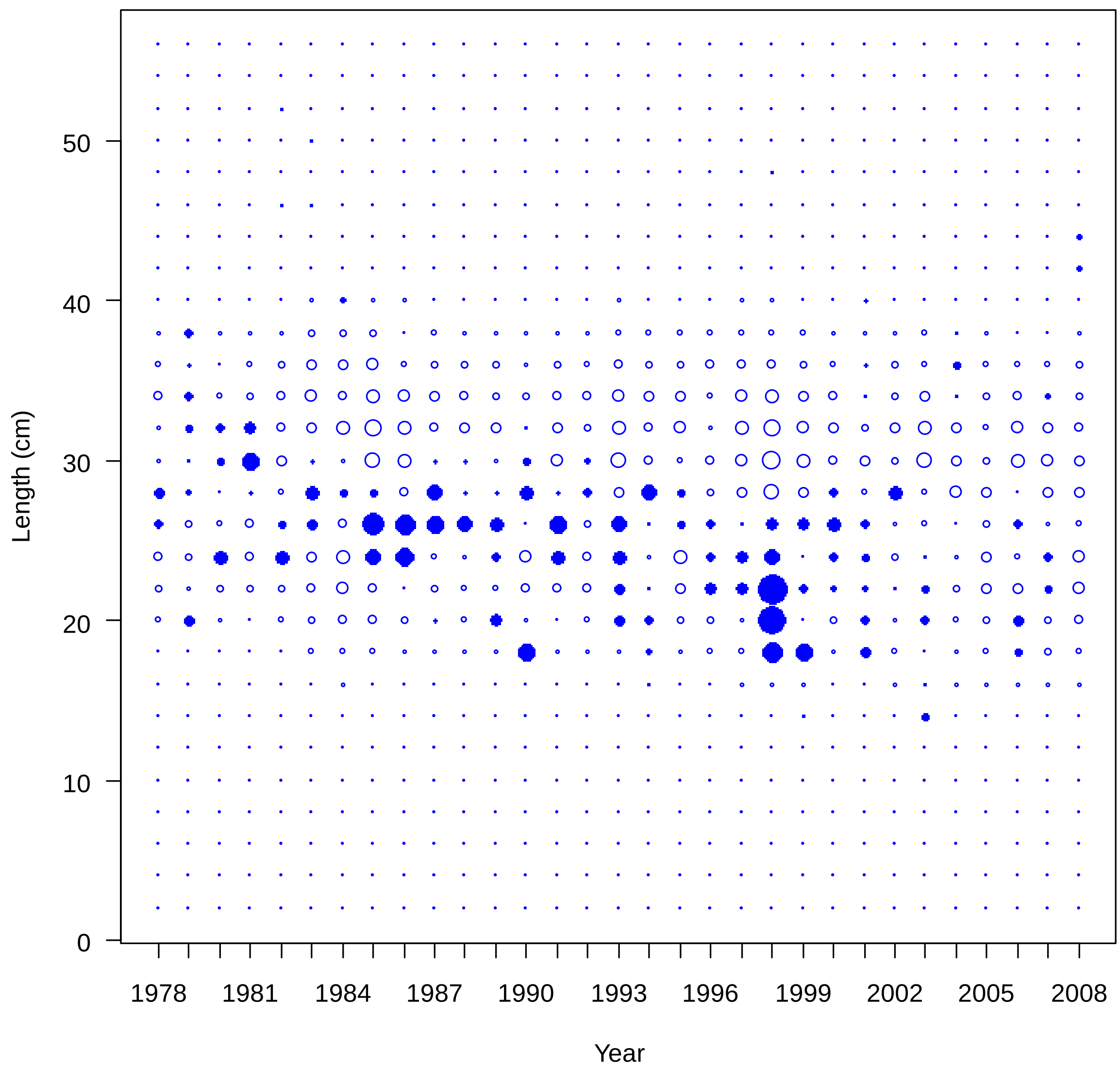

Figure 62. Pearson residuals for the fit of the male length-frequency distributions for the domestic trawl fishery.

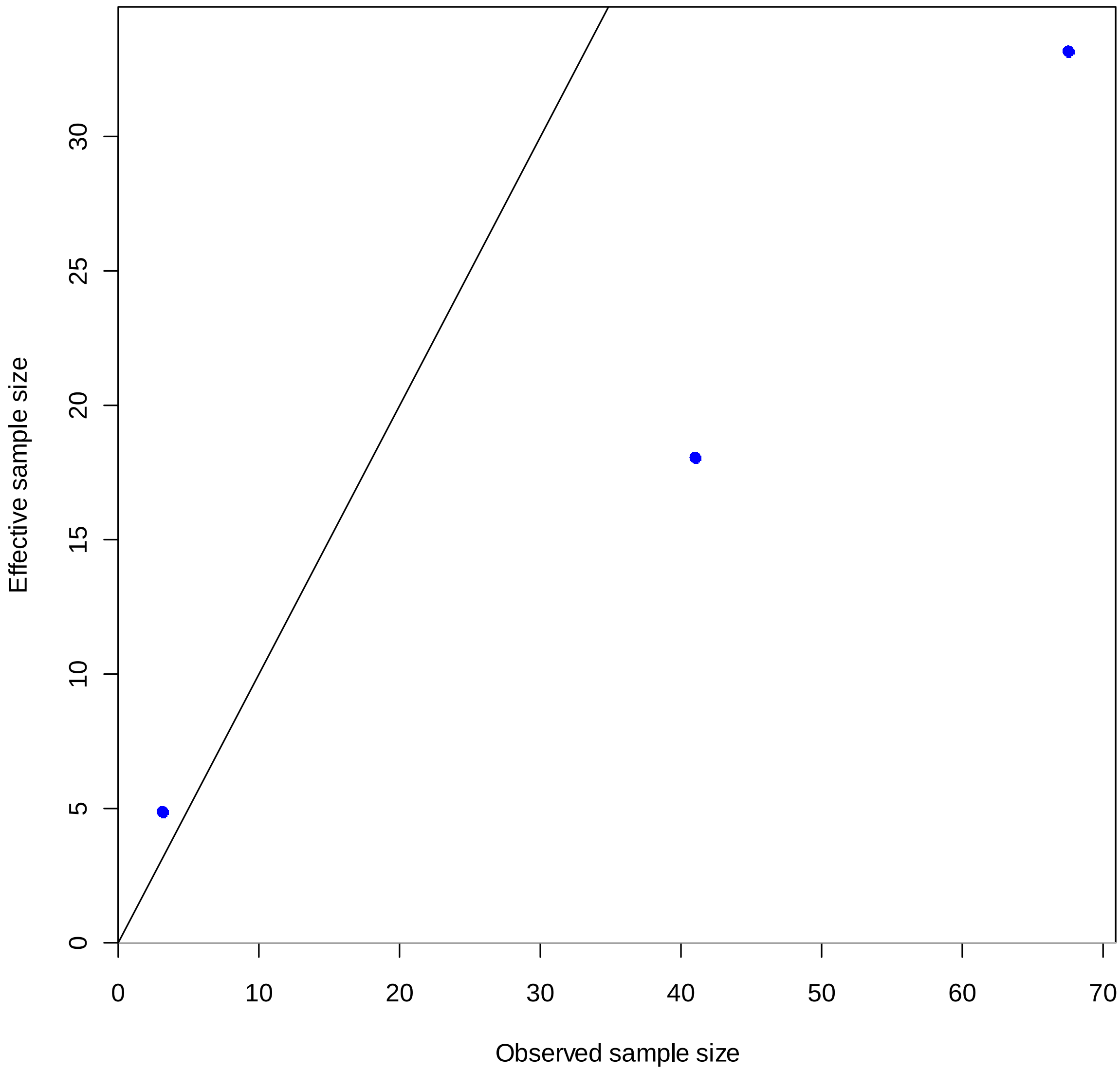

Figure 63. Observed and effective sample sizes for the sex-specific trawl fishery discards length-frequency observations.

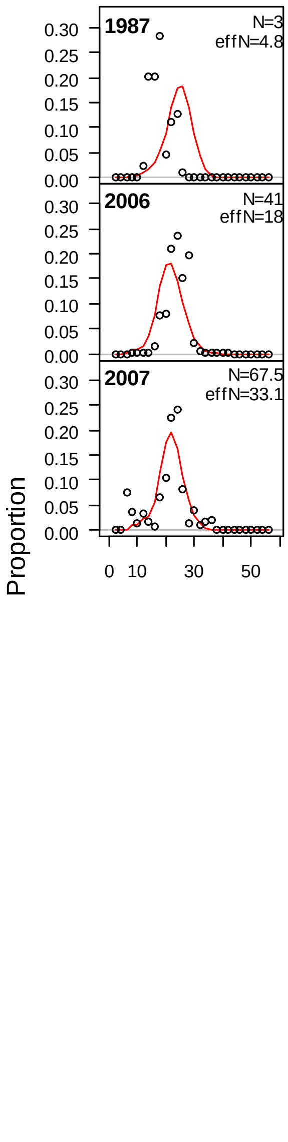

Figure 64. Fit to length-frequency distributions of splitnose rockfish (both sexes combined) for the domestic trawl fishery discard.

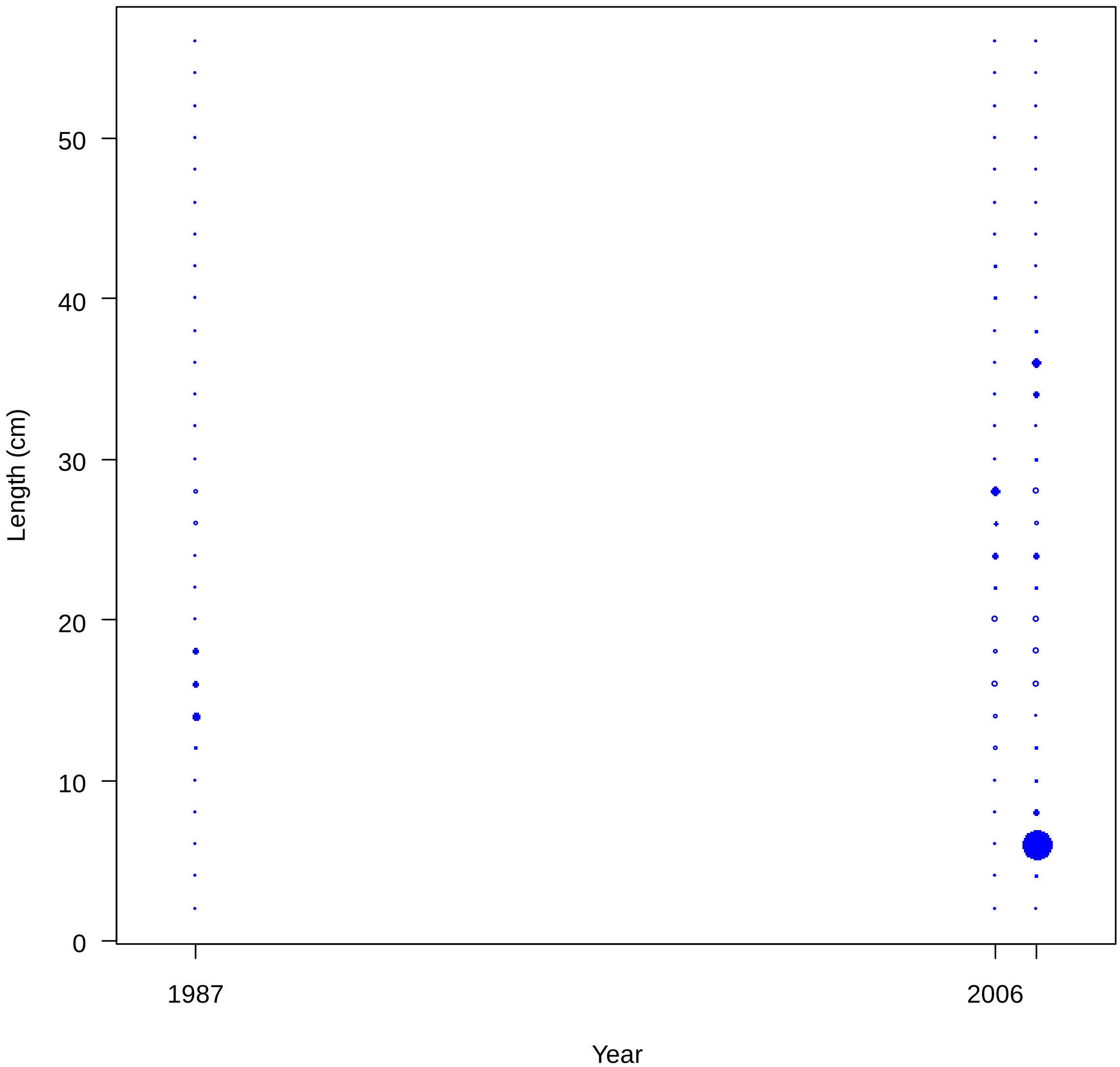

Figure 65. Pearson residuals for the fit of the length-frequency distributions (both sexes combined) for the domestic trawl fishery discard.

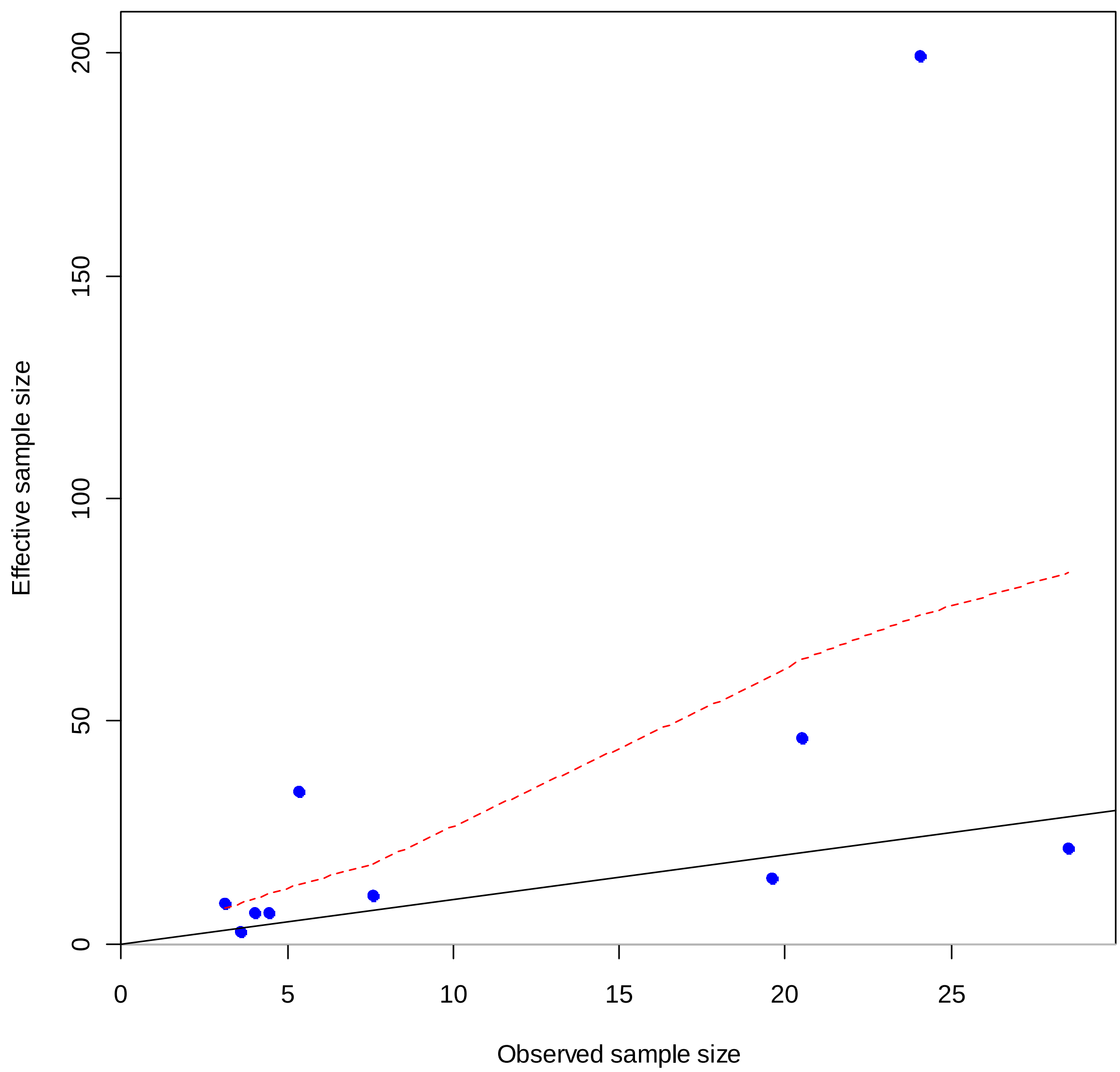

Figure 66. Observed and effective sample sizes for AFSC triennial survey length-frequency observations (both sexes combined).

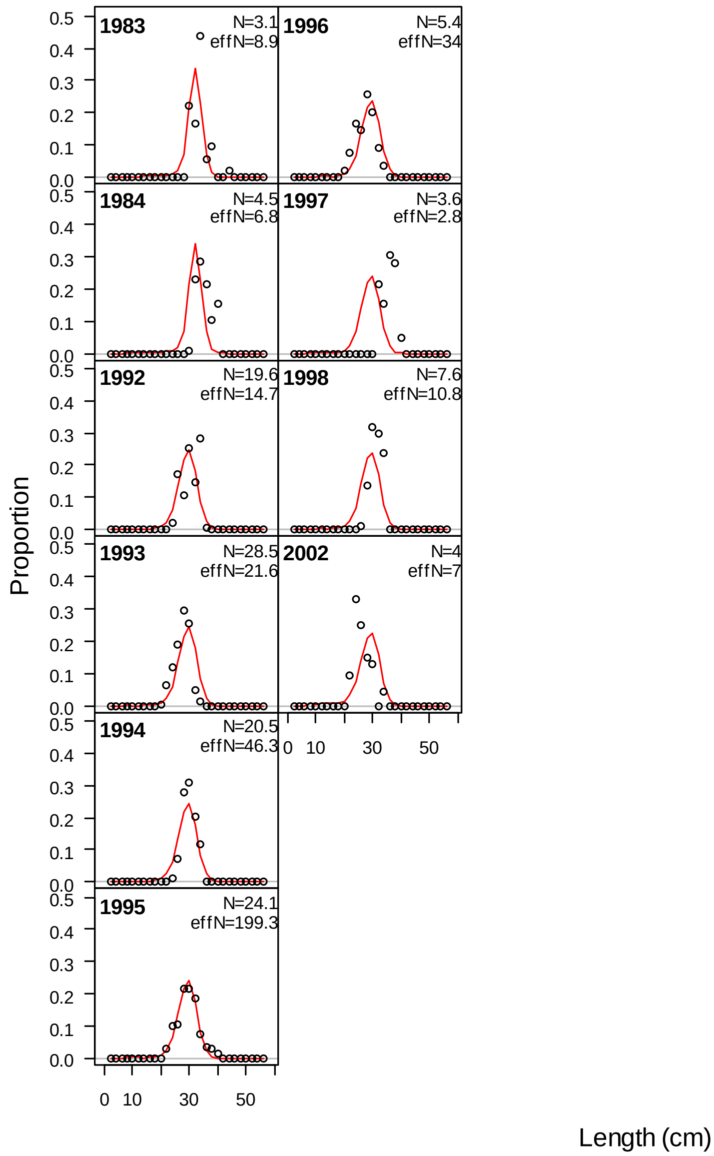

Figure 67. Fit to length-frequency distributions of splitnose rockfish (both sexes combined) for the non-trawl fishery.

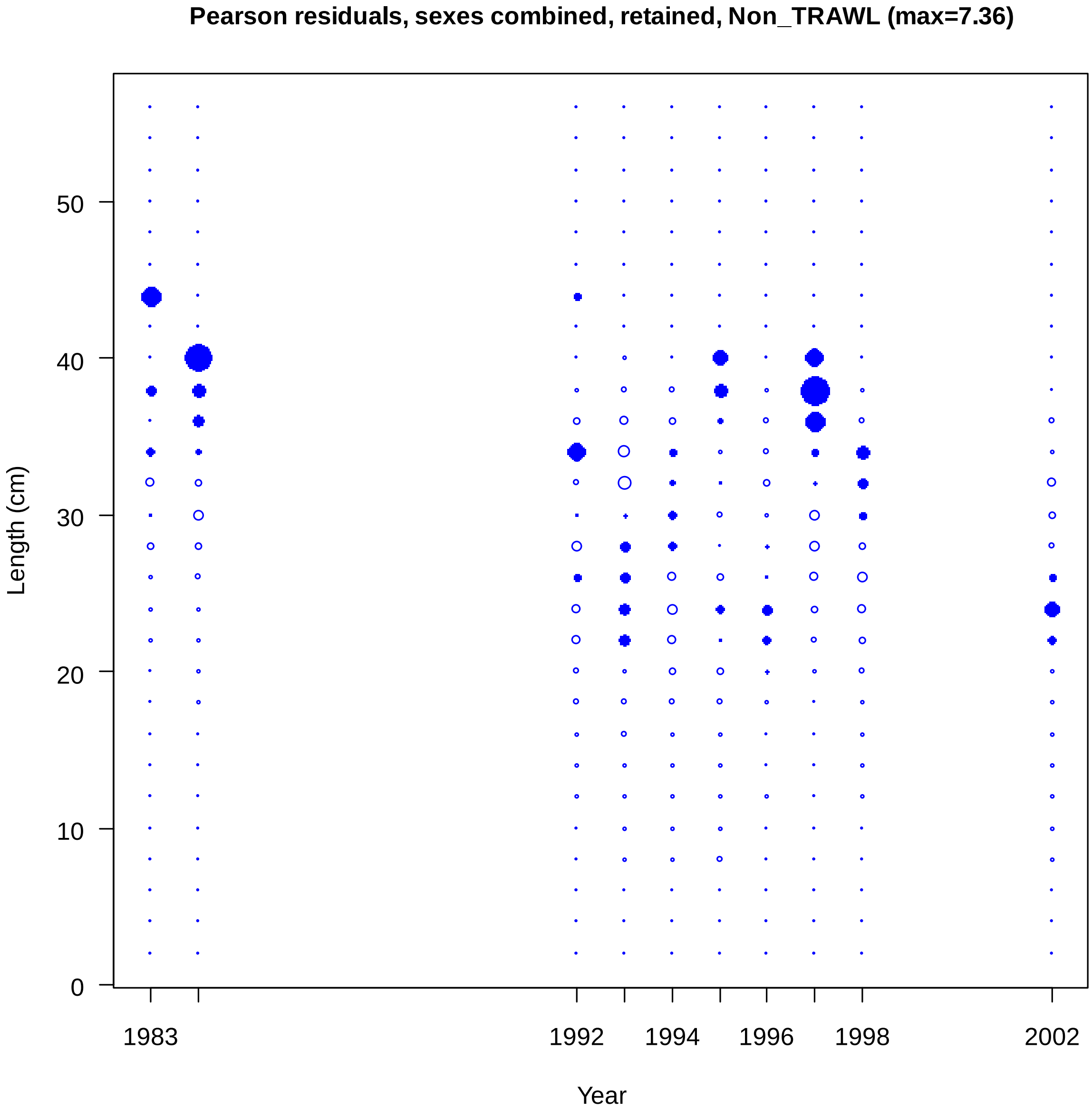

Figure 68. Pearson residuals for the fit of the length-frequency distributions (both sexes combined) for the non- trawl fishery.

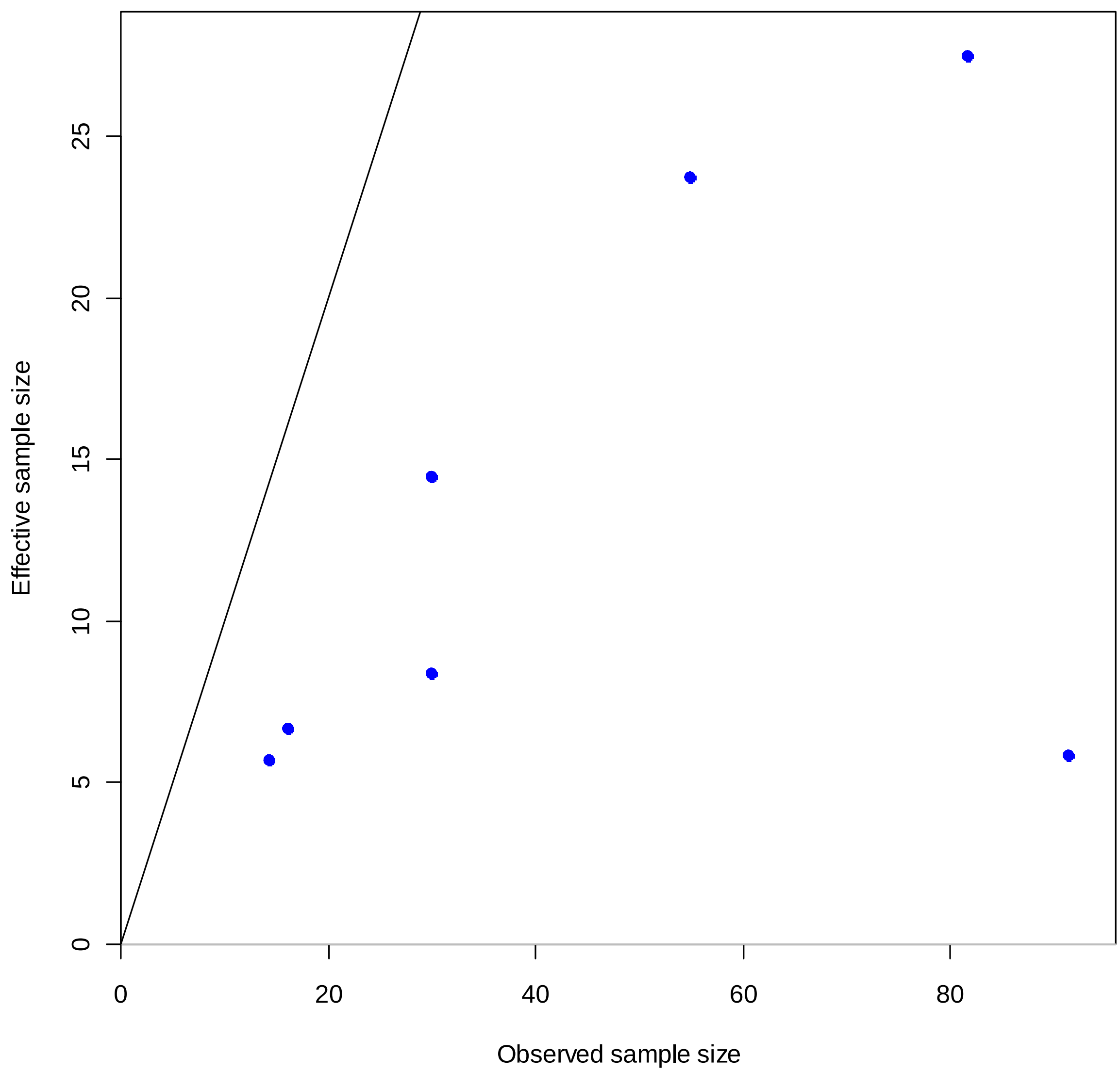

Figure 69. Observed and effective sample sizes for the sex-specific AFSC triennial survey length-frequency observations.

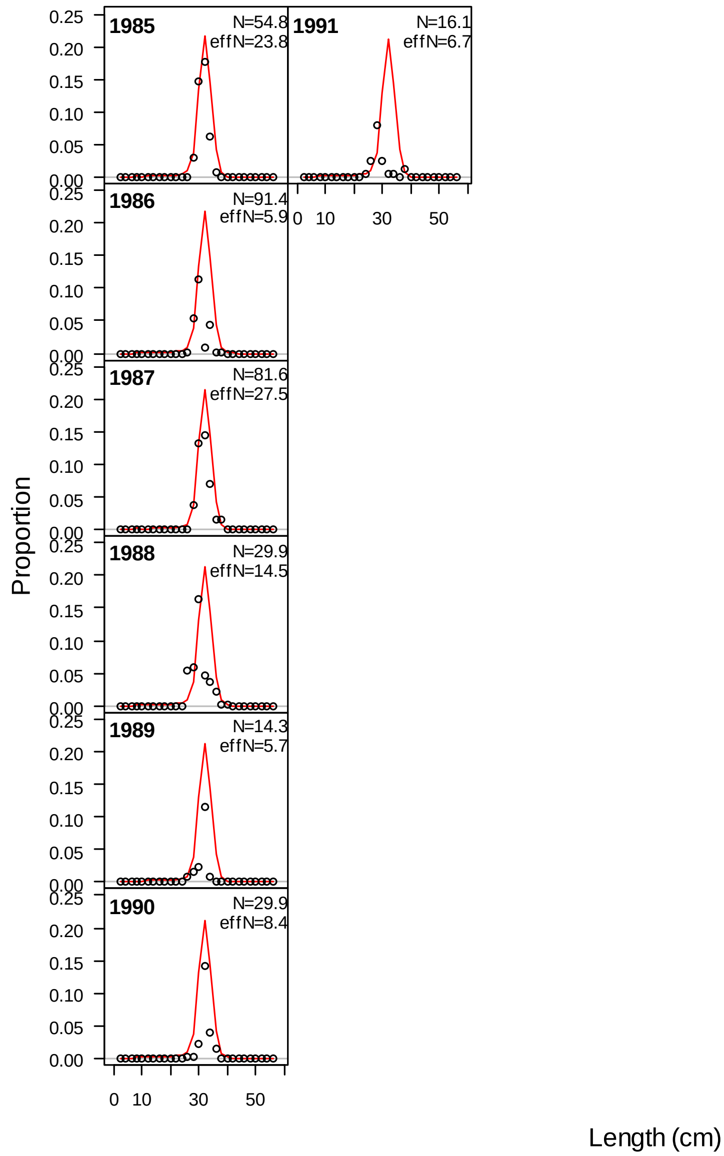

Figure 70. Fit to length-frequency distributions of the female splitnose rockfish for the non-trawl fishery.

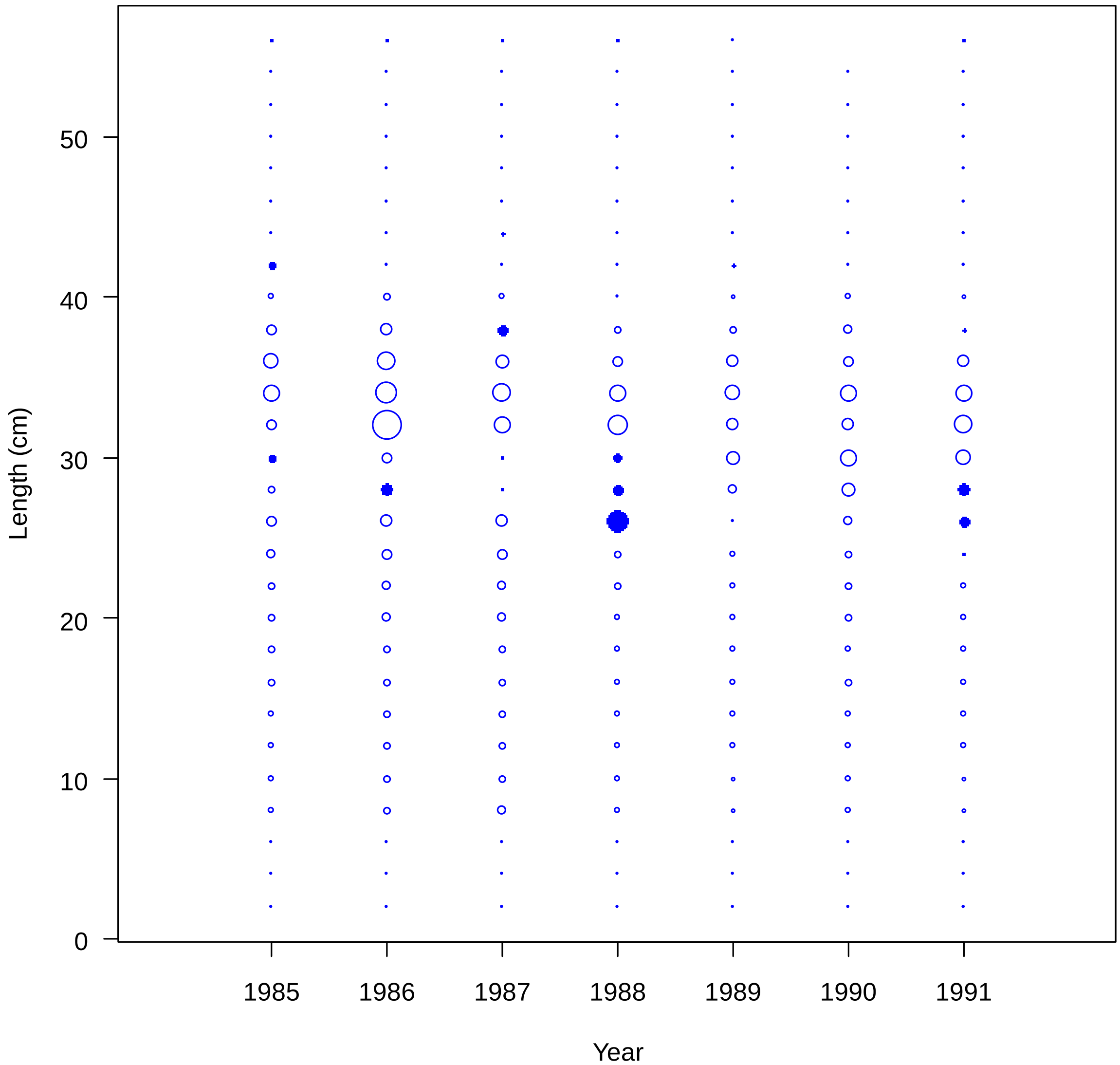

Figure71. Pearson residuals for the fit of the female length-frequency distributions for the non-trawl fishery.

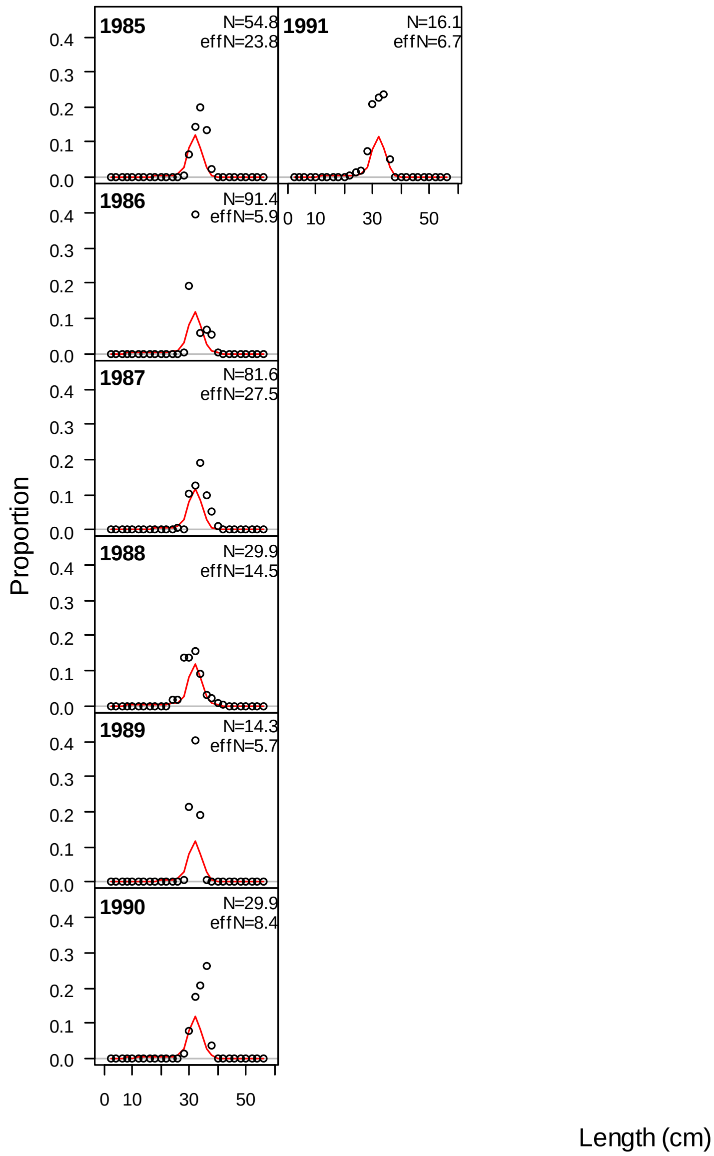

Figure 72. Fit to length-frequency distributions of the male splitnose rockfish for the non-trawl fishery.

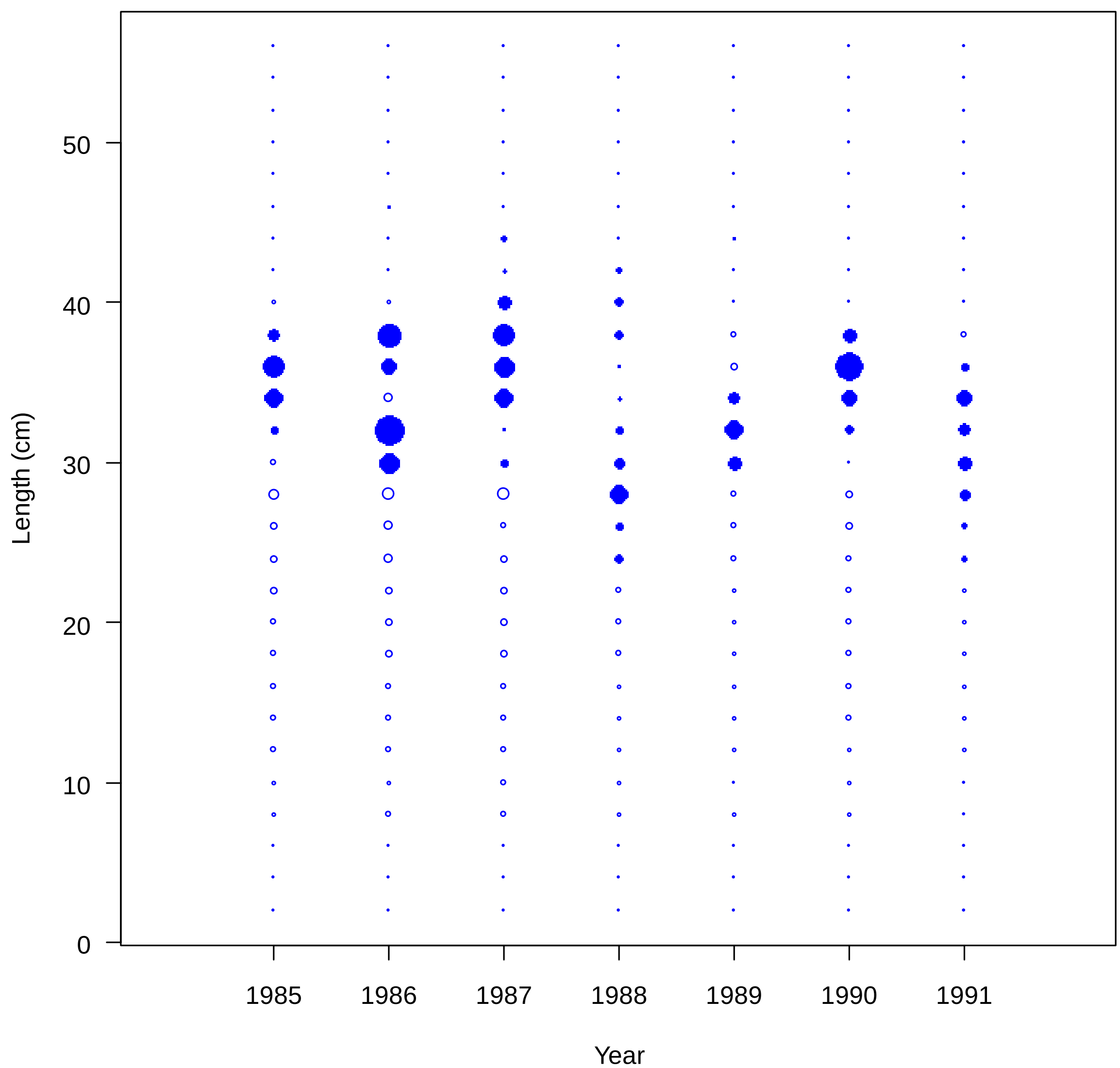

Figure 73. Pearson residuals for the fit of the male length-frequency distributions for the non-trawl fishery.

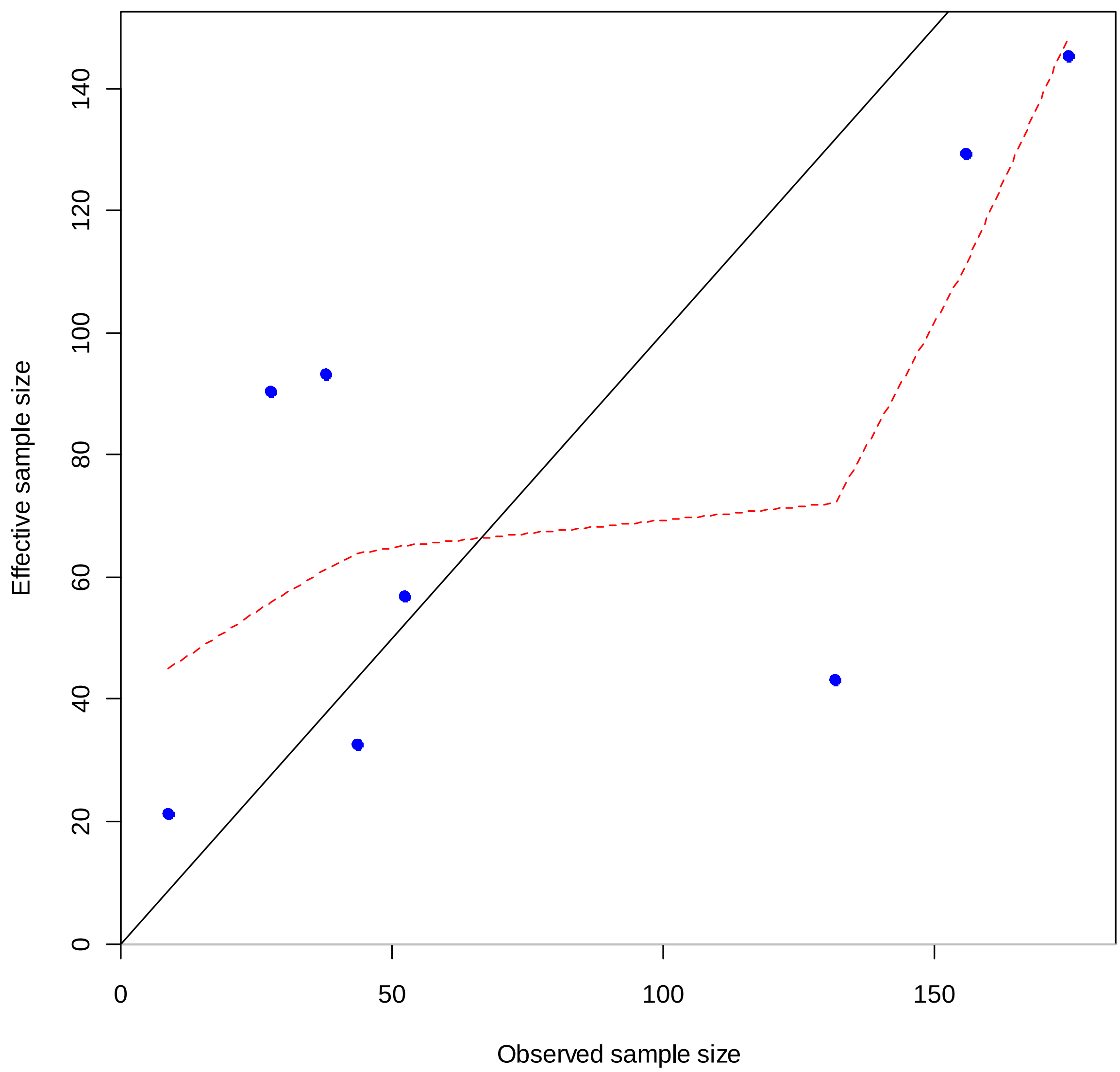

Figure 74. Observed and effective sample sizes for the sex-specific AFSC triennial survey length-frequency observations.

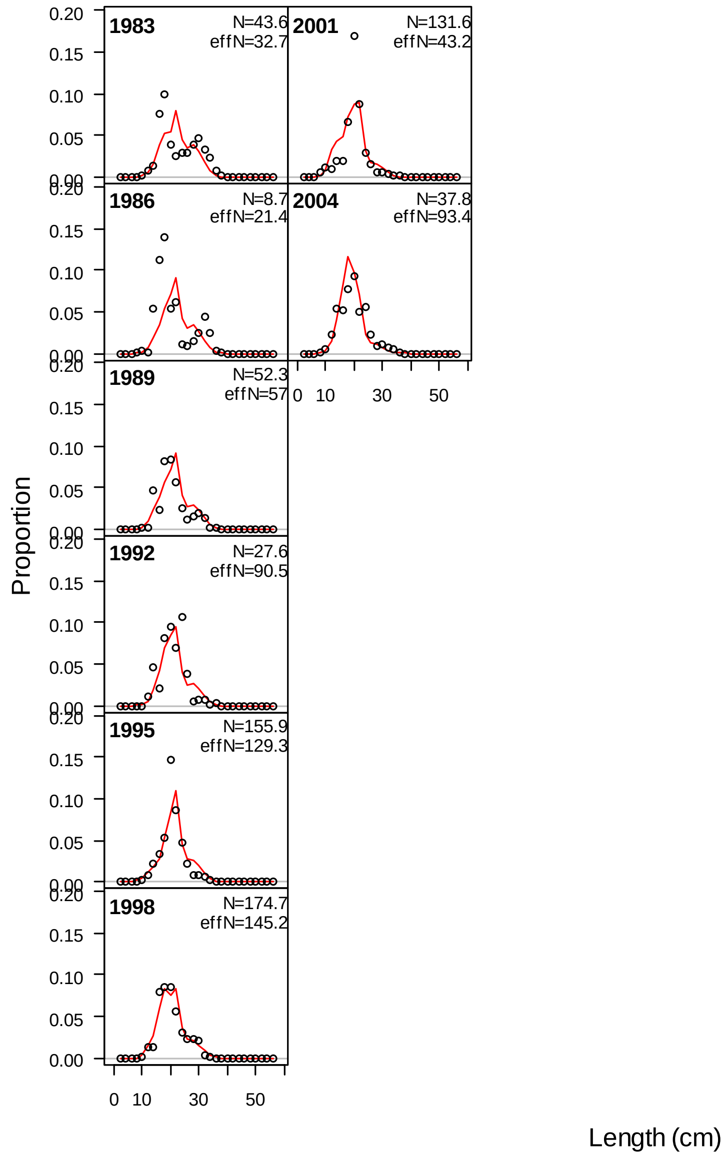

Figure 75. Fit to length-frequency distributions of the female splitnose rockfish for the AFSC triennial survey.

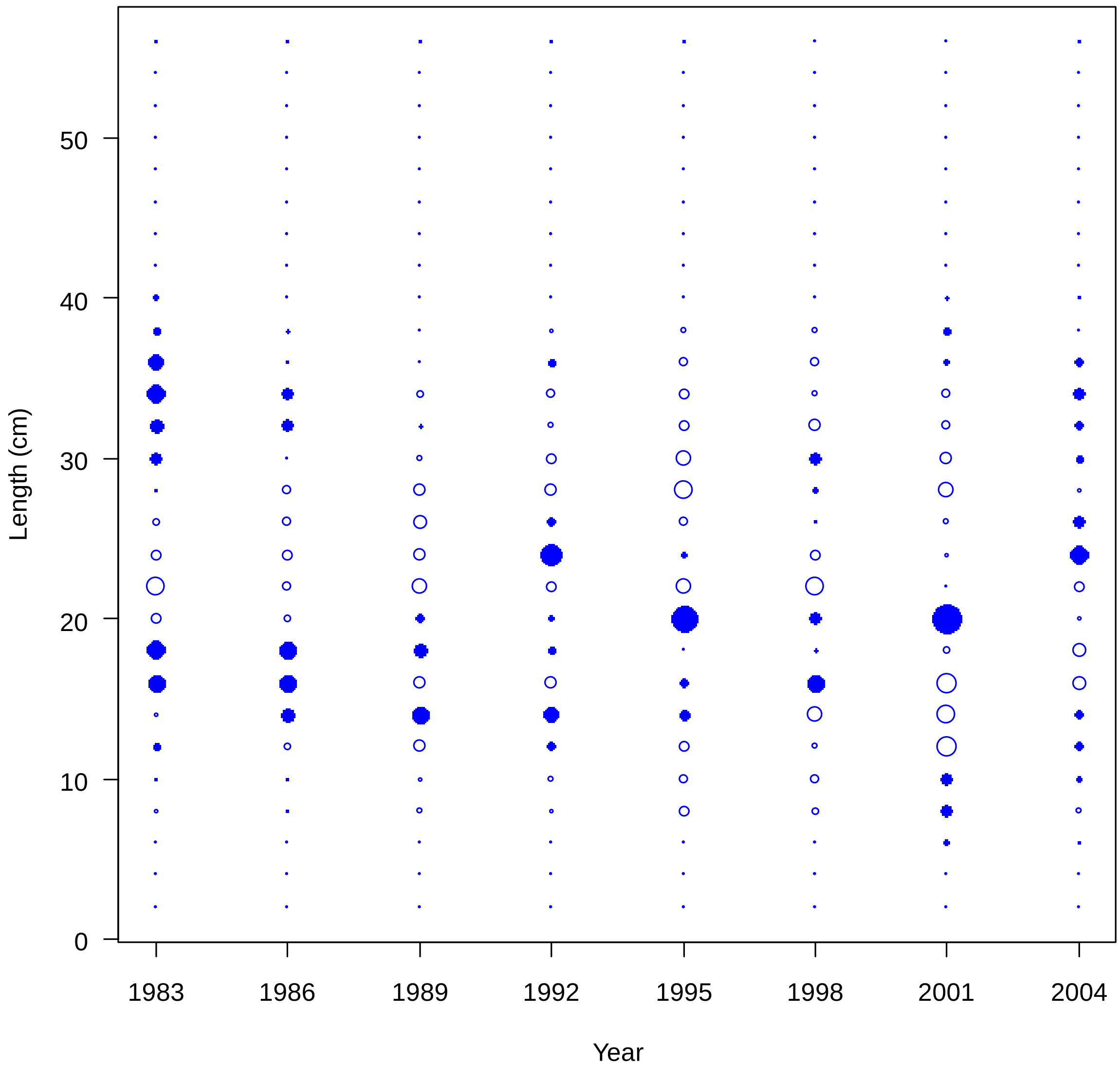

Figure 76. Pearson residuals for the fit of the female length-frequency distributions for the AFSC triennial survey.

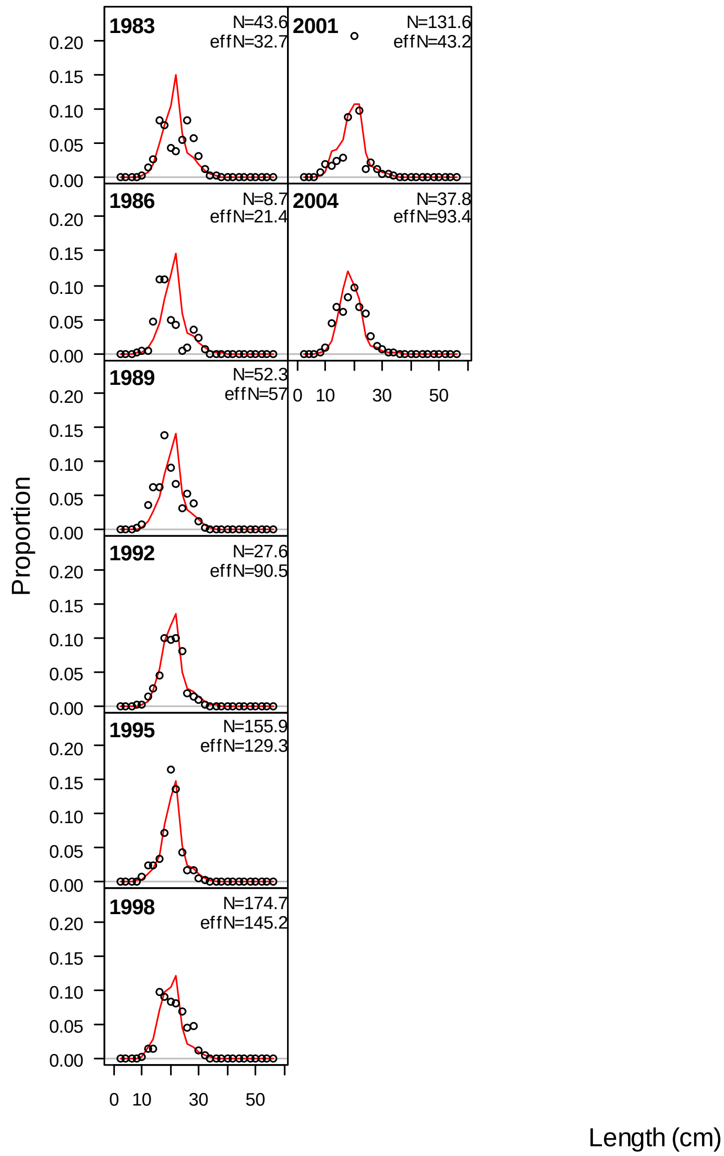

Figure 77. Fit to length-frequency distributions of the male splitnose rockfish for the AFSC triennial survey.

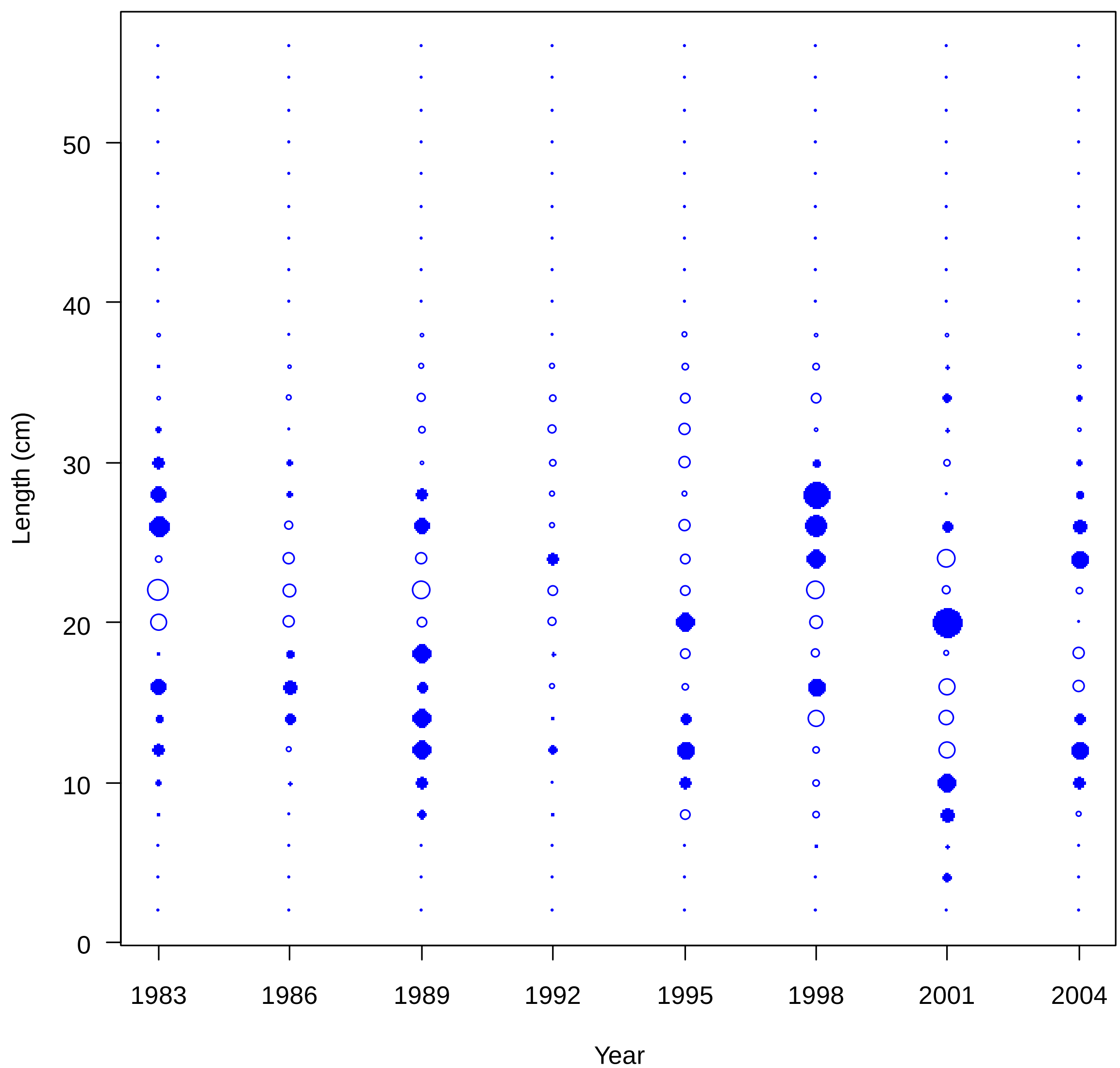

Figure 78. Pearson residuals for the fit of the male length-frequency distributions for the AFSC triennial survey.

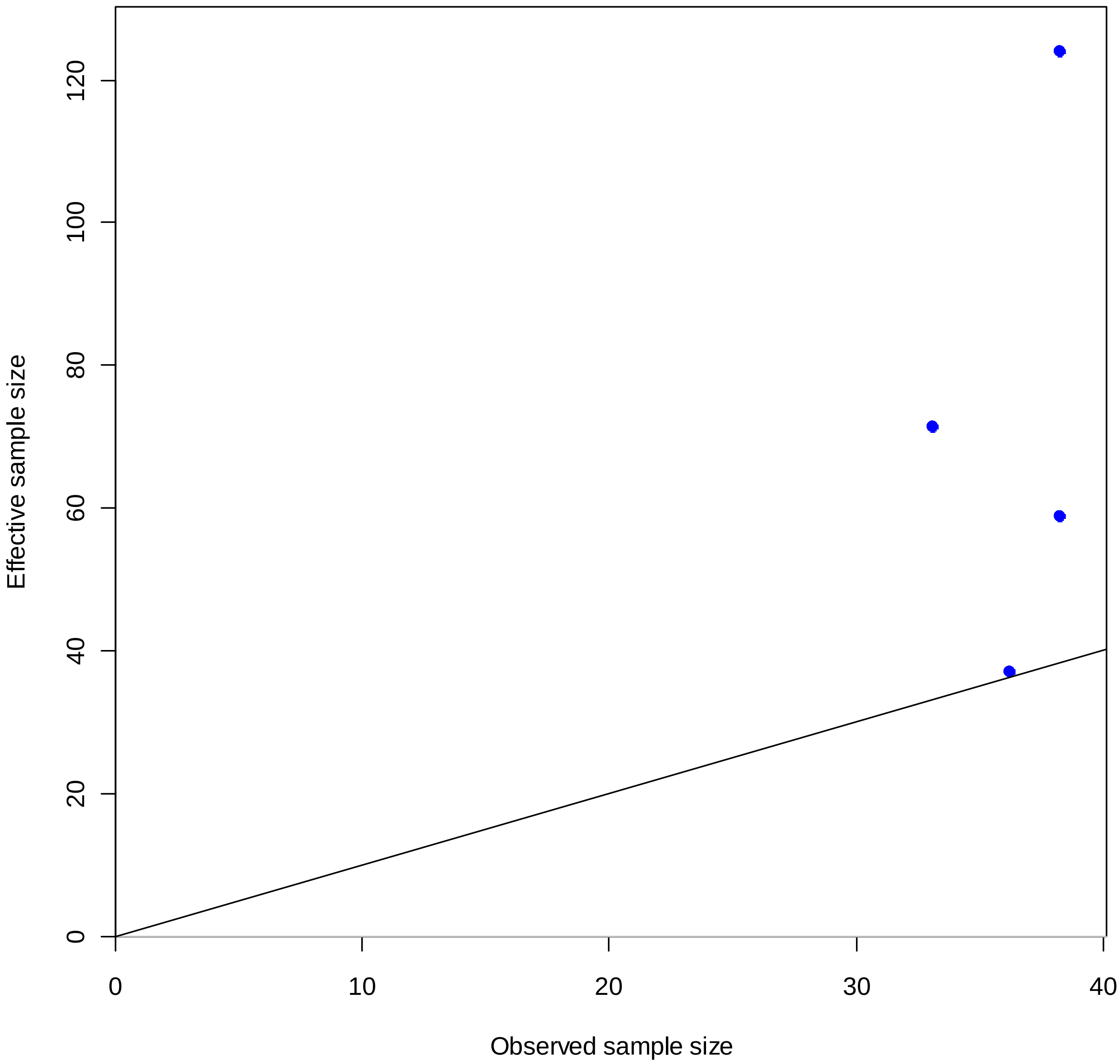

Figure 79. Observed and effective sample sizes for the sex-specific AFSC slope survey length-frequency observations.

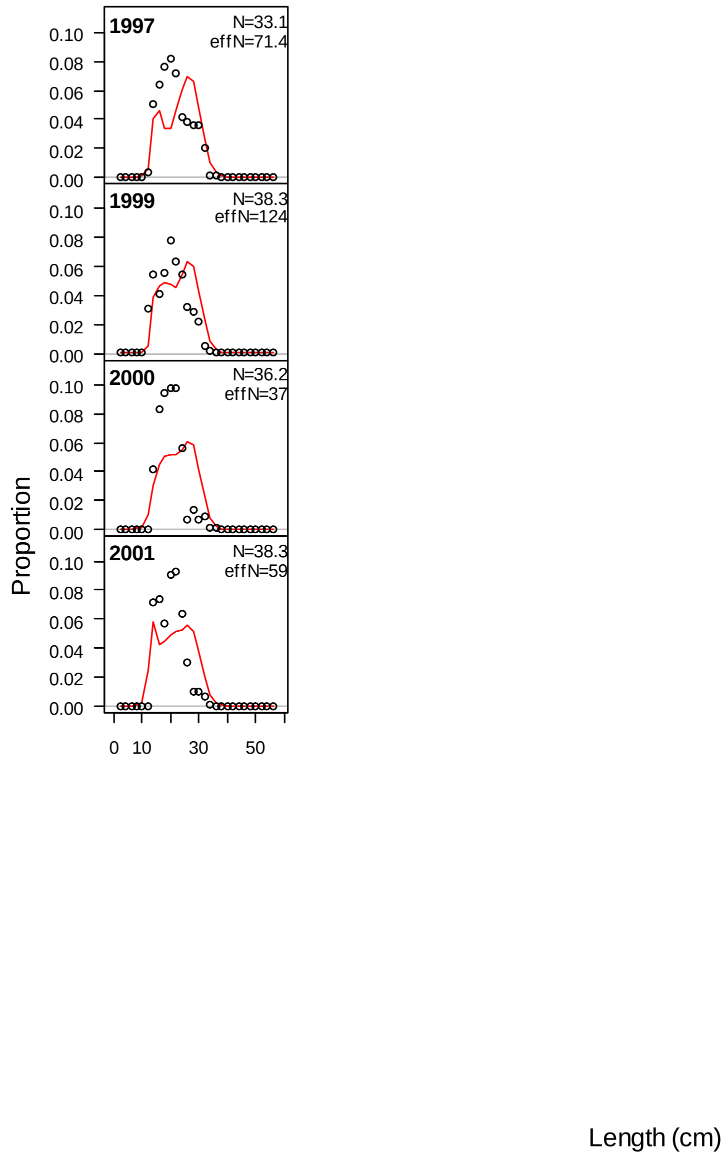

Figure 80. Fit to length-frequency distributions of the female splitnose rockfish for the AFSC slope survey.

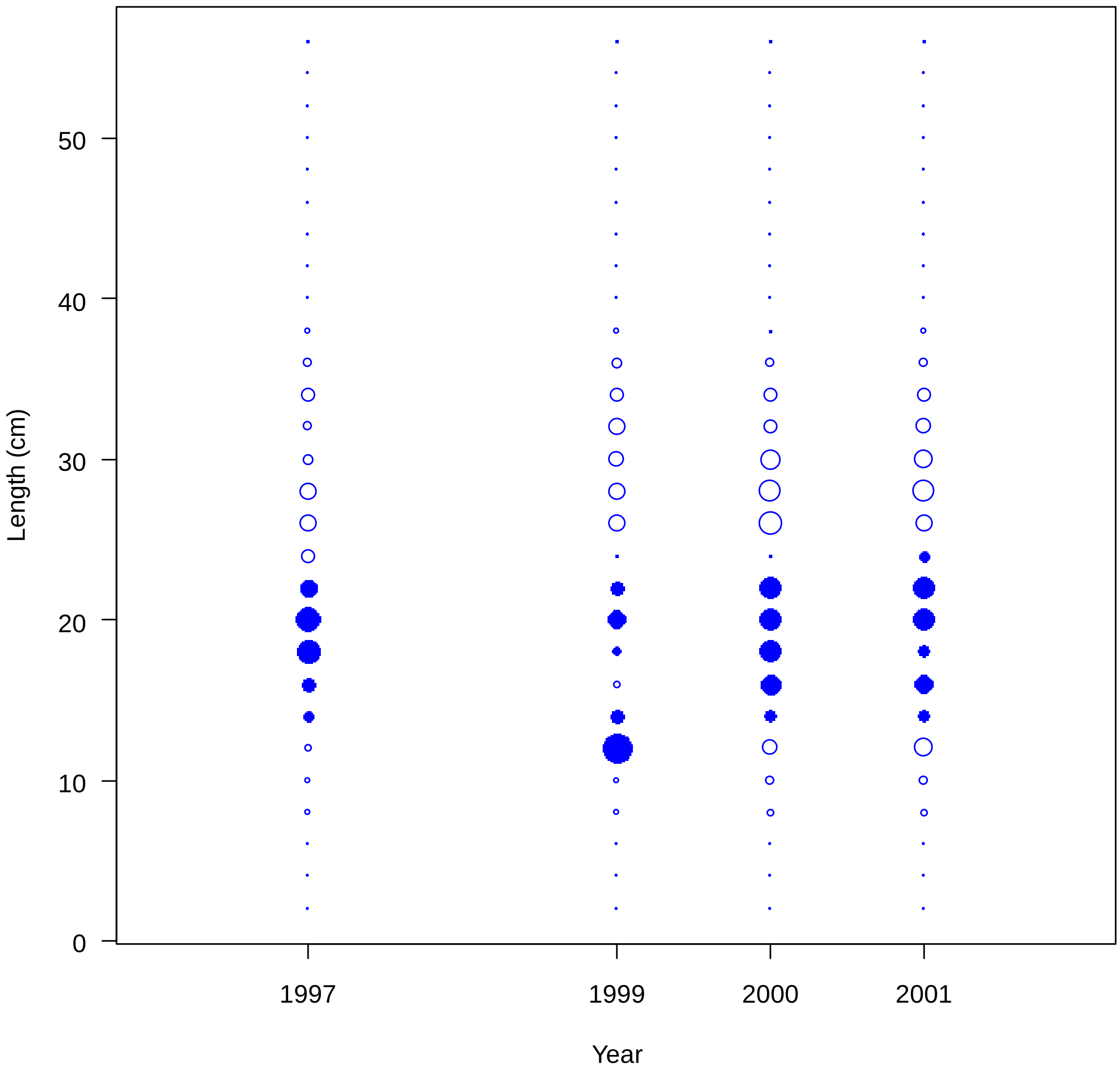

Figure 81. Pearson residuals for the fit of the female length-frequency distributions for the AFSC slope survey.

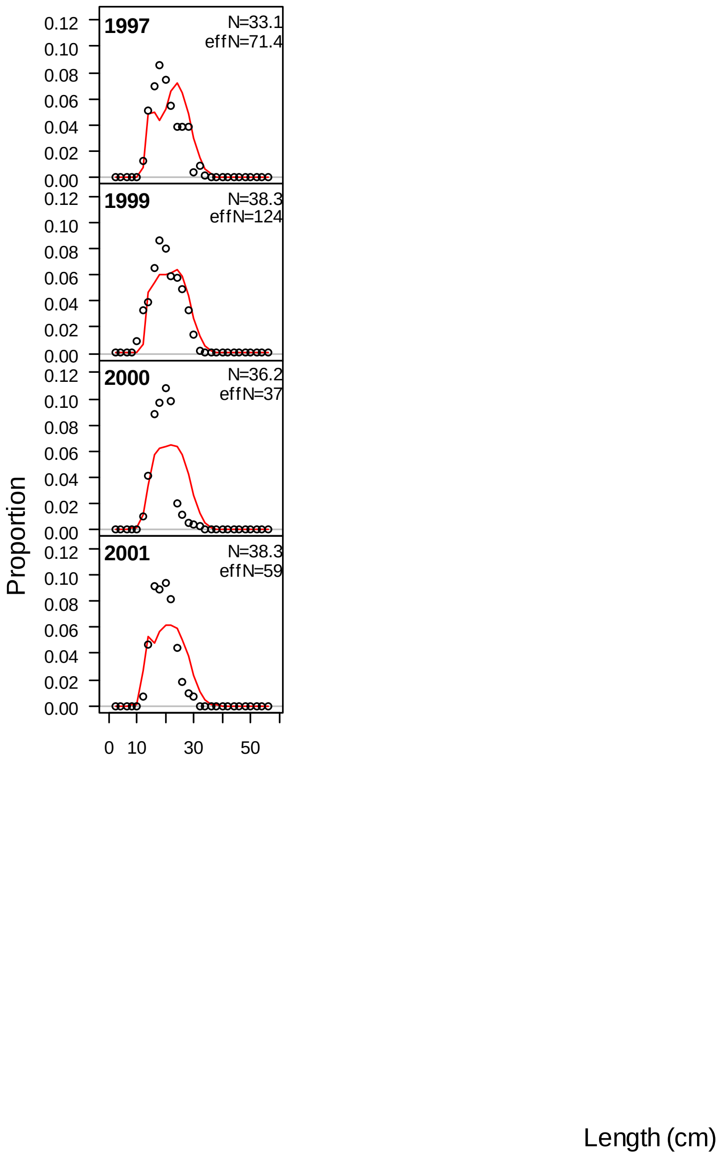

Figure 82. Fit to length-frequency distributions of the male splitnose rockfish for the AFSC slope survey.

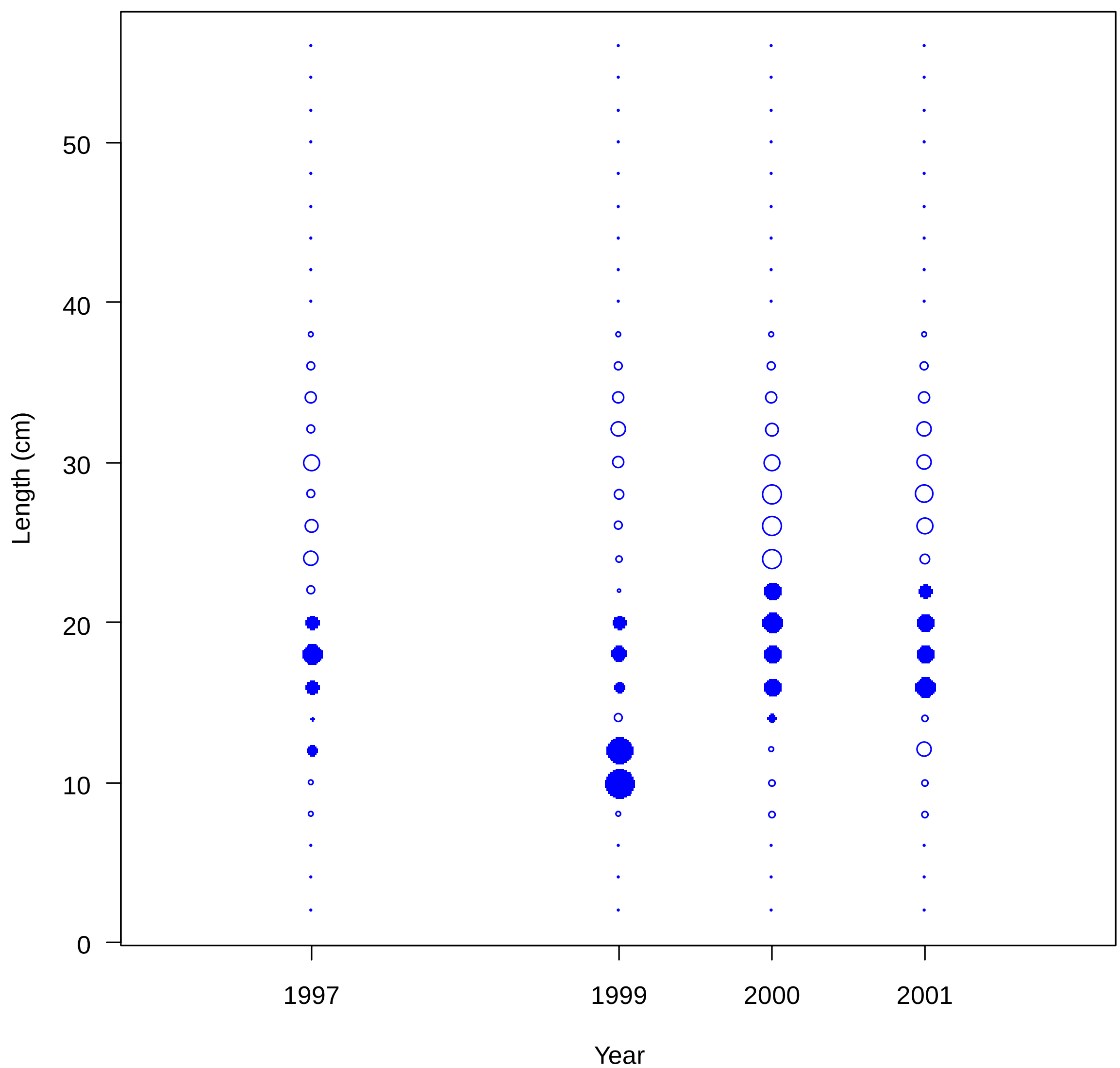

Figure 83. Pearson residuals for the fit of the male length-frequency distributions for the AFSC slope survey.

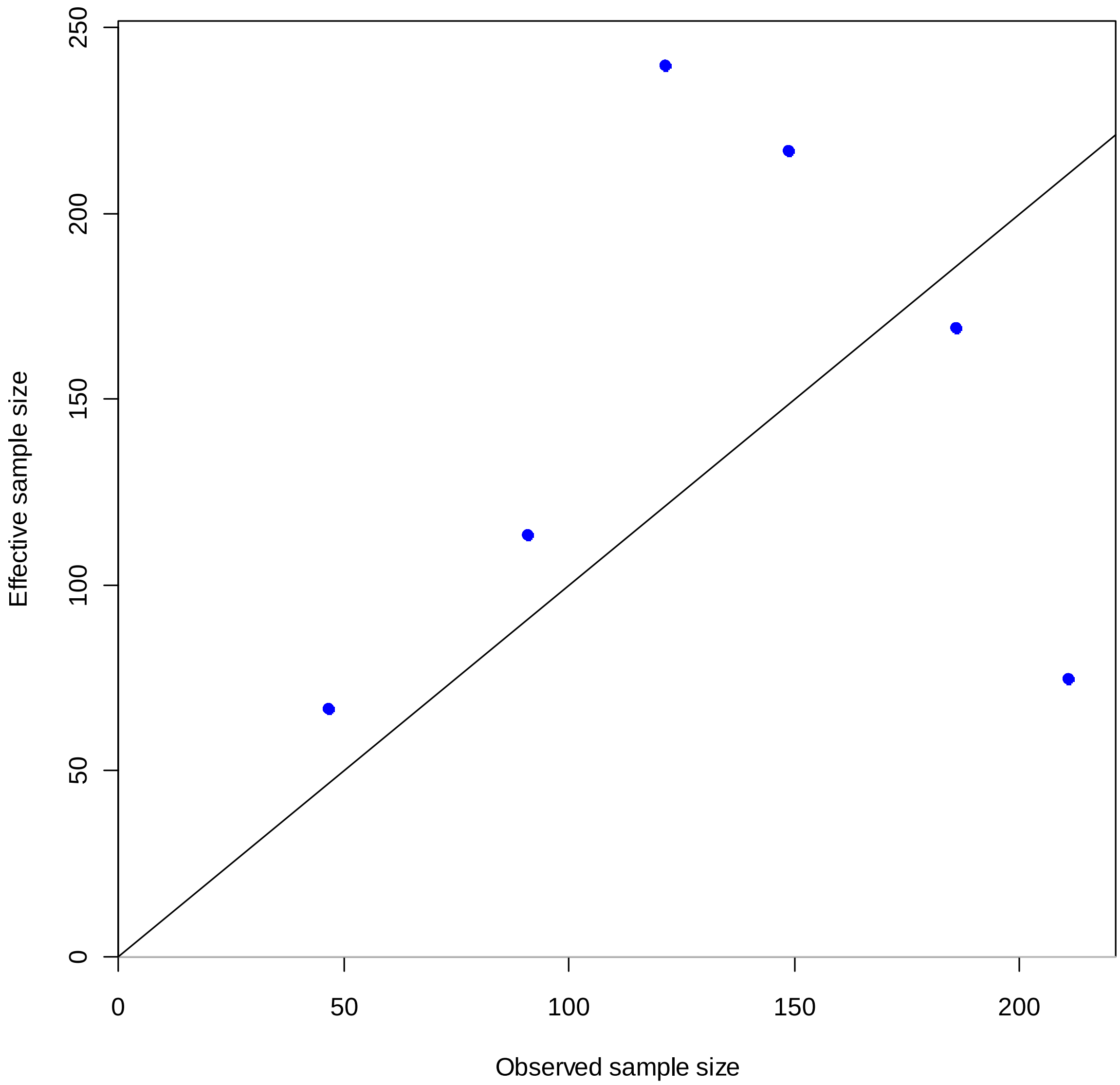

Figure 84. Observed and effective sample sizes for the sex-specific NWFSC shelf-slope survey length-frequency observations.

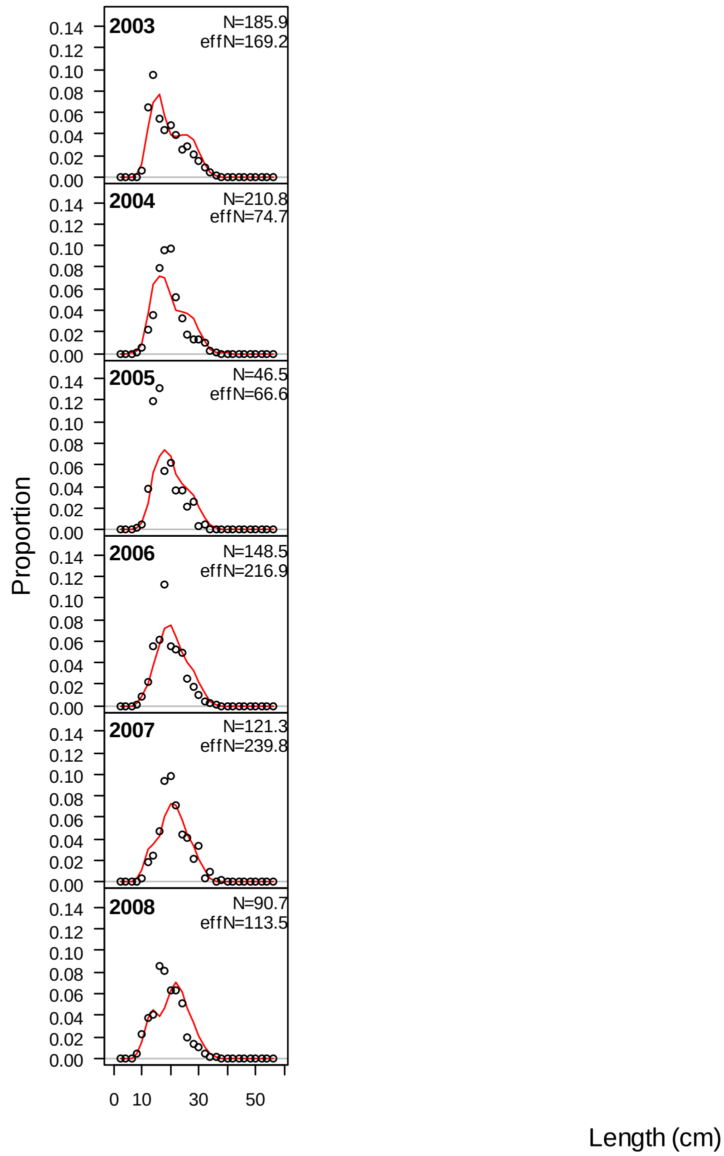

Figure 85. Fit to length-frequency distributions of the female splitnose rockfish for the NWFSC shelf-slope survey.

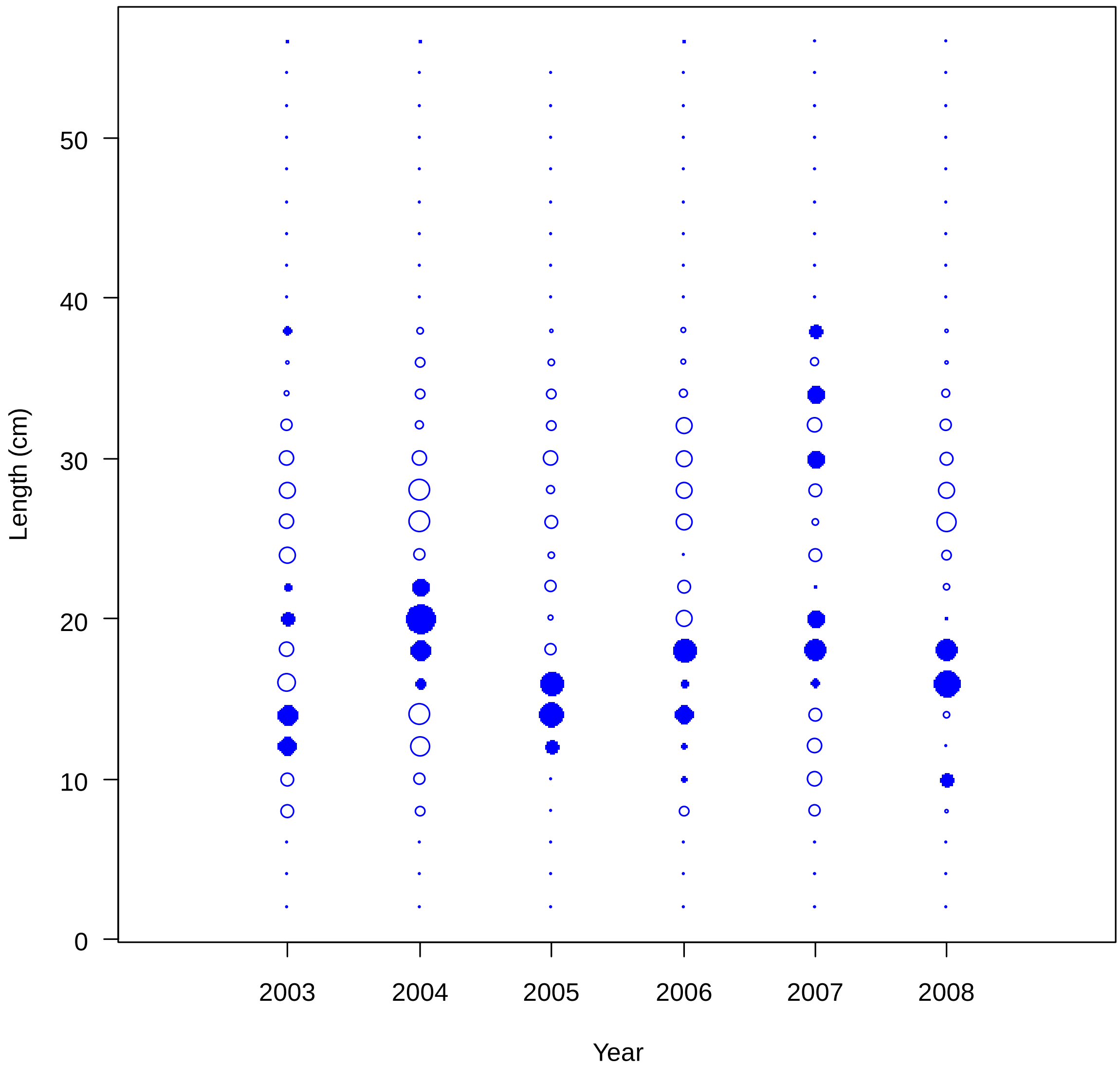

Figure 86. Pearson residuals for the fit of the female length-frequency distributions for the NWFSC shelf-slope survey.

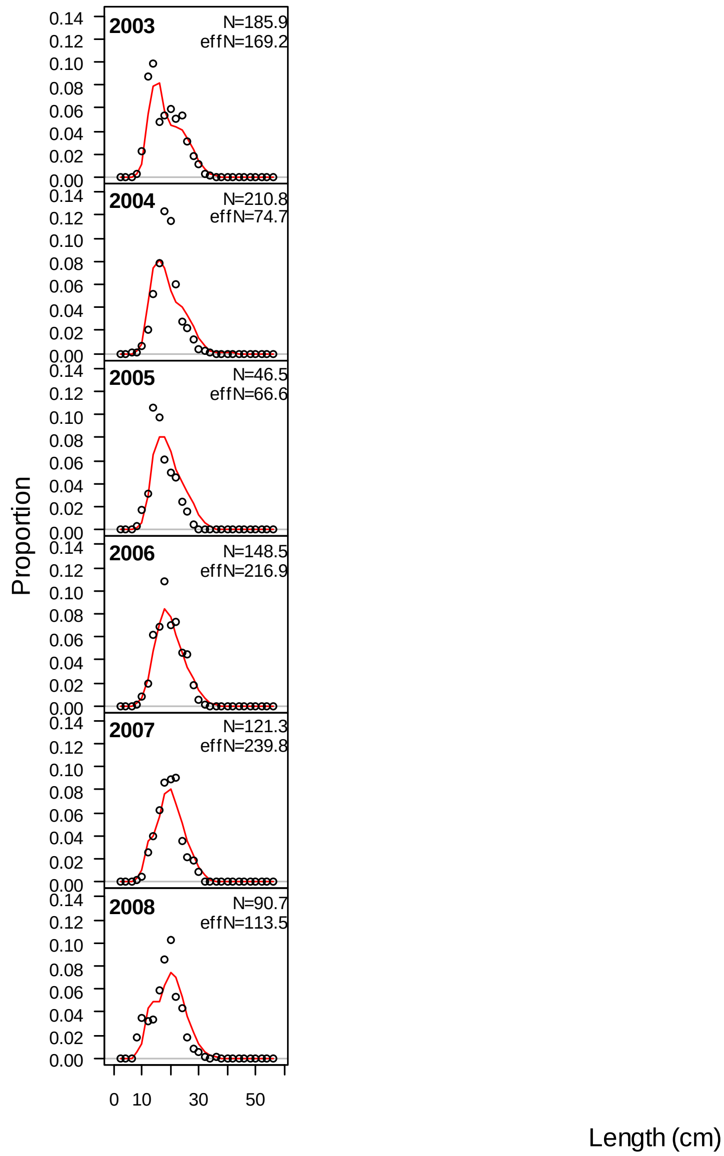

Figure 87. Fit to length-frequency distributions of the male splitnose rockfish for the NWFSC shelf-slope survey.

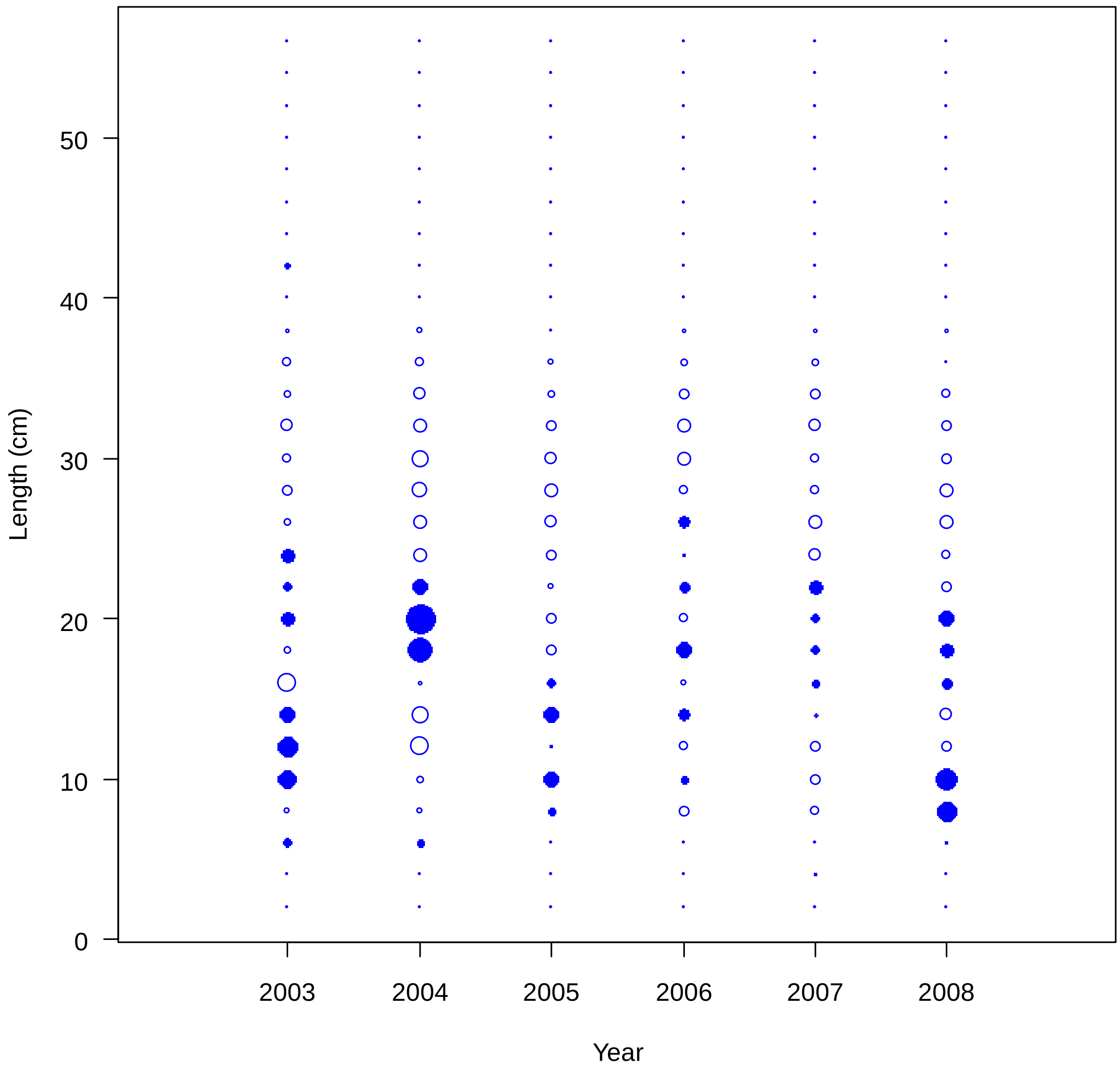

Figure 88. Pearson residuals for the fit of the male length-frequency distributions for the NWFSC shelf-slope survey.

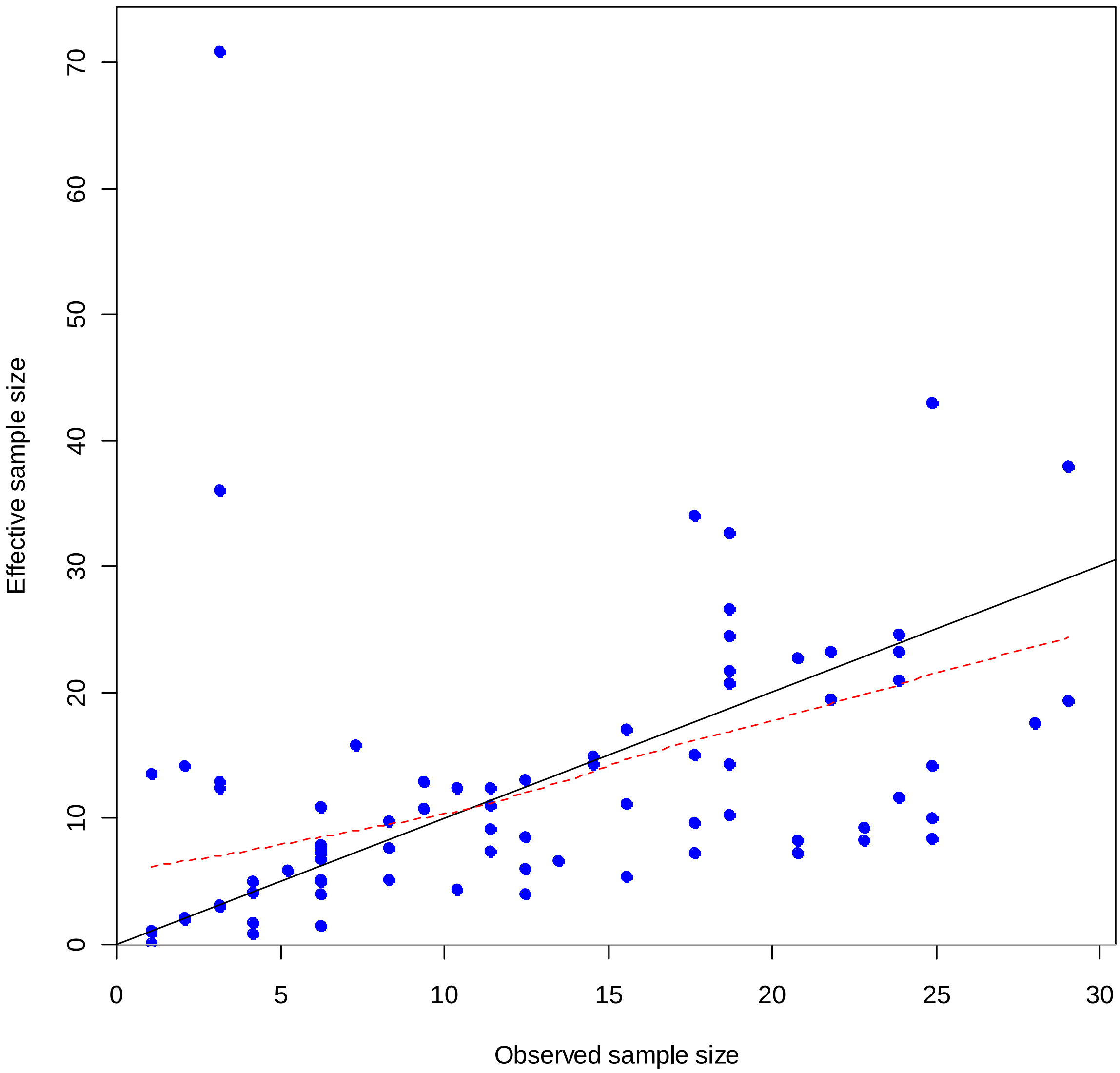

Figure 89. Observed and effective sample sizes for female splitnose rockfish from the NWFSC shelf-slope survey conditional age-at-length compositions.

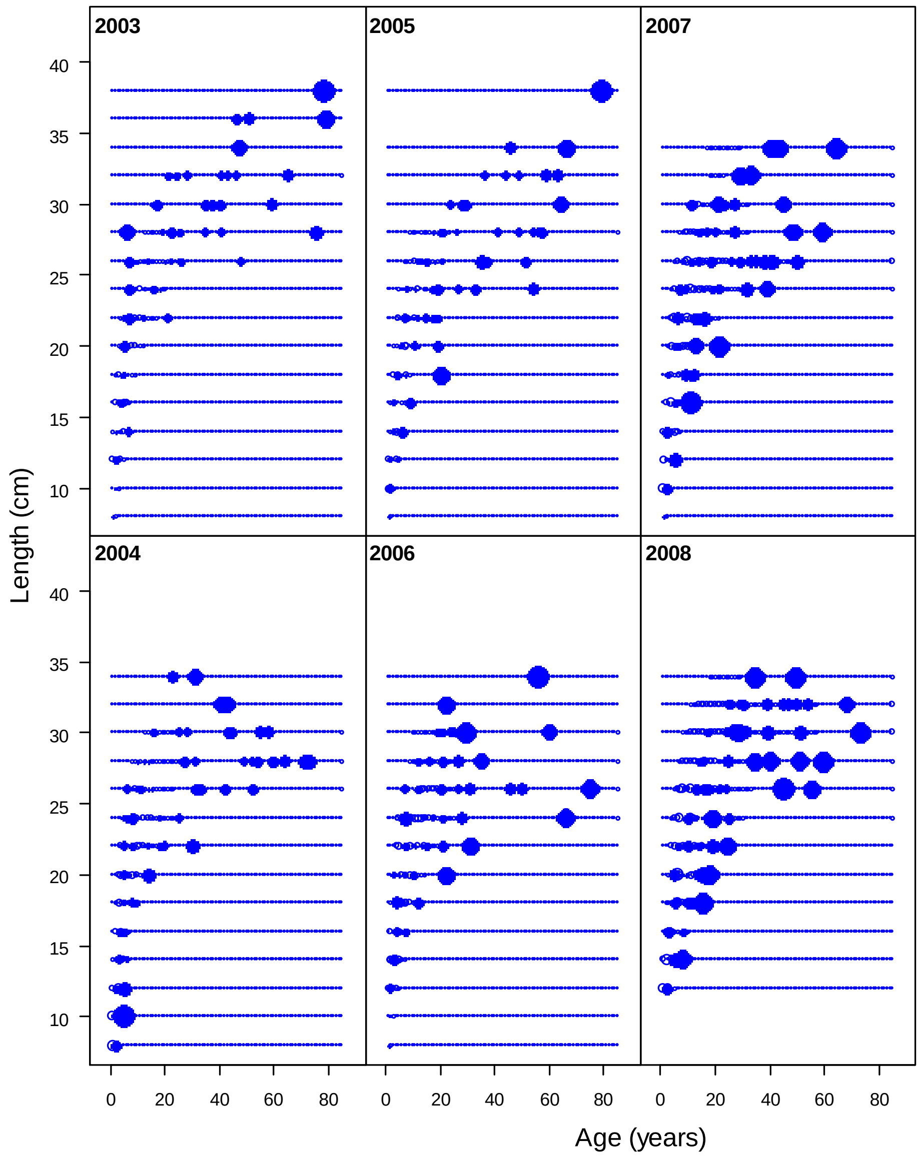

Figure 90. Pearson residuals for the fit of the female conditional age-at-length compositions for the NWFSC shelf-slope survey.

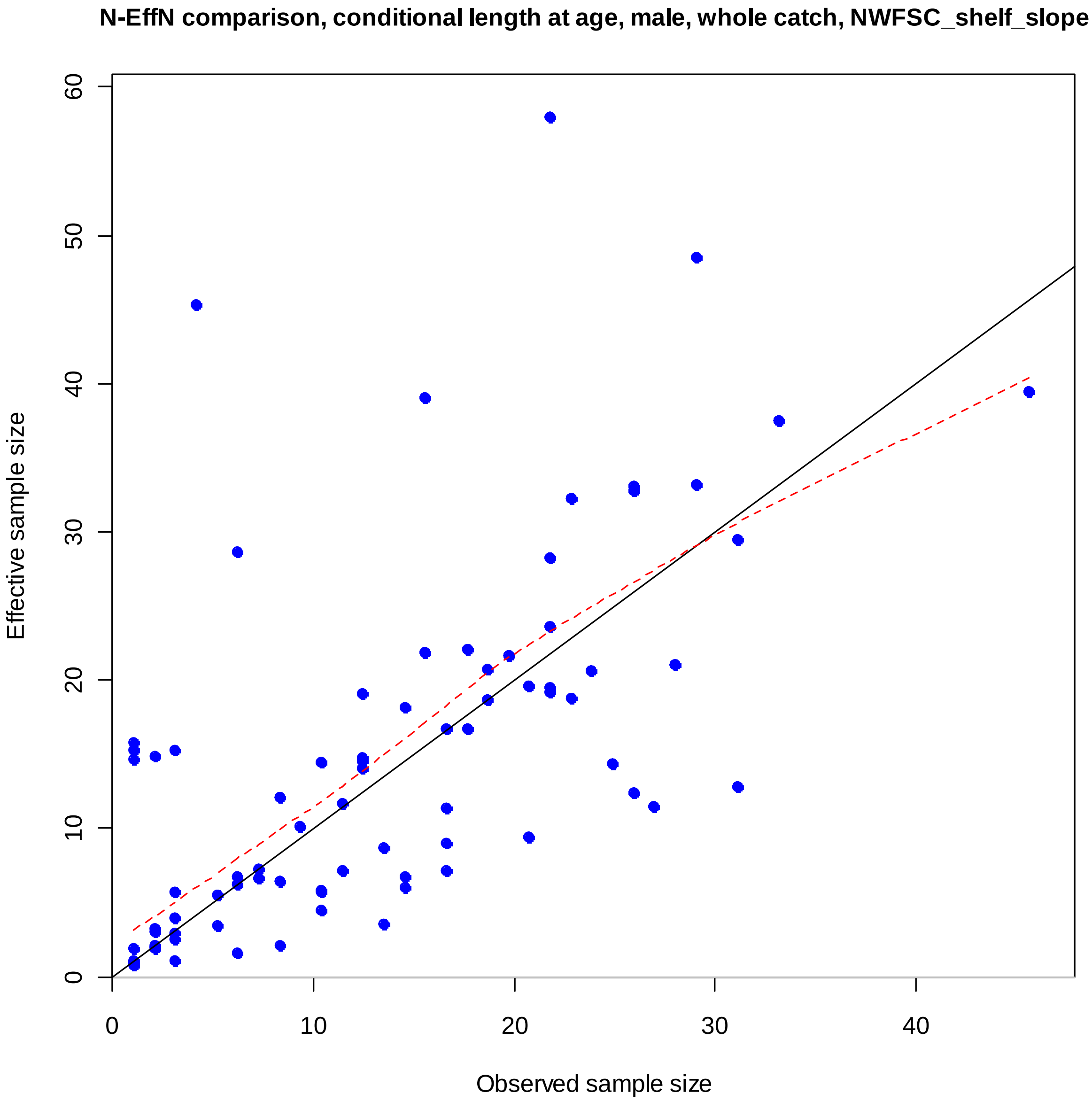

Figure 91. Observed and effective sample sizes for female splitnose rockfish from the NWFSC shelf-slope survey conditional age-at-length compositions.

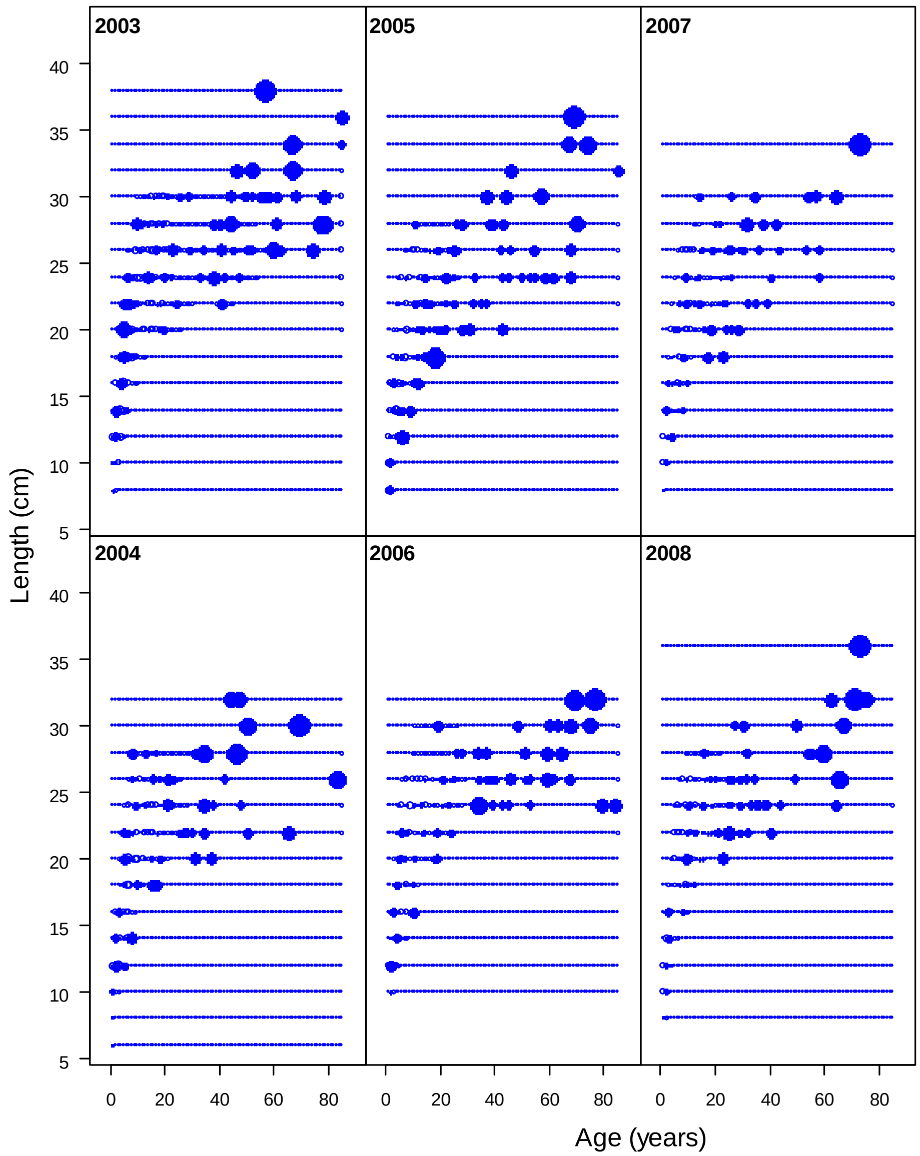

Figure 92. Pearson residuals for the fit of the male conditional age-at-length compositions for the NWFSC shelf-slope survey.

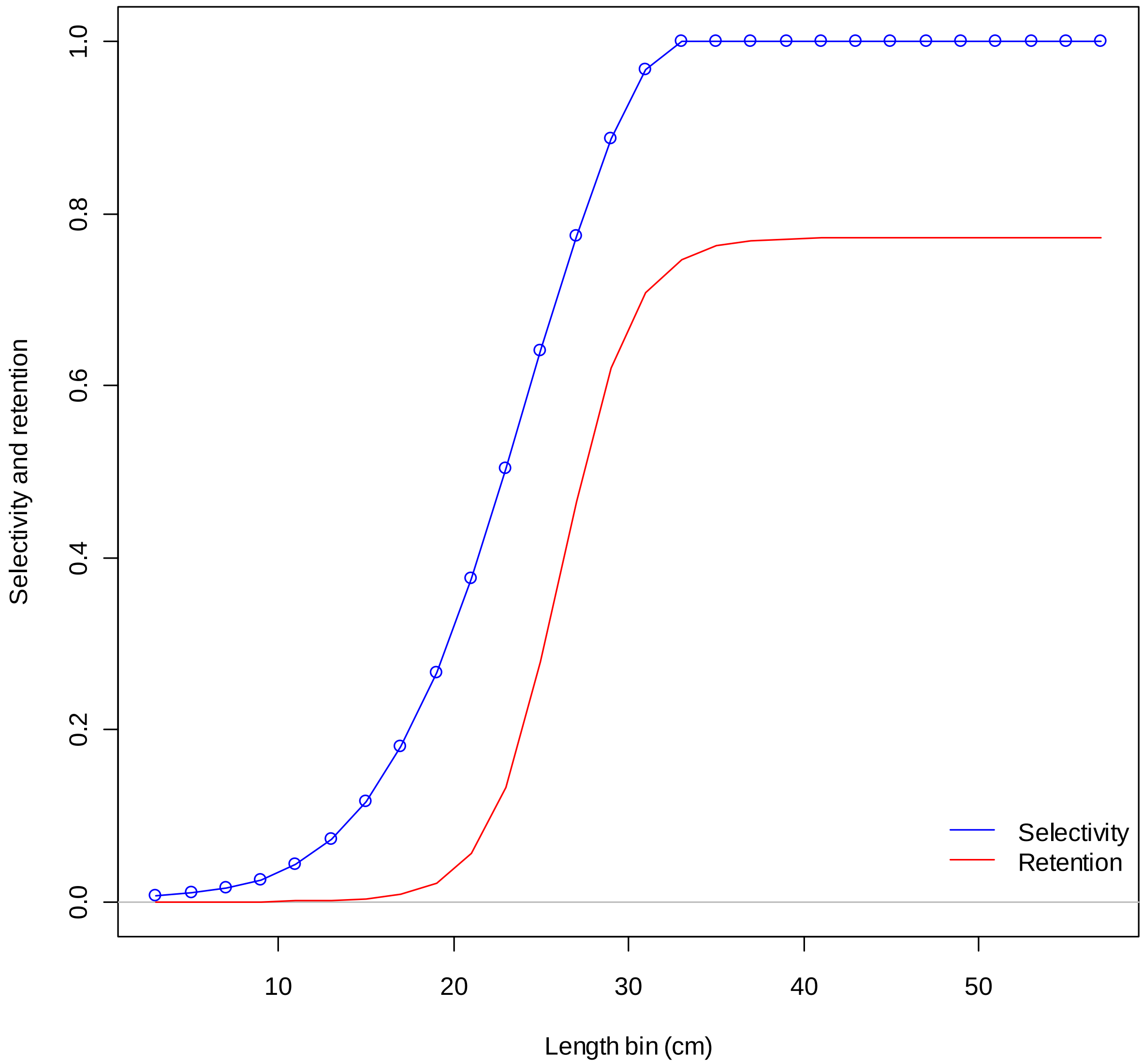

Figure 93. Length-based selectivity and retention curves estimated for the domestic trawl fishery.

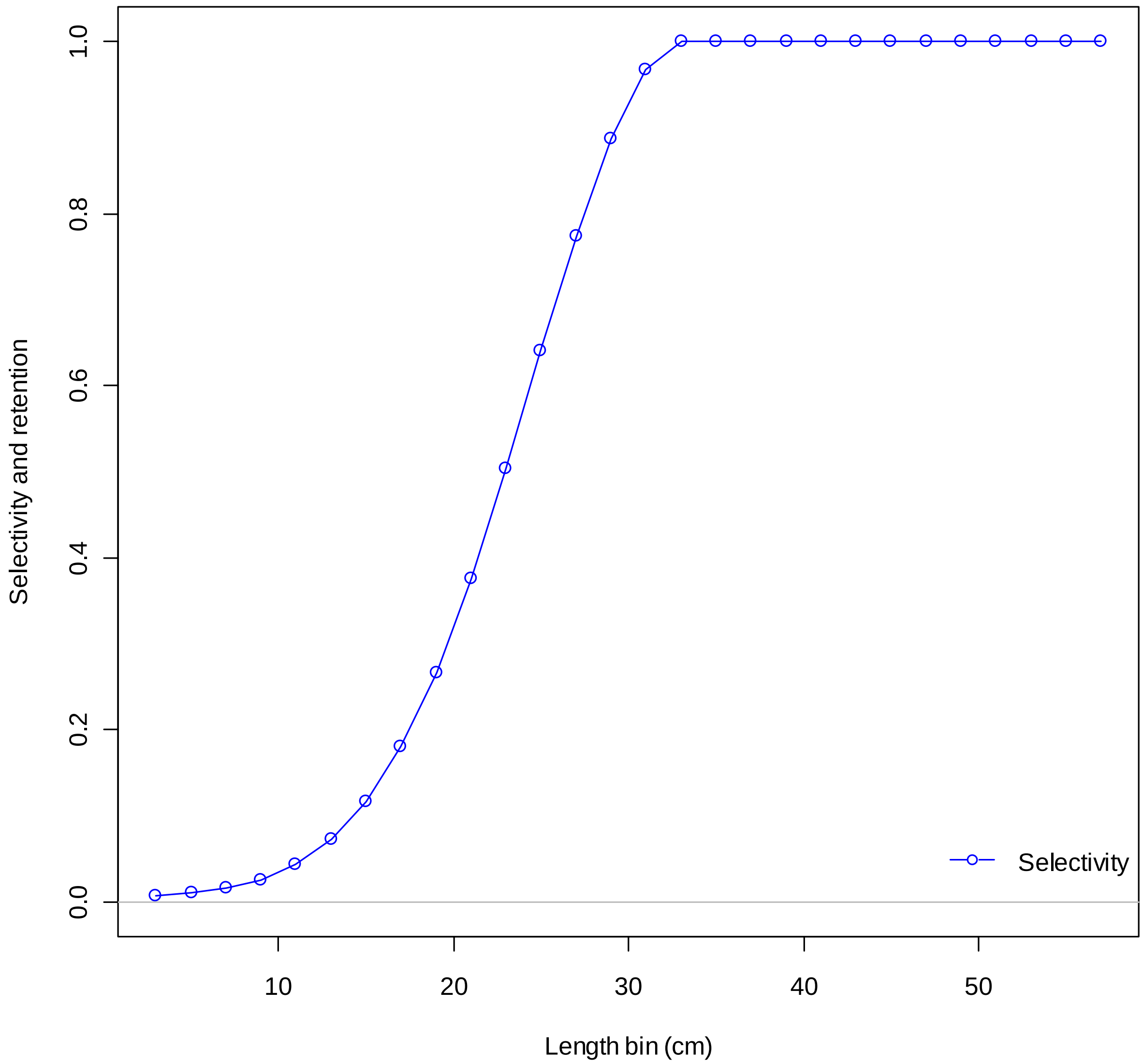

Figure 94. Length-based selectivity curve estimated for the foreign trawl fishery (mirrored to the domestic trawl fishery).

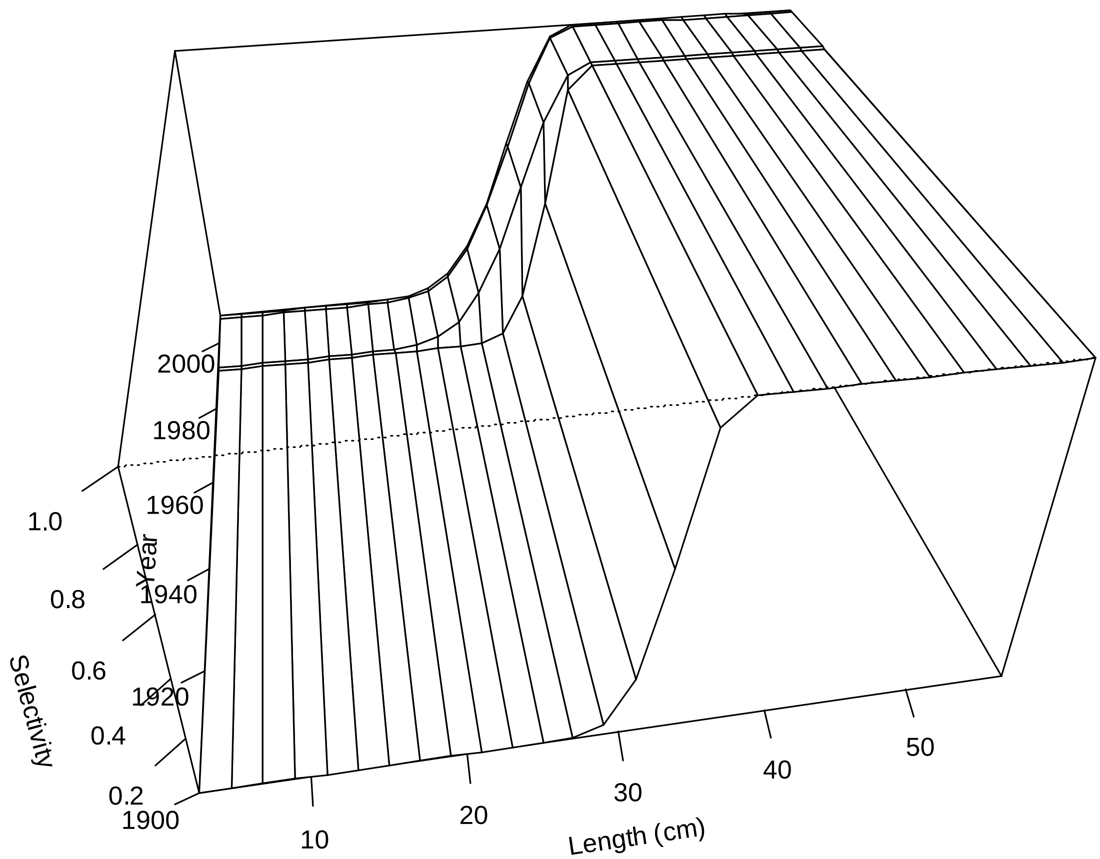

Figure 95. Time-varying length-based selectivity curve estimated for the domestic non-trawl fishery.

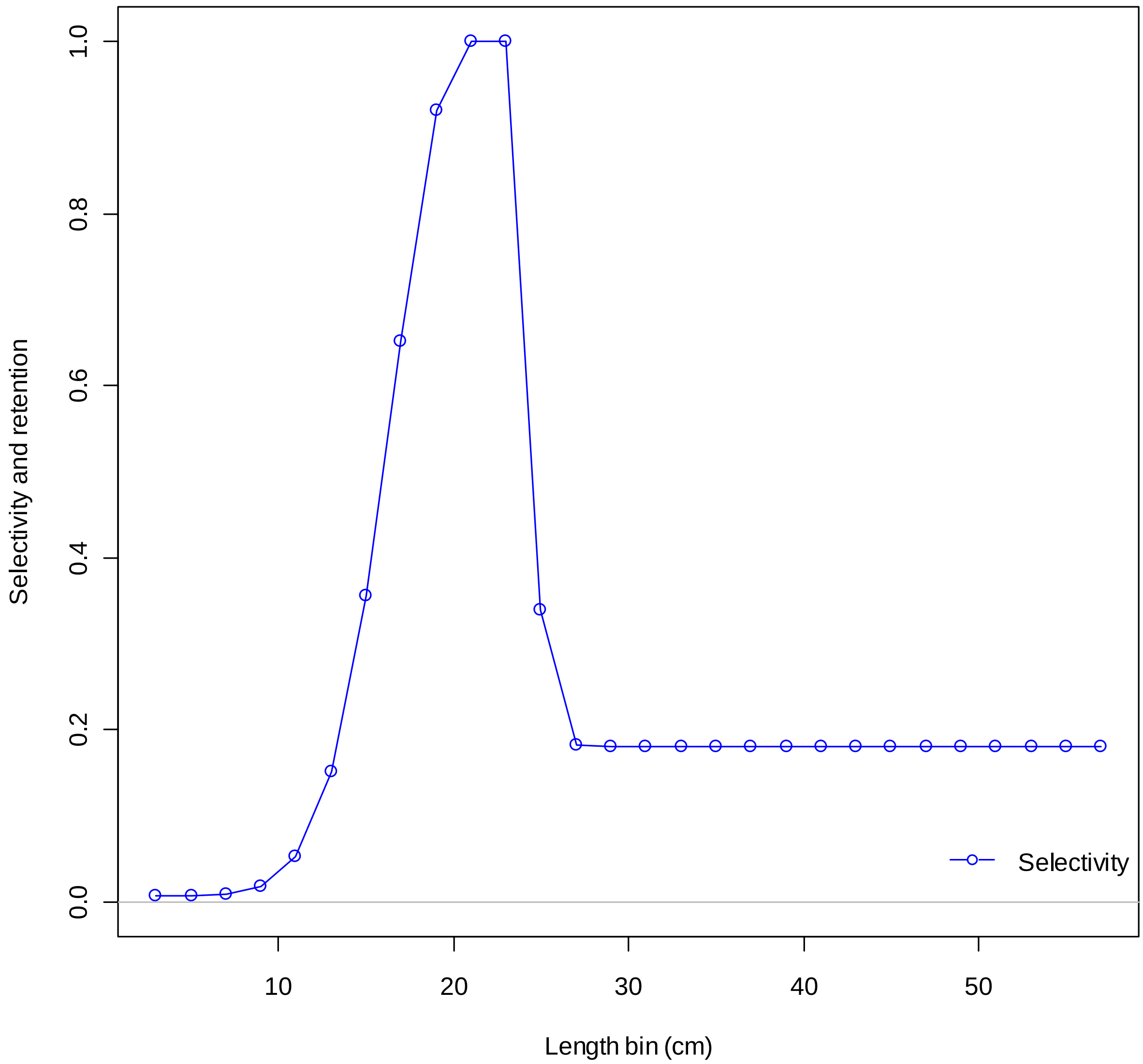

Figure 96. Length-based selectivity curve estimated for the AFSC triennial survey.

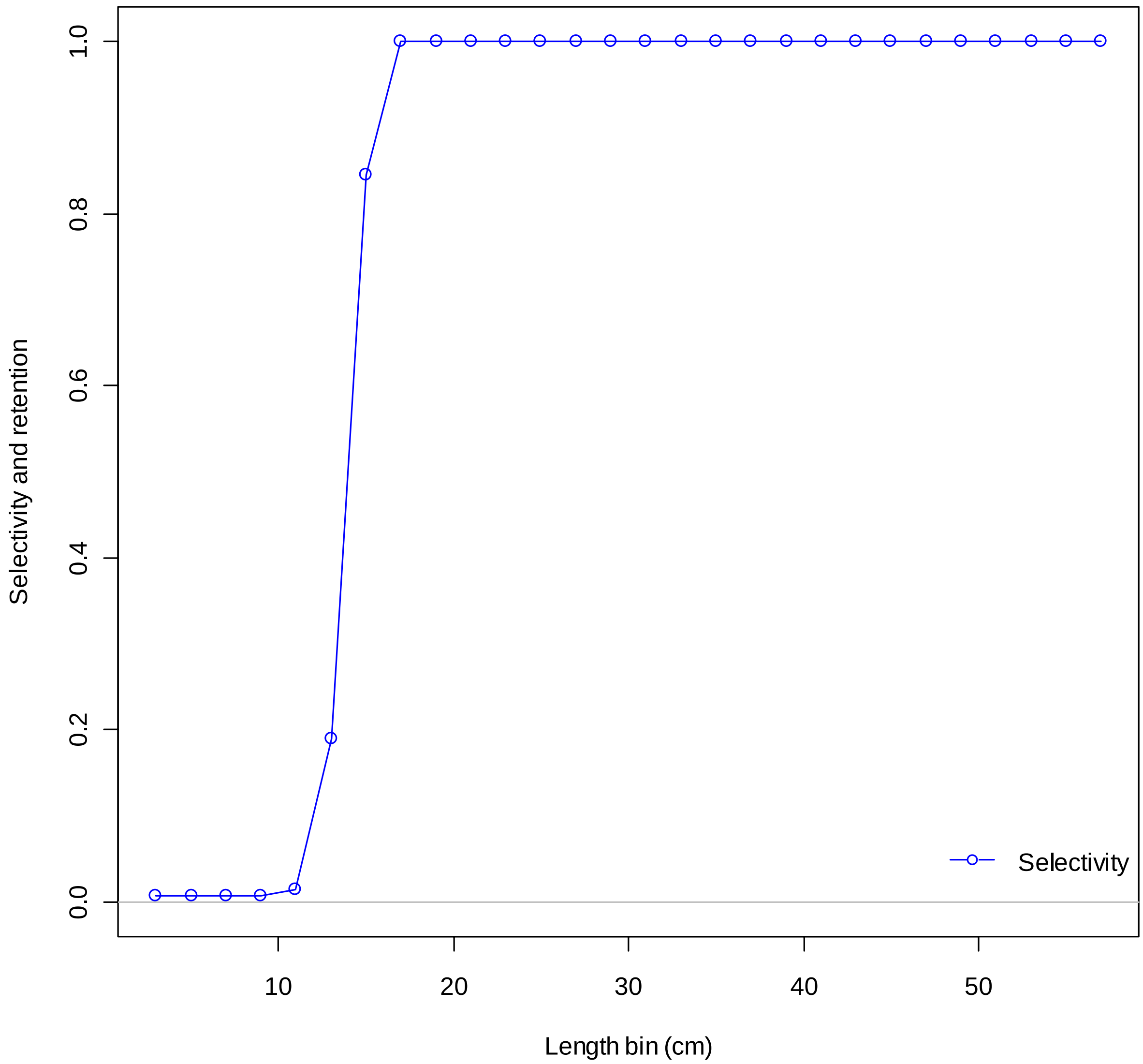

Figure 97. Length-based selectivity curve estimated for the AFSC slope survey.

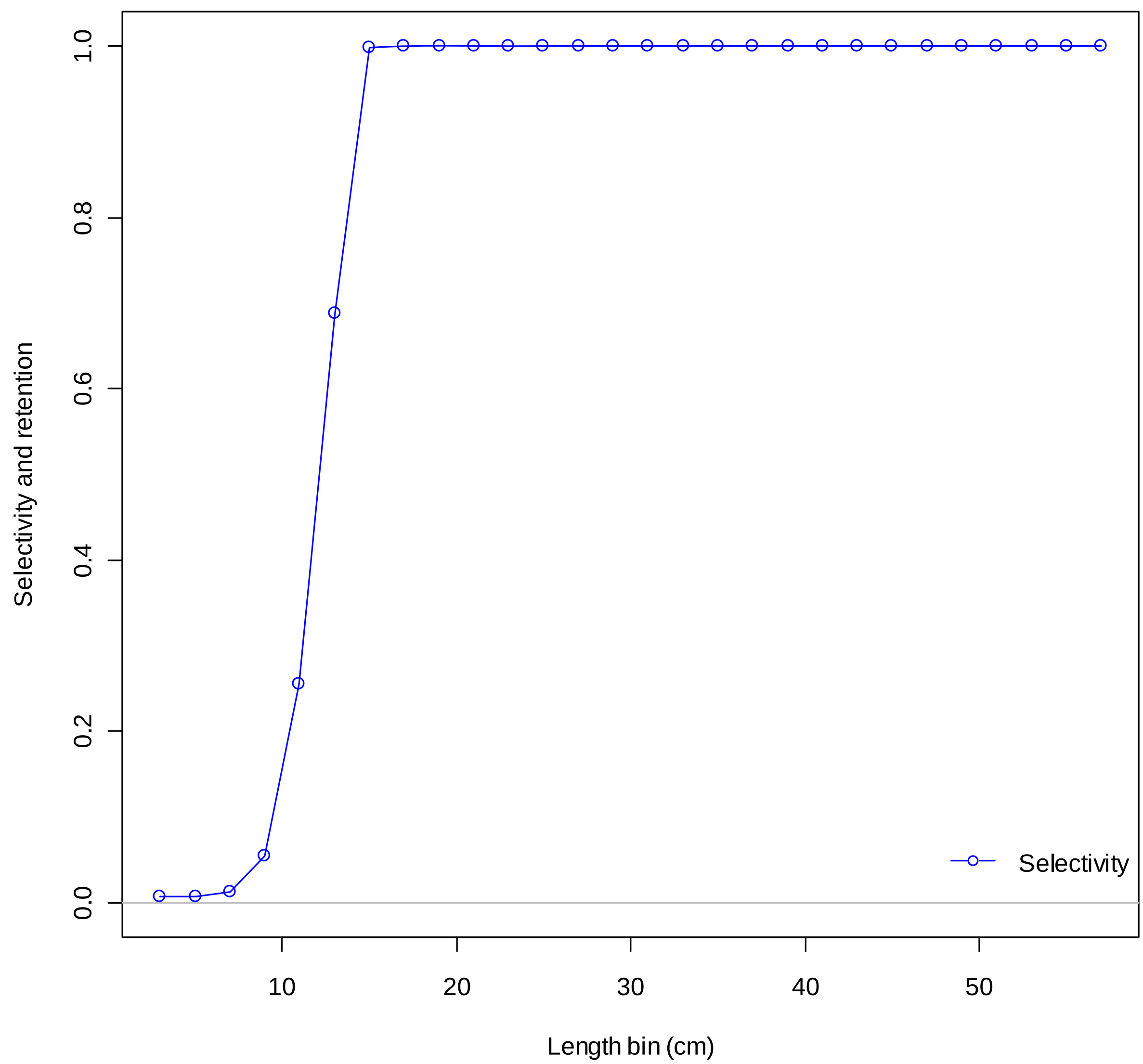

Figure 98. Length-based selectivity curve estimated for the NWFSC shelf-slope survey.

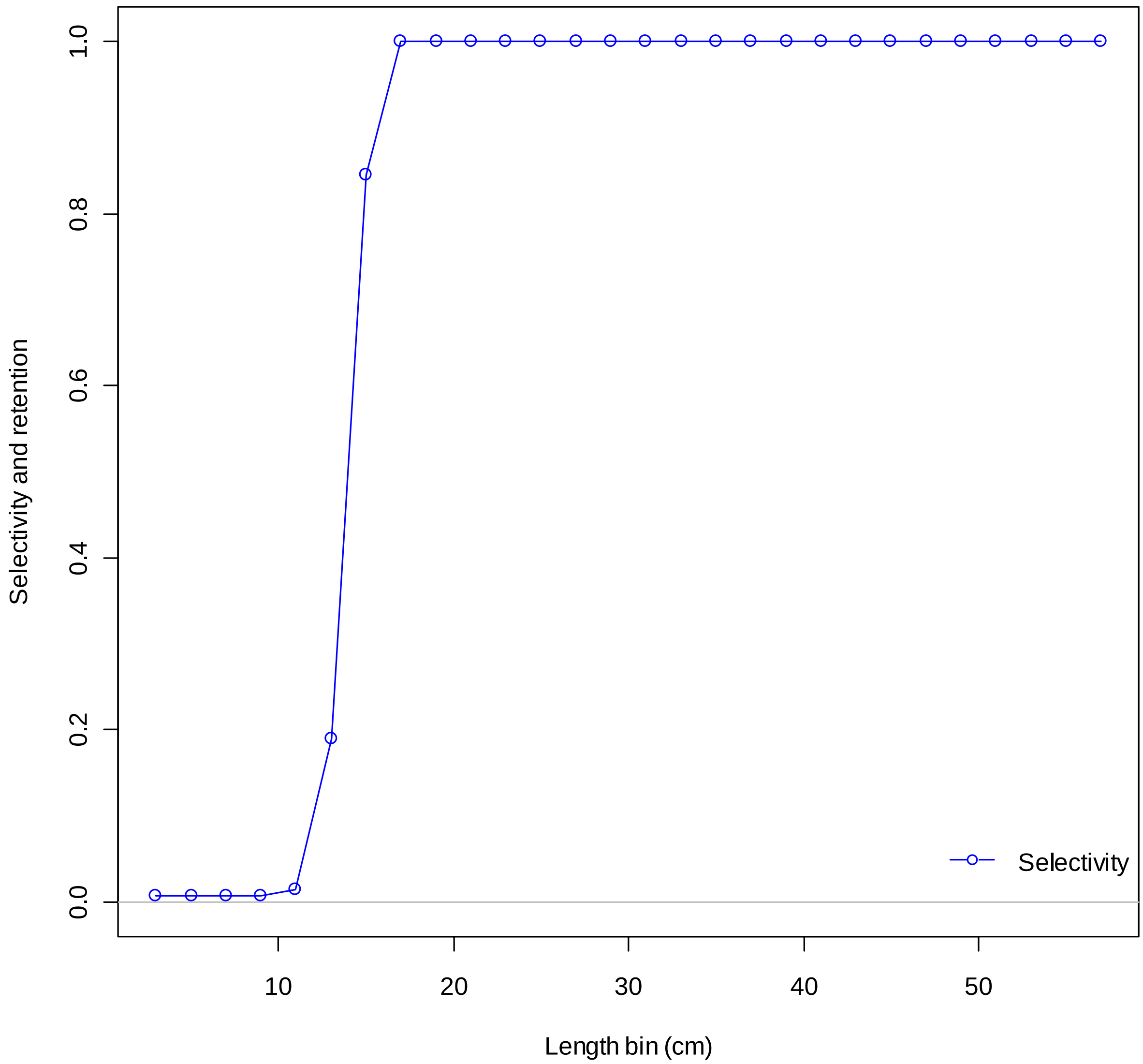

Figure 99. Length-based selectivity curve estimated for the NWFSC slope survey (mirrored to the AFSC slope survey).

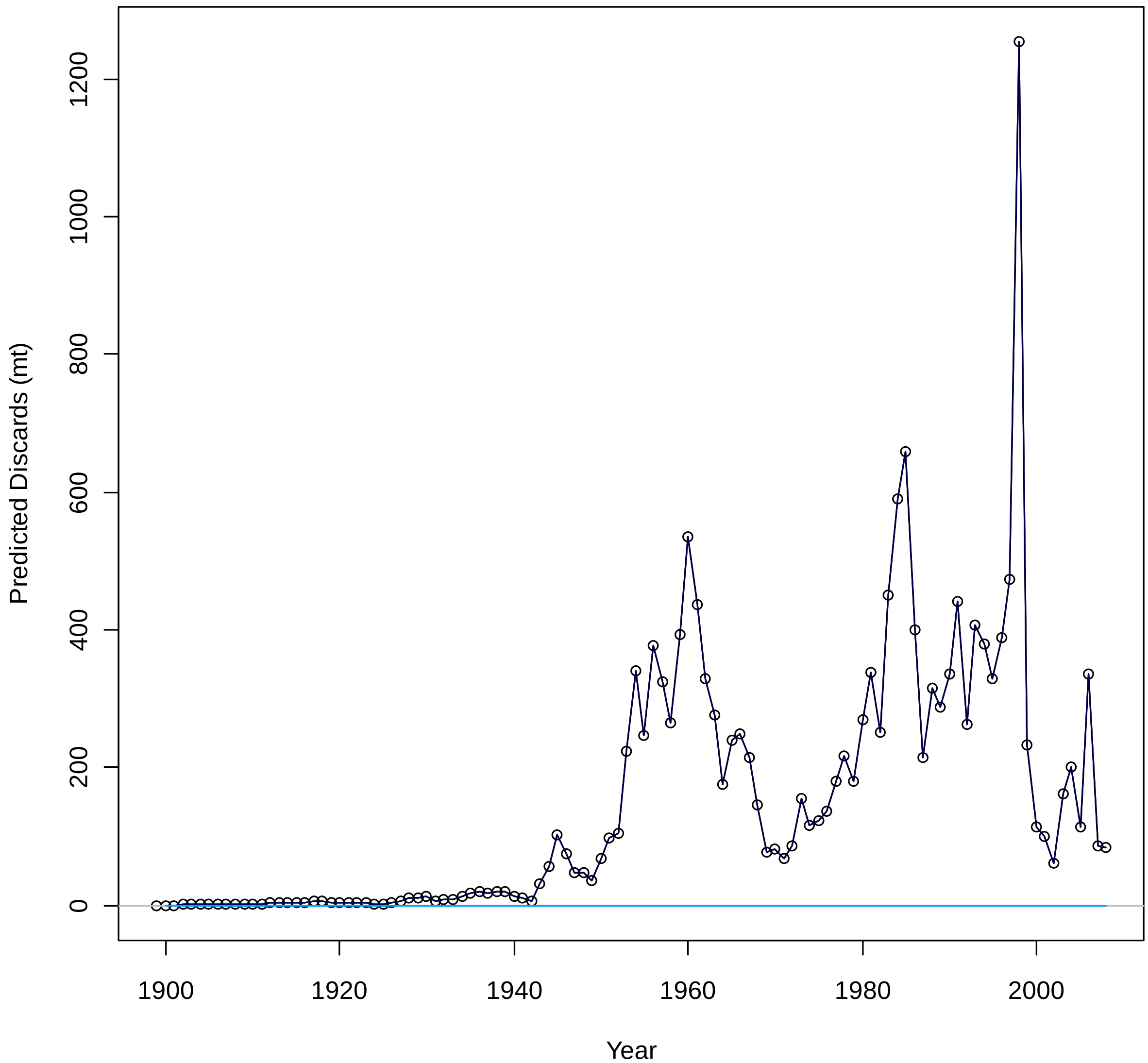

Figure 100. Time-series of the estimated discard of splitnose rockfish by fishery.

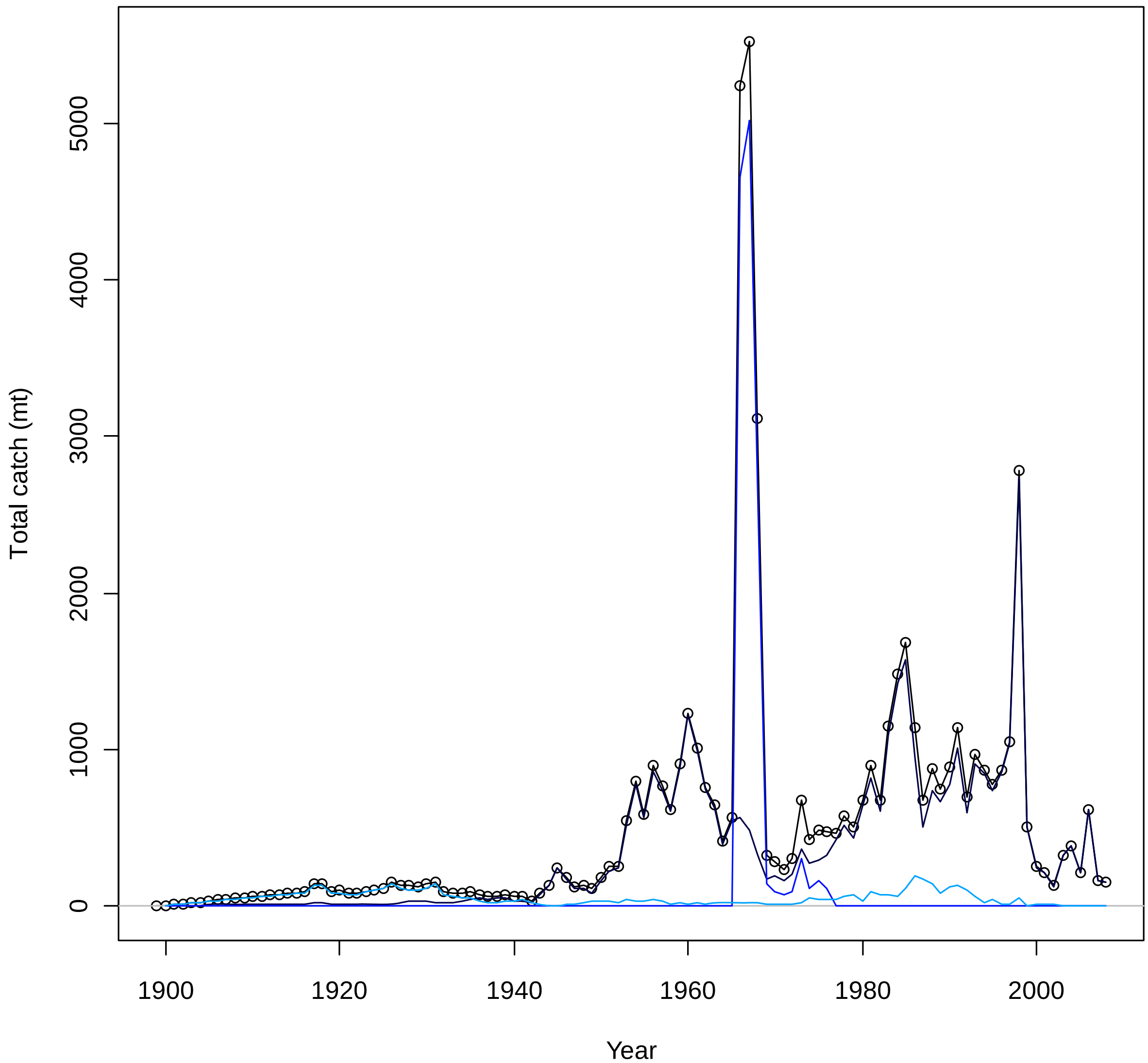

Figure 101. Time-series of the estimated total catch of splitnose rockfish by fishery.

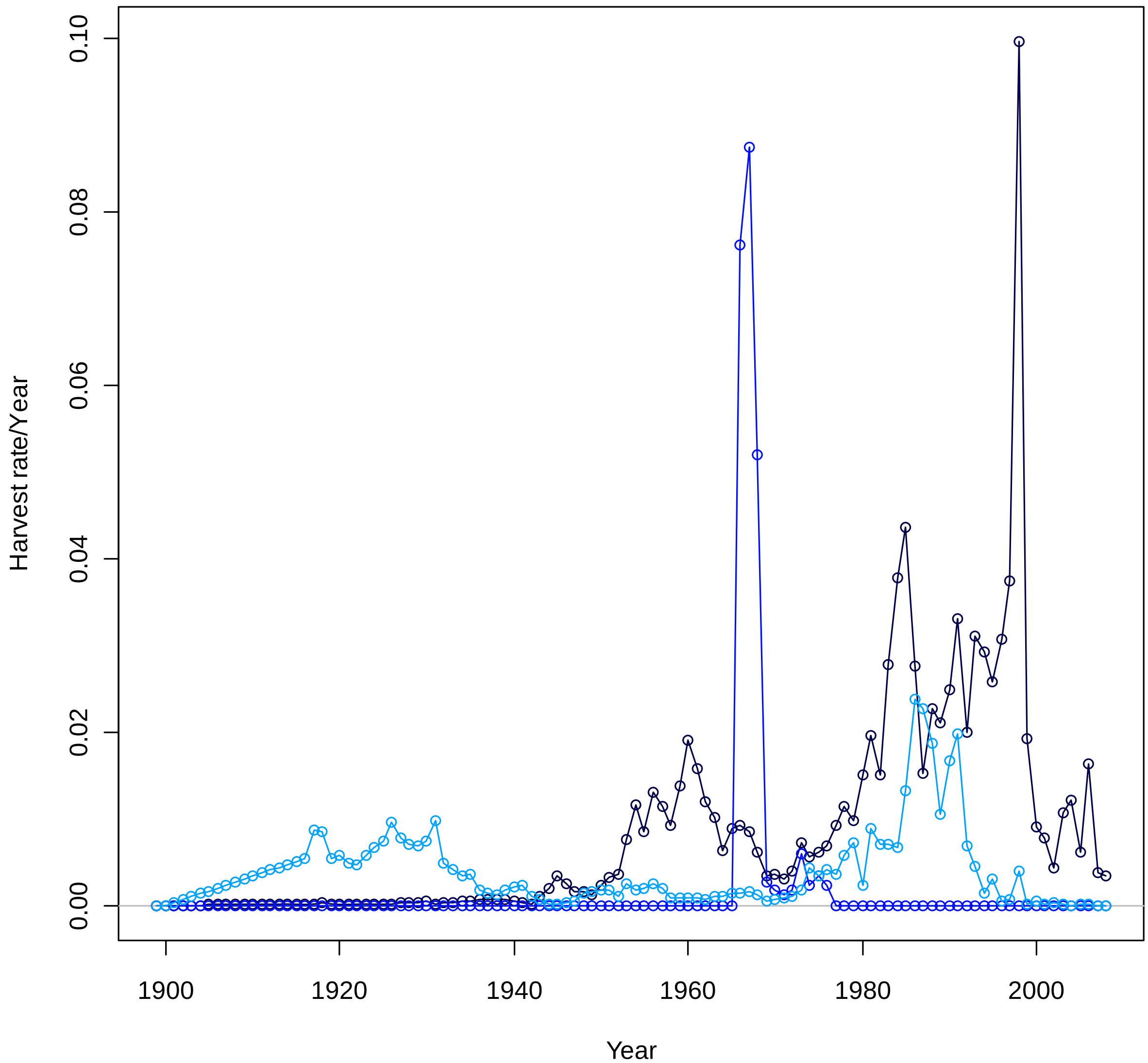

Figure 102. Time-series of the estimated harvest rates for splitnose rockfish by fishery.

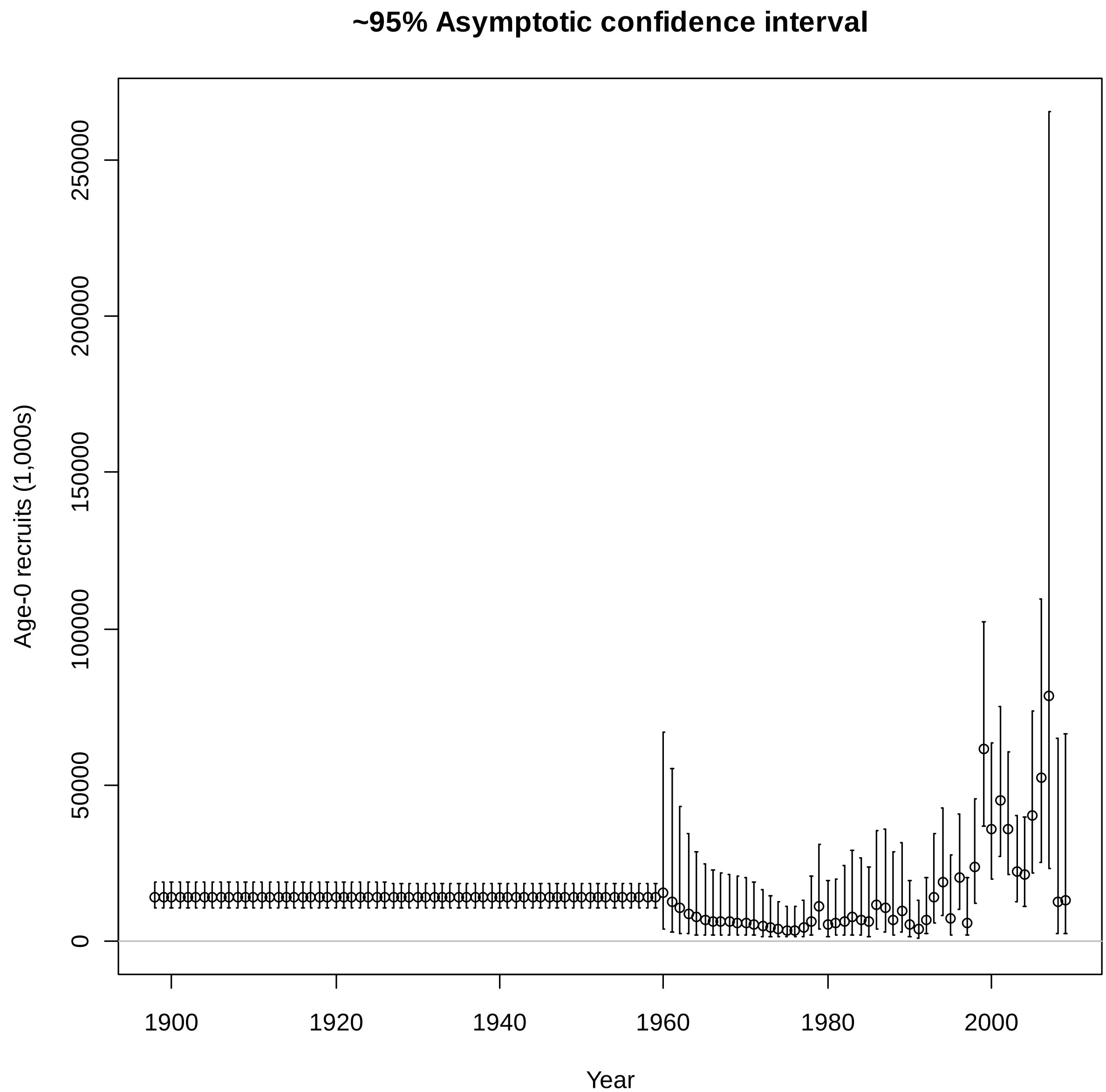

Figure 103. Time-series of the recruitment of splitnose rockfish with 95% confidence interval.

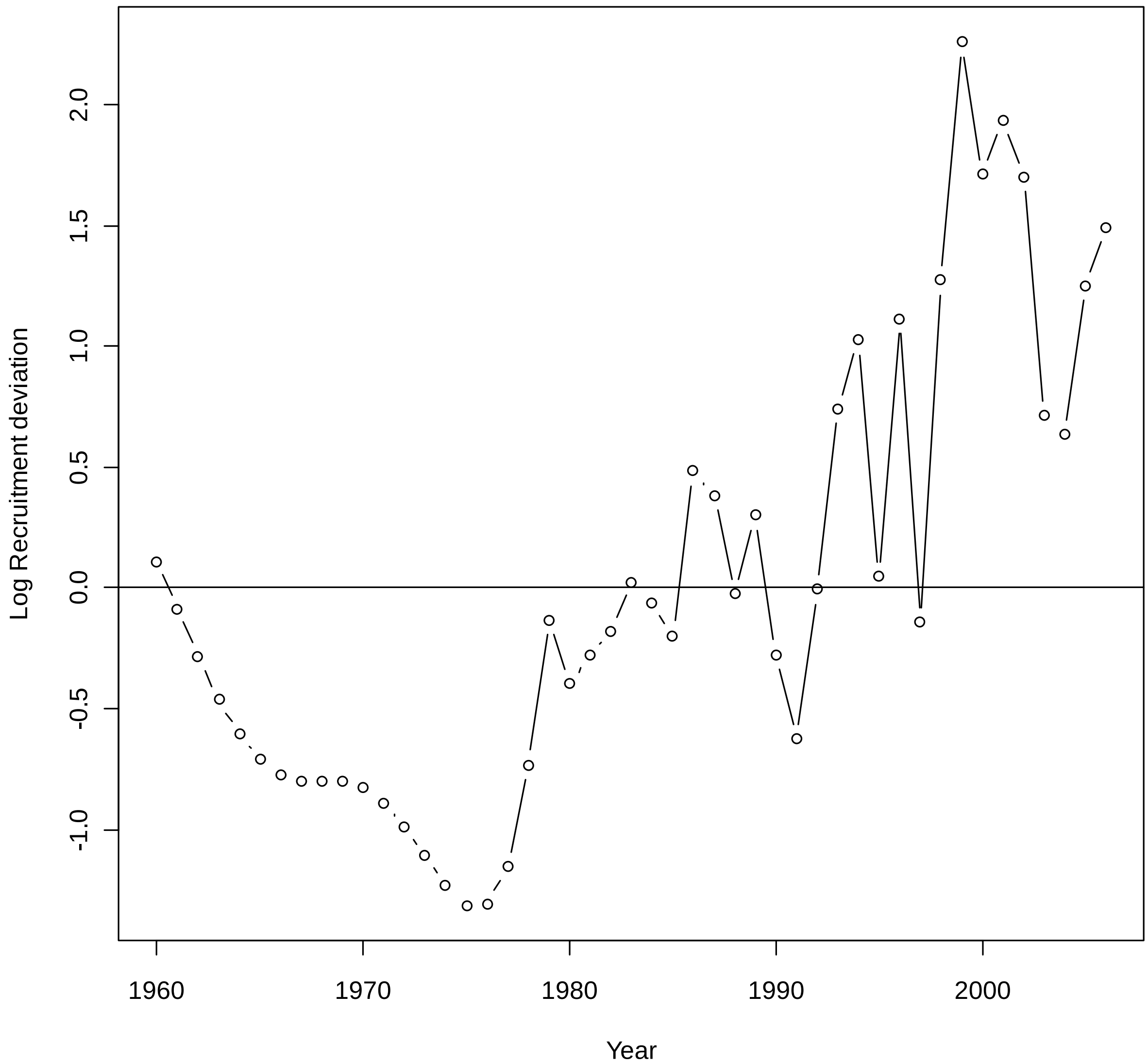

Figure 104. Time-series of the estimated recruitment deviations of splitnose rockfish.

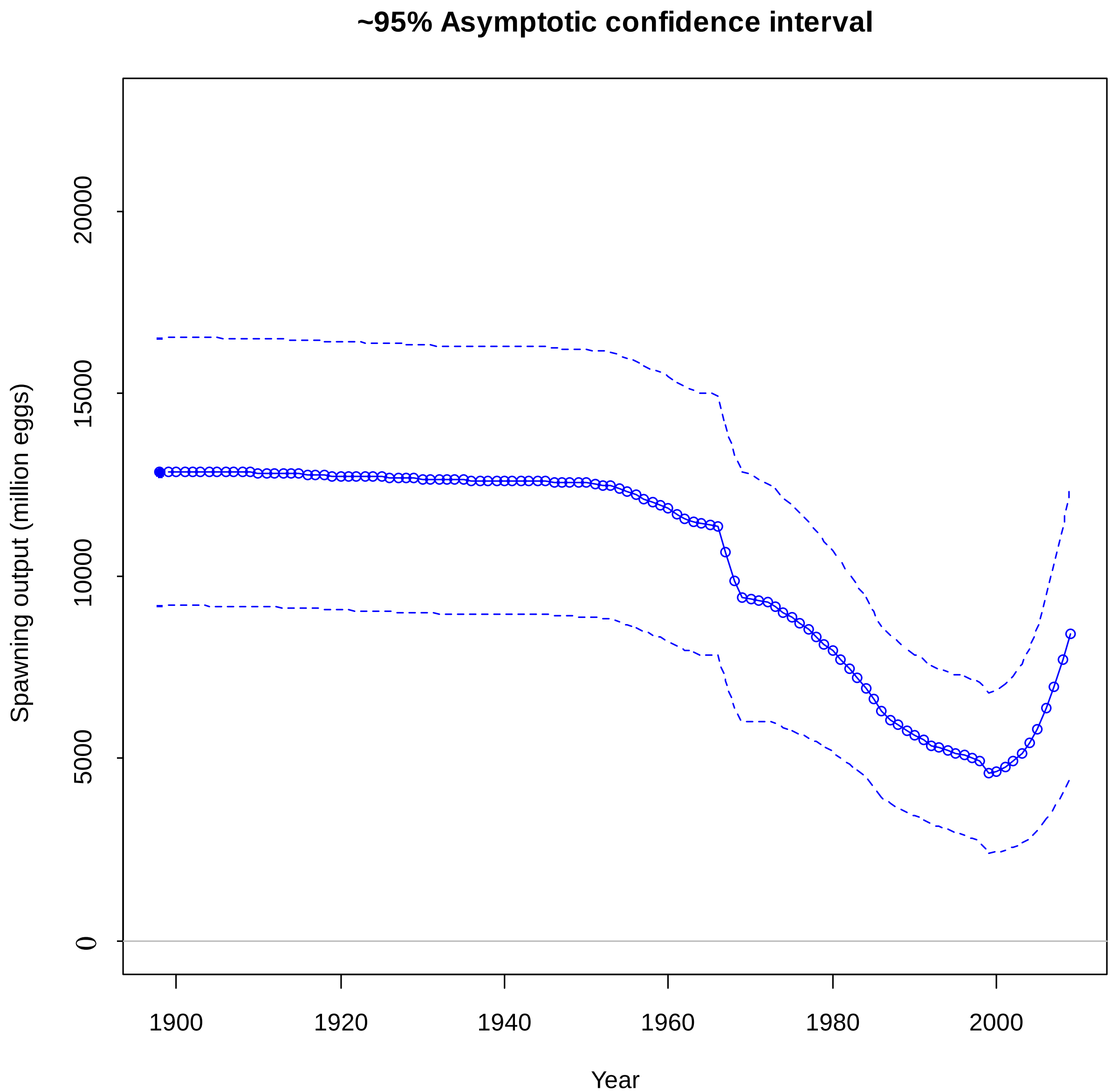

Figure 105. Time-series of the estimated spawning biomass of splitnose rockfish with 95% confidence interval.

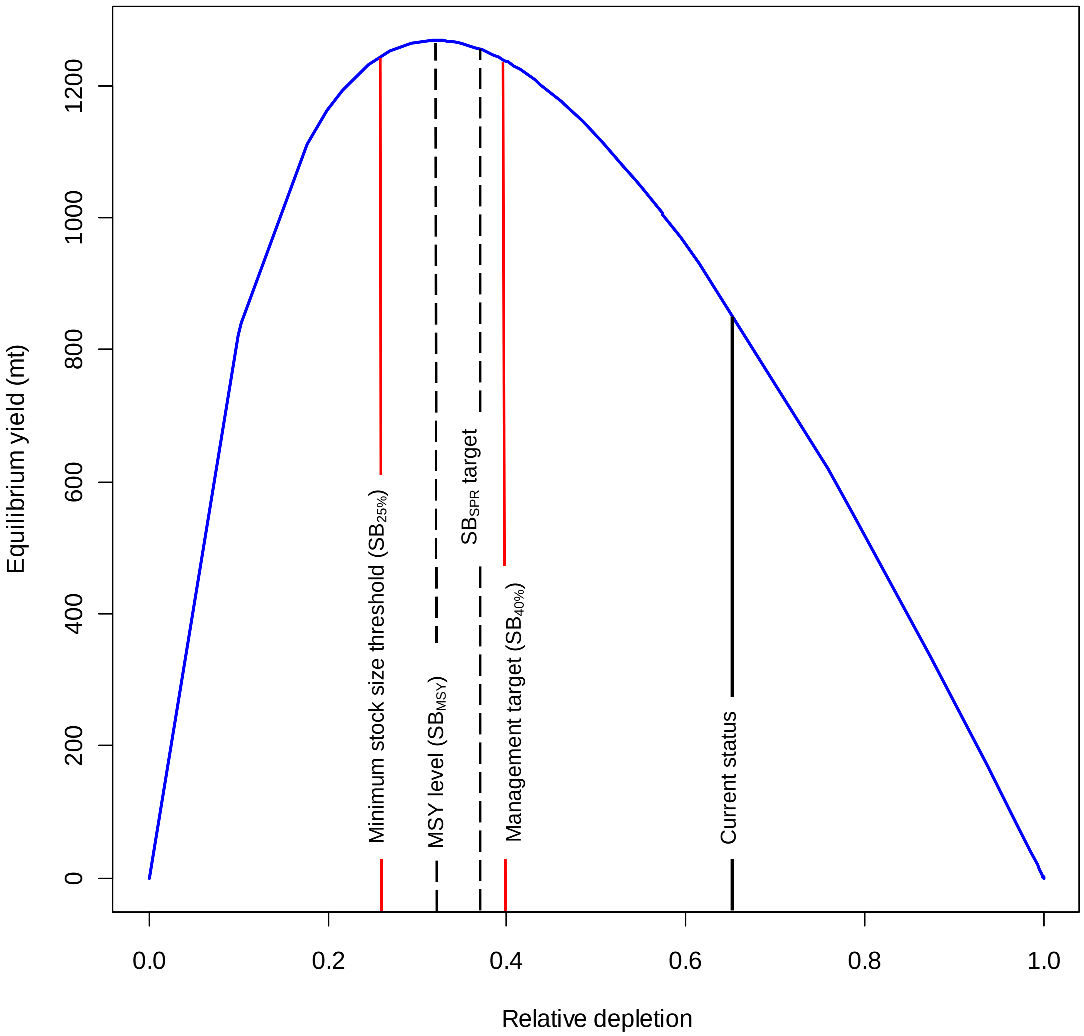

Figure 106. Equilibrium yield curve for splitnose rockfish from the assessment model (based on reference point values in Table 17).

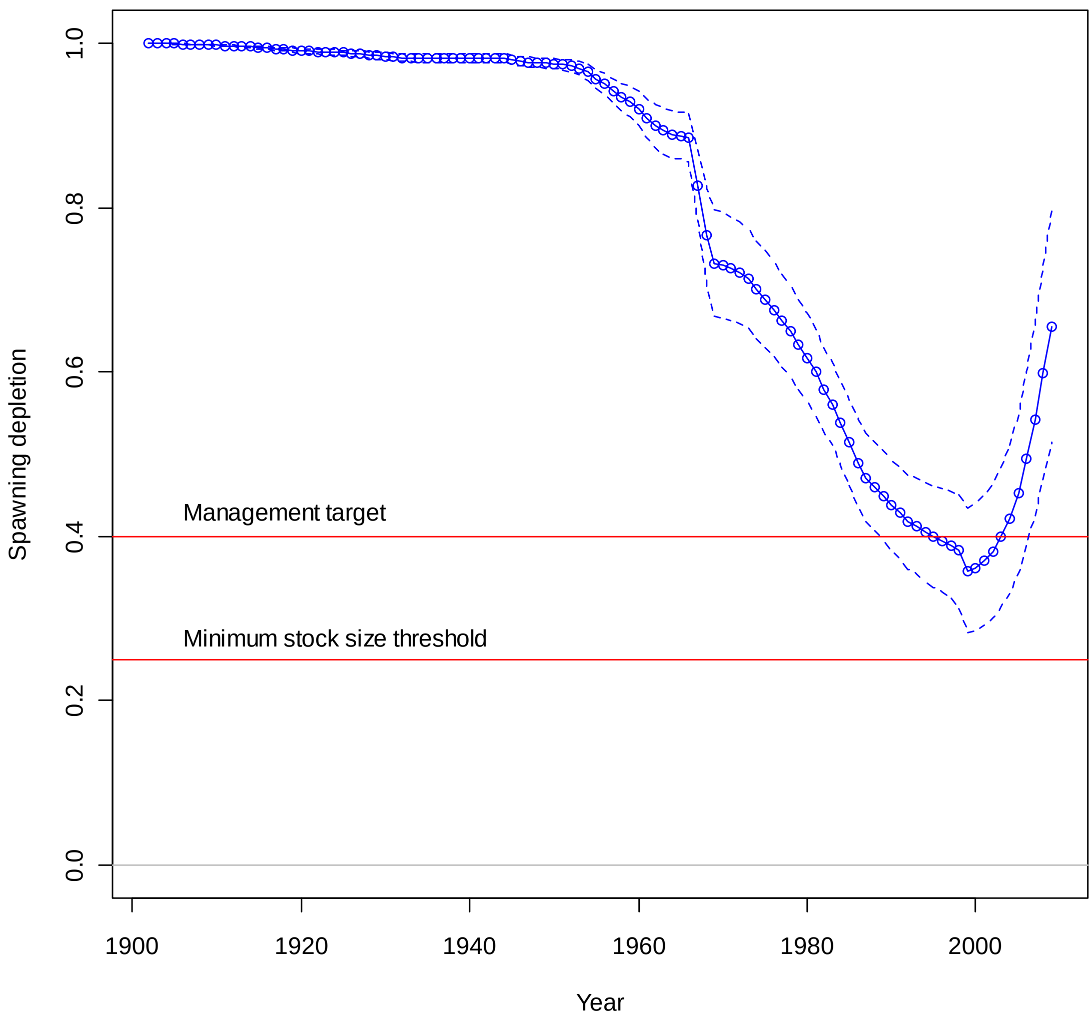

Figure 107. Time-series of the estimated spawning depletion of splitnose rockfish with 95% confidence interval.

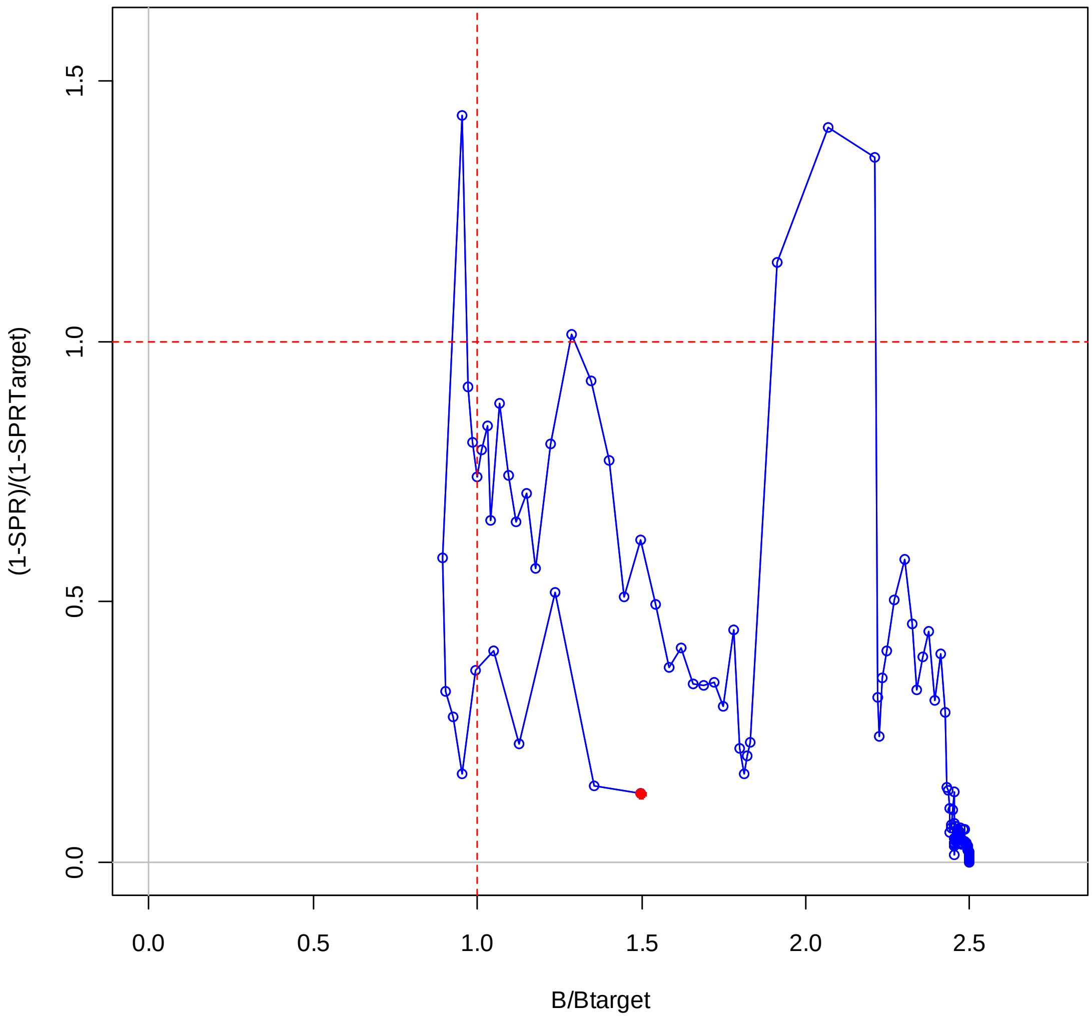

Figure 108. Estimated spawning potential ratio relative to its target of 0.5 versus estimated spawning output relative to its target of $SB_{40\%}$. Red dot indicates the point that corresponds to 2009.

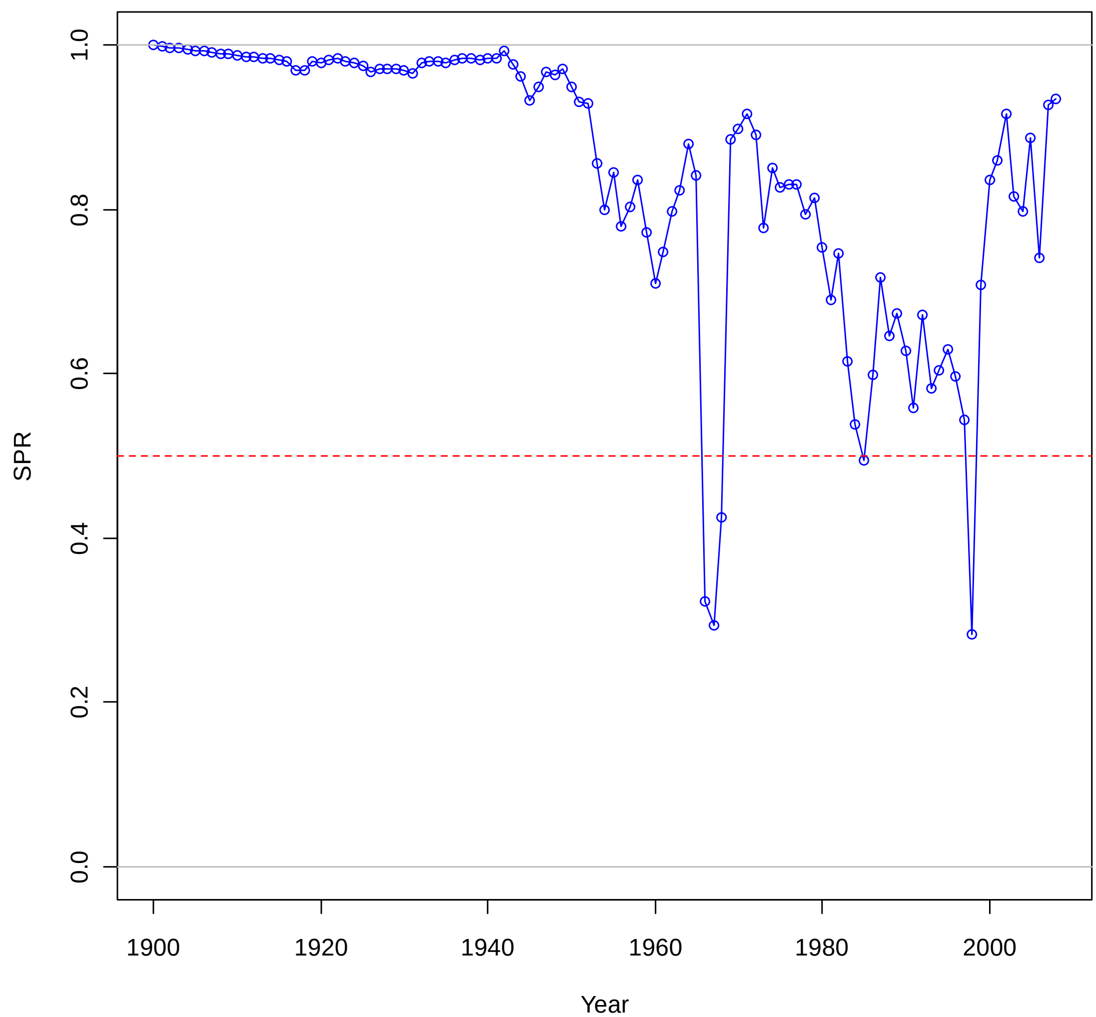

Figure 109. Time-series of estimated spawning potential ratio (SPR) with SPR target of 0.5. Values below target reflect harvest that exceeded current overfishing proxy.

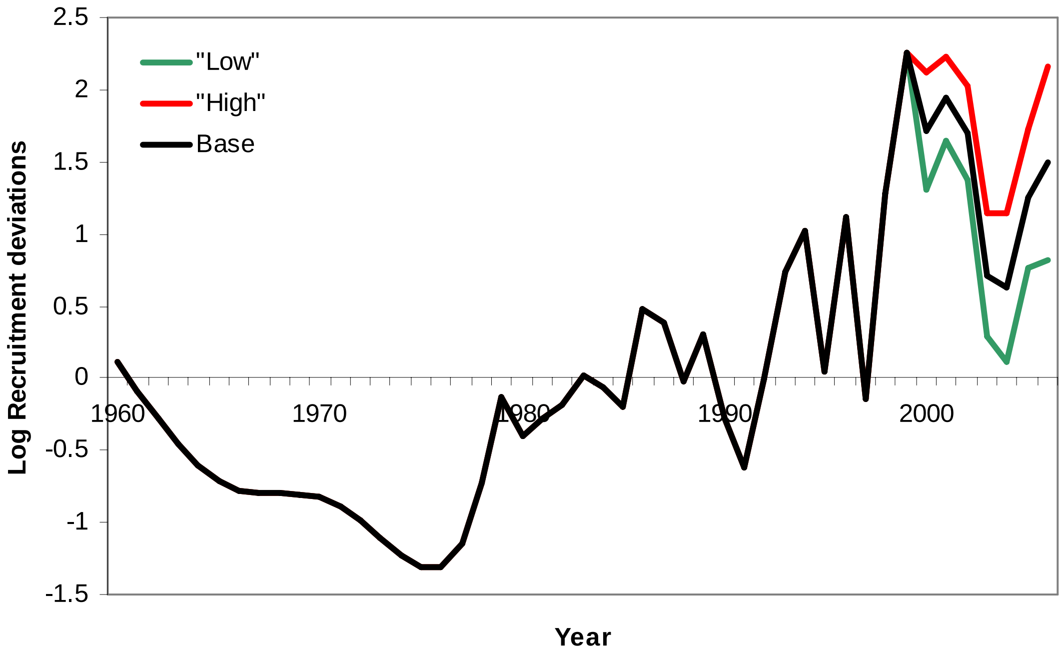

Figure 110. Recruitment deviations settings used to specify base, “low” and “high” recruitment scenarios to bracket uncertainty in recent recruitments and define alternative states of nature (see Section 8 for details).

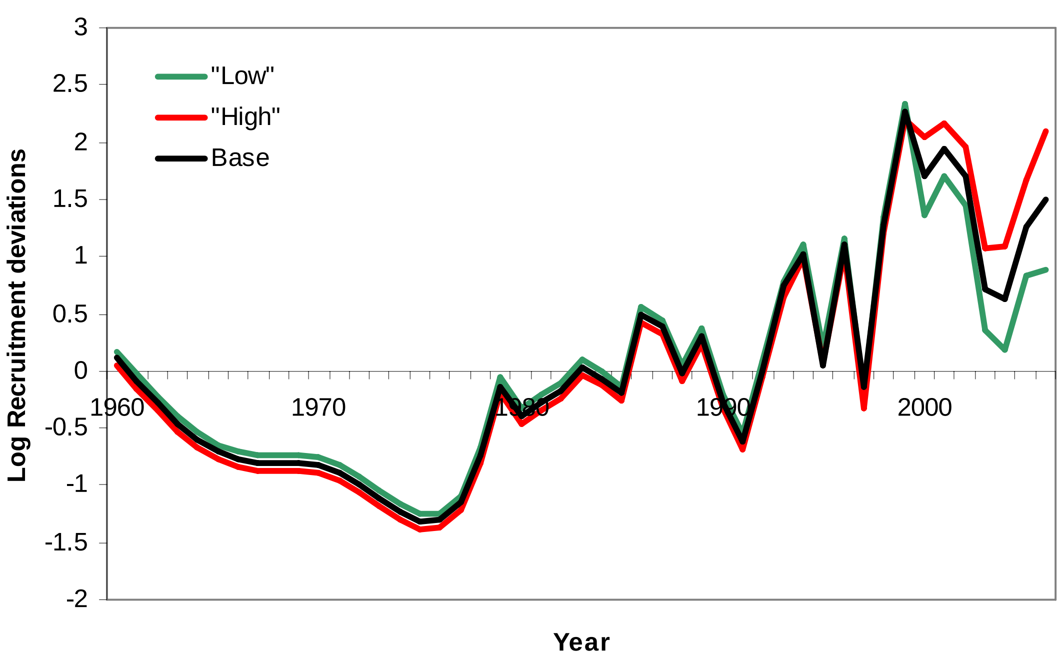

Figure 111. Recruitment deviations for base, “low” and “high” recruitment scenarios with “low” and “high” recruitment deviations adjusted by Stock Synthesis to achieve a sum of zero for the entire period.

Appendix 1: Summary of management history

Major management regulations for splitnose rockfish

Effective 1983

- Limits on domestic rockfish began in 1983, when splitnose rockfish was managed as part of *Sebastes* complex.

Effective January 1, 1992

- Cumulative trip limits for various species and species groups (widow RF; Sebastes Complex; Pacific ocean pearch; deepwater complex; non-trawl sablefish).

Effective 1994

- The *Sebastes* complex was divided into northern and southern areas, with harvest guidelines established for each area.

Effective 1996

- ABC calculated for splitnose rockfish as 868 mt (south) and 274 mt (north)

Effective January 1, 1999:

- General *Sebastes* Complex divided into near-shore, shelf, and slope rockfish
- Dividing line between north and south management areas moved to 40^{o} 10'.
    - In the north, splitnose managed under "minor slope rockfish"
    - In the south, splitnose managed separately, taken out of *Sebastes* complex.
- Splitnose south of Cape Mendocino: cumulative trip limits were set at 32,000 lbs per period (phase 1), 19,000 lbs per period (phase 2), and 10,000 lbs per period (phase 3).
    - October 1 1999: 1 month limit reduced from 10,000 to 5,000 lbs.

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

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

Effective during 2000:

- New rockfish categories in 2000. Rockfish (except thornyheads) are divided into new categories north and south of 40° 10' N. lat., depending on the depth where they most often are caught: nearshore, shelf, or slope. New trip limits have been established for "minor rockfish" species according to these categories.
    - Nearshore: numerous minor rockfish species including black and blue rockfishes.
    - Shelf: shortbelly, widow, yellowtail, bocaccio, chilipepper, cowcod rockfishes, and others.
    - Slope: Pacific ocean perch, splitnose rockfish, and others

<u>Effective during 2000</u>:

- 48 mt of splitnose in Eureka area added to northern minor rockfish ABC. Also, precautionary adjustment of OY was used (reduced the ABC by 25%)
- In Oregon, since 2000, splitnose rockfish were landed in the slope RF category. Prior to 2000, splitnose rockfish were landed in the "other rockfish" category.

Major management shifts for groundfish fishery

Effective October 18, 1982

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

Effective January 1, 1992

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

Effective May 9, 1992

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

Effective January 1, 1994

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

Effective September 8, 1995

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

Effective January 1, 1999:

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

Effective January 1, 2000

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

New rockfish categories in 2000.

- Rockfish (except thornyheads) are divided into new categories north and south of 40° 10' N. lat., depending on the depth where they most often are caught: nearshore, shelf, or slope. New trip limits have been established for "minor rockfish" species according to these categories.
    - o Nearshore: numerous minor rockfish species including black and blue rockfishes.
    - o Shelf: shortbelly, widow, yellowtail, bocaccio, chilipepper, cowcod rockfishes, and others.
    - o Slope: Pacific ocean perch, splitnose rockfish, and others

New Limited Entry Trawl Gear Restrictions in 2000.

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

Effective during 2001:

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

Effective during 2002:

- Darkblotched Conservation Area was established.

Effective during 2003:

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

Effective during 2004:

- Vessel Monitoring System (VMS) was initiated.

Effective during 2005:

- Selective flatfish trawl required shoreward of the RCA North of 40^{o} 10’.

Appendix 2: List of STAR Panel requests

During the STAR Panel review, analysis and evaluation of the base model were performed. STAR Panel requested additional sensitivity runs, summarized in two series corresponding to Day 1 and Day 2 of the STAR Panel review week.

Day 1 panel requests for splitnose STAT team:

1. Provide a sensitivity analysis where the 1900-1977 domestic catch series is reversed (assume an equilibrium catch of 0).
2. Provide a run starting in 1960 assuming equilibrium catch is average of previous years.
3. Provide results (SSB & rec trends, rec devs, B0, Bcurrent, domestic trawl selectivity) for the improved model without tuning.
4. Re-plot length frequencies from raw survey and fisheries data to identify modes.
5. Provide a run (SSB & rec trends, rec devs, B0, Bcurrent, domestic trawl selectivity) with recruitment devs starting in 1960 and bias correction starting in 1980.
6. Provide run #5 (SSB & rec trends, rec devs, B0, Bcurrent, domestic trawl selectivity) with steepness freely estimated and a lower sigma R.
7. Plot length frequencies from the 1977 and 1980 AFSC triennial survey raw data.
8. Provide the improved model run (SSB & rec trends, rec devs, B0, Bcurrent, domestic trawl selectivity) assuming an S-R Ricker function.

Day 2 panel requests to splitnose STAT team:

1. Estimate recruitment devs beginning in 1960 and ending in 2006 (start bias adjustment in 1980 and stop it in 2002).
2. Assume a Bev-Holt stock recruitment function.
3. Provide an untuned model and a model that tunes sigma R.
4. Fix steepness at 0.58.
5. Provide a sensitivity analysis of the above model assuming a Ricker stock recruitment function.
6. Explore increase in L_{∞} for males and females.

The STAR Panel analyses and evaluations led to some changes in the base model specifications. Below we provide a list of the changes to the base model that were implemented during the STAR panel review.

Prior to the STAR Panel, the base model had the following characteristics:

- Recruitment deviations were estimated during the whole modeling period (1901-2008);
- Timing of full bias adjustment was set between 1901 and 2008;
- The entire area of Conception INPFC area was used to calculate abundance indices for the NWFSC and AFSC slope surveys, although these surveys were limited to 34^{o}50’ N. latitude in the south;
- 1977 and 1980 AFSC triennial survey data were included to the assessment;

- Length and age sample sizes were not iterative re-weighted to match mean specified N_{eff} to that of the model-derived mean N_{eff} to balance the model inputs with outputs by changing the *a priori* data weighting rather than fixing the *a priori* data weights;
- Conditional age-at-length data was entered using gender option 3 with female and male within a length bin treated as a single observation.

After the STAR Panel, the base model for splitnose rockfish has the following features:

- Recruitment deviations were estimated for each year between 1960 and 2006, which the period best informed by the data based on evaluation of the variance of the recruitment deviations;
- Timing of full bias adjustment was set between 1980 and 2002, with the first year of bias adjustment a few years into the data-rich period;
- The portion of the Conception INPFC area between 34°50'and 36° N. latitudes, consistent with survey coverage, was used to estimate abundance indices for the NWFSC and AFSC slope surveys;
- 1977 and 1980 AFSC survey length data were not used since the length compositions in those years were implausibly large and the surveys were not sampled well in those years;
- Length and age sample sizes are iterative re-weighted to match mean specified N_{eff} to that of the model-derived mean N_{eff} ;
- Conditional age-at-length data for females and males were entered as separate observations. This was done to enable the age data be analyzed as conditional on length, and to prevent gender from being contaminated by any issues that cause a differential occurrence of males versus females in the data.

Appendix 3: Splitnose rockfish assessment model files

Stock Synthesis starter file

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

Stock Synthesis forecast file

```
#C forecast comment here
1 # Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=F(endyr); 5=Ave F (enter yrs); 6=read Fmult
# -4  # first year for recent ave F for option 5 (not yet implemented)
# -1  # last year for recent ave F for option 5 (not yet implemented)
# 0.74  # F multiplier for option 6 (not yet implemented)
2008 # first year to use for averaging selex to use in forecast (e.g. 2004; or use -x to be rel endyr)
2008 # last year to use for averaging selex to use in forecast
1 # Benchmarks: 0=skip; 1=calc F_spr,F_btgt,F_msy
2 # MSY: 1= set to F(SPR); 2=calc F(MSY); 3=set to F(Btgt); 4=set to F(endyr)
0.5 # SPR target (e.g. 0.40)
0.4 # Biomass target (e.g. 0.40)
12 # N forecast years
1 # read 10 advanced options
 0 # Do West Coast gfish rebuilder output (0/1)
 2000 # Rebuilder:  first year catch could have been set to zero (Ydecl)(-1 to set to endyear+1)
 2002 # Rebuilder:  year for current age structure (Yinit) (-1 to set to endyear+1)
 1 # Control rule method (1=west coast adjust catch; 2=adjust F)
 0.4 # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.40)
 0.1 # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
 1 # Control rule fraction of Flimit (e.g. 0.75)
 1 # basis for max forecast catch by seas and area (0=none; 1=deadbio; 2=retainbio; 3=deadnum; 4=retainnum)
 0 # 0= no implementation error; 1=use implementation error in forecast (not coded yet)
 0.1 # stddev of log(realized F/target F) in forecast (not coded yet)
# end of advanced options
# max forecast catch
# rows are seasons, columns are areas
 -1000
1 # fleet allocation (in terms of F) (1=use endyr pattern, no read; 2=read below)
#  0.225768
0 # Number of forecast catch levels to input (rest calc catch from forecast F
# 1 # basis for input forecatch:  1=retained catch; 2=total dead catch
#Year Seas Fleet Catch
999 # verify end of input
```

Stock Synthesis data file

```
#_Splitnose_Rf
1900	#_styr
2008	#_endyr
1	#_nseas
12	#_months/season
1	#_spawn_seas
3	#_Nfleet
4	#_Nsurveys
1	#_N_areas
Domestic_TRAWL%Foreign_TRAWL%Non_TRAWL%AFSC_triennial%AFSC_slope%NWFSC_shelf_slope%N
WFSC_slope
 0.5	0.5	0.5	0.5	0.5	0.5	0.5 #_surveytiming_in_season
 1	1	1	1	1	1	1#_area_assignments_for_each_fishery_and_survey
 1	1	1	#_units of catch:  1=bio; 2=num
 0.01	0.01	0.01	#_se of log(catch) only used for init_eq_catch and for Fmethod 2 and 3
2 #_Ngenders
100 #_Nages
0	0	0	#_init_equil_catch_for_each_fishery
109 #_N_lines_of_catch_to_read
#_catch_biomass(mtons):_columns_are_fisheries,year,season
#Trawl	#Foreign	#Non-trawl
	0	0	0	1900	1
	0	0	5	1901	1
	1	0	10	1902	1
	1	0	15	1903	1
	1	0	20	1904	1
	2	0	24	1905	1
	2	0	29	1906	1
	2	0	34	1907	1
	3	0	39	1908	1
	3	0	44	1909	1
	3	0	49	1910	1
	3	0	54	1911	1
	4	0	59	1912	1
	4	0	63	1913	1
	4	0	68	1914	1
	5	0	73	1915	1
	5	0	78	1916	1
	7	0	125	1917	1
	9	0	123	1918	1
	6	0	77	1919	1
	6	0	82	1920	1
	5	0	70	1921	1
	4	0	66	1922	1
	4	0	84	1923	1
	2	0	95	1924	1
	2	0	107	1925	1
	6	0	138	1926	1
	9	0	112	1927	1
	13	0	101	1928	1
	13	0	97	1929	1
	16	0	105	1930	1
	7	0	139	1931	1
```

11	0	68	1932	1
12	0	60	1933	1
17	0	48	1934	1
21	0	50	1935	1
24	0	24	1936	1
23	0	19	1937	1
25	0	17	1938	1
24	0	26	1939	1
17	0	30	1940	1
15	0	33	1941	1
7	0	15	1942	1
40	0	9	1943	1
71	0	1	1944	1
132	0	1	1945	1
95	0	5	1946	1
60	0	7	1947	1
60	0	19	1948	1
45	0	23	1949	1
88	0	24	1950	1
124	0	24	1951	1
134	0	15	1952	1
286	0	36	1953	1
433	0	25	1954	1
314	0	26	1955	1
480	0	34	1956	1
413	0	27	1957	1
336	0	11	1958	1
497	0	12	1959	1
678	0	11	1960	1
553	0	12	1961	1
416	0	9	1962	1
348	0	14	1963	1
220	0	14	1964	1
302	0	17	1965	1
313	4664	18	1966	1
269	5025	19	1967	1
183	2778	14	1968	1
96	141	6	1969	1
103	87	7	1970	1
88	63	8	1971	1
114	86	11	1972	1
206	297	18	1973	1
154	108	44	1974	1
167	159	36	1975	1
187	105	42	1976	1
246	0	37	1977	1
299	0	58	1978	1
251	0	72	1979	1
378	0	22	1980	1
477	0	84	1981	1
353	0	66	1982	1
635	0	63	1983	1
827	0	59	1984	1
913	0	111	1985	1
546	0	189	1986	1
289	0	173	1987	1

422	0	138	1988	1
379	0	75	1989	1
436	0	115	1990	1
563	0	132	1991	1
330	0	96	1992	1
503	0	61	1993	1
464	0	19	1994	1
401	0	41	1995	1
470	0	7	1996	1
566	0	8	1997	1
1477	0	49	1998	1
266	0	1	1999	1
126	0	6	2000	1
108	0	2	2001	1
62	0	3	2002	1
157	0	1	2003	1
182	0	0	2004	1
96	0	1	2005	1
273	0	1	2006	1
68	0	0	2007	1
66	0	0	2008	1

```
22 #_N_cpue_and_surveyabundance_observations
#_year      seas    Flt/Svy   value                   se(log)
#AFSC_triennial_survey_GLM
1983        1       4          5205.717               0.3057783
1986        1       4          5559.093               0.3391648
1989        1       4          6346.642               0.3182660
1992        1       4          6052.426               0.3247348
1995        1       4         10625.050               0.3180269
1998        1       4         12083.976               0.3074829
2001        1       4         11761.471               0.2902038
2004        1       4         46213.126               0.3139213
#AFSC_slope_survey _design_based
1997        1       5         14293.38                0.4036147
1999        1       5         11190.25                0.3084850
2000        1       5         27493.91                0.5722418
2001        1       5         12777.11                0.2924198
#NWFSC_shelf_slope_survey_GLMM
2003        1       6         21417.59                0.300464
2004        1       6         53294.45                0.264755
2005        1       6         56004.08                0.258288
2006        1       6         29760.06                0.240372
2007        1       6         40639.14                0.264349
2008        1       6         57425.11                0.339336
#NWFSC_slope_survey_GLMM
1999        1       7         16998.59                0.1473797
2000        1       7         33231.15                0.1357019
2001        1       7         14314.22                0.1950354
2002        1       7         12445.58                0.1217198
2 #_d iscard_type (1=bio or num; 2=fraction)
7 #_N _discard_obs
#_year      seas    Flt/Svy           value               CV
1987        1       1                 0.27                0.5
2002        1       1                 0.80                0.2
2003        1       1                 0.46                0.2
2004        1       1                 0.48                0.2
2005        1       1                 0.55                0.2
2006        1       1                 0.55                0.2
2007        1       1                 0.74                0.2
7 #_N_meanbodywt_obs
#_year      seas    Flt/Svy           part    value_kg        CV
2002        1       1                 1       0.185972872     0.3
2003        1       1                 1       0.231332109     0.3
2004        1       1                 1       0.213188414     0.3
2005        1       1                 1       0.217724338     0.3
2006        1       1                 1       0.226796185     0.3
2007        1       1                 1       0.231332109     0.3
2008        1       1                 1       0.190508795     0.3

1 # length bin method: 1=use databins; 2=generate from binwidth,min,max below; 3=read vector
# binwidth for population size comp
# minimum size in the population (lower edge of first bin and size at age 0.00)
# maximum size in the population (lower edge of last bin)
-0.0001 #_comp_tail_compression
0.0001 #_add_to_comp
0 #_combine males into females at or below this bin number
```

```
28 #_N_LengthBins
	2	4	6	8	10	12	14	16	18	20	22	24
	26	28	30	32	34	36	38	40	42	44	46	48
	50	52	54	56
69_N_Length_obs
#_year seas Flt/Svy gender part Nsamp datavector(female-male)
#Fishery_Domestic_TRAWL
1978	1	1	3	2	89	0	0	0	0	0	0	0
	0	0	0	0.586396	0.756675	8.016124	20.272952
	4.935196	14.805589	3.957629	1.861861	0.239692	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0.140272	1.550587	13.083639
	17.859041	7.659298	4.022342	0.066521	0.186186	0	0
	0	0	0	0	0	0	0	0
1979	1	1	3	2	61	0	0	0	0	0	0	0
	0	0	1.540550	0	1.497947	1.493970	4.556325
	6.822274	16.433672	15.988889	6.128686	0.064758	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0.010793	1.453071	0.726535	2.202328
	5.231736	13.369613	9.356911	7.196051	4.124607	0.987270
	0.814015	0	0	0	0	0	0	0	0	0
1980	1	1	3	2	41	0	0	0	0	0	0	0
	0	0	0	0	5.281671	13.254638	7.975500	5.457121
	6.296159	8.381507	0.043282	0.015413	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0.006756	0	13.195732	6.229230	10.944223
	12.578805	9.113922	0.752685	0.473357	0	0	0	0
	0	0	0	0	0	0
1981	1	1	3	2	48	0	0	0	0	0	0	0
	0	0	0	0	0.225188	0.748930	3.090504	16.420275
	14.698074	10.321752	0.000000	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0.131678	0	0.225188	2.818030	12.344415	27.371365
	11.596333	0	0.008270	0	0	0	0	0	0	0
	0	0	0
1982	1	1	3	2	119	0	0	0	0	0	0	0
	0	0	0	0	2.633947	4.450351	15.715086	18.646487
	14.387555	5.820572	1.487276	0.022493	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0.285061	9.348720	11.425857	9.359278
	4.224505	2.170321	0.021575	0	0	0	0	0
	0.000459	0	0	0.000459	0	0
1983	1	1	3	2	432	0	0	0	0	0	0	0
	0	0	0.788849	0.592909	1.789755	5.806948	10.852827
	19.059615	14.288350	4.316405	0.122781	0.182368	0	0
	0	0.001696	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0.014420	0.615811	2.386905
	11.157127	15.193406	9.523658	2.934434	0.350953	0.018873
	0	0	0	0	0.001696	0	0.000212	0	0	0
1984	1	1	3	2	686	0	0	0	0	0.000227	0
	0	0	0	0.077079	0.309795	1.629237	4.418529
	14.717137	19.852117	16.286689	7.131310	1.205870	0.121076
	0	0	0.002842	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0.006025	0.008526	0.228623
	1.792946	7.450313	12.300282	8.684036	2.348985	1.249866
```

0.108684 0 0.069803 0 0 0 0 0 0 0
0
1985 1 1 3 2 707 0 0 0 0 0 0 0
0 0 0.034106 0.969118 1.905681 5.467448 14.567976
20.530157 8.886977 3.211598 0.606353 0.036238 0.019572
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0.001356 0.000388 0.007558 0.710997
7.011333 16.857932 12.322590 5.073871 1.315025 0.415087
0.012402 0.032943 0 0.003294 0 0 0 0 0
0 0
1986 1 1 3 2 304 0 0 0 0 0 0 0
0 0 0.332138 0.742187 1.541038 7.270855 16.570204
18.550129 7.518757 1.156031 0.307348 0.654663 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0.000506 0.071082 1.360171 10.214561
19.096019 9.113929 3.740786 1.292124 0.010371 0.332391
0.124710 0 0 0 0 0 0 0 0 0
1987 1 1 3 2 176 0 0 0 0 0 0 0
0 0 0.498778 0.615255 2.794015 4.888454 11.971388
14.330937 7.357334 2.824027 0.032871 0.315845 0.003573
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0.525932 0.728159 3.416415
18.272570 19.185091 9.608981 2.531763 0.090037 0.004287
0.004287 0 0 0 0 0 0 0 0 0
1988 1 1 3 2 99 0 0 0 0 0 0 0
0 0 0 0.511154 1.112366 7.387030 15.840033
13.429178 9.023104 5.476686 1.110183 0.034659 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0.673533 3.626107 18.680170
12.134237 9.820537 1.141022 0 0 0 0 0 0
0 0 0 0 0 0
1989 1 1 3 2 117 0 0 0 0 0 0 0
0 0 0 1.478626 5.788271 5.856504 14.886561
10.041964 8.795333 3.593190 0.782641 0.470131 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 1.804101 0.893180 7.215039 16.680427
11.751220 8.077514 1.020095 0.865204 0 0 0 0
0 0 0 0 0 0 0
1990 1 1 3 2 104 0 0 0 0 0 0 0
0 0 0 0.158181 4.406876 2.177352 8.734383
19.934729 9.331032 5.466968 0.864724 0 0.034411
0.001665 0 0.034411 0 0 0 0 0 0 0
0 0 0 0 0 0 1.356474 0.116000 0.061052
0.366315 8.984143 20.033523 11.520039 5.337093 0.791462
0.289167 0 0 0 0 0 0 0 0 0 0
1991 1 1 3 2 104 0 0 0 0 0 0 0
0 0 0.937070 2.006128 0.536886 2.148289 17.994120
20.781015 6.837607 0.509347 0.000992 0.022577 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0.312357 0.005706 11.314056 22.472058
12.026844 1.556325 0.538623 0 0 0 0 0 0
0 0 0 0 0 0
1992 1 1 3 2 86 0 0 0 0 0 0 0
0 0 0.064615 0.232845 1.186928 1.954735 6.657625
20.156821 22.280369 10.720772 0.231681 0.029688 0 0
0 0 0 0 0 0 0 0 0 0 0 0

```
        0 0 0 0 0.057047 0.057047 1.888956 5.945701
        15.278134 10.717862 2.450695 0.088481 0 0 0 0
        0 0 0 0 0 0 0
1993    1 1 3 2 258 0 0 0 0 0 0 0
        0 0.406810 1.034764 2.166375 2.898427 10.617984
        14.740208 20.932738 6.536933 0.271121 0.003107 0.009063
        0 0 0 0 0 0 0 0 0 0 0 0
        0 0 0 0 0 0.029002 1.145854 3.225740
        8.943355 16.150450 7.720334 2.726743 0.423901 0.017091
        0 0 0 0 0 0 0 0 0 0 0
1994    1 1 3 2 192 0 0 0 0 0 0 0
        0 0 0.946346 2.857370 4.047566 4.525928 9.204391
        19.723498 8.915230 3.881195 0.274288 0.001038 0 0
        0 0 0 0 0 0 0 0 0 0 0 0
        0 0 0.031130 0.242467 1.081934 1.952185 4.522469
        9.556158 19.851822 6.016354 2.316057 0.052575 0 0
        0 0 0 0 0 0 0 0 0
1995    1 1 3 2 179 0 0 0 0 0 0 0
        0 0 0.008671 1.013150 4.189761 3.436109 14.258336
        7.719967 16.822381 13.863786 5.399073 0.001289 0 0
        0 0 0 0 0 0 0 0 0 0 0 0
        0 0 0 0 0.011542 0.093511 0.312288 11.240447
        13.221339 7.031644 1.335868 0.025546 0.008613 0.006679
        0 0 0 0 0 0 0 0 0
1996    1 1 3 2 249 0 0 0 0 0 0 0
        0 0 0.187111 1.822381 7.079780 11.717434 12.292186
        8.000621 4.591587 6.702991 3.549859 2.248843 0 0
        0 0 0 0 0 0 0 0 0 0 0 0
        0 0 0 0 0.096196 3.596327 6.740337 11.471874
        8.726358 5.924632 4.032166 1.217330 0.001912 0
        0.000073 0 0 0 0 0 0 0 0
1997    1 1 3 2 305 0 0 0 0 0 0 0
        0 0.010764 0.148714 0.832755 5.669367 17.544856
        17.512675 9.417972 8.669899 4.161138 0.003734 0.000220
        0.003185 0 0 0 0 0 0 0 0 0 0
        0 0 0 0 0 0 0.010764 0.290179 3.821644
        8.286252 9.729239 8.051868 4.827167 0.874052 0.133337
        0.000110 0.000110 0 0 0 0 0 0 0 0
        0
1998    1 1 3 2 433 0 0 0 0 0 0 0
        0 0 0.726442 3.436138 8.348850 13.131078 12.182985
        10.892021 5.429560 0.801293 0.072216 0.059705 0 0
        0.001065 0 0.001065 0 0 0 0 0 0 0
        0 0 0 0 0 1.257664 4.486126 9.979863
        9.092301 12.936312 5.700402 1.223513 0.210711 0.025261
        0.003647 0.000719 0 0 0 0 0.001065 0 0
        0 0
1999    1 1 3 2 211 0 0 0 0 0 0 0
        0 1.595839 1.390616 2.040898 5.956064 8.387804
        15.323732 15.271354 10.661492 2.730998 0.875414 0.036756
        0 0.128647 0 0 0 0 0 0 0 0 0
        0 0 0 0 0.019297 0 1.343445 0.492229
        3.256308 5.074217 14.005709 7.299509 3.221083 0.799145
        0.071062 0 0 0.018378 0 0 0 0 0 0
        0 0
```

2000 1 1 3 2 124 0 0 0 0 0 0 0
0 0 0.541886 1.036095 1.453556 12.292432 15.030932
13.020373 4.022280 1.107028 1.026792 0.227918 0.056979
0 0 0.029071 0 0.029071 0 0 0 0 0
0 0 0 0 0 0 0 0.019768 2.800130
7.616633 17.863622 14.828597 5.329318 1.250058 0.200009
0.188381 0.029071 0 0 0 0 0 0 0 0
0
2001 1 1 3 2 162 0 0 0 0 0 0 0
0.141673 0.735657 1.573995 2.064000 4.439939 7.346175
9.623333 12.811615 8.500351 5.085913 2.700876 1.228262
0.358730 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0.752554 1.624685 2.816554
6.788583 12.506174 9.302295 4.372352 2.650186 1.781954
0.736957 0 0.057189 0 0 0 0 0 0 0
0
2002 1 1 3 2 278 0 0 0 0 0 0 0
0 0.017927 0.297857 1.121101 2.443531 5.331090
14.257150 14.865275 17.406713 1.969166 0.268899 0.034474
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0.017927 0 0.052401 0.479881 2.326319
4.095535 8.986734 16.229074 6.441159 2.258750 1.012162
0.052401 0.034474 0 0 0 0 0 0 0 0
0
2003 1 1 3 2 252 0 0 0 0 0 0 0
0 0.370263 0.646602 1.449424 3.709336 7.606518
17.433974 23.459129 11.143342 1.878468 0.393584 0.159095
0 0 0.074436 0 0 0 0 0 0 0 0
0 0 0 0 0.117883 0.126509 0.253018 1.428019
3.232371 5.972443 8.215743 9.494571 1.990601 0.641491
0.008626 0.185930 0.008626 0 0 0 0 0 0
0 0 0
2004 1 1 3 2 203 0 0 0 0 0 0 0
0 0 0.117831 0.985141 5.837925 8.124273 17.881030
21.436953 9.330587 4.947918 0.253529 0.978621 0.273328
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0.205962 0.538447 1.554253 5.023494
9.303544 4.984861 4.429029 1.160196 1.545319 0.941920
0.145839 0 0 0 0 0 0 0 0 0
2005 1 1 3 2 134 0 0 0 0 0 0 0
0 0.022285 0 0.125219 1.132276 4.731434 17.566368
24.366035 17.084593 11.220884 0.156700 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0.205161 0.278028 2.398260 6.843176
5.374153 5.535098 2.614032 0.328611 0.017686 0 0
0 0 0 0 0 0 0 0
2006 1 1 3 2 162 0 0 0 0 0 0 0
0 0 0.274340 0.590745 1.898202 2.034457 16.444833
35.601513 9.929266 1.103988 0.061726 0.012803 0.012803
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0.805187 2.671154 0.376303 5.078255
12.117125 9.238159 1.353866 0.171920 0.064470 0.110193
0.048695 0 0 0 0 0 0 0 0 0
2007 1 1 3 2 302 0 0 0 0 0 0 0
0 0.025455 0.185315 1.558889 6.498254 10.122084
17.861543 12.203317 4.539206 3.730743 4.611500 2.647361

```
        0.106913    0.022401    0   0.011200375 0   0   0   0   0
        0   0   0   0   0   0   0   0   0   0.652676
        4.230687    8.646689    8.957245    6.459562    3.514881    1.534451
        1.603690    0.204661    0.060075    0.011200    0   0   0   0
        0   0   0   0
2008    1   1   3   2   235 0   0   0   0   0   0   0
        0   0.018004    0.145230    0.704547    2.257670    10.314946
        18.463440   22.265831   13.262759   4.059244    1.897595    2.150847
        0.076816    0   0   0   0   0   0   0   0   0   0
        0   0   0   0   0   0   0.082817    0.255653    0.555716
        3.283883    8.600989    6.254501    3.483124    1.379087    0.410485
        0   0   0   0.038408    0.038408    0   0   0   0   0
        0
#Fishery_Non_TRAWL
1983    1   3   0   2   7   0   0   0   0   0   0   0
        0   0   0   0   0   0   0   22.076707   16.557530
        44.153414   5.519177    9.541628    0   0   2.151543    0   0
        0   0   0   0   0   0   0   0   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   3   0   2   10  0   0   0   0   0   0   0
        0   0   0   0   0   0   0   0.983442    23.025338
        28.383283   21.578693   10.351205   15.678039   0   0   0   0
        0   0   0   0   0   0   0   0   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   3   3   2   123 0   0   0   0   0   0   0
        0   0   0   0   0   0.114658    2.905603    14.855209
        17.797167   6.283821    0.739684    0.092286    0   0.072710    0
        0   0   0   0   0   0   0   0   0   0   0   0
        0   0   0   0   0   0   0   0.331390    6.633388
        14.385391   19.905757   13.359061   2.523875    0   0   0   0
        0   0   0   0   0
1986    1   3   3   2   205 0   0   0   0   0   0   0
        0   0   0   0   0.004399    0.068184    5.496536    11.279006
        0.994171    4.495766    0.065985    0.010997    0.004399    0   0
        0   0   0   0   0   0   0   0   0   0   0   0
        0   0   0   0   0   0   0.015396    0.384911    19.329154
        39.802046   5.690091    6.827230    5.448147    0.070384    0.006598
        0   0.006598    0   0   0   0   0
1987    1   3   3   2   183 0   0   0   0   0   0   0
        0   0   0   0   0   0   3.854030    13.334676   14.442542
        7.050055    1.564441    1.490583    0.010072    0   0.013429    0
        0   0   0   0   0   0   0   0   0   0   0   0
        0   0   0   0   0   0.443146    0.083929    10.212509
        12.394669   19.263437   9.692148    5.193541    0.866150    0.050358
        0.040286    0   0   0   0   0   0
1988    1   3   3   2   67  0   0   0   0   0   0   0
        0   0   0   0   0   5.456766    5.892958    16.498248
        4.675982    3.716359    2.162060    0.197741    0.075607    0   0
        0   0   0   0   0   0   0   0   0   0   0   0
        0   0   0   0   0.082877    1.603734    1.760763    13.740058
        13.652820   15.567704   8.998648    2.939936    2.148974    0.700816
        0.127950    0   0   0   0   0   0   0
1989    1   3   3   2   32  0   0   0   0   0   0   0
        0   0   0   0   0   0.813923    1.533630    2.253337
```

11.695891 0.722324 0.057577 0.049725 0 0.049725 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0.813923 21.627846
40.646428 19.084009 0.594085 0 0.052342 0.002617
0.002617 0 0 0 0 0 0
1990 1 3 3 2 67 0 0 0 0 0 0 0
0 0 0 0 0.011857 0.201565 0.142281 2.296261
14.131294 3.896925 1.574974 0 0 0.001976 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0.021737 1.393171 7.748399
17.516402 20.816536 26.361552 3.815904 0.069164 0 0
0 0 0 0 0 0
1991 1 3 3 2 36 0 0 0 0 0 0 0
0 0 0 0 0.564844 2.553095 7.998192 2.485314
0.519657 0.384094 0 1.174876 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0.225938 1.558970 2.033439 7.568911 21.034794
22.774514 23.881609 5.241753 0 0 0 0 0 0
0 0 0 0
1992 1 3 0 2 44 0 0 0 0 0 0 0
0 0 0 0.071395 2.260828 17.206092 10.792480
25.309376 14.766778 28.545931 0.809139 0.118991 0 0
0.118991 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
1993 1 3 0 2 64 0 0 0 0 0 0 0
0 0 0.521371 6.430245 12.170365 19.149686 29.834018
25.685716 5.090295 1.118303 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 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 3 0 2 46 0 0 0 0 0 0 0
0 0 0 0 1.349941 7.180123 27.964002 31.133429
20.516499 11.542976 0.313030 0 0 0 0 0 0
0 0 0 0 0 0 0 0 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 3 0 2 54 0 0 0 0 0 0 0
0 0 0 2.708700 10.230316 10.463693 21.512740
21.440049 18.517102 7.464228 3.305532 2.961206 1.396434
0 0 0 0 0 0 0 0 0 0 0 0
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 3 0 2 12 0 0 0 0 0 0 0
0 0 1.851852 7.407407 16.666667 14.814815 25.925926
20.370370 9.259259 3.703704 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 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 3 0 2 8 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 21.637427 15.204678
30.409357 28.070175 4.678363 0 0 0 0 0 0
0 0 0 0 0 0 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	3	0	2	17	0	0	0	0	0	0	0
	0	0	0	0	0	1.244999	13.521672	32.023340
	29.641666	23.568323	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	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	3	0	2	9	0	0	0	0	0	0	0
	0	0	0	9.375	33.125000	25	15.000000	13.125000	0
	4.375000	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	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_triennial_survey
1983	1	4	3	0	171	0	0	0	0.027783564	0.165889797
	0.85751402	1.4129731	7.5903761	9.9250437	3.9557663	2.572567
	2.893676	2.9422399	3.9368511	4.6169282	3.3102359	2.30856857
	0.769746105	0.11233358	0.036236696	0	0	0	0	0	0
	0	0	0	0	0	0.09110844	0.221204353	1.54210926
	2.5864901	8.2739816	7.601371	4.3147739	3.760569	5.3744403
	8.332419	5.697152	3.1847063	1.1667961	0.27803483	0.140114621
	0	0	0	0	0	0	0	0	0	0
1986	1	4	3	0	34	0	0	0	0.107145587	0.214291173
	0.04837821	5.4652105	11.2704924	14.0837267	5.405365	6.09179
	1.125915	0.9706667	1.4122956	2.4986769	4.345525	2.39003873
	0.217276248	0.10863812	0	0	0	0	0	0	0	0
	0	0	0	0	0.0267864	0.323431814	0.28217742	4.7760833
	10.790618	10.9781507	4.8858441	4.25797	0.4274761	0.869105
	3.585058	2.3900387	0.6518287	0	0	0	0	0	0
	0	0	0	0	0	0
1989	1	4	3	0	205	0	0	0	0	0.171361476
	0.23660539	4.7795383	2.3661228	8.3151259	8.3798997	5.64337
	2.589473	1.1242364	1.6179502	2.0457136	1.4514581	0.28669068
	0.130065439	0.01969854	0	0	0	0	0	0	0	0
	0	0	0	0	0.25256296	0.623628925	3.64247164	6.1933399
	6.3453834	14.0003364	9.0372304	6.746794	3.1907349	5.29038
	3.766645	1.3281152	0.3662348	0.02941621	0.029416211	0	0
	0	0	0	0	0	0	0	0
1992	1	4	3	0	108	0	0	0	0	0.008889279
	1.1466921	4.6811399	2.0848828	8.2157738	9.5480039	7.022729
	10.6626	3.8018738	0.5687644	0.7347201	0.7489603	0.04534015
	0.283262227	0	0	0	0	0	0	0	0	0	0
	0	0	0	0.04987156	0.071518286	1.35662591	2.4684307
	4.5053003	9.9133779	9.651476	10.026252	8.1116284	1.933061
	1.450005	0.776619	0.132201	0	0	0	0	0	0
	0	0	0	0	0	0
1995	1	4	3	0	611	0	0	0	0	0.217580809
	0.79383329	2.2747056	3.3309377	5.3199859	14.6399797	8.657207
	4.721075	2.2762206	0.796179	0.8413501	0.6413561	0.19641883
	0.016766657	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0.706853766	2.47897825	2.4251185	3.4954153
	7.3378195	16.6121876	13.619349	4.2988192	1.770394	1.740511
	0.5600172	0.2077593	0.01566209	0.007519502	0	0	0	0
	0	0	0	0	0	0
1998	1	4	3	0	685	0	0	0	0	0.110366277
	1.32868349	1.385951	7.9007294	8.4888905	8.6112644	5.628477
	3.109213	2.392417	2.3734866	2.1602803	0.4464451	0.25258319
```

0.005931879 0 0 0 0 0 0 0 0 0 0
0 0 0.00218337 0.00436674 0.172998758 1.4236272 1.3253257
9.7160109 8.9504098 8.3907304 8.16033 6.8453805 4.468056
4.715482 1.1879975 0.4423818 0 0 0 0 0 0
0 0 0 0 0 0
2001 1 4 3 0 516 0 0 0.024471167 0.508174617
1.234219797 0.88099815 1.8647231 1.9796174 6.6444633 17.1075743
8.863494 3.00832 1.5715086 0.523478 0.5843034 0.3688678
0.10214686 0.095318392 0.04155258 0.00766762 0 0 0 0
0 0 0 0 0 0.0383078 0.01276927 0.69615424
1.935360369 1.54625484 2.264325 2.8383011 8.8156896 20.8895952
9.744976 1.2306983 2.135224 1.17359 0.5478859 0.4055976
0.25303146 0.061340961 0 0 0 0 0 0 0 0
0 0
2004 1 4 3 0 148 0 0 0.003186884 0.024933014
0.453397394 2.26714516 5.3289737 5.169825 7.6684776 9.297953
5.061404 5.668598 2.2675641 0.8948239 1.0167816 0.729491
0.50140835 0.150794408 0 0.000996216 0 0 0 0 0
0 0 0.000895237 0 0 0 0.01967798 0.895443951
4.44947197 6.821479 6.0235094 8.3221705 9.5989117 6.881335
5.8601268 2.510274 1.164108 0.6434137 0.1495375 0.15289638
0.000996216 0 0 0 0 0 0 0 0 0 0
#AFSC_slope_survey
1997 1 5 3 0 64 0 0 0 0 0 0.695824739
6.098557 6.87432 8.273305 8.525714 8.232002 3.562191
3.4331076 3.3103366 3.0541793 1.5907719 0.05619 0.02321652 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 2.480057 5.620365 6.541656 8.752067 8.05173
4.155297 3.4831788 3.3514231 3.2325451 0.1717472 0.40416144
0.02605796 0 0 0 0 0 0 0 0 0 0
0
1999 1 5 3 0 74 0 0 0 0 0.002001
3.073238 5.486203 4.113620 5.576454 7.780213
6.376009 5.511246 3.159221 2.883473 2.184926
0.488498 0.148672 0 0 0 0 0
0 0 0 0 0 0 0
0 0 0 0.915511 3.282763 3.982526
6.566731 8.689811 8.096302 5.986200 5.779898 4.986792
3.362471 1.403518 0.163707 0 0 0 0 0 0
0 0 0 0 0 0
2000 1 5 3 0 70 0 0 0 0 0.00110614
0.00221228 4.742446 9.494066 9.985193 10.074417 10.11356
5.384019 0.3459697 0.411232 0.221655 0.2265352 0.03075616
0.01873034 0.01356787 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1.201693 4.725996 9.731447
10.064683 11.334075 10.143965 0.7977041 0.5591778 0.1534044
0.1366764 0.08337207 0.0023388 0 0 0 0 0 0
0 0 0 0 0
2001 1 5 3 0 74 0 0 0 0 0 0
5.281422 5.30275 5.904823 9.809239 10.054316 8.486755
2.8858751 0.8225256 0.7711233 0.5569848 0.01469592 0.003260566
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0.004383358 1.831751 2.48269 8.753128 9.756421
10.147643 8.086803 5.0911697 2.6981853 0.7452325 0.508823
0 0 0 0 0 0 0 0 0 0 0 0
0

```
#NWFS_Shelf_slope_survey
2003	1	6	3	0	328	0	0	0	0.035623	0.618952
	6.544369	9.478403	5.441022	4.405332	4.798903	3.956021
	2.602111	2.816569	2.086568	1.449899	0.832646	0.386946
	0.103408	0.062613	0	0	0	0	0	0	0	0
	0	0	0	0.030447	0.25462	2.231135	8.757765	9.955593
	4.852926	5.384414	5.913043	5.085843	5.421971	3.089091
	1.827813	1.156936	0.245198	0.154813	0.003781	0.003781
	0	0.011447	0	0	0	0	0	0	0
2004	1	6	3	0	372	0	0	0	0.033065	0.459068
	2.121699	3.629819	7.94222	9.601723	9.792088	5.281902
	3.186864	1.7607	1.213971	1.335336	0.941432	0.265835
	0.018397	0	0	0	0	0	0	0	0	0	0
	0	0	0.017387	0.128022	0.571541	2.063893	5.154074
	7.858012	12.369144	11.542343	6.048686	2.808785	2.180688
	1.169971	0.310184	0.183953	0.009199	0	0	0	0
	0	0	0	0	0	0	0
2005	1	6	3	0	82	0	0	0	0.11577	0.52345	3.867567
	11.962903	13.215381	5.417383	6.183541	3.637909	3.631087
	2.176199	2.534165	0.368295	0.444997	0.038361	0.002096
	0.006288	0	0	0	0	0	0	0	0	0	0
	0	0	0.308414	1.735739	3.187574	10.692834	9.814979
	6.03933	4.923878	4.600585	2.432754	1.57786	0.461508	0.038369
	0.026709	0.028835	0.003146	0.002096	0	0	0	0
	0	0	0	0	0
2006	1	6	3	0	262	0	0	0	0.086816	0.884577
	2.194446	5.507611	6.090099	11.253099	5.475685	5.217721
	4.964781	2.546888	1.833211	1.02943	0.336479	0.249099
	0.065275	0	0	0	0	0	0	0	0	0	0
	0	0	0	0.071316	0.849859	1.875328	6.144941
	6.819685	10.788745	7.005002	7.282005	4.639045	4.501169
	1.752238	0.500347	0.035101	0	0	0	0	0	0
	0	0	0	0	0	0
2007	1	6	3	0	214	0	0	0	0.059993	0.382561
	1.860761	2.444475	4.731813	9.397365	9.833519	7.144545
	4.346657	4.115529	2.154478	3.369774	0.3671	0.984605
	0.003129	0.109114	0	0	0	0	0	0	0	0
	0	0	0.001596	0	0.107845	0.423762	2.618308
	4.064211	6.282923	8.613929	8.98585	9.135546	3.534454
	2.153623	1.809923	0.918353	0.040944	0.003314	0	0
	0	0	0	0	0	0	0	0	0
2008	1	6	3	0	160	0	0	0	0.368916	2.247331
	3.743855	4.114336	8.600423	8.157921	6.368745	6.377739
	5.077913	1.915617	1.360277	0.973243	0.414276	0.143945
	0.060725	0	0	0	0	0	0	0	0	0	0
	0	0	0.002303	1.828859	3.577432	3.265767	3.417998
	5.967035	8.633704	10.279719	5.3882	4.317925	1.858722
	0.811082	0.545563	0.1305	0	0.049931	0	0	0	0
	0	0	0	0	0	0
#Discard_Lengths: Fishery_Domestic_TRAWL
1987	1	1	0	1	13	0	0	0	0	0	935	8413
	8413	11959	1870	4582	5320	462	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0
```

2006	1	1	0	1	175	0	0	0	6	6	28	133
	614	2984	3078	8217	9303	6000	7709	792	157	55	12	9
	8	8	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0											
2007	1	1	0	1	288	0	2	4312	2026	697	1878	1030
	420	3885	6170	13142	14054	4845	793	2233	662	961	1140	97
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0											
85	#_N_age_bins											
	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	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	76	77	78	79	80	81	82	83	84
	85											
1	#_N_ageerror_definitions											
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	-1	-1	-1	-1	-1							
	0.333613		0.333613		0.452903		0.569346		0.683008		0.793957	
	0.902257		1.00797	1.11116	1.21189	1.31021	1.40619	1.49987	1.59132	1.68058	1.76772	1.85277
	1.93579	2.01683	2.09594	2.17315	2.24853	2.3221		2.39392	2.46402	2.53245	2.59924	2.66445
	2.72809	2.79021	2.85086	2.91005	2.96783	3.02423	3.07929	3.13303	3.18548	3.23669	3.28667	3.33546
	3.38309	3.42957	3.47495	3.51924	3.56248	3.60469	3.64588	3.6861		3.72535	3.76367	3.80107
	3.83758	3.87321	3.908		3.94195		3.9751		4.00745	4.03903	4.06986	4.09995
	4.12933	4.158		4.18599	4.2133		4.23997		4.266		4.296556	
	4.321757		4.346367		4.370402		4.393874		4.416797		4.439183	
	4.461045		4.482395		4.503246		4.523608		4.543494		4.562914	
	4.581879		4.600401		4.618489		4.636154		4.653405		4.670252	
	4.686705		4.702772		4.718464		4.733788		4.748754		4.763369	
	4.777642		4.791581		4.805193		4.818487		4.83147	4.844149		
	4.856531		4.868623		4.880432		4.891965					
169	#_N_Agecomp_obs											
2	#_Lbin_method:		1=poplenbins;		2=datalenbins;		3=lengths					
0	#_combine		males	into	females	at	or	below	this	bin	number	
#Yr	Seas	Flt/Svy	Gender	Part	Ageerr	Lbin_lo	Lbin_hi	Nsamp	datavector			
#Females												
2003	1	6	1	0	1	4	4	3	4	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	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	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	6	1	0	1	5	5	3	2	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	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	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	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	6	1	0	1	6	6	20	0	26	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	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	16	4
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	6	1	0	1	7	7	17	0	9	12	6
	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	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	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	11
	2	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	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	6	1	0	1	8	8	22	0	0	12	19
	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	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	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
	14	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	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	6	1	0	1	9	9	18	0	0	1	10
	9	3	1	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	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
	7	11	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	6	1	0	1	10	10	17	0	0	0	3
	10	3	3	0	0	1	0	0	0	0	0	0
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2003	1	6	1	0	1	11	11	20	0	0	0	0
	3	4	9	1	1	1	0	2	0	0	0	0
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2003	1	6	1	0	1	12	12	15	0	0	0	0
	0	2	6	3	1	2	0	1	0	1	0	2
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2003	1	6	1	0	1	13	13	12	0	0	0	0
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	0	3	0	1	0	0	1	3	0	0	0	0
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2003	1	6	1	0	1	14	14	6	0	0	0	0
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2003	1	6	1	0	1	15	15	6	0	0	0	0
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2003	1	6	1	0	1	16	16	6	0	0	0	0
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2003	1	6	1	0	1	17	17	1	0	0	0	0
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2003	1	6	1	0	1	18	18	3	0	0	0	0
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2003	1	6	1	0	1	19	19	1	0	0	0	0
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2004	1	6	1	0	1	4	4	1	0	1	0	0
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2004	1	6	1	0	1	5	5	6	0	6	0	0
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2004	1	6	1	0	1	6	6	12	0	11	0	1
	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	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	14	1
	0	1	0	0	0	0	0	0	0	0	0	0
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2004	1	6	1	0	1	7	7	15	0	3	14	1
	0	1	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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	3	1	0	0	1	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	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	6	1	0	1	8	8	17	0	0	8	3
	8	1	0	0	0	0	0	0	0	0	0	0
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	7	3	1	0	0	0	0	0	0	0	0	0
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2004	1	6	1	0	1	9	9	18	0	0	0	4
	9	3	1	2	1	0	0	0	0	0	0	0
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	6	11	2	0	1	1	2	1	0	0	0	1
	0	1	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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2004	1	6	1	0	1	10	10	24	0	0	0	1
	16	5	6	0	1	0	0	0	0	2	1	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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	3	13	10	0	4	0	0	1	0	0	0	1
	0	0	1	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0		
2004	1	6	1	0	1	11	11	21	0	0	0	0
	6	4	3	6	3	0	0	0	0	1	0	0
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	0	1	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2004	1	6	1	0	1	12	12	18	0	0	0	0
	1	2	3	6	2	1	2	0	1	0	0	0
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2004	1	6	1	0	1	13	13	9	0	0	0	0
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	2	0	1	0	0	2	1	1	0	0	0	0
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	0	0	0	0	0	0	0	1	0	0		
2004	1	6	1	0	1	14	14	10	0	0	0	0
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	0	0	0	1	0	0	2	0	0	0	0	0
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2004	1	6	1	0	1	15	15	6	0	0	0	0
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2004	1	6	1	0	1	16	16	2	0	0	0	0
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2004	1	6	1	0	1	17	17	2	0	0	0	0
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2005	1	6	1	0	1	4	4	3	3	0	0	0
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2005	1	6	1	0	1	5	5	4	0	5	0	0
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2005	1	6	1	0	1	6	6	14	0	10	4	0
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2005	1	6	1	0	1	7	7	13	0	2	11	1
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2005	1	6	1	0	1	8	8	18	0	0	8	6
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2005	1	6	1	0	1	9	9	24	0	0	0	13
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2005	1	6	1	0	1	10	10	28	0	0	0	2
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2005	1	6	1	0	1	11	11	23	0	0	0	0
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2005	1	6	1	0	1	12	12	23	0	0	0	0
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2005	1	6	1	0	1	13	13	11	0	0	0	0
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2005	1	6	1	0	1	14	14	11	0	0	0	0
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2005	1	6	1	0	1	15	15	4	0	0	0	0
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2005	1	6	1	0	1	16	16	4	0	0	0	0
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2005	1	6	1	0	1	17	17	2	0	0	0	0
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2005	1	6	1	0	1	19	19	1	0	0	0	0
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2006	1	6	1	0	1	4	4	2	3	0	0	0
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2006	1	6	1	0	1	5	5	3	2	1	0	0
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	0	0	0	0	0	0	0	0	0	0		
2006	1	6	1	0	1	6	6	6	0	9	1	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	13	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	1	0	1	7	7	10	0	1	12	3
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	0	0	0	0	0	0	0	0	0	0	2	4
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	1	0	1	8	8	11	0	0	2	8
	1	1	2	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	5	3	1	1	0	0	1	0	0	0	0	0
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2006	1	6	1	0	1	9	9	22	0	0	2	16
	8	3	2	1	0	0	0	1	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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	6	5	5	4	1	1	1	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	1	0	1	10	10	24	0	0	1	2
	7	5	9	4	0	2	0	0	0	0	0	0
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	1	7	4	9	4	1	1	2	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	1	0	1	11	11	28	0	0	0	0
	1	6	10	7	1	1	2	0	1	0	1	0
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	0	0	0	0	0	0	0	0	0	0		
2006	1	6	1	0	1	12	12	24	0	0	0	0
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	0	0	0	3	3	0	3	1	2	3	1	0
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2006	1	6	1	0	1	13	13	15	0	0	0	0
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	0	0	0	2	0	0	0	0	0	0	1	0
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	1	0	1	1	0	2	1	1	1	1	0	0
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	0	1	0	0	0	0	0	2	0	0	1	0
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2006	1	6	1	0	1	14	14	5	0	0	0	0
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2006	1	6	1	0	1	15	15	8	0	0	0	0
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	0	0	0	1	1	0	0	0	0	0	0	1
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2006	1	6	1	0	1	16	16	1	0	0	0	0
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2006	1	6	1	0	1	17	17	1	0	0	0	0
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2007	1	6	1	0	1	4	4	1	3	0	0	0
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2007	1	6	1	0	1	5	5	4	1	3	0	0
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2007	1	6	1	0	1	6	6	7	0	5	2	1
	1	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	2	0	0	0	0	0	0	0	0	0	0	0
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2007	1	6	1	0	1	7	7	12	0	7	3	4
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2007	1	6	1	0	1	8	8	9	0	0	2	1
	4	1	1	0	0	0	1	0	0	0	0	0
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2007	1	6	1	0	1	9	9	18	0	0	2	3
	6	5	2	2	4	0	1	1	0	0	0	0
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2007	1	6	1	0	1	10	10	20	0	0	0	0
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2007	1	6	1	0	1	11	11	27	0	0	0	0
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	0	2	7	12	7	11	1	0	4	1	4	0
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	0	0	0	0	0	0	0	0	0	0		
2007	1	6	1	0	1	12	12	23	0	0	0	0
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	0	0	1	0	1	1	0	0	0	0	0	0
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2007	1	6	1	0	1	13	13	21	0	0	0	0
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	0	2	0	0	0	0	0	0	0	1	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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	0	1	1	2	0	0	0	1	1	2	2	0
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	0	0	0	1	0	0	0	0	0	0	0	0
	0	1	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		
2007	1	6	1	0	1	14	14	8	0	0	0	0
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2007	1	6	1	0	1	15	15	6	0	0	0	0
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2007	1	6	1	0	1	16	16	2	0	0	0	0
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2007	1	6	1	0	1	17	17	3	0	0	0	0
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2008	1	6	1	0	1	6	6	12	0	19	2	1
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2008	1	6	1	0	1	7	7	12	0	1	6	2
	3	1	1	1	0	0	0	0	0	0	0	0
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2008	1	6	1	0	1	8	8	11	0	0	8	2
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2008	1	6	1	0	1	9	9	17	0	0	1	3
	8	2	2	1	0	2	1	0	0	0	1	0
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2008	1	6	1	0	1	10	10	18	0	0	0	1
	7	0	3	4	3	1	0	0	0	1	0	1
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	0	0	0	0	0	0	0	0	0	0		
2008	1	6	1	0	1	11	11	18	0	0	0	0
	0	5	4	3	2	6	1	0	1	1	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	1	0	1	12	12	23	0	0	0	0
	0	1	1	6	7	8	0	1	2	1	1	1
	0	0	3	0	0	0	0	0	1	0	0	0
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	0	0	0	1	3	1	7	0	2	0	1	3
	2	1	1	1	0	0	0	0	0	1	1	0
	0	1	0	0	0	1	0	1	1	0	1	1
	0	0	0	0	1	0	0	0	0	0	0	0
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	1	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	1	0	1	13	13	14	0	0	0	0
	0	0	0	0	1	1	0	1	3	2	0	2
	2	1	0	0	1	1	0	1	0	0	0	0
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	0	0	0	0	2	0	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0	0	0	0
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	0	0	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		
2008	1	6	1	0	1	14	14	6	0	0	0	0
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	0	0	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	1	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	0	1	0
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	2	1	0	0	0	0	0	0	0	0	0	0
	0	0	0	1	1	0	0	0	0	0	0	0
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	0	0	1	1	0	0	0	2	0	0	0	0
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2008	1	6	1	0	1	15	15	8	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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2008	1	6	1	0	1	16	16	6	0	0	0	0
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	0	0	0	0	0	0	0	0	1	1	0	0
	1	1	0	0	0	0	0	0	0	0	1	0
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	0	0	0	0	0	0	0	2	0	0	0	1
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2008	1	6	1	0	1	17	17	2	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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#Males												
2003	1	6	2	0	1	4	4	2	4	0	0	0
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2003	1	6	2	0	1	5	5	4	2	2	0	0
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	0	0	0	0	0	0	0	0	0	2	2	0
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2003	1	6	2	0	1	6	6	16	0	26	5	0
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	0	0	0	0	0	0	0	0	0	0	16	4
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2003	1	6	2	0	1	7	7	14	0	9	12	6
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	0	0	0	0	0	0	0	0	0	0	8	11
	2	0	1	0	0	0	0	0	0	0	0	0
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2003	1	6	2	0	1	8	8	16	0	0	12	19
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2003	1	6	2	0	1	9	9	14	0	0	1	10
	9	3	1	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	3
	7	11	0	0	0	0	0	0	0	0	0	0
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2003	1	6	2	0	1	10	10	30	0	0	0	3
	10	3	3	0	0	1	0	0	0	0	0	0
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2003	1	6	2	0	1	11	11	21	0	0	0	0
	3	4	9	1	1	1	0	2	0	0	0	0
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2003	1	6	2	0	1	12	12	21	0	0	0	0
	0	2	6	3	1	2	0	1	0	1	0	2
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2003	1	6	2	0	1	13	13	20	0	0	0	0
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2003	1	6	2	0	1	14	14	11	0	0	0	0
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2003	1	6	2	0	1	15	15	10	0	0	0	0
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2003	1	6	2	0	1	16	16	2	0	0	0	0
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2003	1	6	2	0	1	17	17	2	0	0	0	0
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2003	1	6	2	0	1	18	18	1	0	0	0	0
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2003	1	6	2	0	1	19	19	1	0	0	0	0
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2004	1	6	2	0	1	3	3	1	0	0	0	0
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2004	1	6	2	0	1	4	4	1	0	1	0	0
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2004	1	6	2	0	1	5	5	3	0	6	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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2004	1	6	2	0	1	6	6	13	0	11	0	1
	2	0	0	0	0	0	0	0	0	0	0	0
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2004	1	6	2	0	1	7	7	12	0	3	14	1
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2004	1	6	2	0	1	8	8	16	0	0	8	3
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	0	0	0	0	0	0	0	0	0	0	0	0
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	7	3	1	0	0	0	0	0	0	0	0	0
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2004	1	6	2	0	1	9	9	19	0	0	0	4
	9	3	1	2	1	0	0	0	0	0	0	0
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	6	11	2	0	1	1	2	1	0	0	0	1
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2004	1	6	2	0	1	10	10	25	0	0	0	1
	16	5	6	0	1	0	0	0	0	2	1	0
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	3	13	10	0	4	0	0	1	0	0	0	1
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	0	0	0	0	0	0	0	0	0	0		
2004	1	6	2	0	1	11	11	22	0	0	0	0
	6	4	3	6	3	0	0	0	0	1	0	0
	0	1	0	1	0	0	0	0	0	0	0	0
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	0	4	5	2	4	3	1	2	1	0	0	0
	0	1	0	0	0	0	0	0	0	1	1	1
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	0	0	0	0	0	0	0	0	0	0	0	0
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2004	1	6	2	0	1	12	12	15	0	0	0	0
	1	2	3	6	2	1	2	0	1	0	0	0
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	0	0	1	1	0	3	1	1	0	0	0	0
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2004	1	6	2	0	1	13	13	8	0	0	0	0
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2004	1	6	2	0	1	14	14	10	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0		
2004	1	6	2	0	1	15	15	2	0	0	0	0
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2004	1	6	2	0	1	16	16	2	0	0	0	0
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2005	1	6	2	0	1	4	4	6	3	0	0	0
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2005	1	6	2	0	1	5	5	3	0	5	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
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2005	1	6	2	0	1	6	6	14	0	10	4	0
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2005	1	6	2	0	1	7	7	20	0	2	11	1
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2005	1	6	2	0	1	8	8	24	0	0	8	6
	4	1	0	0	1	0	0	0	0	0	0	0
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	7	3	6	1	1	0	0	1	1	0	0	0
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2005	1	6	2	0	1	9	9	22	0	0	0	13
	5	8	5	0	0	0	0	0	0	0	0	0
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	0	0	3	0	0	0	0	0	0	0	0	0
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2005	1	6	2	0	1	10	10	28	0	0	0	2
	10	13	2	1	1	0	3	1	0	0	0	0
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	1	7	9	5	0	1	1	2	2	2	0	0
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2005	1	6	2	0	1	11	11	25	0	0	0	0
	1	5	10	0	1	2	0	2	1	0	2	0
	1	0	1	0	0	0	0	0	0	0	0	0
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2005	1	6	2	0	1	12	12	21	0	0	0	0
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	0	0	0	2	1	0	2	2	1	0	3	0
	1	1	0	0	0	0	3	1	0	1	0	0
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	0	0	0	1	0	1	0	0	0	0	1	0
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2005	1	6	2	0	1	13	13	12	0	0	0	0
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2005	1	6	2	0	1	14	14	7	0	0	0	0
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2005	1	6	2	0	1	15	15	3	0	0	0	0
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2005	1	6	2	0	1	16	16	2	0	0	0	0
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2005	1	6	2	0	1	17	17	1	0	0	0	0
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2005	1	6	2	0	1	18	18	1	0	0	0	0
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2006	1	6	2	0	1	5	5	6	2	1	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	6	6	8	0	9	1	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	7	7	13	0	1	12	3
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	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	4
	8	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	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	8	8	16	0	0	2	8
	1	1	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	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	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
	5	3	1	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	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	9	9	21	0	0	2	16
	8	3	2	1	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
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	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
	6	5	5	4	1	1	1	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	10	10	25	0	0	1	2
	7	5	9	4	0	2	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	0	0
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	1	7	4	9	4	1	1	2	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
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	11	11	32	0	0	0	0
	1	6	10	7	1	1	2	0	1	0	1	0
	0	0	0	0	1	0	0	0	0	0	0	0
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	0	1	9	6	7	1	2	1	2	2	2	1
	0	1	0	2	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	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	12	12	21	0	0	0	0
	0	2	11	5	3	1	0	0	0	0	0	0
	1	0	0	0	1	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	0	0	0	0	0	0	0	0
	0	1	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	3	0	0	0	0	1
	0	0	0	1	0	1	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	1	0	0	0	0	1	0		
2006	1	6	2	0	1	13	13	17	0	0	0	0
	0	0	2	0	1	1	2	3	0	0	1	0
	0	0	0	2	0	0	0	0	0	0	1	0
	0	0	1	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	1	0	0	0	1	0	0
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	0	0	0	0	0	1	0	1	0	0	2	0
	1	0	1	1	0	2	1	1	1	1	0	0
	0	0	0	0	0	0	1	0	0	1	1	0
	1	0	0	0	0	0	2	0	0	0	0	1
	0	1	0	0	0	0	0	2	0	0	1	0
	0	0	0	1	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	14	14	6	0	0	0	0
	0	0	0	0	0	0	0	1	0	0	0	1
	0	0	0	0	1	0	0	0	0	0	1	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
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	0	0	0	0	0	0	0	0	0	0	1	0
	1	0	0	0	0	0	1	0	0	1	0	0
	0	0	0	0	0	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	1	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		
2006	1	6	2	0	1	15	15	7	0	0	0	0
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	0	0	1	0	1	0	0	1	1	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	1	1	0	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2006	1	6	2	0	1	16	16	2	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
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	0	0	0	0	0	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	1	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	4	4	1	3	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	2	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	5	5	1	1	3	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	6	6	9	0	5	2	1
	1	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	8	1
	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	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	7	7	10	0	7	3	4
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0

	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	7	2
	2	2	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	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	8	8	12	0	0	2	1
	4	1	1	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	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	4
	5	3	1	3	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	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	9	9	17	0	0	2	3
	6	5	2	2	4	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
	0	0	0	0	0	0	0	0	0	0	0	0
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	3	4	4	1	6	1	0	0	0	0	0	0
	0	1	0	0	0	0	0	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	10	10	30	0	0	0	0
	6	7	4	2	1	0	0	0	2	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
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	7	11	6	6	2	0	0	0	0	0	1
	1	0	2	0	0	0	0	0	1	0	1	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	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		

2007	1	6	2	0	1	11	11	44	0	0	0	0
	0	11	6	6	4	0	0	3	0	2	1	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
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	2	7	12	7	11	1	0	4	1	4	0
	0	0	1	0	0	0	0	1	1	0	0	0
	0	0	0	0	1	0	0	1	0	0	0	1
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	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	12	12	28	0	0	0	0
	0	2	8	4	7	2	0	0	1	0	0	1
	0	0	1	0	1	1	0	0	0	0	0	0
	0	0	1	0	0	0	0	0	0	0	1	0
	0	0	0	0	0	0	0	0	0	0	0	0
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	0	0	1	3	3	9	4	1	3	3	3	1
	0	0	0	1	1	1	1	0	0	0	1	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	1	0	0	0	0	0
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	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	13	13	18	0	0	0	0
	0	0	1	3	1	0	3	2	0	3	0	1
	0	2	0	0	0	0	0	0	0	1	0	0
	1	0	0	0	1	0	1	0	0	1	0	1
	1	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	0	0	0	0	0	0	0	0	0	0
	0	0	0	1	0	0	0	0	0	1	2	2
	0	1	1	2	0	0	0	1	1	2	2	0
	0	1	1	0	0	0	0	0	1	0	0	0
	0	0	0	1	0	0	0	0	0	0	0	0
	0	1	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		
2007	1	6	2	0	1	14	14	5	0	0	0	0
	0	0	0	0	0	0	0	0	1	1	0	0
	1	0	0	1	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	1	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	0	0	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	0	0	0
	0	0	0	2	1	0	0	0	0	1	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	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	15	15	6	0	0	0	0
	0	0	0	0	0	0	1	0	0	0	0	0
	0	0	0	0	2	0	1	0	0	0	1	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	0	0	0	0	0	0	0	0	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	0	0	0	1	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
	1	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	6	2	0	1	17	17	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	1
	0	0	1	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	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	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	0	0	0	0		
2008	1	6	2	0	1	4	4	3	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	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	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	5	5	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	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	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	4	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	6	6	18	0	19	2	1
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	21	6
	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	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	7	7	10	0	1	6	2
	3	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	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	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
	3	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	8	8	11	0	0	8	2
	2	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	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	7
	1	2	2	1	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	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	9	9	15	0	0	1	3
	8	2	2	1	0	2	1	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	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	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	4	4	3	0	2	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	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	10	10	26	0	0	0	1
	7	0	3	4	3	1	0	0	0	1	0	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	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	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	4	5	5	14	3	0	0	1	1	1
	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
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	11	11	27	0	0	0	0
	0	5	4	3	2	6	1	0	1	1	0	0
	0	0	1	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
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	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	3	4	7	0	3	3	1	1
	1	1	1	0	1	2	1	0	1	3	1	0
	0	1	0	0	1	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	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	12	12	23	0	0	0	0
	0	1	1	6	7	8	0	1	2	1	1	1
	0	0	3	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	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	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	7	0	2	0	1	3
	2	1	1	1	0	0	0	0	0	1	1	0
	0	1	0	0	0	1	0	1	1	0	1	1
	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	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	13	13	12	0	0	0	0
	0	0	0	0	1	1	0	1	3	2	0	2
	2	1	0	0	1	1	0	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	2	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	0	0	0	0	0
	0	0	0	0	0	2	1	0	0	0	0	1
	1	0	1	0	1	0	0	0	0	1	1	0
	0	1	0	1	0	0	1	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	2	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	14	14	8	0	0	0	0
	0	0	0	0	0	0	0	0	0	1	0	1
	0	0	0	0	0	0	0	0	1	0	0	0
	0	0	0	0	0	1	0	0	0	0	0	1
	0	0	0	0	0	0	0	0	0	0	1	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	0
	0	0	0	0	0	0	0	0	0	0	0	0
	2	1	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	1	1	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		
2008	1	6	2	0	1	15	15	3	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	1	0	0	0	0	0	0	1	0	0	2	2
	0	0	1	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	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	1
	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	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		
2008	1	6	2	0	1	16	16	3	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
	1	1	0	0	0	0	0	0	0	0	1	0
	0	0	0	0	1	0	1	0	0	1	0	0
	0	1	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	0	0	0	0	0	0	0	0	0	0	0

	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	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	2	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2008	1	6	2	0	1	18	18	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
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	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	0	0	0	0		

0 #_N_MeanSize-at-Age_obs
#Yr Seas Flt/Svy Gender Part Ageerr Ignore datavector(female-male)
samplesize(female-male)
0 #_N_environ_variables
0 #_N_environ_obs
0 # N sizefreq methods to read
#Sizefreq N bins per method
#Sizetfreq units(bio/num) per method
#Sizefreq scale(kg/lbs/cm/inches) per method
#Sizefreq mincomp per method
#Sizefreq N obs per method
#_Sizefreq bins
#_Year season Fleet Partition Gender SampleSize <data>
0 # no tag data
0 # no morphcomp data
999
ENDDATA

Stock Synthesis control file

#C Splitnose model_One_Trawl
#_data_and_control_files: splitnose_simple.dat // splitnose_simple.ctl
1 #_N_Growth_Patterns
1 #_N_Morphs_Within_GrowthPattern

1 #_Nblock_Patterns
1 #_Blocks_per_pattern
1992 2008

0.5 #_fracfemale
0 #_natM_type:_0=1Parm; 1=N_breakpoints;_2=Lorenzen;_3=agespecific;_4=agespec_withseasinterpolate
1 # GrowthModel: 1=vonBert with L1&L2; 2=Richards with L1&L2; 3=not implemented; 4=not implemented
1.66 #_Growth_Amin_Age_for_L1
999 #_Growth_Amax_Age_for_L2 (999 to use as Linf)
0 #_SD_add_to_LAA (set to 0.1 for SS2 V1.x compatibility)
0 #_CV_Growth_Pattern: 0 CV=f(LAA); 1 CV=F(A); 2 SD=F(LAA); 3 SD=F(A)
1 #_maturity_option: 1=length logistic; 2=age logistic; 3=read age-maturity matrix by growth_pattern; 4=read age-fecundity
#_placeholder for empirical age-maturity by growth pattern
4 #_First_Mature_Age
1 #_fecundity option:(1)eggs=Wt*(a+b*Wt);(2)eggs=a*L^b;(3)eggs=a*Wt^b
1 #_parameter_offset_approach (1=none, 2= M, G, CV_G as offset from female-GP1, 3=like SS2 V1.x)
1 #_env/block/dev_adjust_method (1=standard; 2=with logistic trans to keep within base parm bounds)

#_growth_parms

#_LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-var	use_dev	dev_minyr	dev_maxyr	dev_stddev	Block	Block_Fxn	
0.01	0.1	0.048	0.048	-1	0.02	-5	0	0	0	0	0.5	0	0	#NatM_p_1_Fem_GP:1
2	40	14	14	-1	0.02	3	0	0	0	0	0.5	0	0	#L_at_Amin_Fem_GP_1
2	60	30	30	-1	0.02	3	0	0	0	0	0.5	0	0	#L_at_Amax_Fem_GP_1
0.05	0.3	0.14	0.14	-1	0.02	3	0	0	0	0	0.5	0	0	#VonBert_K_Fem_GP_1
0.05	0.3	0.13	0.13	-1	0.02	4	0	0	0	0	0.5	0	0	#CV_young_Fem_GP_1
0.05	0.3	0.2	0	-1	0.02	4	0	0	0	0	0.5	0	0	#CV_old_Fem_GP_1
0.01	0.1	0.048	0.048	-1	0.02	-5	0	0	0	0	0.5	0	0	#NatM_p_1_Mal_GP:1
-3	3	0	0	-1	0.02	-3	0	0	0	0	0.5	0	0	#L_at_Amin_Mal_GP_1
2	60	27	27	-1	0.02	3	0	0	0	0	0.5	0	0	#L_at_Amax_Mal_GP_1
0.05	0.3	0.16	0.16	-1	0.02	3	0	0	0	0	0.5	0	0	#VonBert_K_Mal_GP_1
0.05	0.3	0.13	0.13	-1	0.02	4	0	0	0	0	0.5	0	0	#CV_young_Mal_GP_1
0.05	0.3	0.2	0.2	-1	0.02	4	0	0	0	0	0.5	0	0	#CV_old_Mal_GP_1
-3	3	0.00002	0.00002	-1	0.02	-3	0	0	0	0	0.5	0	0	#Wtlen_1_Fem
2	4	3.0139	3.0139	-1	0.02	-3	0	0	0	0	0.5	0	0	#Wtlen_2_Fem
15	30	21.84	21.84	-1	0.02	-3	0	0	0	0	0.5	0	0	#Mat50%_Fem
-5	3	-0.5683	-0.5683	-1	0.02	-3	0	0	0	0	0.5	0	0	#Mat_slope_Fem
-3	300000	237500	1	-1	0.02	-3	0	0	0	0	0.5	0	0	#Eg/gm_inter_Fem
-3	3000000	74300	0	-1	0.02	-3	0	0	0	0	0.5	0	0	#Eg/gm_slope_wt_Fem
-3	3	0.00002	0.00002	-1	0.02	-3	0	0	0	0	0.5	0	0	#Wtlen_1_Mal
-3	3	2.9684	2.9684	-1	0.02	-3	0	0	0	0	0.5	0	0	#Wtlen_2_Mal
-4	4	0	0	-1	0.02	-4	0	0	0	0	0.5	0	0	#RecrDist_GP_1
-4	4	0	0	-1	0.02	-4	0	0	0	0	0.5	0	0	#RecrDist_Area_1
-4	4	0	0	-1	0.02	-4	0	0	0	0	0.5	0	0	#RecrDist_Seas_1
1	1	1	1	-1	0.02	-4	0	0	0	0	0.5	0	0	#CohortGrowDev

#_seasonal_effects_on_biology_parms

0 0 0 0 0 0 0 0 0 0 #_Fwtlen1, Fwtlen2, mat1, mat2, fec1, fec2, Mwtlen1, Mwtlen2, L1, K

```
3       #_SR_function
#_LO    HI      INIT    PRIOR   PR_typeSD       PHASE
3       15      7       7       -1      0.02     1      #SR_R0
0.2     1       0.58    0.58     0      0.181   -2      #SR_steep
0.1     1.5     1       1        1      0.02    -3      #SR_sigmaR
0       0       0       0       -1      0.02    -3      #SR_envlink
-2      2       0       0       -1      0.02    -1      #SR_R1_offset
0       0       0       0       -1      0.02    -99     #SR_autocorr
0 #_SR_env_link
0 #_SR_env_target_0=none;1=devs;_2=R0;_3=steepness
1 #do_recdev:  0=none; 1=devvector; 2=simple deviations
1960 # first year of main recr_devs; early devs can preceed this era
2006 # last year of main recr_devs; forecast devs start in following year
5 #_recdev phase1 # (0/1) to read 11 advanced options
0 #_recdev_early_start (0=none; neg value makes relative to recdev_start)
-4 #_recdev_early_phase
0 #_forecast_recruitment phase (incl. late recr) (0 value resets to maxphase+1)
1 #_lambda for prior_fore_recr occurring before endyr+1
1979 #_last_early_yr_nobias_adj_in_MPD
1980 #_first_yr_fullbias_adj_in_MPD
2002 #_last_yr_fullbias_adj_in_MPD
2003 #_first_recent_yr_nobias_adj_in_MPD
-15 #min rec_dev
15 #max rec_dev
0 #_read_recdevs
#_end of advanced SR options#Fishing Mortality info
0.2 # F ballpark for tuning early phases
2001 # F ballpark year (neg value to disable)
1 # F_Method:  1=Pope; 2=instan. F; 3=hybrid (hybrid is recommended)
0.9 # max F or harvest rate, depends on F_Method
#_initial_F_parms
#_LO    HI      INIT    PRIOR   PR_type SD      PHASE
0       1       0       0.01    0       0.2     -2      #InitF_FISHERY1_Domestic_Trawl
0       1       0       0.01    0       0.2     -2      #InitF_FISHERY2_Foreign_Trawl
0       1       0       0.01    0       0.2     -2      #InitF_FISHERY3_Non_Trawl
#_Q_setup
#       A=do    power,  B=env-var,      C=extra SD,     D=devtype(<0=mirror,    0/1=none,       2=cons, 3=rand, 4=randwalk);
#_A     B       C       D       E       F
0       0       0       0       1       0       #1Fishery_Domestic_Trawl
0       0       0       0       1       0       #2Fishery_Foreign_Trawl
```

```
0	0	0	0	1	0	#3Fishery_Non_Trawl
0	0	0	1	1	0	#4Survey_AFSC_triennial
0	0	0	1	1	0	#5Survey_AFSC_slope
0	0	0	1	1	0	#6Survey_NWFSC_shelf_slope
0	0	0	1	1	0	#7Survey_NWFSC_slope
#_size_selex_types
#_Pattern	Discard	Male	Special
	24	1	0	0	#	1	FISHERY_Domestic_Trawl
	5	0	0	1	#	2	FISHERY_Foreign_Trawl
	24	0	0	0	#	3	FISHERY_Non_Trawl
	24	0	0	0	#	4	SURVEY_AFSC_triennial
	24	0	0	0	#	5	SURVEY_AFSC_slope
	24	0	0	0	#	6	SURVEY_NWFSC_shelf_slope
	5	0	0	5	#	7	SURVEY_NWFSC_slope
#_age_selex_types
#_Pattern	Retention	Male	Special
	10	0	0	0	#	1	FISHERY_Domestic_Trawl
	10	0	0	0	#	2	FISHERY_Foreign_Trawl
	10	0	0	0	#	3	FISHERY_Non_Trawl
	10	0	0	0	#	4	SURVEY_AFSC_triennial
	10	0	0	0	#	5	SURVEY_AFSC_slope
	10	0	0	0	#	6	SURVEY_NWFSC_shelf_slope
	10	0	0	0	#	7	SURVEY_NWFSC_slope
#_selex_parms
#_LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-var	use_dev	dev_minyr	dev_maxyr	dev_stddev	Block	Block_Fxn
#_size_sel:1_Fishery_Domestic_Trawl
12	35	30	30	1	0.2	2	0	0	0	0	0.5	0	0	#PEAK
-6	4	-2	-4	1	0.2	-5	0	0	0	0	0.5	0	0	#TOP:_width
-1	9	3.2	3.2	1	0.2	3	0	0	0	0	0.5	0	0	#Asc_width
-1	9	4	4	1	0.2	-4	0	0	0	0	0.5	0	0	#Desc_width
-5	9	-5	-5	-1	0.2	-4	0	0	0	0	0.5	0	0	#INIT:select_1st_bin
-5	9	8	8	1	0.2	-2	0	0	0	0	0.5	0	0	#FINAL:select _last_bin
#_Retention_Fishery_1_Domestic_Trawl
12	35	25	25	1	0.2	4	0	0	0	0	0.5	0	0	#_Inflection_for_retention
0.5	7	1	1	1	0.2	4	0	0	0	0	0.5	0	0	#_Slope_for_retention
0	1	1	1	-1	0.2	4	0	0	0	0	0.5	0	0	#_Asymptotic_retention
0	1	0	0	-1	0.2	-4	0	0	0	0	0.5	0	0	#_Male_offset_to_inflection
#_size_sel:	2_Fishery_Foreign_Trawl
-2	60	0	0	-1	0.2	-4	0	0	0	0	0.5	0	0	#MinBin_#_in_Fishery_1
-2	60	0	0	-1	0.2	-4	0	0	0	0	0.5	0	0	#MaxBin_#_in_Fishery_1
```

#_size_sel:		3_Fishery_Non_Trawl												
12	55	30	30	1	0.2	2	0	0	0	0	0.5	1	2	#PEAK
-6	4	-2	-4	1	0.2	-5	0	0	0	0	0.5	1	2	#TOP:_width
-1	9	3.2	3.2	1	0.2	3	0	0	0	0	0.5	1	2	#Asc_width
-1	9	4	4	1	0.2	-4	0	0	0	0	0.5	1	2	#Desc_width
-5	9	-5	-5	-1	0.2	-4	0	0	0	0	0.5	0	0	#INIT:select_1st_bin
-5	9	8	1	1	0.2	-3	0	0	0	0	0.5	1	2	#FINAL: select _last_bin
#_size_sel:		4_AFSC_triennial												
12	35	14	14	1	0.2	2	0	0	0	0	0.5	0	0	#PEAK
-6	4	-1.5	-1.5	1	0.2	5	0	0	0	0	0.5	0	0	#TOP:_width
-1	9	2.6	2.6	1	0.2	3	0	0	0	0	0.5	0	0	#Asc_width
-1	9	4	4	1	0.2	4	0	0	0	0	0.5	0	0	#Desc_width
-5	9	-5	-5	-1	0.2	-4	0	0	0	0	0.5	0	0	#INIT:select_1st_bin
-5	9	1	1	1	0.2	2	0	0	0	0	0.5	0	0	#FINAL: select _last_bin
#_size_sel:		5_AFSC_slope												
12	35	14	14	1	0.2	2	0	0	0	0	0.5	0	0	#PEAK
-6	4	-1.5	-1.5	1	0.2	-5	0	0	0	0	0.5	0	0	#TOP:_width
-1	9	3.5	3.5	1	0.2	3	0	0	0	0	0.5	0	0	#Asc_width
-1	9	4	4	1	0.2	-4	0	0	0	0	0.5	0	0	#Desc_width
-5	9	-5	-5	-1	0.2	-4	0	0	0	0	0.5	0	0	# INIT:select_1st_bin
-5	9	8	8	1	0.2	-2	0	0	0	0	0.5	0	0	#FINAL: select _last_bin
#_size_sel:		6_NWFSC_shelf_slope												
12	35	18	18	1	0.2	2	0	0	0	0	0.5	0	0	#PEAK
-6	4	-2	-5	1	0.2	-5	0	0	0	0	0.5	0	0	#TOP:_width
-1	9	4.5	4.5	1	0.2	3	0	0	0	0	0.5	0	0	#Asc_width
-1	9	4	4	1	0.2	-4	0	0	0	0	0.5	0	0	#Desc_width
-5	9	-5	-5	-1	0.2	-4	0	0	0	0	0.5	0	0	# INIT:select_1st_bin
-5	9	8	8	1	0.2	-2	0	0	0	0	0.5	0	0	#FINAL: select _last_bin
#_size_sel:		7_NWFSC_slope												
-2	60	0	0	-1	0.2	-4	0	0	0	0	0.5	0	0	# MinBin_#_in__Survey_5
-2	60	0	0	-1	0.2	-4	0	0	0	0	0.5	0	0	# MaxBin_#_in_Survey_5

#_custom_sel-env_setup (0/1)
#_placeholder when no enviro fxns

1	#_Custom_block_setup							
	12	55	33	33	1	0.2	4	#PEAK
	-6	4	-4	-4	1	0.2	-4	#TOP:_width of plateau
	-1	9	3.2	3.2	1	0.2	4	#Asc_width
	-1	9	2.6	2.6	1	0.2	-4	#Desc_width
	-5	9	8	1	1	0.2	-4	#FINAL:select_last_bin

```
2 #separart_adj_method
# Tag loss and Tag reporting parameters go next
0 # TG_custom: 0=no read; 1=read if tags exist
#_Cond -6 6 1 1 2 0.01 -4 0 0 0 0 0 0 0 #_placeholder if no parameters
1 #_Variance_adjustments_to_input_values
# 1 2 3 4 5 6 7
0 0 0 0 0 0 0 #_add_to_survey_CV
0 0 0 0 0 0 0 #_add_to_discard_stddev
0 0 0 0 0 0 0 #_add_to_bodywt_CV
0.23448992 1 0.445904061 0.255107381 0.516962717 0.566707707 1 #_mult_by_lencomp_N
1 1 1 1 1 1.03678358 1 #_mult_by_agecomp_N
1 1 1 1 1 1 1 #_mult_by_size-at-age_N
300 #_DF_for_discard_like
300 #_DF_for_meanbodywt_like
1 #_maxlambdaphase
1 #_sd_offset

0 # number of changes to make to default Lambdas (default value is 1.0)
0 # (0/1) read specs for more stddev reporting
999
```

Appendix 4: Additional pre-STAR Panel sensitivity runs

Additional pre-STAR Panel sensitivity runs included:

- Estimation of recruitment deviations: Large recruits in the years 1940 and 2006 could possibly drive the population dynamics in very different ways than if recruitments in those years are assumed to come from the stock-recruit relationship. We explored runs that do not estimate those years (start 1950; end 2005) while including a third run that starts estimation of recruitment deviation in 1970, the years in which the standard deviation of recruitment deviations is minimized when all years are estimated.
- Retrospective analysis: Retrospective patterns are common features of assessments when years of data are removed. These sensitivity runs consider the populations dynamics when assessment data is taken out of the model, but still estimated to the terminal year of 2009. The last five years of data are considered in succession, followed by a final sensitivity taking the last 10 years of data out (effectively all of the NWFSC survey data).
- Trawl fishery conditional age-at-length data: Includes the biased and imprecise ageing data from the trawl survey for the years 1980, 1981 and 1983-1985.
- Tuned σ_R and N_{eff}: In additional to iteratively comparing the specified σ_R to the residual mean square error of the estimated recruitment deviation, the effective sample size (N_{eff}) for the length and age compositions were also modified iteratively to match mean specified N_{eff} to that of the model-derived mean N_{eff}. This approach attempts to balance the model inputs with outputs by changing the *a priori* data weighting rather than fixing the *a priori* data weights.
- Dome-shaped selectivity option: Currently, fishery and slope surveys are fixed asymptotically regarding the selectivity of older individuals. This sensitivity option allows dome-shaped selectivity by freeing up the selectivity of the last length bin.
- Domestic catch history: Pre-1981: Coast-wide estimates of historical catch before 1981 are considered most uncertain. These trials consider under- and overestimation of historical catch.
- Gender-separated conditional ages: The base cases prior to STAR Panel used a combined-sex formulation of conditional ages. This sensitivity looks at the influence of treating the sexes separately.
- Proportional egg-weight relationship: Dick (pers. comm.) estimated the species-specific egg to female weight relationship slope and intercept parameters for a variety of rockfishes, including *S. diploproa*, and found a significant linear relationship between eggs produced and female weight. Past assessments have generally assumed this relationship to have a slope 0 and intercept of 1, so we include this run to compare to the positive linear assumption of our base cases.

Generally, the sensitivity of model estimates to most of these changes was low. The one triennial survey treatment was notably sensitive to starting recruitment deviations in year 1970 (Table A4.1). This run decreased the scale of the spawning output, but increased the depletion value. Recruitment series post-1970 looked similar among all runs (Fig. A4.1). The 1940 recruitment bump in the base case seems not to have affected the general conclusions of splitnose population dynamics. Likewise, the retrospective analysis presented only minor deviations from the base case (Table A4.1, Fig. A4.2). Each of the base cases had one outlying retrospective pattern. For the 1 AFSC triennial survey time series base case, removal of data from 2004 onward (effectively removing the NWFSC shelf-slope survey) had a severe affect on the spawning output, dropping it below the target reference point of 40% (this is the only sensitivity to have done this). When removing all of the NWFSC survey data (data from 1999 onward), the retrospective pattern is again similar to the base case. For the base case treatment using two AFSC triennial survey time series, removing 10 years of data had the largest deviation in population trajectory. This dropped the scale of the initial spawning output, but maintained a similar ending spawning output, thus increasing the absolute value of depletion.

Inclusion of the 1980s conditional age-at-length data from the trawl fishery caused large differences from the base case, but in opposite directions between the two treatments of the AFSC triennial survey (Table A4.1). In both cases the scale of the initial spawning output was reduced, but ending spawning output when 2 triennial surveys was used continued to decrease. While exploring the differences in recruitment, adding the biased and imprecise data resulted in large recruitments in the 1920s not detected by the base model (Fig. A4.3). Given the large uncertainty in this age data, it is not apparent how this data may affect the model if the uncertainty was reduced. Establishing more accurate and precise ages for this data set should be a certain priority for future assessments.

Tuning the effective sample size (N_{eff}) of the length and age compositions along with the recruitment variability (σ_R) also produced notable results (Table A4.1). Although absolute depletion rates did not differ greatly from the base cases, important differences are seen in the absolute scale of spawning output (Fig. A4.4). In both base cases, the tuning of both recruitment variability and length and age data constrains the population dynamics, reducing the degree of the population fluctuations. The degree of recruitment variability was higher for the base case trials than the tuned models. Length and age data were also down-weighted in the tuned model (Fig. A4.5). These trials also generally drop the scale of the population spawning output. The base case treatment using 1 Triennial survey time series was most sensitive to this change because of its relatively higher estimate of spawning output.

In the base model, slope survey selectivity curves are assumed to be asymptotic. When we allowed the model to estimate selectivity, it did so as dome-shaped curve. However this generated very unrealistic values for spawning output, which were an order of magnitude larger than for the asymptotic base case model. Such levels of spawning output seem highly unlikely given what we know regarding the size of other west coast groundfish populations.

The remaining four sensitivity trials showed little change from the base cases, though the treatment using 2 AFSC triennial survey time series was most sensitive the assumption of a non-proportional egg-weight relationship.

The sensitivity to the assumed base case values of natural mortality (*M*) and recruitment compensation (steepness or *h*) were explored as likelihood profiles. Both of these parameters were inestimable in the base cases, but often prove important considerations for model uncertainty. In both base case treatments of the AFSC triennial survey, the data argue for values of both M and h near those used in each base case (Fig. A4.6). Both base case treatments also show more sensitivity in the spawning output and depletion estimates to M than to h (Figs. A4.7-A4.8). Depletion is the least sensitive of these derived values, whereas the scale of the initial spawning output was most sensitive. All derived parameter values from the likelihood profiles were within the range of derived values seen in the other sensitivity trials.

Table A4.1. Additional pre-STAR Panel sensitivity runs for each of the two base cases when the triennial survey is treated as either a) one or b) two time-series. Spawning output (SB) is reported in millions of eggs. *When the egg-weight relationship is assumed proportional, the spawning output is given in metric tons.

a) One triennial survey time-series				
	SB_{1900}	SB_{2009}	Depletion	-LogLikelihood
Base case	11957	7001	58.56%	4349.03
Recruitment estimation				
start:1950	10004	5725	57.23%	4335.89
start:1970	8569	6027	70.33%	4399.82
end:2005	11684	7372	63.10%	4424.34
Retrospective analysis				
no 2008	12838	6948	54.12%	3868.61
no 2007-2008	13090	7437	56.81%	3401.76
no 2006-2008	11054	5749	52.01%	2973.12
no 2005-2008	10668	5413	50.74%	2510.28
no 2004-2008	9692	3437	35.46%	2174.22
no 1999-2008	12540	6943	55.37%	1345.16
Trawl fishery conditional age at length data	7570	6440	85.07%	6445.86
Tuned σ_R and N_{eff}	9113	4802	52.70%	2220.47
Dome-shaped selectivity option	23943	15664	65.42%	4045.98
Domestic catch history: Pre-1981				
Double catches	14049	7384	52.56%	4422.9
Half catches	11418	7010	61.39%	4352.07
Gender-separated conditional ages	12384	6865	55.43%	3931.53
Proportional egg-weight relationship*	42778	25723	60.13%	4348.89

Table A4.1. (continued). Additional pre-STAR Panel sensitivity runs for each of the two base cases when the triennial survey is treated as either a) one or b) two time-series. Spawning output (SB) is reported in millions of eggs. *When the egg-weight relationship is assumed proportional, the spawning output is given in metric tons.

b) Two triennial survey time-series		SB_{1900}	SB_{2009}	Depletion	-LogLikelihood
Base case		9868	5145	52.14%	4203.26
Recruitment estimation					
	start:1950	8384	3995	47.66%	4291.93
	start:1970	8127	4659	57.33%	4242.56
	end:2005	9066	4218	46.52%	4280.21
Retrospective analysis					
	no 2008	10359	5300	51.17%	3750.5
	no 2007-2008	8372	4481	53.52%	3387.02
	no 2006-2008	9090	4786	52.65%	2962.91
	no 2005-2008	9310	5085	54.62%	2392
	no 2004-2008	9036	4434	49.07%	1980.26
	no 1999-2008	6565	4708	71.72%	1303.61
Trawl fishery conditional age at length data		7648	2296	30.02%	8436.87
Tuned σ_R and N_{eff}		8545	4297	50.28%	2604.67
Dome-shaped selectivity option		20287	12221	60.24%	3912.38
Domestic catch history: Pre-1981					
	Double catches	11248	5353	47.59%	4196.91
	Half catches	9252	5105	55.18%	4207.33
Gender-separated conditional ages		9980	5385	53.96%	3808.69
Proportional egg-weight relationship*		34219	15223	44.49%	4282.92

.

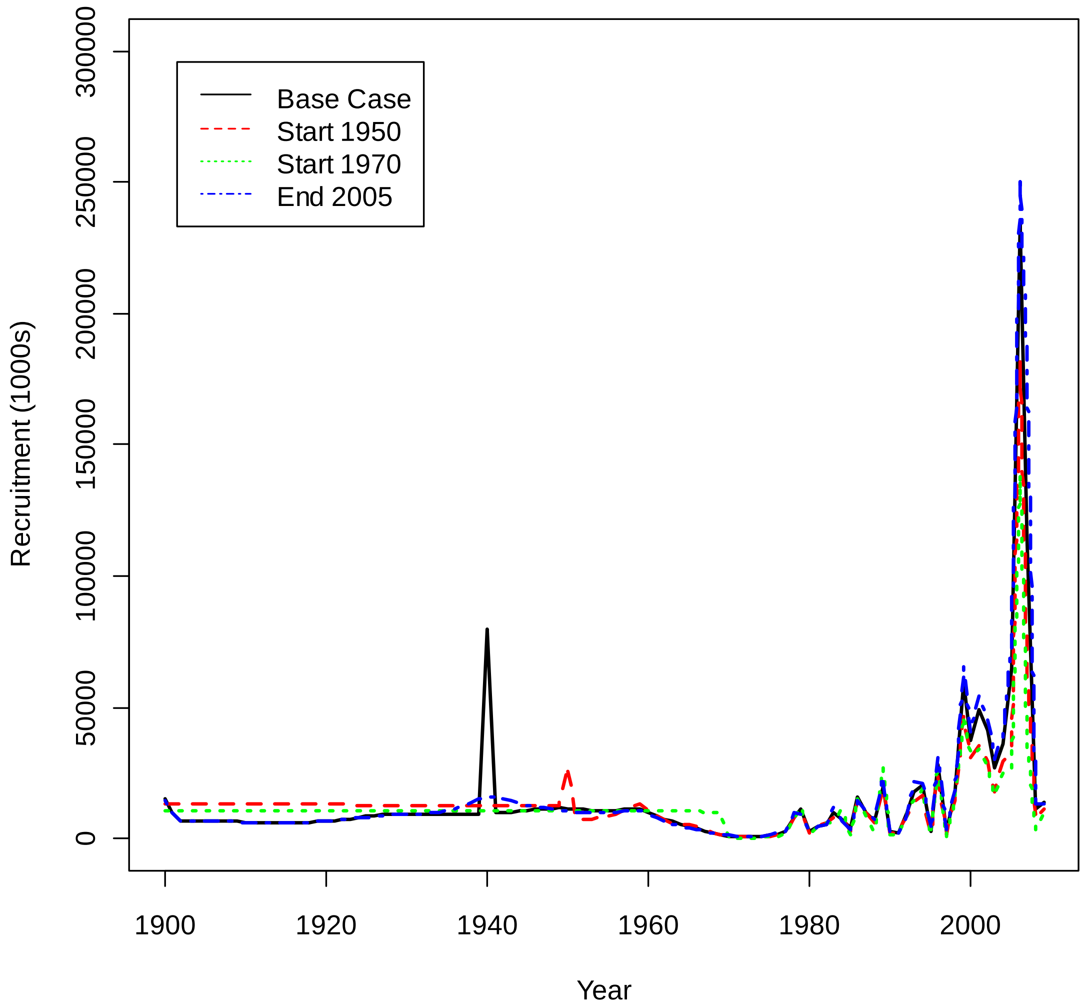
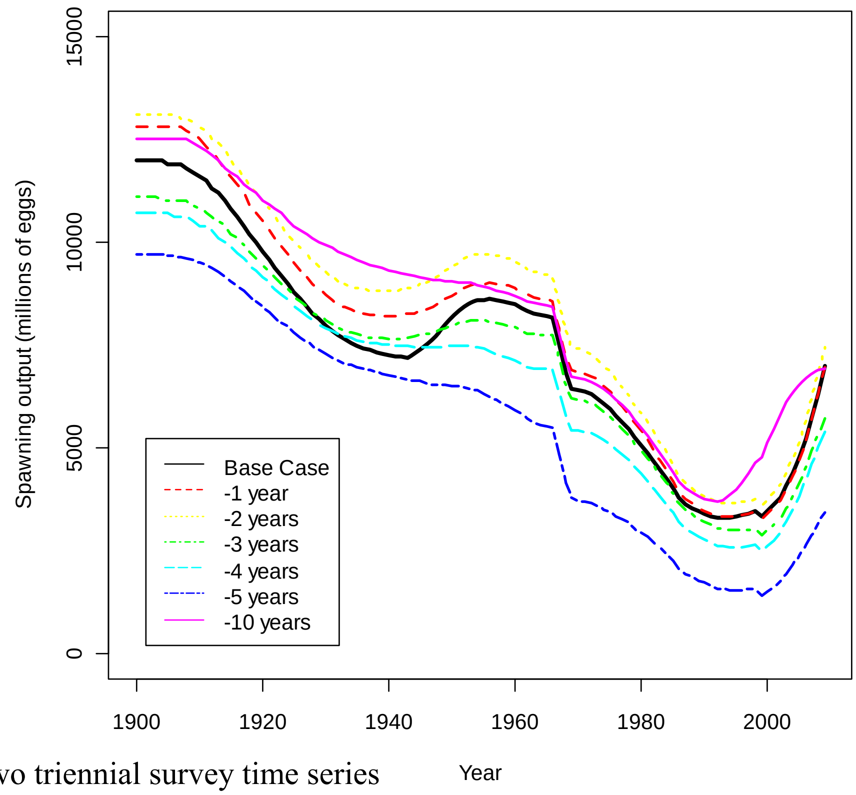


Figure A4.1. Pre-STAR Panel sensitivity analysis: Recruitment time series for the pre-STAR Panel base case and three sensitivity runs (see text for details).

A) One triennial survey time series



B) Two triennial survey time series

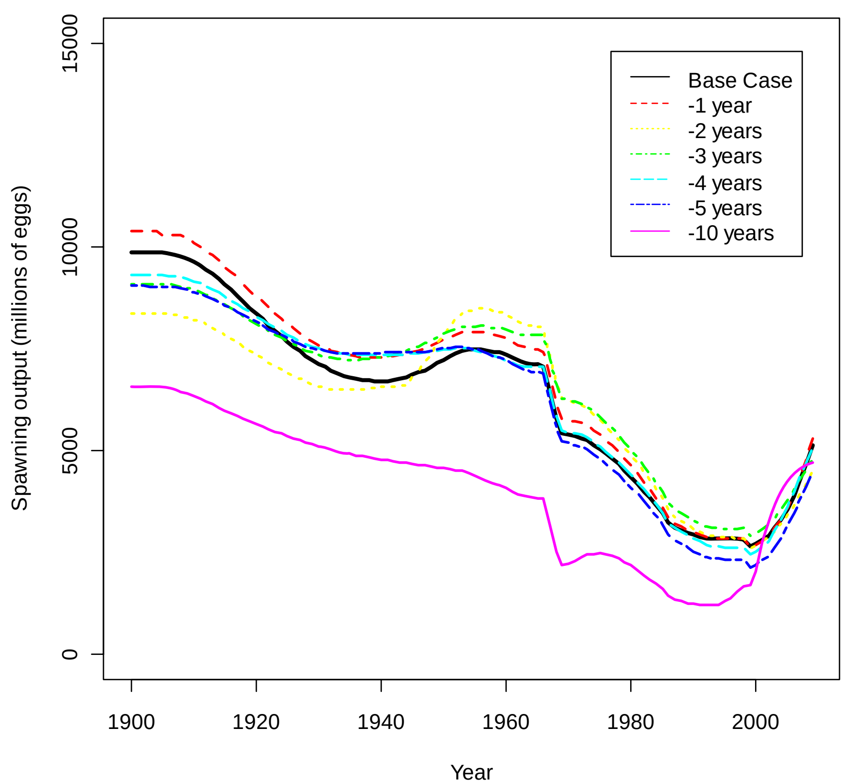
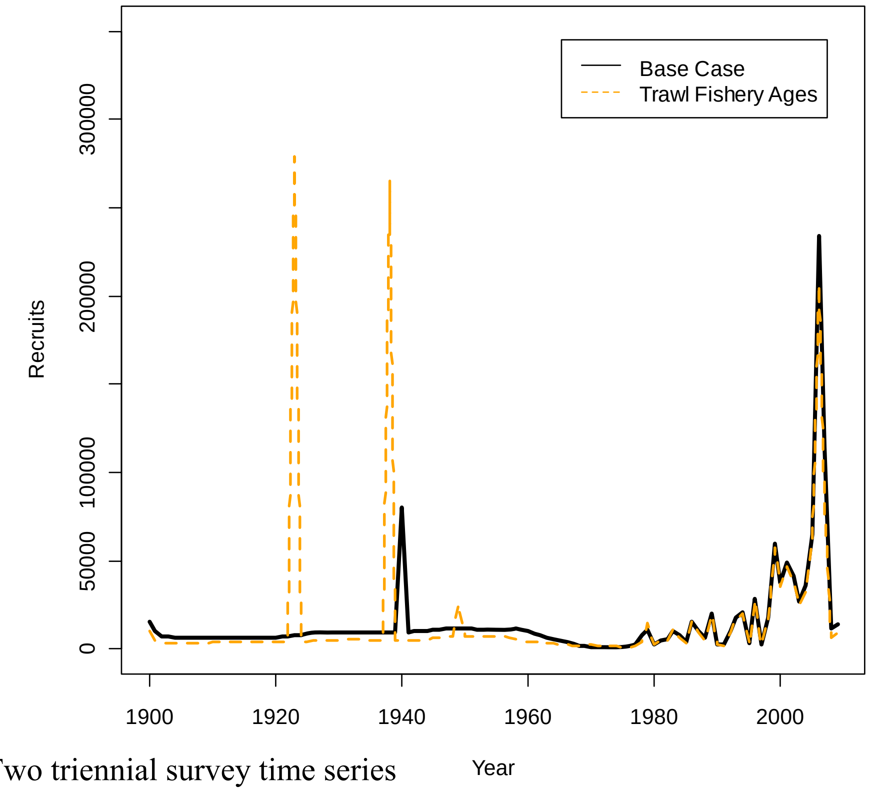


Figure A4.2. Pre-STAR Panel sensitivity analysis: Retrospective analysis for each pre-STAR Panel base case when treating the AFSC triennial survey as A) one survey and B) two survey time series. Minus years are taken starting from year 2008.

A) One triennial survey time series



B) Two triennial survey time series

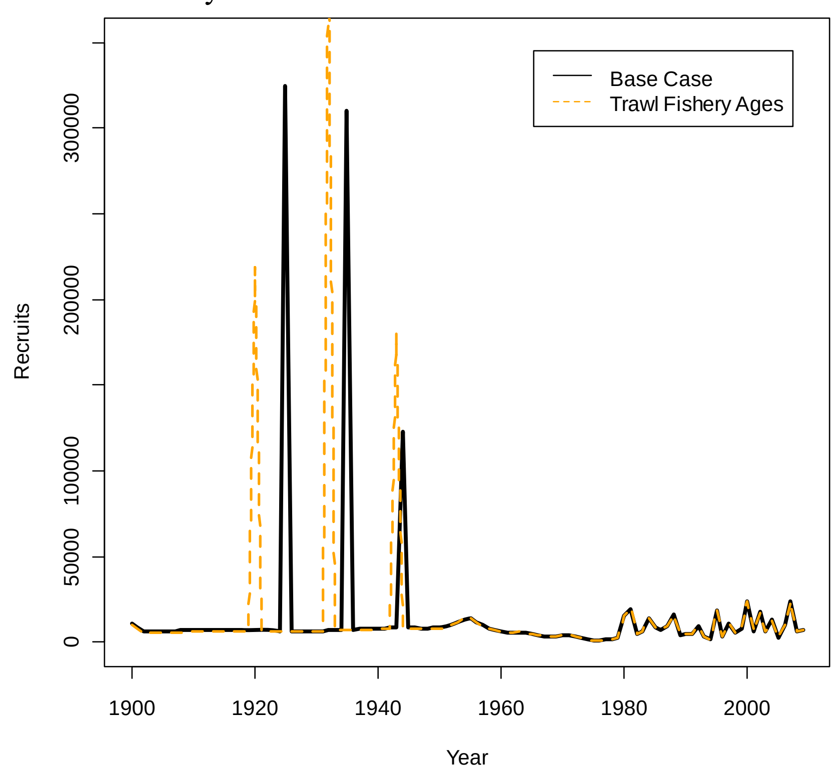
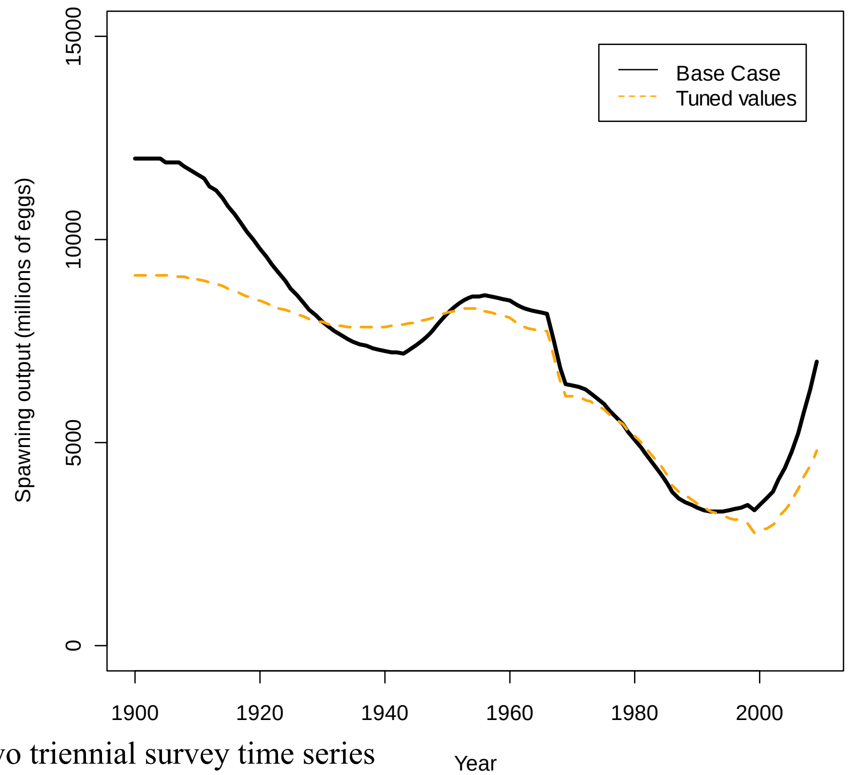


Figure A4.3. Pre-STAR Panel sensitivity analysis: Recruitment patterns for the inclusion of the biased and imprecise trawl fishery conditional age at length data compared to the pre-STAR Panel base case for the two treatments of the AFSC triennial survey time series.

A) One triennial survey time series



B) Two triennial survey time series

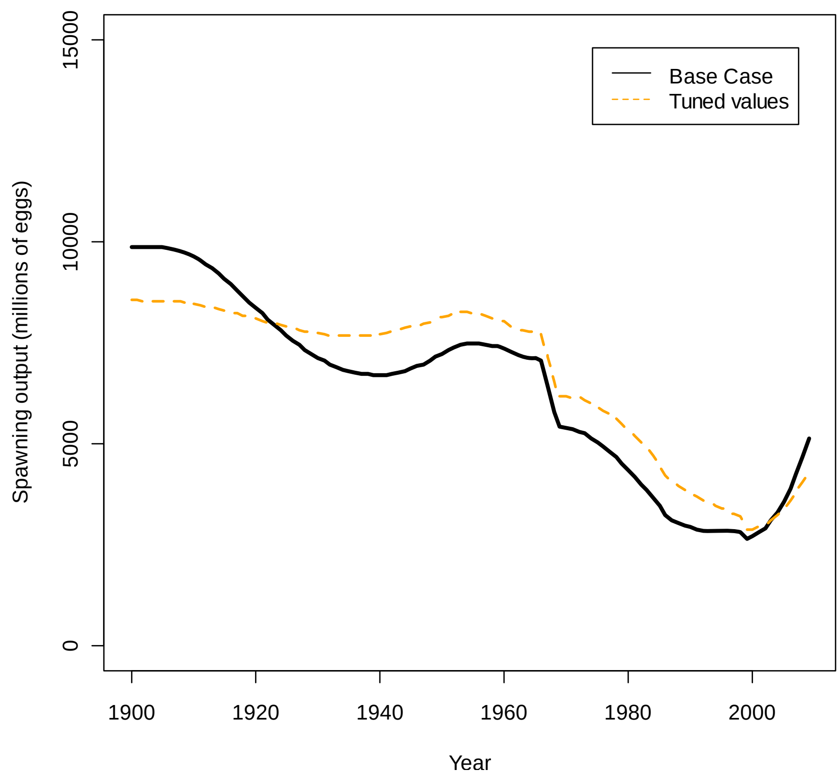
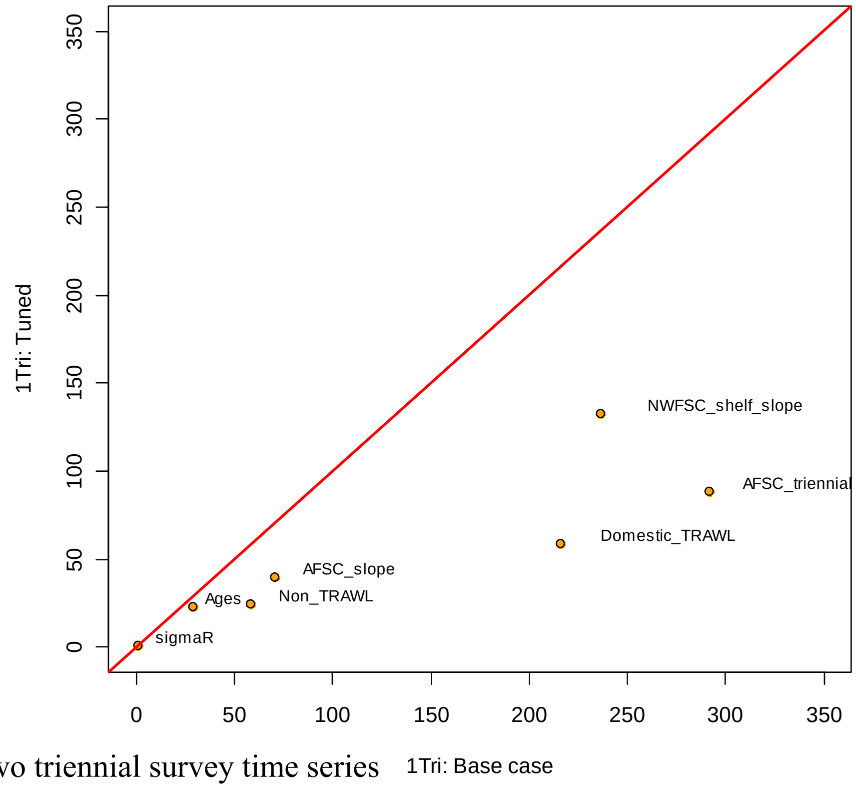


Figure A4.4. Pre-STAR Panel sensitivity analysis: Spawning output trajectory for the pre-STAR Panel base case and sensitivity trial that tuned the values of σ_R and length/age composition mean N_{eff} for each of the two AFSC triennial trawl survey treatments.

A) One triennial survey time series



B) Two triennial survey time series

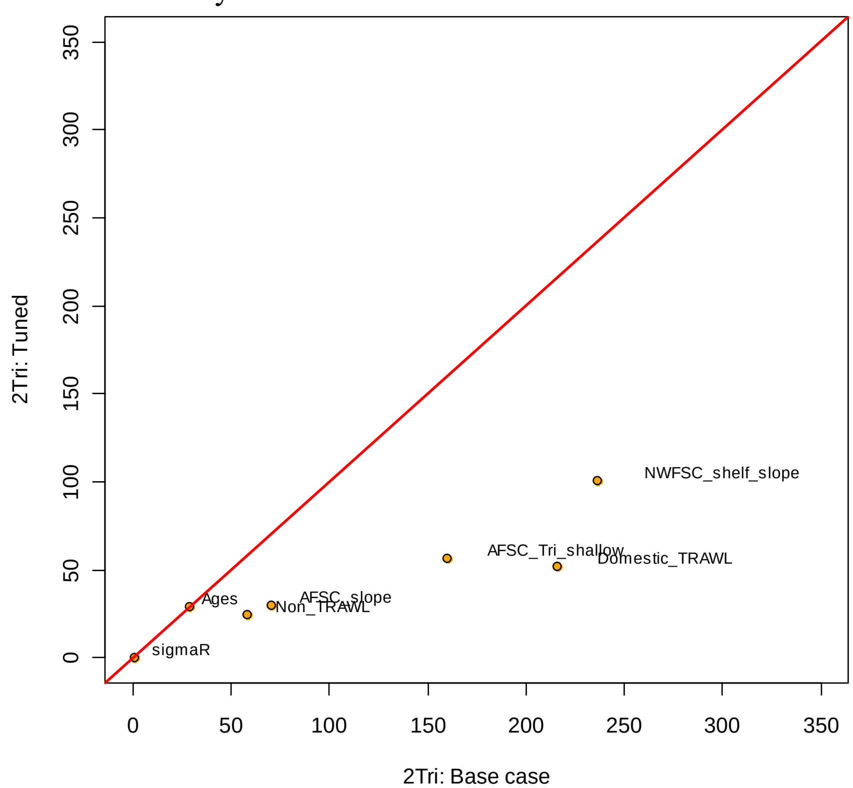


Figure A4.5. Pre-STAR Panel analysis: Comparison of mean effective sample sizes for the length and age compositions for each fleet and survey and recruitment variance (σ_R) between the pre-STAR Panel base case before and after tuning for each treatment of the AFSC Triennial survey.

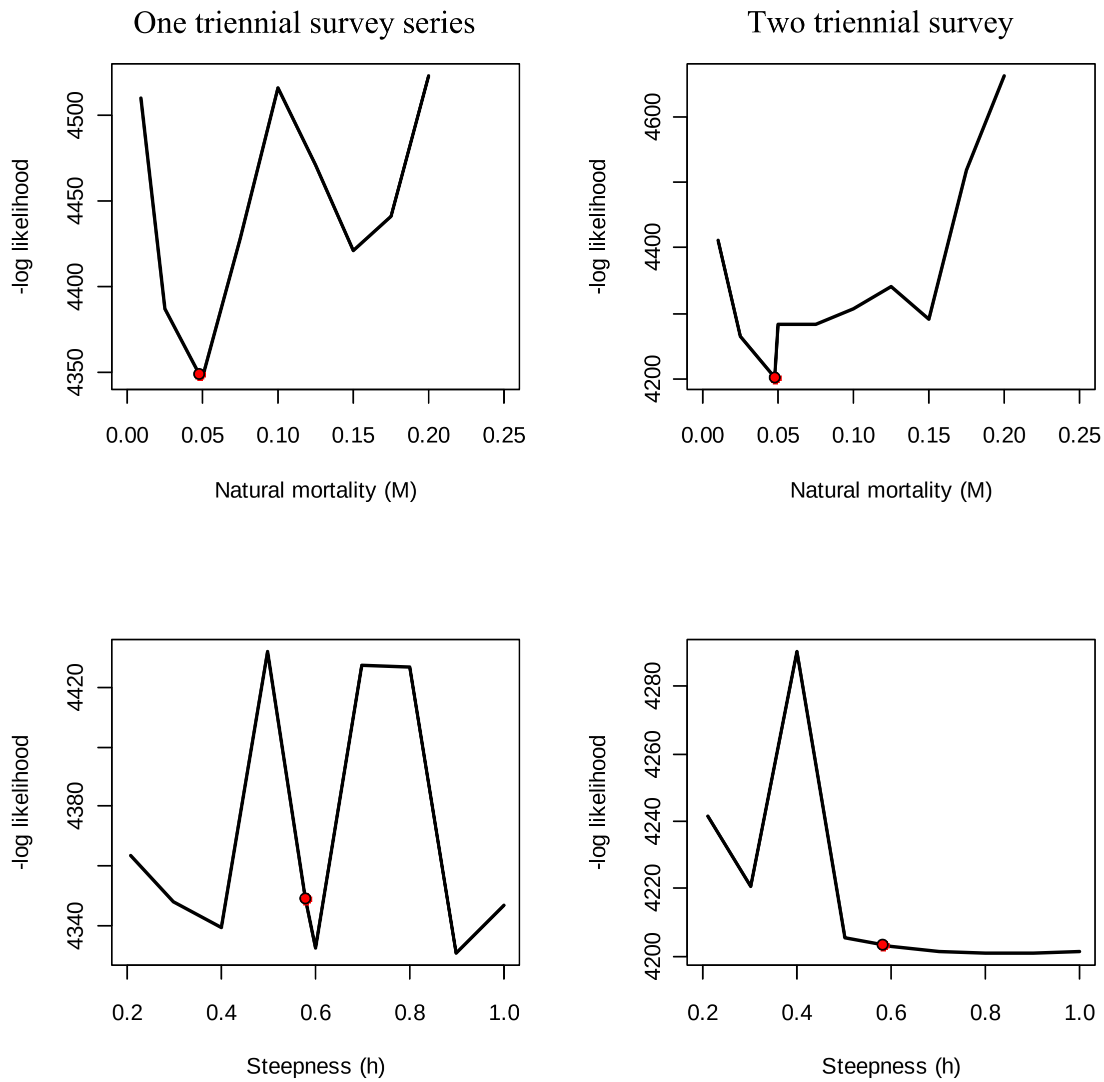


Figure A4.6. Pre-STAR Panel analysis: Likelihood profiles for natural mortality (top panels) and steepness (bottom panels) for each of the pre-STAR Panel base cases when one triennial survey time series is used (left panels) or when two triennial survey time series are used (right panels).

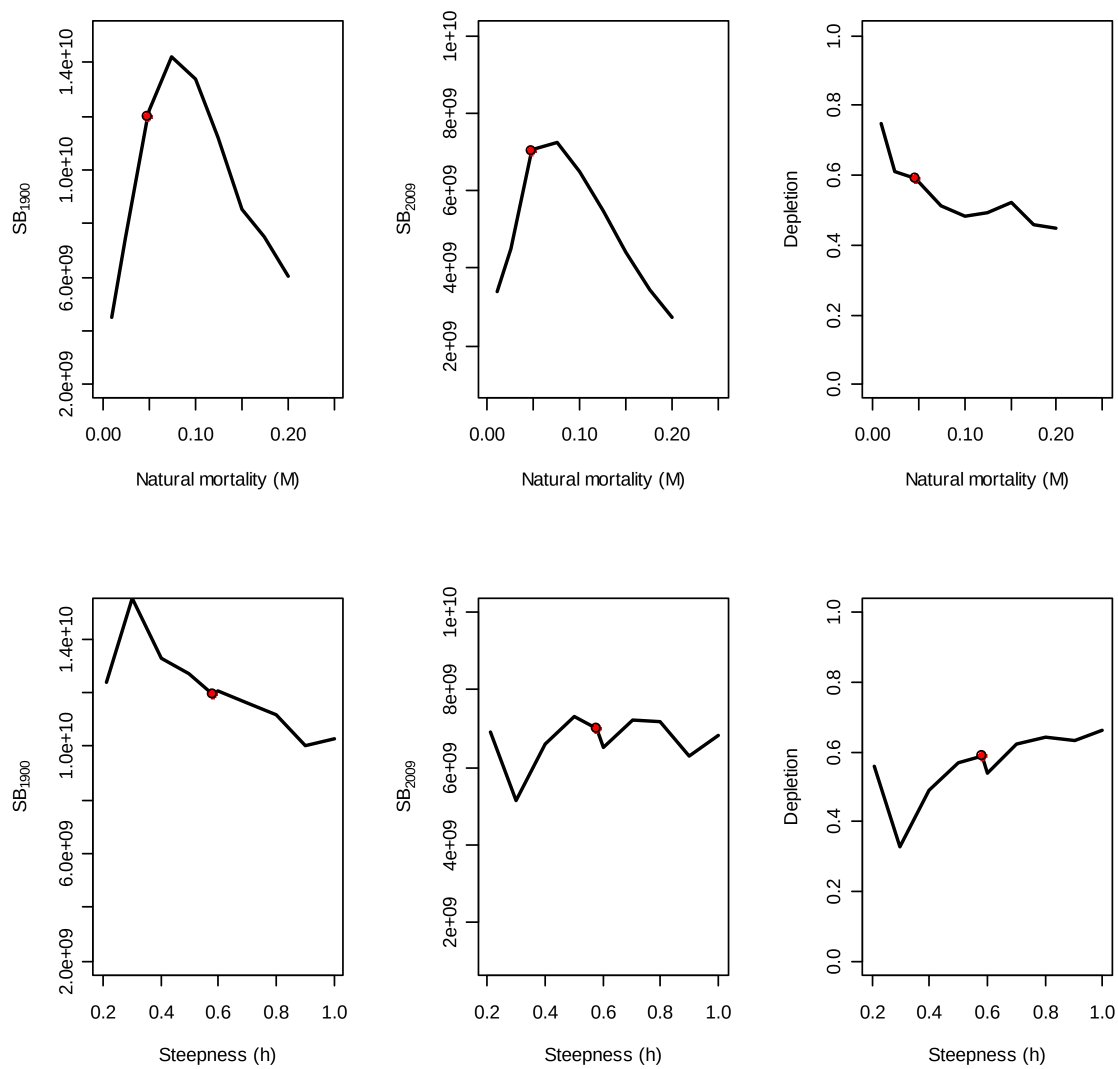


Figure A4.7. Pre-STAR Panel analysis: Values for initial spawning biomass (SB_{1900}; left panels), ending spawning output (SB_{2009}; center panels) and depletion (right panels) for the natural mortality (top panels) and recruitment compensation (steepness; bottom panels) likelihood profiles when the AFSC triennial survey is treated as one time series. The pre-STAR Panel base case values are indicated by the red point.

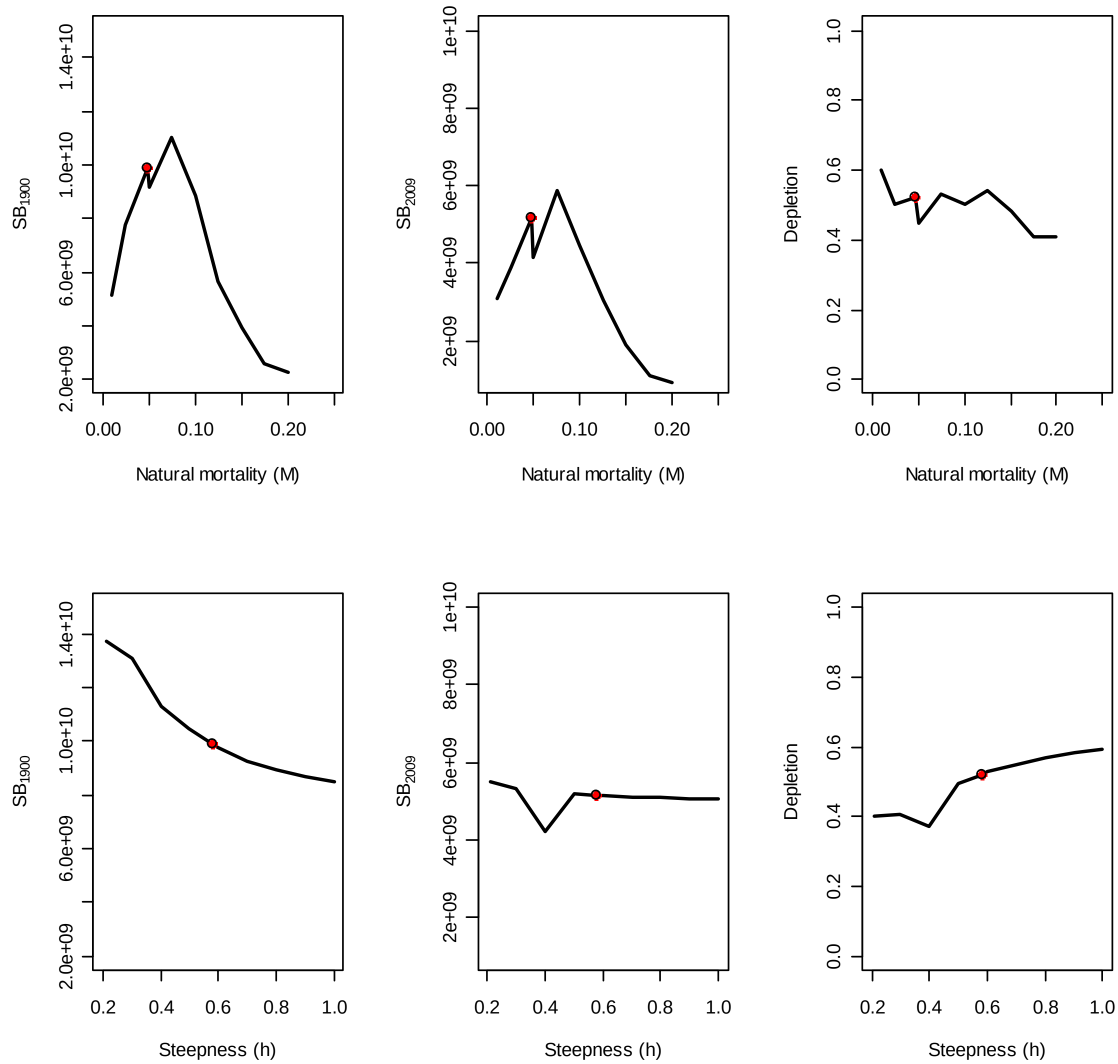


Figure A4.8. Pre-STAR Panel analysis: Values for initial spawning biomass (SB_{1900}; left panels), ending spawning output (SB_{2009}; center panels) and depletion (right panels) for the natural mortality (top panels) and recruitment compensation (steepness; bottom panels) likelihood profiles when the AFSC triennial survey is treated as two time series. The pre-STAR Panel base case values are indicated by the red point.