Status of China rockfish off the U.S. Pacific Coast in 2015

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This assessment reports the status of the China rockfish (*Sebastes nebulosus*) resource in U.S. waters off the coast of the California, Oregon, and Washington using data through 2014. China rockfish are modelled with three independent stock assessments to account for spatial variation in exploitation history as well as regional differences in growth and size composition of the catch. The northern area model is defined as Washington state Marine Catch Areas (MCAs) 1-4. The central area model spans from the Oregon-Washington border to 40°10′ N. latitude. The southern area model spans 40°10′ N. latitude to the U.S.-Mexico border. However, very little catch of China rockfish occurs south of Point Conception, California (34°27′ N. latitude).

Catches

China rockfish are most often caught by hook-and-line (both recreational and commercial fisheries) as well as by traps in the commercial live-fish fishery. Although China rockfish were not a major target species, the commercial rockfish fishery along the U.S. Pacific West Coast developed in the late 1800s and early 1990s. Available estimates of China rockfish catch in California begin in the early 1900s, along with small commercial catches in Oregon until recreational landings began to increase in the early 1970s (Figures a-c). Reconstructed recreational landings of China rockfish in the northern assessment begin in 1967. As of 1995, Washington has prohibited commercial nearshore fixed gear in state waters and does not have a historical reconstruction of China rockfish commercial landings. The majority of commercial removals of China rockfish are now landed by live-fish fisheries in California and southern Oregon. The magnitude of total removals over the last 10 years peaked in 2009 (35.52 mt) and has been decreasing since then. In recent years, California has the largest removals of the three states (dominated by the recreational fleet) with smallest removals coming from the Oregon recreational fleet (Table a).

The nearshore live-fish fishery developed in California in the late 1980s and early 1990s and extended into Oregon by the mid-1990s, driven by the market prices for live fish. Northern Oregon (north of Florence) does not contribute significantly to the live-fish fishery (maximum removal of 0.02 mt) as the market for this sector of the fishery is centered in California. Catches from the live-fish fishery in southern Oregon (south of Florence) has composed the majority of the catch in that state since 1999, and peaked in 2002. In California, the landings of live fish begin exceeding the landings of dead fish south of 40°10′ N. latitude in 1998 and north of 40°10′ N. latitude in 1999; and the pattern continues through 2014.

The historical reconstruction of landings from the recreational fishery for China rockfish in California goes back to 1928, and the fishery began significantly increasing in the late 1940s. The recreational catches in California are significantly higher than the commercial catches, and have decreased in the last five years (Table a). Recreational catches in California peaked in 1987 at 53.29 mt and have declined to roughly 10-20 mt per year over the last 10 years. The trend is opposite in Oregon, with the magnitude of the commercial landings greater than the recreational landings. The historical landings from the recreational fleet in Oregon start in 1973 at 0.86 mt, peak in 1983 at 6.07 mt and again in 1993 at 6.04 mt. The recreational catches over the last 10 years in Oregon have ranged from 1.67 mt in 2014 to 3.66 mt in 2007. Recreational landings in Washington peaked in 1992 (7.98 mt) and have remained between 2-4 mt from 2005-2014.

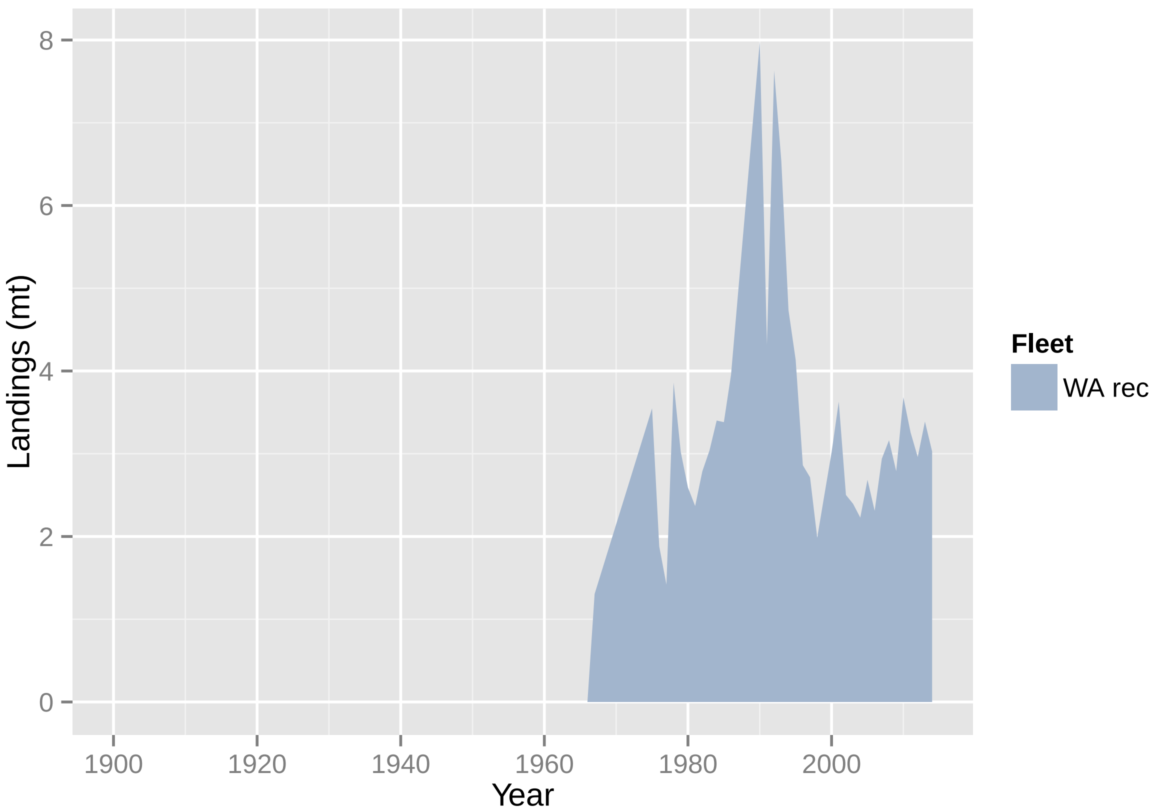

Figure a: China rockfish landings for Washington. Washington has does not have a commercial nearshore fishery.

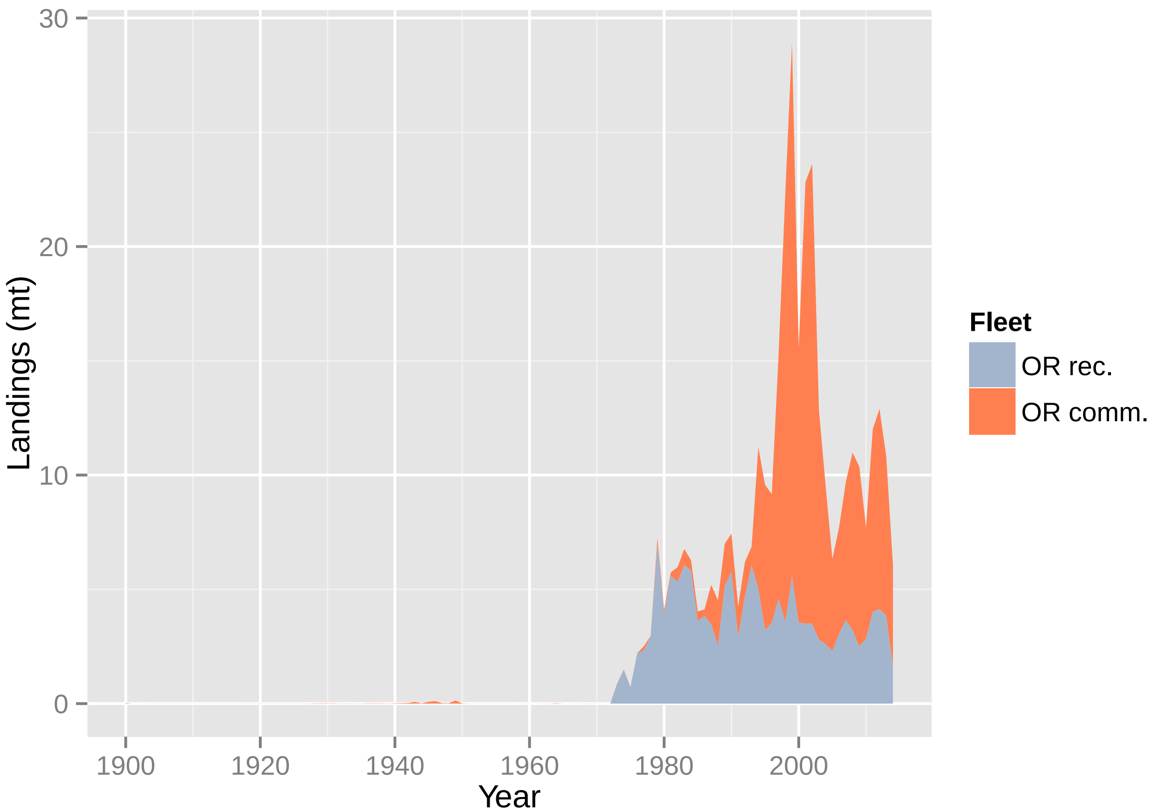

Figure b: Stacked line plot of China rockfish landings history for Oregon by fleet (recreational and commercial).

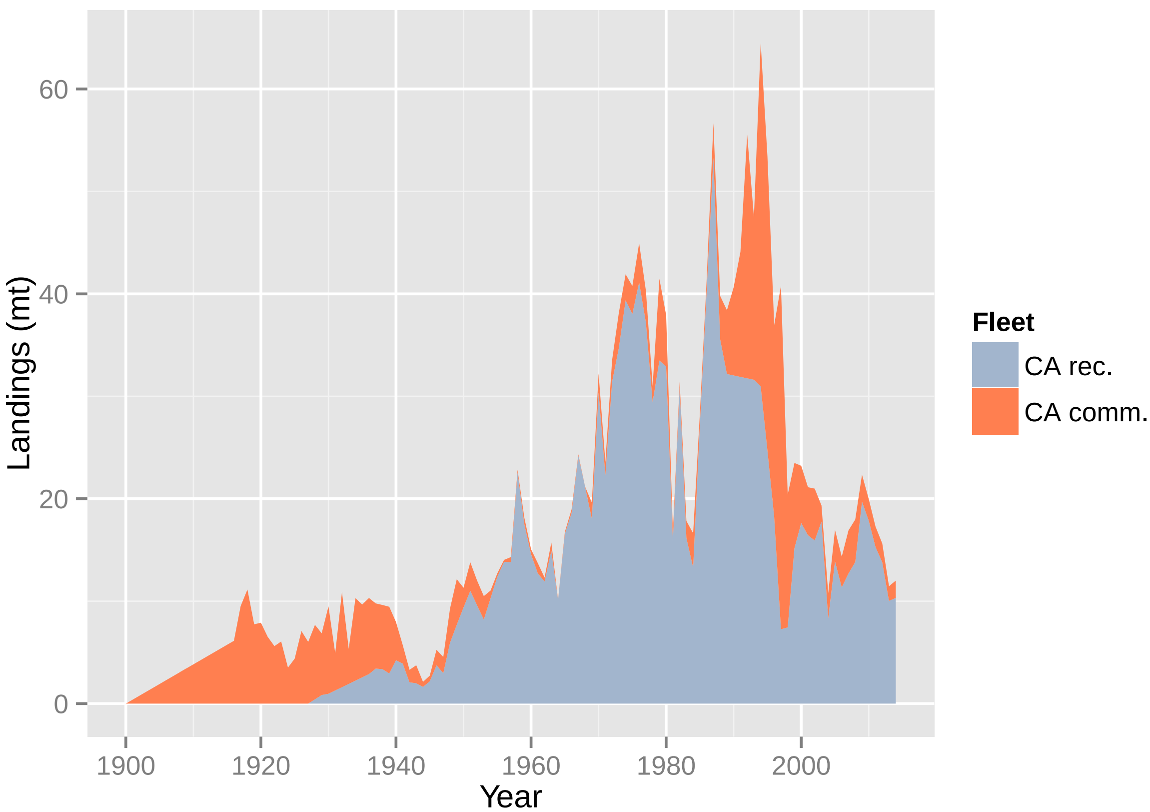

Figure c: Stacked line plot of China rockfish landings history for California by fleet (recreational and commercial).

Table a: Recent China rockfish landings (mt) by fleet.

Year	Washington recreational	Oregon commercial	Oregon recreational	California commercial	California recreational	Total
2005	2.69	4.02	2.31	3.06	13.91	25.98
2006	2.31	4.64	3.07	3.00	11.35	24.37
2007	2.94	6.03	3.66	4.21	12.70	29.54
2008	3.16	7.76	3.22	4.15	13.82	32.12
2009	2.79	7.88	2.50	2.63	19.72	35.52
2010	3.68	4.84	2.85	2.11	17.85	31.34
2011	3.26	7.98	4.02	1.99	15.29	32.54
2012	2.96	8.76	4.14	1.83	13.80	31.49
2013	3.39	6.98	3.85	1.43	10.03	25.68
2014	3.03	4.38	1.67	1.69	10.32	21.08

Data and assessment

China rockfish was assessed as a data moderate stock in 2013 (Cope et al. 2015) using the XDB-SRA modeling framework. This assessment uses the newest version of Stock Synthesis (3.24u). The model begins in 1900, and assumes the stock was at an unfished equilibrium that year.

Data within the central and northern models were stratified as follows: central model north and south of Florence, OR and the northern model groups MCAs 1-2 (southern WA) and MCAs 3-4 (northern WA) (Figure d). Data for the management area south of 40°10′ N. latitude are aggregated, in part because historical removals from the dominant fisheries (recreational charter and private boat modes) prior to 2004 are not available at a finer spatial scale. The data used in the assessments includes commercial and recreational landings, Catch per Unit Effort (CPUE) indices from recreational and commercial fleets, and length and age compositions. Discard data (total discards in mt and size compositions) from the commercial live-fish fishery were modelled south of 40°10′ N. latitude. Where available, age and length compositions for the recreational party/charter (CPFV) and private/rental modes were developed separately.

Stock biomass

Estimated spawning output in the northern area (Washington state) declined between the 1960s and 1990s but has been largely stable during the past two decades (Figure e and Table b). The estimated relative depletion level (spawning output relative to unfished spawning output) of the northern stock in 2015 is 73.4% (~95% asymptotic interval: ± 63.6% - 83.2%) (Figure f).

The central area model for China rockfish estimates that spawning output is just above

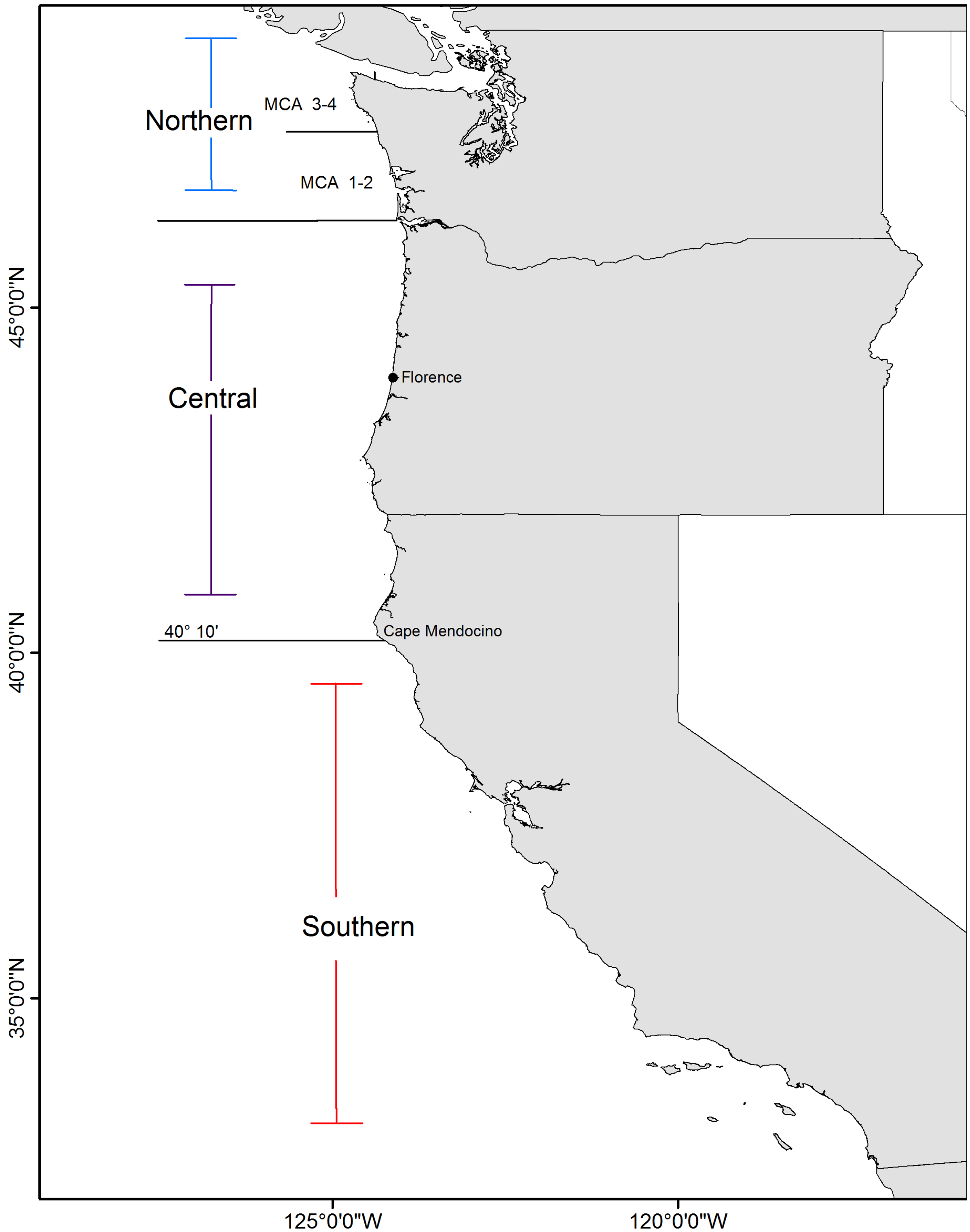

Figure d: Map depicting the boundaries for the three base-case models, Southern model (south of 40°10′ N. latitude), Central model (south of 40°10′ N. latitude to the OR-WA border), and the Northern model (WA state MCAs 1-4).

the biomass target in 2015 (Figure e and Table c). The rate of spawning output decline is estimated to be steepest during the 1980s to 1990s and continued to decline from the early 2000s at a slower rate to an estimated minimum of 39.6% in 2014. The estimated relative depletion level of the central stock in 2015 is 61.5% (~95% asymptotic interval: ± 53.8% - 69.2%) (Figure f).

The assessment for the southern management area suggests that China rockfish were lightly, but steadily exploited since the early 1900s, with more rapid declines in spawning output beginning with development of the recreational fishery in the 1950s (Figure e and Table d). The estimated relative depletion level of the southern stock in 2015 is 29.6% (~95% asymptotic interval: ± 25.0% - 34.3%) (Figure f). Although spawning output in the southern area is more depleted than the central and northern areas, it is the only area with an increasing trend over the past 15 years.

Table b: Recent trend in beginning of the year biomass and depletion for the northern China rockfish model.

Year	Spawning Output (billion eggs)	~ 95% confidence interval	Estimated depletion	~ 95% confidence interval
2006	17.942	(8.86-27.03)	0.734	(0.638-0.83)
2007	18.030	(8.94-27.12)	0.738	(0.642-0.833)
2008	18.044	(8.95-27.14)	0.738	(0.643-0.833)
2009	18.034	(8.93-27.13)	0.738	(0.642-0.833)
2010	18.062	(8.96-27.17)	0.739	(0.644-0.834)
2011	17.993	(8.89-27.1)	0.736	(0.64-0.833)
2012	17.971	(8.86-27.08)	0.735	(0.638-0.832)
2013	17.981	(8.87-27.09)	0.736	(0.639-0.833)
2014	17.944	(8.83-27.06)	0.734	(0.637-0.832)
2015	17.950	(8.83-27.07)	0.734	(0.637-0.832)

Table c: Recent trend in beginning of the year biomass and depletion for the central (north of 40°10′ N. latitude to the OR-WA border) China rockfish model.

Year	Spawning Output (billion eggs)	~ 95% confidence interval	Estimated depletion	~ 95% confidence interval
2006	40.643	(27.6-53.68)	0.624	(0.551-0.697)
2007	40.851	(27.8-53.9)	0.627	(0.555-0.7)
2008	40.630	(27.57-53.69)	0.624	(0.551-0.698)
2009	40.313	(27.25-53.38)	0.619	(0.545-0.694)
2010	40.125	(27.05-53.2)	0.616	(0.541-0.692)
2011	40.380	(27.29-53.47)	0.620	(0.545-0.695)
2012	40.112	(27.01-53.21)	0.616	(0.54-0.692)
2013	39.706	(26.6-52.82)	0.610	(0.533-0.687)
2014	39.573	(26.45-52.7)	0.608	(0.53-0.686)
2015	40.033	(26.88-53.19)	0.615	(0.538-0.692)

Table d: Recent trend in beginning of the year spawning output and depletion for the southern (south of 40°10′ N. latitude) China rockfish model.

Year	Spawning Output (billion eggs)	~ 95% confidence interval	Estimated depletion	~ 95% confidence interval
2006	14.430	(9.47-19.39)	0.217	(0.164-0.27)
2007	15.173	(10.01-20.34)	0.228	(0.174-0.283)
2008	15.819	(10.46-21.18)	0.238	(0.182-0.294)
2009	16.289	(10.77-21.81)	0.245	(0.187-0.303)
2010	16.361	(10.75-21.97)	0.246	(0.186-0.306)
2011	16.444	(10.73-22.16)	0.247	(0.186-0.309)
2012	16.758	(10.91-22.6)	0.252	(0.189-0.315)
2013	17.168	(11.18-23.15)	0.258	(0.193-0.323)
2014	17.899	(11.73-24.07)	0.269	(0.203-0.336)
2015	18.565	(12.23-24.9)	0.279	(0.211-0.347)

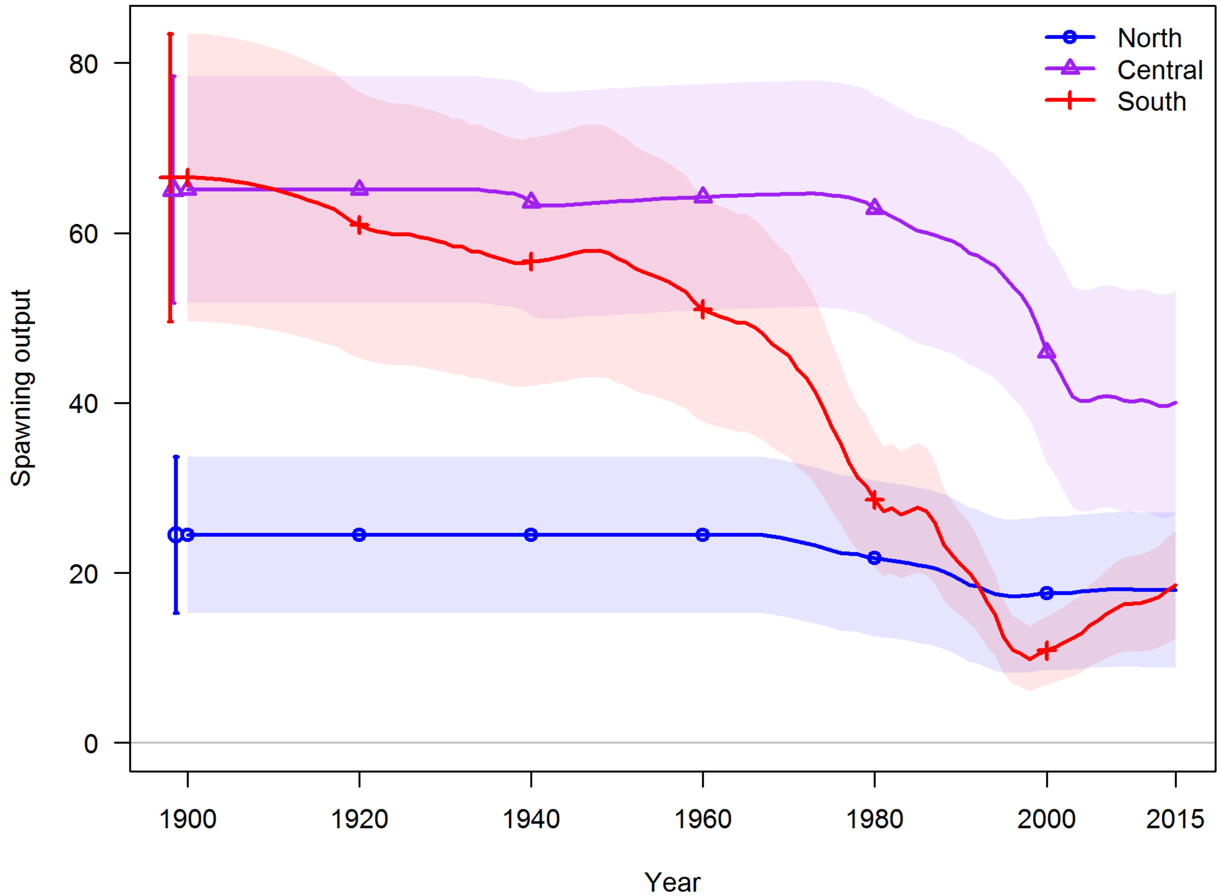

Figure e: Time series of spawning output trajectory (circles and line: median; light broken lines: 95% credibility intervals) for the three models of China rockfish (North=Washington state, Central = 40°10′ N. latitude to the OR/WA border, and South = south of 40°10′ N. latitude).

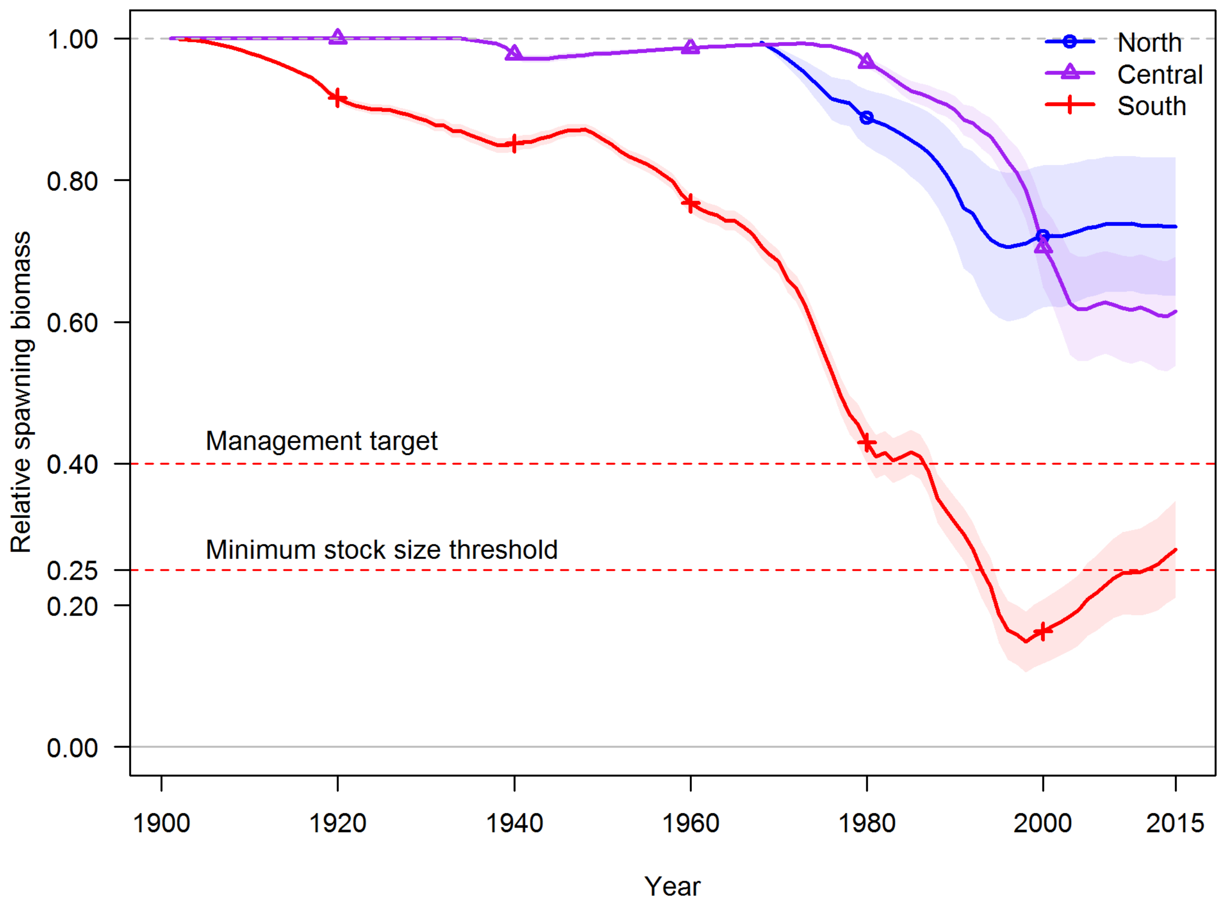

Figure f: Estimated relative depletion with approximate 95% asymptotic confidnce intervals (dashed lines) for the three base case assessment models.

Recruitment

Length and age composition data for China rockfish contain insufficient information to reliably resolve year-class strength. Therefore, all three base models assume that recruitment follows a deterministic Beverton-Holt stock-recruitment relationship, so trends in recruitment reflect trends in estimated spawning output. Given the assumed value of steepness and estimates of current stock status, estimated recruitment has remained fairly constant in the central and northern models, while the estimated biomass in the southern area has declined enough to impact spawning output (Figure g, Tables e, f and g).

Table e: Recent recruitment for the northern model (Washington state MCAs 1-4).

Year	Estimated Recruitment (1,000s)	~ 95% confidence interval
2006	33.29	(21.33 - 45.24)
2007	33.30	(21.35 - 45.25)
2008	33.30	(21.35 - 45.26)
2009	33.30	(21.35 - 45.26)
2010	33.31	(21.35 - 45.26)
2011	33.30	(21.34 - 45.25)
2012	33.29	(21.33 - 45.25)
2013	33.29	(21.33 - 45.25)
2014	33.29	(21.33 - 45.25)
2015	33.29	(21.33 - 45.25)

Table f: Recent recruitment for the central model (40°10′ N. latitude to the OR/WA border).

Year	Estimated Recruitment (1,000s)	~ 95% confidence interval
2006	68.27	(54.59 - 81.94)
2007	68.31	(54.64 - 81.97)
2008	68.26	(54.59 - 81.94)
2009	68.20	(54.51 - 81.9)
2010	68.17	(54.47 - 81.87)
2011	68.22	(54.52 - 81.91)
2012	68.17	(54.46 - 81.87)
2013	68.09	(54.36 - 81.81)
2014	68.06	(54.32 - 81.8)
2015	68.15	(54.43 - 81.87)

Table g: Recent recruitment for the southern model (south of 40°10′ N. latitude).

Year	Estimated Recruitment (1,000s)	~ 95% confidence interval
2006	122.32	(105.92 - 138.73)
2007	123.93	(107.67 - 140.18)
2008	125.23	(109.07 - 141.39)
2009	126.13	(109.98 - 142.28)
2010	126.27	(109.96 - 142.57)
2011	126.42	(109.97 - 142.87)
2012	126.99	(110.52 - 143.46)
2013	127.71	(111.29 - 144.13)
2014	128.94	(112.72 - 145.15)
2015	129.99	(113.95 - 146.03)

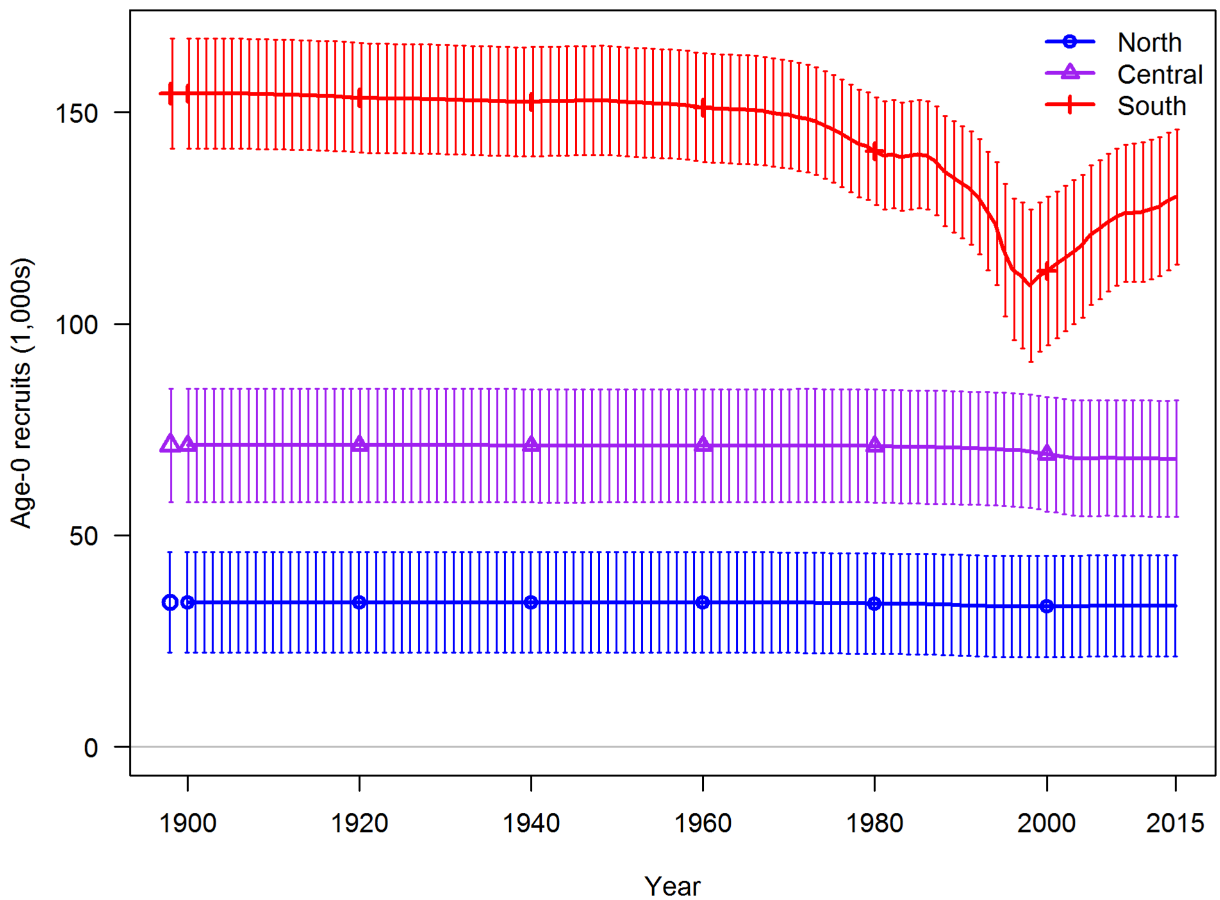

Figure g: Time series of estimated China rockfish recruitments for the three base-case models with 95% confidence or credibility intervals.

Exploitation status

Harvest rates estimated by the northern area model for Washington have never exceeded management target levels (Table h and Figure h). Model results for the central area suggest that harvest rates have briefly exceeded the current proxy MSY value around 2000, but has remained below the management target in the last decade (Table i and Figure h). Historical harvest rates for China rockfish rose steadily in the southern management area until the mid-1990s and exceeded the target SPR harvest rate for several decades, and is just below the target harvest rate as of 2013 (Table j and Figure h). A summary of China rockfish exploitation histories for the northern, central, and southern areas is provided as Figure i.

Table h: Recent trend in spawning potential ratio and exploitation for the northern China rockfish model (Washington state MCAs 1-4). Fishing intensity is (1-SPR) divided by 50% (the SPR target) and exploitation is F divided by F_{SPR}.

Year	Fishing intensity	~ 95% confidence interval	Exploitation rate	~ 95% confidence interval
2005	0.44	(0.27-0.61)	0.32	(0.17-0.47)
2006	0.39	(0.24-0.55)	0.28	(0.15-0.4)
2007	0.47	(0.3-0.65)	0.35	(0.19-0.51)
2008	0.50	(0.32-0.68)	0.38	(0.2-0.55)
2009	0.45	(0.28-0.63)	0.33	(0.18-0.49)
2010	0.56	(0.36-0.76)	0.44	(0.24-0.64)
2011	0.51	(0.32-0.7)	0.39	(0.21-0.57)
2012	0.48	(0.3-0.66)	0.35	(0.19-0.52)
2013	0.53	(0.34-0.72)	0.41	(0.22-0.59)
2014	0.48	(0.3-0.67)	0.36	(0.19-0.53)

Table i: Recent trend in spawning potential ratio and exploitation for the central China rockfish model (40°10′ N. latitude to the OR/WA border). Fishing intensity is (1-SPR) divided by 50% (the SPR target) and exploitation is F divided by F_{SPR}.

Year	Fishing intensity	˜ 95% confidence interval	Exploitation rate	˜ 95% confidence interval
2005	0.55	(0.42-0.68)	0.40	(0.28-0.52)
2006	0.62	(0.49-0.76)	0.48	(0.34-0.62)
2007	0.78	(0.63-0.93)	0.68	(0.48-0.88)
2008	0.82	(0.66-0.97)	0.73	(0.52-0.95)
2009	0.78	(0.63-0.93)	0.68	(0.48-0.88)
2010	0.61	(0.48-0.75)	0.47	(0.33-0.61)
2011	0.80	(0.65-0.96)	0.72	(0.5-0.93)
2012	0.85	(0.69-1.01)	0.79	(0.55-1.02)
2013	0.77	(0.62-0.93)	0.67	(0.47-0.87)
2014	0.53	(0.4-0.66)	0.39	(0.27-0.5)

Table j: Recent trend in spawning potential ratio and exploitation for the southern China rockfish model (south of 40°10′ N. latitude). Fishing intensity is (1-SPR) divided by 50% (the SPR target) and exploitation is F divided by F_{SPR}.

Year	Fishing intensity	˜ 95% confidence interval	Exploitation rate	˜ 95% confidence interval
2005	1.30	(1.16-1.45)	1.50	(1.15-1.85)
2006	1.18	(1.03-1.33)	1.19	(0.91-1.47)
2007	1.18	(1.03-1.33)	1.22	(0.93-1.51)
2008	1.23	(1.08-1.37)	1.35	(1.04-1.67)
2009	1.35	(1.21-1.48)	1.76	(1.34-2.17)
2010	1.34	(1.2-1.48)	1.70	(1.29-2.1)
2011	1.25	(1.1-1.4)	1.41	(1.06-1.75)
2012	1.20	(1.05-1.35)	1.27	(0.96-1.58)
2013	1.02	(0.86-1.18)	0.90	(0.68-1.12)
2014	1.04	(0.89-1.2)	0.96	(0.73-1.19)

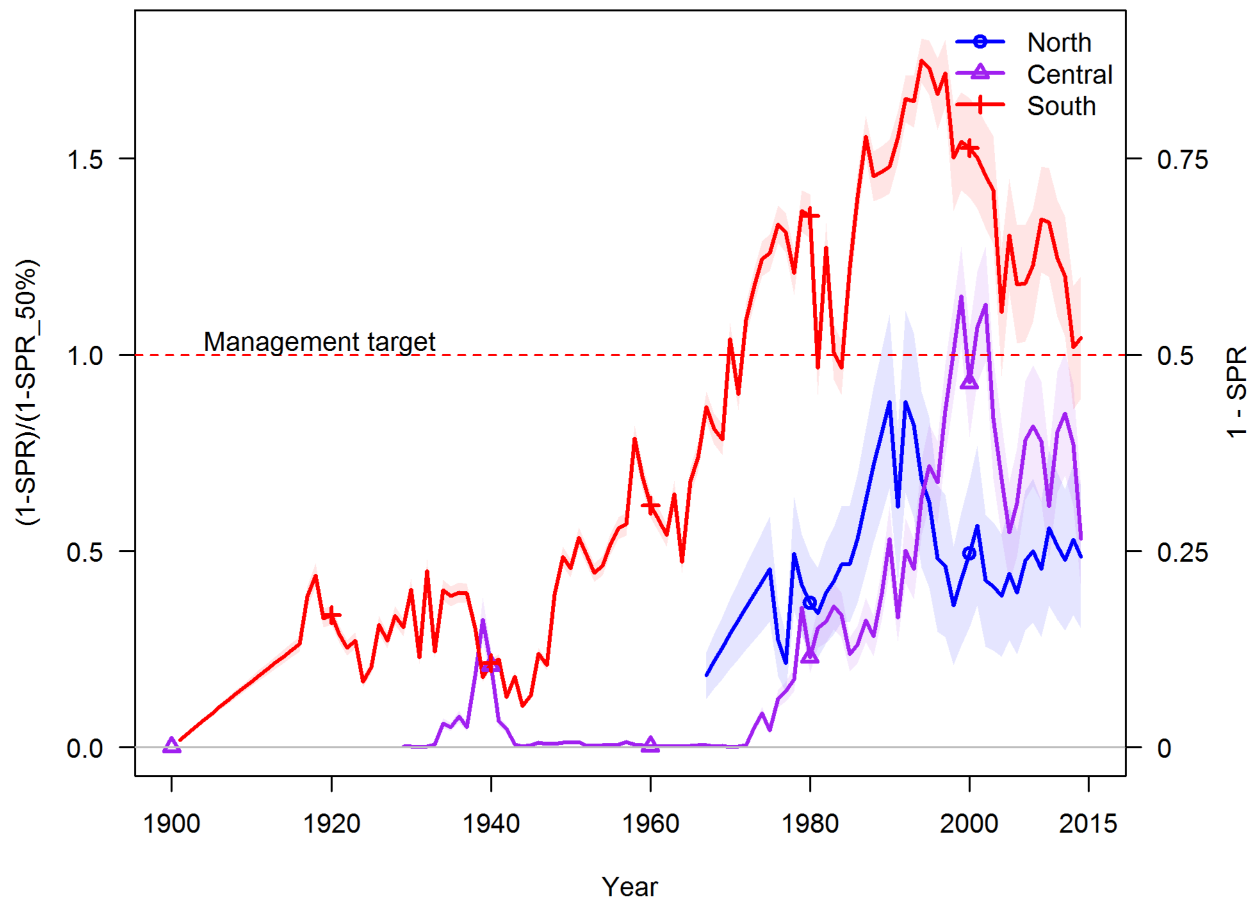

Figure h: Estimated spawning potential ratio (SPR) for the northern, central, and southern base-case models. One minus SPR is plotted so that higher exploitation rates occur on the upper portion of the y-axis. The management target is plotted as a red horizontal line and values above this reflect harvests in excess of the overfishing proxy based on the $SPR_{50\%}$ harvest rate. The last year in the time series is 2014.

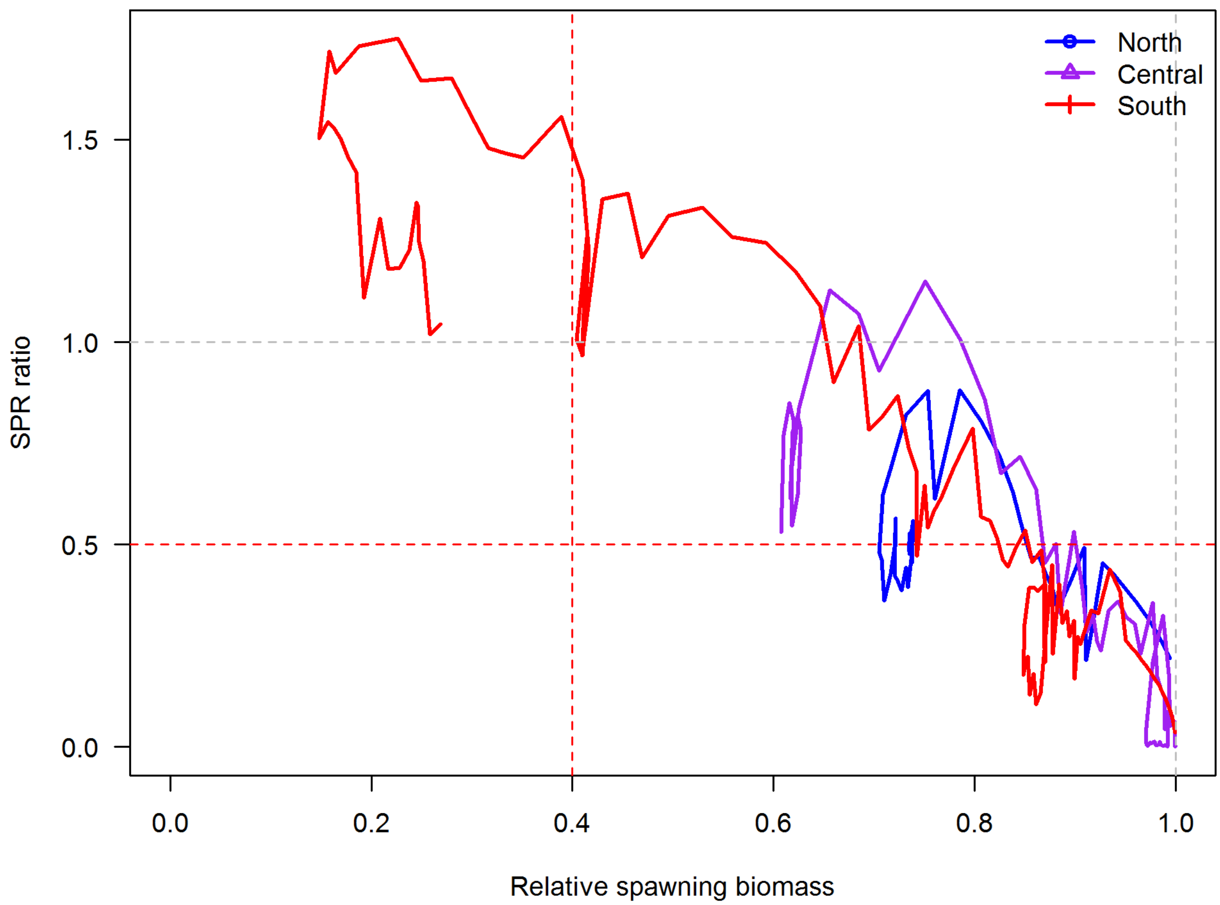

Figure i: Phase plot of estimated relative (1-SPR) vs. relative spawning biomass for the southern, central, and northern base case models. The relative (1-SPR) is (1-SPR) divided by 50% (the SPR target). Relative depletion is the annual spawning biomass divided by the unfished spawning biomass.

Ecosystem considerations

In this assessment, ecosystem considerations were not explicitly included in the analysis. This is primarily due to a lack of relevant data and results of analyses (conducted elsewhere) that could contribute ecosystem-related quantitative information for the assessment.

Recently available habitat information was used to select the data used in the onboard observer indices (see Appendix F, p.9).

Reference points

The management line for China rockfish is at 40°10′ N. latitude, with differing management guidelines north and south. From 2005-2010, the Nearshore Rockfish Complexes north and south of 40°10′ N. latitude were managed by a total catch Optimum Yield (OY). As of the Pacific Fishery Management Council (PFMC) 2011-12 management cycle, China rockfish has a component OFL and ABC within the northern and southern Nearshore Rockfish Complexes, based on the work by Dick and MacCall (2010).

This stock assessment estimates that China rockfish in the north are above the biomass target. The spawning output of the stock declined between the 1960s and 1990s but has largely been stable during the past few decades. The estimated relative depletion level in 2015 is 73.4% (~95% asymptotic interval: ± 63.7% - 83.2%, corresponding to an unfished spawning output of 24.4 billion eggs (~95% asymptotic interval: 15.2 – 33.7 billion eggs) of spawning output in the base model (Table k). Unfished age 5+ biomass was estimated to be 240.8 mt in the base case model. The target spawning output based on the biomass target ($SB_{40\%}$) is 9.8 billion eggs, which gives a catch of 6.3 mt. Equilibrium yield at the proxy F_{MSY} harvest rate corresponding to $SPR_{50\%}$ is 5.8 mt.

This stock assessment estimates that central area China rockfish are just above the biomass target. The rate of spawning output decline is estimated to be steepest during the 1980s to 1990s and has continued to decline since the 1990s at a slower rate. The estimated relative depletion level in 2015 is 61.5% (~95% asymptotic interval: ± 53.8% - 69.2%), corresponding to an unfished spawning output of 65.1 billion eggs (~95% asymptotic interval: 51.8 – 78.4 billion eggs) of spawning output in the base model (Table l). Unfished age 5+ biomass was estimated to be 591.5 mt in the base case model. The target spawning output based on the biomass target ($SB_{40\%}$) is 26 billion eggs, which gives a catch of 15.7 mt. Equilibrium yield at the proxy F_{MSY} harvest rate corresponding to $SPR_{50\%}$ is 14.5 mt.

This stock assessment estimates that China rockfish south of 40°10′ N. latitude are below the biomass target, but above the minimum stock size threshold, and have been increasing over the last 15 years. The estimated relative depletion level in 2015 is 27.9% (~95% asymptotic interval: ± 21.2% - 34.7%), corresponding to an unfished spawning output of 66.5 billion eggs (~95% asymptotic interval: 49.6 - 83.4 billion eggs) of spawning output in the base model (Table m). Unfished age 5+ biomass was estimated to be 768.6 mt in the base case model.

The target spawning output based on the biomass target ($SB_{40\%}$) is 26.6 billion eggs, which gives a catch of 21.1 mt. Equilibrium yield at the proxy F_{MSY} harvest rate corresponding to $SPR_{50\%}$ is 19.5 mt.

Table k: Summary of reference points and management quantities for the northern (Washington state MCAs 1-4) base case model.

Quantity	**Estimate**	**95% Confidence Interval**
Unfished spawning output (billions of eggs)	24.4	(15.2-33.7)
Unfished age 5+ biomass (mt)	240.8	(153-328.7)
Unfished recruitment (R0, thousands)	34.2	(22.3-46)
Spawning output (2015, billions of eggs)	17.9	(8.8-27.1)
Depletion (2015)	0.7344	(0.6369-0.8319)
Reference points based on $\mathbf{SB_{40\%}}$		
Proxy spawning output ($B_{40\%}$)	9.8	(6.1-13.5)
SPR resulting in $B_{40\%}$ ($SPR_{B40\%}$)	0.444	(0.444-0.444)
Exploitation rate resulting in $B_{40\%}$	0.0551	(0.0522-0.058)
Yield with $SPR_{B40\%}$ at $B_{40\%}$ (mt)	6.3	(4-8.5)
Reference points based on SPR proxy for MSY		
Spawning output	11.3	(7-15.5)
SPR_{proxy}	0.5	
Exploitation rate corresponding to SPR_{proxy}	0.0458	(0.0435-0.0482)
Yield with SPR_{proxy} at SB_{SPR} (mt)	5.8	(3.7-7.9)
Reference points based on estimated MSY values		
Spawning output at MSY (SB_{MSY})	5.6	(3.5-7.8)
SPR_{MSY}	0.2875	(0.2823-0.2927)
Exploitation rate at MSY	0.0924	(0.0863-0.0985)
MSY (mt)	7	(4.5-9.4)

Table l: Summary of reference points and management quantities for the central (40°10′ N. latitude to the OR/WA border) base case model.

Quantity	**Estimate**	**95% Confidence Interval**
Unfished spawning output (billions of eggs)	65.1	(51.8-78.4)
Unfished age 5+ biomass (mt)	591.5	(473.7-709.3)
Unfished recruitment (R0, thousands)	71.3	(57.9-84.6)
Spawning output (2015, billions of eggs)	40	(26.9-53.2)
Depletion (2015)	0.6149	(0.5381-0.6918)
Reference points based on $\mathbf{SB_{40\%}}$		
Proxy spawning output ($B_{40\%}$)	26	(20.7-31.4)
SPR resulting in $B_{40\%}$ ($SPR_{B40\%}$)	0.444	(0.444-0.444)
Exploitation rate resulting in $B_{40\%}$	0.0584	(0.0567-0.0602)
Yield with $SPR_{B40\%}$ at $B_{40\%}$ (mt)	15.7	(12.6-18.7)
Reference points based on SPR proxy for MSY		
Spawning output	30	(23.8-36.1)
SPR_{proxy}	0.5	
Exploitation rate corresponding to SPR_{proxy}	0.0484	(0.0469-0.0498)
Yield with SPR_{proxy} at SB_{SPR} (mt)	14.5	(11.7-17.3)
Reference points based on estimated MSY values		
Spawning output at MSY (SB_{MSY})	15.4	(12.2-18.6)
SPR_{MSY}	0.2925	(0.29-0.295)
Exploitation rate at MSY	0.098	(0.094-0.1019)
MSY (mt)	17.3	(14-20.7)

Table m: Summary of reference points and management quantities for the southern (south of 40°10′ N. latitude) base case model.

Quantity	**Estimate**	**95% Confidence Interval**
Unfished spawning output (billions of eggs)	66.5	(49.6-83.4)
Unfished age 5+ biomass (mt)	768.6	(660.1-877)
Unfished recruitment (R0, thousands)	154.5	(141.5-167.4)
Spawning output (2015, billions of eggs)	18.6	(12.2-24.9)
Depletion (2015)	0.2791	(0.2113-0.3469)
Reference points based on $\mathbf{SB_{40\%}}$		
Proxy spawning output ($B_{40\%}$)	26.6	(19.8-33.4)
SPR resulting in $B_{40\%}$ ($SPR_{B40\%}$)	0.444	(0.444-0.444)
Exploitation rate resulting in $B_{40\%}$	0.057	(0.0491-0.065)
Yield with $SPR_{B40\%}$ at $B_{40\%}$ (mt)	21.1	(19.9-22.3)
Reference points based on SPR proxy for MSY		
Spawning output	30.6	(22.8-38.4)
SPR_{proxy}	0.5	
Exploitation rate corresponding to SPR_{proxy}	0.0476	(0.041-0.0541)
Yield with SPR_{proxy} at SB_{SPR} (mt)	19.5	(18.4-20.6)
Reference points based on estimated MSY values		
Spawning output at MSY (SB_{MSY})	15.5	(11.2-19.9)
SPR_{MSY}	0.2898	(0.2832-0.2965)
Exploitation rate at MSY	0.0938	(0.0784-0.1092)
MSY (mt)	23.4	(22.1-24.8)

Management performance

China rockfish is managed in the northern and southern Nearshore Rockfish Complex (split at 40°10′ N. latitude. Since the 2011-2012 management cycle, China rockfish has a contribution OFL and ACL within each the northern and southern Nearshore Rockfish Complexes (Table n). The estimated catch of China rockfish north of 40°10′ N. latitude of Nearshore Rockfish Complex has been above both the China rockfish contribution to the northern Nearshore Rockfish Complex OFL and ACL in all years (2011-2014). The estimated catch of China rockfish south of 40°10′ N. latitude of Nearshore Rockfish Complex has been below the China rockfish contribution to the northern Nearshore Rockfish Complex OFL and ACL in all years (2011-2014). A summary of these values as well as other base case summary results can be found in Table s.

Table n: Recent trend in total catch and commercial landings (mt) relative to the management guidelines. Estimated total catch reflect the commercial landings plus the model estimated discarded biomass. Note: 2015 and 2016 ACLs are proposed and not yet in regulations

Year	Management guideline	Nearshore rockfish north	China contrib. north	Estimated catch north	Nearshore rockfish south	China contrib. south	Estimated catch south
2005	**ABC**	na	na	10.10	na	na	16.70
	Total Catch OY	122	na		615	na	
2006	**ABC**	na	na	11.30	na	na	13.60
	Total Catch OY	122	na		615	na	
2007	**ABC**	na	na	15.80	na	na	14.20
	Total Catch OY	142	na		564	na	
2008	**ABC**	na	na	16.90	na	na	16.00
	Total Catch OY	142	na		564	na	
2009	**ABC**	na	na	15.40	na	na	21.00
	Total Catch OY	155	na		650	na	
2010	**ABC**	na	na	12.40	na	na	19.30
	Total Catch OY	155	na		650	na	
2011	**OFL**	116	11.7	16.60	1156	19.8	16.20
	ACL	99	9.8		1001	16.5	
2012	**OFL**	116	11.7	17.50	1145	19.8	14.10
	ACL	99	9.8		990	16.5	
2013	**OFL**	110	9.8	15.60	1164	16.6	10.40
	ACL	94	8.2		1005	13.8	
2014	**OFL**	110	9.8	10.10	1160	16.6	11.80
	ACL	94	8.2		1001	13.8	
2015	**OFL**	88	7.2		1313	55.2	
	ACL	69	6.6		1114	50.4	
2016	**OFL**	88	7.4		1288	52.7	
	ACL	69	6.8		1006	50.4	

Unresolved problems and major uncertainties

As in most/all stock assessments, the appropriate value for stock-recruit steepness remains a major uncertainty for China rockfish. In this assessment a prior value was available from a meta-analysis, allowing bracketing of the uncertainty. Exploration of the southern model during the STAR panel meeting established that the range of uncertainty in current and projected biomass status provided by this bracketing was very similar to the range due to natural mortality, and that natural mortality alone would be used to bracket uncertainty in model results for management advice.

While the northern and the southern area models are able to estimate a plausible value of natural mortality with an apparently good level of precision, this was not possible with the central area model.

The fishery-dependent abundance indices used in the assessment are relatively noisy. There is no fishery-independent index. The assessments assume that trends in CPUE indices are representative of population trends.

Assessment results for the central and the northern area models are dependent on the method used for weighting the conditional age-at-length data. This is an area of active research and there is a lack of consensus on an agreed approach. A workshop is planned for later this year that might provide guidance. For this assessment, the Panel recommended use of harmonic mean method, because it is a well-understood and frequently applied method that provided intermediate results compared to other alternatives.

The current term of reference for stock assessment require development of a single decision table with states of nature ranging along the dominant axis of uncertainty. This presumes that uncertainty is consequential only for a single variable or estimated quantity, such as natural mortality, steepness, or ending biomass. This approach may fail to capture important elements of uncertainty that should be communicated to the Council and its advisory bodies. Additional flexibility in the development of decision tables is needed.

Decision Tables

The forecasts of stock abundance and yield were developed using the final base models. The total catches in 2015 and 2016 are set to the PFMC adopted China rockfish contribution ACLs in the northern and central models (Table n). The southern model total catches in 2015 and 2016 are set to the average annual catch from 2012-2014. The exploitation rate for 2017 and beyond is based upon an SPR harvest rate of 50%. The average of 2010-2014 catch by fleet was used to distribute catches in forecasted years. The forecasted projections of the OFL for each model are presented in Table o.

Uncertainty in the forecasts is based upon the three states of nature agreed upon at the STAR panel and are based on a low value of M, 0.05, and a high value, 0.09. Current medium-term forecasts based on the alternative states of nature project that the stock, under the current control rule as applied to the base model, will decline towards the target stock size Table p. The current control rule under the low state of nature results in a stock decline into the precautionary zone, while the high state of nature maintains the stock at near unfished levels. Removing the catches resulting from the low M state of nature, assuming the base and high values of M both maintain the stock at well above the current target stock size, as does removing the recent average catches under all states of nature. Removing the high M catches under the base model M and high M states of nature results in the population going to extremely low levels during the projection period, spawning biomass and stock depletion values are not reported for years in which the stock goes to these very low levels.

Current medium-term forecasts based on the alternative states of nature for the central model project that the stock, under the current control rule as applied to the base model, will decline towards the target stock size Table q. The current control rule under the low state of nature results in a stock in the precautionary zone, while the high state of nature maintains the stock increasing from 40% to 50% depletion from 2017 - 2026. Removing the catches resulting from the low M state of nature, assuming the base and high values of M both maintain the stock at well above the current target stock size. Removing the high M catches under the base model M and low M states of nature results in the population going to extremely low levels during the projection period. Removing average catches under the base M and high M states of nature result in the stock remaining above the current target stock size, and an ending depletion of 37% in 2026 for the low M state of nature.

Assuming that catches in 2015 and 2016 equal recent average catch, and that catches beginning in 2017 follow the default ACL harvest control rule, projections of expected China spawning output from the southern base model suggest the stock will be at roughly 30% of unfished spawning output in 2017, and increase to 38% by 2026 (Table r). The stock is expected to remain below the target stock size (40% of unfished spawning output) in the base model and "low M" states of nature through 2026, and to exceed target size in the "high M" scenario, assuming stationarity in the stock-recruitment assumptions.

Table o: Projections of potential OFL (mt) for each model, using the base model forecast.

Year	North	Central	South	Total
2017	9.63	20.52	13.31	43.46
2018	9.29	20.05	13.84	43.18
2019	8.98	19.62	14.34	42.93
2020	8.69	19.21	14.80	42.71
2021	8.43	18.84	15.24	42.51
2022	8.20	18.50	15.63	42.33
2023	7.99	18.19	16.00	42.18
2024	7.80	17.91	16.34	42.05
2025	7.64	17.67	16.65	41.95
2026	7.49	17.45	16.93	41.87

Table p: Summary of 10-year projections beginning in 2017 for alternate states of nature based on an axis of uncertainty for the northern model. Columns range over low, mid, and high states of nature, and rows range over different assumptions of catch levels. An entry of '–' indicates that the stock is driven to very low abundance under the particular scenario.

			States of nature					
			Low M 0.05		Base M 0.07		High M 0.09	
	Year	Catch	Spawning Output	Depletion	Spawning Output	Depletion	Spawning Output	Depletion
40-10 Rule, Low M	2017	3.39	10.1	0.541	18.2	0.745	59.30	0.93
	2018	3.37	10.1	0.541	18.1	0.741	59.30	0.93
	2019	3.35	10	0.535	18.1	0.741	59.20	0.92
	2020	3.32	9.9	0.53	18.1	0.741	59.20	0.92
	2021	3.30	9.9	0.53	18	0.736	59.20	0.92
	2022	3.29	9.8	0.525	18	0.736	59.10	0.92
	2023	3.27	9.8	0.525	18	0.736	59.10	0.92
	2024	3.25	9.7	0.519	18	0.736	59.10	0.92
	2025	3.23	9.7	0.519	17.9	0.732	59.10	0.92
	2026	3.22	9.6	0.514	17.9	0.732	59.10	0.92
40-10 Rule	2017	8.82	10.1	0.541	18.2	0.745	59.30	0.93
	2018	8.49	9.5	0.509	17.6	0.72	58.70	0.92
	2019	8.22	8.8	0.471	17	0.696	58.10	0.91
	2020	7.96	8.3	0.444	16.5	0.675	57.70	0.90
	2021	7.72	7.7	0.412	16	0.655	57.20	0.89
	2022	7.51	7.2	0.385	15.6	0.638	56.90	0.89
	2023	7.32	6.8	0.364	15.2	0.622	56.50	0.88
	2024	7.14	6.4	0.343	14.9	0.61	56.20	0.88
	2025	6.99	6	0.321	14.6	0.597	56.00	0.88
	2026	6.85	5.6	0.3	14.3	0.585	55.80	0.87
40-10 Rule, High M	2017	38.81	10.1	0.541	18.2	0.745	59.30	0.93
	2018	36.27	6.2	0.332	14.4	0.589	55.50	0.87
	2019	34.02	-	-	11	0.45	52.30	0.82
	2020	32.06	-	-	8	0.327	49.40	0.77
	2021	30.35	-	-	5.4	0.221	46.90	0.73
	2022	28.87	-	-	3.3	0.135	44.80	0.70
	2023	27.59	-	-	-	-	43.00	0.67
	2024	26.51	-	-	-	-	41.40	0.65
	2025	25.57	-	-	-	-	40.10	0.63
	2026	24.79	-	-	-	-	39.00	0.61
Average Catch	2017	2.45	10	0.535	18.1	0.741	59.20	0.92
	2018	2.45	10.1	0.541	18.1	0.741	59.30	0.93
	2019	2.45	10.1	0.541	18.2	0.745	59.30	0.93
	2020	2.45	10.1	0.541	18.3	0.749	59.40	0.93
	2021	2.45	10.2	0.546	18.3	0.749	59.40	0.93
	2022	2.45	10.2	0.546	18.4	0.753	59.50	0.93
	2023	2.45	10.2	0.546	18.4	0.753	59.50	0.93
	2024	2.45	10.3	0.551	18.5	0.757	59.60	0.93
	2025	2.45	10.3	0.551	18.5	0.757	59.60	0.93
	2026	2.45	10.3	0.551	18.6	0.761	59.70	0.93

Table q: Summary of 10-year projections beginning in 2017 for alternate states of nature based on an axis of uncertainty for the central model. Columns range over low, mid, and high states of nature, and rows range over different assumptions of catch levels. An entry of '–' indicates that the stock is driven to very low abundance under the particular scenario.

			States of nature					
			Low M 0.05		Base M 0.07		High M 0.09	
	Year	Catch	Spawning Output	Depletion	Spawning Output	Depletion	Spawning Output	Depletion
40-10 Rule, Low M	2017	6.70	20.2	0.41	41.40	0.64	109.50	0.85
	2018	6.80	20.5	0.42	41.90	0.64	110.10	0.86
	2019	6.90	20.8	0.42	42.30	0.65	110.50	0.86
	2020	6.90	21	0.43	42.70	0.66	111.00	0.86
	2021	7.00	21.2	0.43	43.00	0.66	111.40	0.87
	2022	7.10	21.4	0.43	43.40	0.67	111.70	0.87
	2023	7.10	21.5	0.44	43.70	0.67	112.10	0.87
	2024	7.20	21.7	0.44	43.90	0.67	112.30	0.87
	2025	7.20	21.8	0.44	44.20	0.68	112.60	0.88
	2026	7.30	22	0.45	44.40	0.68	112.90	0.88
40-10 Rule	2017	18.80	20.2	0.41	41.40	0.64	109.50	0.85
	2018	18.40	19.2	0.39	40.50	0.62	108.70	0.85
	2019	18.00	18.2	0.37	39.70	0.61	107.90	0.84
	2020	17.60	17.2	0.35	38.90	0.6	107.20	0.83
	2021	17.20	16.3	0.33	38.10	0.59	106.60	0.83
	2022	16.90	15.4	0.31	37.50	0.58	106.10	0.83
	2023	16.70	14.6	0.3	36.90	0.57	105.60	0.82
	2024	16.40	13.9	0.28	36.40	0.56	105.20	0.82
	2025	16.20	13.2	0.27	35.90	0.55	104.80	0.82
	2026	16.00	12.6	0.26	35.50	0.55	104.50	0.81
40-10 Rule, High M	2017	64.10	20.2	0.41	41.40	0.64	109.50	0.85
	2018	60.50	14.2	0.29	35.40	0.54	103.60	0.81
	2019	57.30	8.8	0.18	30.00	0.46	98.30	0.76
	2020	54.40	4.1	0.08	25.20	0.39	93.60	0.73
	2021	51.90	0.4	0.01	20.90	0.32	89.60	0.70
	2022	49.80	0	0	17.10	0.26	86.00	0.67
	2023	47.90	0	0	13.80	0.21	83.00	0.65
	2024	46.30	-	-	10.90	0.17	80.40	0.63
	2025	44.92	-	-	8.40	0.13	78.20	0.61
	2026	43.74	-	-	6.30	0.1	76.20	0.59
Average Catch	2017	11.28	20.2	0.41	41.40	63.70%	109.50	0.85
	2018	11.28	20	0.41	41.40	63.50%	109.50	0.85
	2019	11.28	19.8	0.40	41.30	63.40%	109.50	0.85
	2020	11.28	19.5	0.40	41.20	63.30%	109.50	0.85
	2021	11.28	19.3	0.39	41.10	63.10%	109.50	0.85
	2022	11.28	19	0.38	41.00	63.00%	109.50	0.85
	2023	11.28	18.7	0.38	40.90	62.90%	109.40	0.85
	2024	11.28	18.5	0.37	40.80	62.70%	109.40	0.85
	2025	11.28	18.3	0.37	40.80	62.60%	109.40	0.85
	2026	11.28	18	0.37	40.70	62.50%	109.40	0.85

Table r: Summary of 10-year projections beginning in 2017 for alternate states of nature based on an axis of uncertainty for the southern model. Columns range over low, mid, and high states of nature, and rows range over different assumptions of catch levels.

			States of nature					
			Low M 0.05		Base M 0.07		High M 0.09	
	Year	Catch	Spawning Output	Depletion	Spawning Output	Depletion	Spawning Output	Depletion
40-10 Rule, Low M	2017	5.08	14.30	0.21	19.82	0.30	23.16	0.40
	2018	5.73	15.25	0.22	21.05	0.32	24.44	0.42
	2019	6.35	16.17	0.23	22.24	0.33	25.66	0.44
	2020	6.96	17.06	0.25	23.37	0.35	26.80	0.46
	2021	7.54	17.91	0.26	24.44	0.37	27.86	0.48
	2022	8.08	18.71	0.27	25.45	0.38	28.84	0.49
	2023	8.60	19.47	0.28	26.39	0.40	29.74	0.51
	2024	9.08	20.18	0.29	27.27	0.41	30.56	0.52
	2025	9.54	20.85	0.30	28.09	0.42	31.31	0.54
	2026	9.97	21.47	0.31	28.84	0.43	31.99	0.55
40-10 Rule	2017	10.81	14.30	0.21	19.82	0.30	23.16	0.40
	2018	11.46	14.87	0.21	20.63	0.31	24.02	0.41
	2019	12.07	15.40	0.22	21.38	0.32	24.81	0.42
	2020	12.64	15.90	0.23	22.09	0.33	25.53	0.44
	2021	13.17	16.35	0.23	22.74	0.34	26.19	0.45
	2022	13.65	16.76	0.24	23.34	0.35	26.79	0.46
	2023	14.10	17.14	0.25	23.90	0.36	27.33	0.47
	2024	14.51	17.48	0.25	24.40	0.37	27.81	0.47
	2025	14.89	17.79	0.26	24.87	0.37	28.24	0.48
	2026	15.23	18.08	0.26	25.30	0.38	28.63	0.49
40-10 Rule, High M	2017	17.86	14.30	0.21	19.82	0.30	23.16	0.40
	2018	18.18	14.40	0.21	20.10	0.30	23.50	0.40
	2019	18.41	14.48	0.21	20.36	0.31	23.80	0.41
	2020	18.62	14.54	0.21	20.59	0.31	24.07	0.41
	2021	18.81	14.59	0.21	20.80	0.31	24.32	0.41
	2022	18.99	14.62	0.21	20.99	0.32	24.55	0.42
	2023	19.15	14.65	0.21	21.17	0.32	24.76	0.42
	2024	19.30	14.67	0.21	21.34	0.32	24.96	0.43
	2025	19.45	14.68	0.21	21.51	0.32	25.14	0.43
	2026	19.58	14.70	0.21	21.67	0.33	25.32	0.43
Average Catch	2017	13.11	14.30	0.21	19.82	0.30	23.16	0.40
	2018	13.11	14.72	0.21	20.45	0.31	23.85	0.41
	2019	13.11	15.14	0.22	21.09	0.32	24.52	0.42
	2020	13.11	15.56	0.22	21.71	0.33	25.17	0.43
	2021	13.11	15.98	0.23	22.33	0.34	25.80	0.44
	2022	13.11	16.39	0.24	22.94	0.34	26.42	0.45
	2023	13.11	16.81	0.24	23.53	0.35	27.01	0.46
	2024	13.11	17.23	0.25	24.12	0.36	27.58	0.47
	2025	13.11	17.64	0.25	24.70	0.37	28.13	0.48
	2026	13.11	18.06	0.26	25.26	0.38	28.67	0.49

Table s: China rockfish base case results summary.

Region	Quantity	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
North of	Landings (mt)	11.63	16.14	16.97	15.37	12.58	16.92	17.71	15.67	9.93	
40°10′ N	Total Est. Catch (mt)	11.34	15.79	16.86	15.42	12.44	16.56	17.51	15.65	10.06	
	Nearshore RF ABC/OFL						116	116	110	110	88
	China contrib. ABC/OFL						11.7	11.7	9.8	9.8	7.2
	Nearshore RF OY/ACL	122	142	142	155	155	99	99	94	94	69
	China contrib. OY/ACL						9.8	9.8	8.2	8.2	6.6
South of	Landings (mt)	12.74	13.39	15.16	20.15	18.75	15.62	13.79	10.01	11.17	
40°10′ N	Total Est. Catch (mt)	13.60	14.22	16.02	20.98	19.32	16.21	14.13	10.44	11.85	
	Nearshore RF ABC/OFL						1,156	1,145	1,164	1,160	1,313
	China contrib. ABC/OFL						19.8	19.8	16.6	16.6	55.2
	Nearshore RF OY/ACL	615	564	564	650	650	1,001	990	1,005	1,001	1,114
	China contrib. OY/ACL						16.5	16.5	13.8	13.8	50.4
Northern	(1-SPR)(1-$SPR_{50\%}$)	0.44	0.39	0.47	0.50	0.45	0.56	0.51	0.48	0.53	
model	Exploitation rate	0.32	0.28	0.35	0.38	0.33	0.44	0.39	0.35	0.41	
	Age 5+ biomass (mt)	182.55	183.26	183.36	183.25	183.49	182.90	182.72	182.82	182.52	182.58
	Spawning Output	17.9	18.0	18.0	18.0	18.1	18.0	18.0	18.0	17.9	17.9
	95% CI	(8.86-27.03)	(8.94-27.12)	(8.95-27.14)	(8.93-27.13)	(8.96-27.17)	(8.89-27.1)	(8.86-27.08)	(8.87-27.09)	(8.83-27.06)	(8.83-27.07)
	Depletion	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	95% CI	(0.638-0.83)	(0.642-0.833)	(0.643-0.833)	(0.642-0.833)	(0.644-0.834)	(0.64-0.833)	(0.638-0.832)	(0.639-0.833)	(0.637-0.832)	(0.637-0.832)
	Recruits	33.29	33.30	33.30	33.30	33.31	33.30	33.29	33.29	33.29	33.29
	95% CI	(21.33 - 45.24)	(21.35 - 45.25)	(21.35 - 45.26)	(21.35 - 45.26)	(21.35 - 45.26)	(21.34 - 45.25)	(21.33 - 45.25)	(21.33 - 45.25)	(21.33 - 45.25)	(21.33 - 45.25)
Central	(1-SPR)(1-$SPR_{50\%}$)	0.55	0.62	0.78	0.82	0.78	0.61	0.80	0.85	0.77	
model	Exploitation rate	0.40	0.48	0.68	0.73	0.68	0.47	0.72	0.79	0.67	
	Age 5+ biomass (mt)	386.73	388.36	386.42	383.69	382.08	384.10	381.88	378.59	377.54	381.29
	Spawning Output	41	41	41	40	40	40	40	40	40	40
	95% CI	(27.6-53.68)	(27.8-53.9)	(27.57-53.69)	(27.25-53.38)	(27.05-53.2)	(27.29-53.47)	(27.01-53.21)	(26.6-52.82)	(26.45-52.7)	(26.88-53.19)
	Depletion	0.62	0.63	0.62	0.62	0.62	0.62	0.62	0.61	0.61	0.61
	95% CI	(0.551-0.697)	(0.555-0.7)	(0.551-0.698)	(0.545-0.694)	(0.541-0.692)	(0.545-0.695)	(0.54-0.692)	(0.533-0.687)	(0.53-0.686)	(0.538-0.692)
	Recruits	68.27	68.31	68.26	68.20	68.17	68.22	68.17	68.09	68.06	68.15
	95% CI	(54.59 - 81.94)	(54.64 - 81.97)	(54.59 - 81.94)	(54.51 - 81.9)	(54.47 - 81.87)	(54.52 - 81.91)	(54.46 - 81.87)	(54.36 - 81.81)	(54.32 - 81.8)	(54.43 - 81.87)
Southern	(1-SPR)(1-$SPR_{50\%}$)	1.30	1.18	1.18	1.23	1.35	1.34	1.25	1.20	1.02	
model	Exploitation rate	1.50	1.19	1.22	1.35	1.76	1.70	1.41	1.27	0.90	
	Age 5+ biomass (mt)	234.08	241.35	247.83	252.61	253.37	254.50	258.52	263.64	272.36	280.18
	Spawning Output	14	15	16	16	16	16	17	17	18	19
	95% CI	(9.47-19.39)	(10.01-20.34)	(10.46-21.18)	(10.77-21.81)	(10.75-21.97)	(10.73-22.16)	(10.91-22.6)	(11.18-23.15)	(11.73-24.07)	(12.23-24.9)
	Depletion	0.22	0.23	0.24	0.24	0.25	0.25	0.25	0.26	0.27	0.28
	95% CI	(0.164-0.27)	(0.174-0.283)	(0.182-0.294)	(0.187-0.303)	(0.186-0.306)	(0.186-0.309)	(0.189-0.315)	(0.193-0.323)	(0.203-0.336)	(0.211-0.347)
	Recruits	122.32	123.93	125.23	126.13	126.27	126.42	126.99	127.71	128.94	129.99
	95% CI	(105.92 - 138.73)	(107.67 - 140.18)	(109.07 - 141.39)	(109.98 - 142.28)	(109.96 - 142.57)	(109.97 - 142.87)	(110.52 - 143.46)	(111.29 - 144.13)	(112.72 - 145.15)	(113.95 - 146.03)

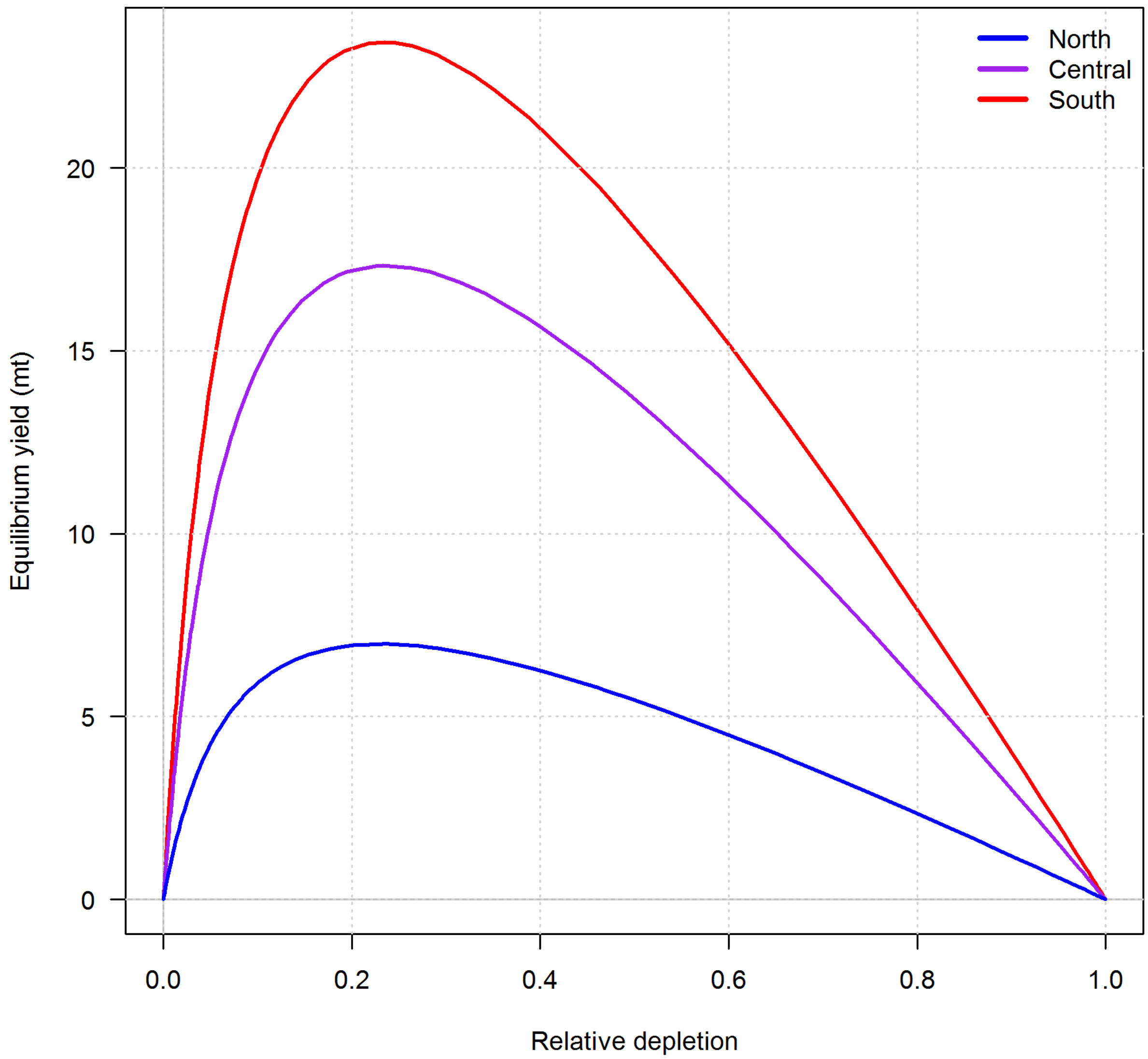

Figure j: Equilibrium yield curve for the base case models. Values are based on the 2014 fishery selectivity and with steepness fixed at 0.773.

Research and data needs

We recommend the following research be conducted before the next assessment:

1. The number of hours fished in Washington should be recorded for each dockside sample (vessel) so that future CPUE can be measured as angler hours rather than just number of anglers per trip. This will allow for a more accurate calculation of effort.

2. The number of hours fished in Oregon should be recorded for each dockside sample (vessel), instead of the start and end times of the entire trip. This will allow for a more accurate calculation of effort.

3. Compare the habitat-based methods used to subset data for the onboard observer indices to Stephens-MacCall and other filtering methods.

4. Explore the sensitivity of Stephens-MacCall when the target species is "rare" or not common encountered in the data samples.

5. A standardized fishery independent survey sampling nearshore rockfish in all three states would provide a more reliable index of abundance than the indices developed from catch rates in recreational and commercial fisheries. However, information value of such surveys would depend on the consistency in methods over time and space and would require many years of sampling before an informative index could be obtained.

6. A coastwide evaluation of genetic structure of China rockfish is a research priority. Genetic samples should be collected at sites spaced regularly along the coast throughout the range of the species to estimate genetic differences at multiple spatial scales (i.e., isolation by distance).

7. Difficulties were encountered when attempting to reconstruct historical recreational catches at smaller spatial scales, and in distinguishing between landings from the private and charter vessels. Improved methods are needed to allocate reconstructed recreational catches to sub-state regions within each fishing mode.

8. There was insufficient time during the STAR Panel review to fully review the abundance indices used in the China rockfish assessments. Consideration should be given to scheduling a data workshop prior to STAR Panel review for review of assessment input data and standardization procedures for indices, potentially for all species scheduled for assessment. The nearshore data workshop, held earlier this year, was a step in this direction, but that meeting did not deal with the modeling part of index development.

9. The Marine Recreational Fisheries Statistics Survey (MRFSS) index in Oregon was excluded from the assessment model because it was learned that multiple intercept interviews were done for a single trip. Evaluate whether database manipulations or some other approach can resolve this issue and allow these data to be used in the assessment.

10. Many of the indices used in the China rockfish assessment model used the Stephens-MacCall (2004) approach to subset the CPUE data. Research is need to evaluate the performance of the method when there are changes in management restrictions and in relative abundance of different species. Examination of the characteristics of trips retained/removed should be a routine part of index standardization, such as an evaluation of whether there are time trends in the proportion of discarded trips.

11. Fishery-dependent CPUE indices are likely to be the only trend information for many nearshore species for the foreseeable future. Indices from a multi-species hook-and-line fishery may be influenced by regulatory changes, such as bag limits, and by interactions with other species (e.g., black rockfish) due to hook competition. It may be possible to address many of these concerns if a multi-species approach is used to develop the indices, allowing potential interactions and common forcing to be evaluated.

12. Consider the development of a fishery-independent survey for nearshore stocks. As the current base model structure has no direct fishery-independent measure of stock trends, any work to commence collection of such a measure for nearshore rockfish, or use of existing data to derive such an index would greatly assist with this assessment.

13. Basic life history research may help to resolve assessment uncertainties regarding appropriate values for natural mortality and steepness.

14. Examine length composition data of discarded fish from recreational onboard observer programs in California and Oregon. Consider modeling discarded catch using selectivity and retention functions in Stock Synthesis rather than combining retained and discarded catch and assuming they have identical size compositions. Another option would be to model discarded recreational catch as a separate fleet, similar to the way commercial discards were treated in the southern model.

15. Ageing data were influential in the China rockfish stock assessments. Collection and ageing of China rockfish otoliths should continue. Samples from younger fish not typically selected by the fishery are needed to better define the growth curve.

16. Consider evaluating depletion estimators of abundance using within season CPUE indices. This approach would require information on total removals on a reef-by-reef basis.

17. The extensive use of habitat information in index development is a strength of the China rockfish assessment. Consideration should be given to how to further incorporate habitat data into the assessment of nearshore species. The most immediate need seems to be to increase the resolution of habitat maps for waters off Oregon and Washington, and standardization of habitat data format among states.

18. Although all the current models for China rockfish estimated implausibly large recruitment deviations when allowed to do so, particularly early in the modeled time period,

further exploration of available options in stock synthesis could produce acceptable results. In addition, this work may provide guidance on any additional options that could be added to stock synthesis to better handle this situation. For example, assuming different levels autocorrelation in the stock-recruit relationship for data-moderate stocks may help curb the tendency to estimate extreme recruitment with sparse datasets.

19. Research is needed on data-weighting methods in stock assessments. In particular, a standard approach for conditional age-at-length data is needed. The Center for the Advancement of Population Assessment Methodology (CAPAM) data weighting workshop, scheduled for later this year, should make important progress on this research need.

1 Introduction

1.1 Basic Information and Life History

China rockfish (*Sebastes nebulosus*) is a medium-sized, commercially (mainly in the live-fish fishery) and recreationally prized deeper-dwelling nearshore rockfish ranging from southern California, north to the Gulf of Alaska (Love et al. 2002). Core abundance is found from northern California to southern British Columbia, Canada. China rockfish are rarely encountered in the Southern California Bight (Love et al. 1998).

There is limited information available on either stock structure or life history. No genetic research has been conducted for China rockfish, and no published research indicates separate stocks along the West Coast. China rockfish do not appear to exhibit sexual dimorphism (Lenarz and Echeverria 1991), although data are limited. Fits to von Bertalanffy growth curves (Bertalanffy 1938) using age-length data from Washington, Oregon, and California indicate regional differences in growth and estimates of L_∞. These data represent fish collected from the recreational and commercial sectors as well as for research.

China rockfish are among the longer-lived rockfish. Love (2002) reports China rockfish live to at least 79 years, which is corroborated by the available age data used in this assessment. The oldest aged China rockfish from Alaska was 78 years old (Munk 2001). Recently aged China rockfish from the West Coast had a maximum age of 83 years from California (recreational or research) in 1973. The oldest aged fish from Oregon was 79 from the commercial dead-fish fishery in 2003 and in Washington, 77 years from the recreational fleet in 2000.

Little is known about the maturity schedule and fecundity of China rockfish. Echeverria (1987) collected 69 China rockfish, of which the age at first maturity was 3 years for males and females (26 cm). Both males and females exhibited 50% maturity at 4 years (27 cm) and 100% maturity at 6 years (30 cm). A study by Lea et al. (1999) captured females releasing larvae in April and May, and spent females in April, June and October off the coast of California. Echeverria (1987) identified January - June as the months of parturition for China rockfish in north-central California, with the peak of reproductive activity in January.

One diet study indicated that China rockfish in central California predominantly feed on crustaceans and ophiuroids, while the diets of China rockfish in northern California was dominated by crustaceans and mollusks (Lea et al. 1999). This is similar to the diet described by Love et al. (2002) of benthic organisms, including brittle stars, crabs, and shrimps.

Both juvenile and adult China rockfish tend to be solitary and exhibit high site fidelity within rocky habitats. Surveys of rockfishes in *Nereocystis* and *Macrocystis* kelp forests observed China rockfish in only the *Macrocystis* kelp forests, and overall sightings within the kelp forests were rare (Bodkin 1986). Juvenile China rockfish inhabit shallow, subtidal waters (Love et al. 2002), and an experimental study with captive China rockfish found that juveniles exhibit both site fidelity and territoriality (Lee and Berejikian 2009). A tag and recapture study by Lea et al. (1999) indicated China rockfish have high site fidelity.

While Lea et al. (1999) did not report exact distances, all China rockfish from the study were recaptured in the same "general locality at which they were released." In other rockfish movement studies, China rockfish were tagged but never recaptured (Hanan and Curry 2012), or there was a sample size of one fish (Hannah and Rankin 2011). An ongoing study has used acoustic telemetry to tag and track seven China rockfish at Redfish Rocks, off the south coast of Oregon (pers. comm. Tom Calvanese, Oregon State University). The location where each fish was released after tagging was recorded using GPS. The maximum distance traveled from release point was calculated using the location of the most distant receiver at which that fish was detected, plus 250 m (estimated receiver detection range). Preliminary analyses estimate the maximum distance traveled by China rockfish (n=7) averaged 1,344 $\pm$ 334 m between May 1, 2011, and December 31, 2012.

Little is known about dispersal of juvenile China rockfish during the pelagic stage, and they are not captured in the Southwest Fisheries Science Center's (SWFSC) juvenile rockfish cruise. The 2013 assessment model treated the species as two stocks, north and south of Cape Mendocino, CA (40°10′ N. latitude), which is also the management boundary for China rockfish. For this assessment we explore assessment models north and south of 40°10′ N. latitude, as well as separate northern California/Oregon and Washington models in the north.

1.1.1 Early Life History

China rockfish, like other species in the genus *Sebastes*, are iteroparous, have internal fertilization,and bear live young. Gestation periods range from 1-2 months among the *Sebastes* spp. that have been studied, but no data specific to China rockfish were found in our literature search. Parturition (release of larvae into the water) by China rockfish was reported between January and June in Central California (Echeverria 1987), but the duration of the pelagic larval and juvenile stages is unknown. Closely-related, nearshore rockfish species (e.g. gopher, black-and-yellow, kelp, and copper) recruit at small sizes (1.5-2 cm), and are thought to have short pelagic juvenile stages relative to other *Sebastes* (Anderson 1983, Love et al. 2002).

1.2 Map

A map showing the scope of the assessment and depicting boundaries for fisheries or data collection strata is provided in Figure 1.

1.3 Ecosystem Considerations

In this assessment, ecosystem considerations were not explicitly included in the analysis. However, we did use information on the distribution of rocky habitat to inform the onboard observer program indices of relative abundance from California and Oregon. The onboard observer program collects location-specific encounters of China rockfish. We overlaid the locations of China rockfish encounters with high-resolution bathymetry data to obtain a proxy of the extent of China rockfish habitat (see Appendix F for details, p.F-1).

Much research is needed to elucidate the role of China rockfish in the ecosystem, including predator/prey interactions.

1.4 Fishery Information and Summary of Management History

The rockfish fishery off the U.S. Pacific coast first developed off California in the late 19th century as a hook-and-line fishery (Love et al. 2002). The rockfish trawl fishery was established in the early 1940s, when the United States became involved in World War II and wartime shortage of red meat created an increased demand for other sources of protein (Harry and Morgan 1961, Alverson et al. 1964). China rockfish are most commonly captured by hook-and-line or traps. They are rarely encountered in the trawl fishery due to the elusive behavior and affinity for rocky crevices. Their high site fidelity and territoriality lend to the evasiveness of the species.

Catch reconstructions of China rockfish indicate a developing fishery in California in the 1940s, and not until the 1970s in Oregon. The recreational fishery in Washington developed in the late 1960s, but the magnitude of catches compared to the other states is relatively small. China rockfish is not a directed target recreational species in any of the three states.

Prior to 2000, the Pacific Fishery Management Council (PFMC; Council) managed the fishery for China rockfish as part of the *Sebastes* complex, with no separate Acceptable Biological Catch (ABC) or Optimum Yield (OY) for China rockfish. In 2000, the Council established the northern and southern Nearshore Complexes (north and south of 40°10′ N. latitude), of which China rockfish is included.

The Council established management guidelines for the northern and southern Nearshore Rockfish Complexes in the 2005-2006 management cycle (Total Catch OY; 122 mt north of 40°10′ N. latitude and 615 mt south of 40°10′ N. latitude). The 2011-2012 management cycle adopted and Overfishing Limit (OFL) and Annual Catch Limit (ACL) for the northern and southern Nearshore Rockfish Complexes, and the China rockfish contribution to the complex, which differ north and south of 40°10′ N. latitude. In 2003, the Council established Rockfish Conservation Areas to control catches of overfished rockfish species, and large portions of the shelf were closed to fishing.

In 1995, Washington closed commercial hook-and-line gear in state waters (0-3 miles). Oregon's commercial nearshore fishery developed in the mid 1990s as an open access fishery. Oregon adopted formal management of the commercial nearshore fishery in 2004. Oregon adopted a 12 inch size limit in the commercial fishery for China rockfish in 2000, and California did the same in 2001. California required a nearshore fishery permit as of 1999 and has had area-specific closures since 2000 to minimize interactions with canary and yelloweye rockfishes.

Washington adopted depth closures for the recreational fishery in 2006 for MCAs 2 (closed seaward of 30 fm), 3 (closed seaward of 20 fm) and 4 (closed seaward of 20 fm).

In November 2002, Oregon implemented the first depth closure seaward of 27 fm. In general, from June 1 - September 30, groundfish are prohibited seaward of 40 fm from 2004-2009. In July 2010 and 2011, seaward of 20 fm was closed due to yelloweye rockfish interactions. From 2012-2014, groundfish take seaward of 30 fm from April 1-September 30 is prohibited. As of 2015, retention of China rockfish is prohibited in the Oregon recreational fishery.

California adopted a 3-hook and 1-line regulation in 2000, which changed to 2-hooks and 1-line in 2001. California manages the recreational fishery through management areas, which have been dynamic through time. In general starting in 2004, north of $40°10'$ N. latitude to the CA/OR border, the nearshore rockfish fishery is closed seaward of 30 fm May-December, (and closed in January-April as of 2005). In 2008, the depths seaward of 20 fm were closed May-August and the closures from September-December change annually through 2014. Depth closures between Pt. Conception and Cape Mendocino have been much more dynamic. In general, depth closures began in 2001 at 20 fm and have dynamically varied by month and depth (20-40 fm) through 2014.

1.5 Management Performance

China rockfish is managed in the northern and southern Nearshore Rockfish Complex, split at $40°10'$ N. latitude. Since the 2011-2012 management cycle, China rockfish has a contribution OFL and ACL within each the northern and southern Nearshore Rockfish Complexes (Table n). The estimated catch of China rockfish north of $40°10'$ N. latitude of Nearshore Rockfish Complex has been above both the China rockfish contribution to the northern Nearshore Rockfish Complex OFL and ACL in all years (2011-2014). The estimated catch of China rockfish south of $40°10'$ N. latitude of Nearshore Rockfish Complex has been below the China rockfish contribution to the northern Nearshore Rockfish Complex OFL and ACL in all years (2011-2014). A summary of these values as well as other base case summary results can be found in Table s.

2 Assessment

2.1 Data

Data used in the China rockfish assessment are summarized in Figures 2 - 4. A description of each data source is below.

2.1.1 Fishery-Dependent Data: Commercial Landings

Washington

Washington does not have a nearshore commercial fishery and there are no records of China rockfish being landed by any commercial gears in Washington. There is no record of tribal catch of China rockfish in Washington.

Oregon

China rockfish landings from Oregon commercial fisheries were minor until twenty years ago (Table 1, Figure 5). Prior to the mid-1990s, there were only trace landings of China rockfish from longline fisheries (i.e., less than one metric ton per year), and no landings from the trawl fisheries (based on species composition samples obtained since the 1960s) (Douglas 1998). However, landings of China rockfish rapidly increased from 1995-2000 due to the emergence of a live-fish market that paid high prices for ornate rockfish, such as China rockfish (especially in Southern Oregon). Following a peak in catch from 1998-2000, decreased landings of China rockfish during the early 2000s coincided with new regulations designed to limit harvests from the live fish fishery, such as landings limits, permit limits, and minimum size limits (Rodomsky et al. 2014).

There is a relatively high degree of confidence in the accuracy of historic China rockfish landings because comprehensive sampling of commercial landings began before the fishery for China rockfish developed. Specifically, since 1992, the Oregon Department of Fish and Wildlife has obtained robust species composition samples from landings categories containing China rockfish at fine levels of stratification (i.e., year, quarter, gear, disposition, area caught, and market category). China rockfish landed into improper market categories, has been practically non-existent, presumably due to the high price differential for China rockfish (as opposed to other rockfish). China rockfish landings since 1992 were obtained from PacFIN, which estimates species specific landings of rockfish by the above mentioned strata.

However, China rockfish landings could not be obtained from PacFIN prior to 1992 since China rockfish were not included in species composition samples (of rockfish category landings) from the longline and rod-and-reel fisheries (and thus China rockfish landings incorrectly appear as zeros in PacFIN). Accordingly, landings of China rockfish were obtained from the commercial catch reconstruction developed by Karnowski et al. (2014), whom borrowed species compositions (from earliest complete years) and applied them to market category landings from years before species compositions were obtained.

All China rockfish landings from the Karnowski et al. (2014) reconstruction were used except for those occurring from the salmon troll fishery, which were reported as 1-2 metric tons per year from the mid-1960s to the early 1990s. Since a species composition had never been obtained from the market categories containing China rockfish for the salmon troll fishery, Karnowski et al. (2014) borrowed species compositions from the recreational salmon fishery and applied them the commercial salmon troll fishery landings. Although China rockfish appeared in the recreational salmon fishery landings, it was concluded at the Nearshore

Stock Assessment Workshop (Agenda Item D.8 Attachment 10, June 2015) that the China rockfish caught during recreational salmon trips were not caught by troll gear, but rather by jig gear from anglers who also targeted benthic rockfish species before or after trolling for salmon. Since China rockfish are associated with rocky reef habitat (Love et al. 1998) and salmon trollers fish the surface waters for coho salmon and avoid rocky reefs when fishing for Chinook salmon (to prevent entanglement of expensive downrigger gear on rocks), it was deemed improbable that China rockfish be caught by salmon troll gear.

California

The CALCOM database was queried (May 15, 2015) for commercial landing estimates of China rockfish in California, 1969-2014. Landings were stratified by year, quarter, live/dead, market category, gear group, port complex, and source of species composition data (actual port samples, borrowed samples, or assumed nominal market category).

The majority of commercial China rockfish landings are made by vessels using hook-and-line gear (Figure 6). However, CALCOM landings estimates also include a large fraction of trawl-caught China rockfish from 1969-1988, which is unlikely given the species' preference for rocky habitat. The reported trawl catch was mainly from the Monterey port complex and was landed in the "China rockfish" market category (258).

An analysis of species composition data from port samples in market category 258, by gear type, revealed that the sampled trawl-caught landings contained mainly deeper-water species, including greenspotted rockfish (*Sebastes chlorostictus*), sometimes known as "chinafish." Species landed by hook-and-line gears in the China rockfish market category, on the other hand, consisted of a mixture of nearshore species (e.g., China, quillback, gopher, black-and-yellow, and brown; Figure 7). When port samples are not available to estimate species composition in a stratum, and no samples are available to 'borrow' from an adjacent stratum, landings in a market category are assigned to the 'nominal' species category, in this case China rockfish.

Given the available species composition data from the trawl catch, and the fact that trawl gear is unlikely to be fished in China rockfish habitat, estimates of trawl-caught China rockfish were removed from the landings estimates in the current assessment. A similar analysis led to the removal of a small amount (about 5 mt) of landings by set-net and mid-water trawl gear groups.

In years prior to 1978, landing receipts are available for California but there are no associated port sample data. In CALCOM, a ratio estimator (based on the expanded landings estimates in the earliest sampled years) is used to allocate catch to species in unsampled years. In the case of China rockfish, this procedure propagated the estimates of trawl-caught China backward in time to 1969 (Figure 6). These ratio estimates of trawl-caught China rockfish were also removed from the final time series of landed catch.

The previous assessment of China rockfish (Cope et al. 2015) modeled two China rockfish populations, north and south of $40°10'$ N. latitude (roughly Cape Mendocino). The majority of landings occurred south of Cape Mendocino, and the revised estimates are substantially lower in early years, primarily due to the removal of trawl catch (Figure 8).

California's commercial live-fish fishery began targeting nearshore rockfish species in the mid-1980s in southern California, and condition codes (live or dead) were required on landing receipts starting in 1993 (CDFG 2002). However, fish landed live are not always recorded as live landings on the landing receipts, so estimates of live landings should be viewed as a minimum estimate (CDFG 2002). Live annual landings of China rockfish surpassed landings of dead fish by the late 1990s, due to the increased value of fish landed live (Table 2, Figure 9).

Commercial landings of China rockfish in California from 1916-1968 were obtained from the historical reconstruction of Ralston et al.(2010), and also available from the CALCOM website. Their analysis differentiates between trawl-caught landings and "other" gears. In the case of China rockfish, less than 2 mt of landings from 1916-1968 were attributed to trawl gears, and these were excluded from the assessment. The remaining "other" gear types (cumulative removals of 197 mt from 1916-1968) landed China rockfish mainly south of Cape Mendocino, with a short pulse of landings between Cape Mendocino and the California-Oregon border in the 1930s and early 1940s (Figure 10). Due to the relatively large landing estimates south of Cape Mendocino in the early years, catches from 1900 to 1916 were interpolated with a linear ramp from 0 mt in 1900 to 6.1 mt in 1916 (the first year of commercial landings estimated by Ralston et al. (2010).

2.1.2 Fishery-Dependent Data: Commercial Discards

Washington

Discards of China rockfish likely occurred before the closure of nearshore commercial fisheries in 1995 for non-trawl gears and in 1999 for trawl gears. However, there is no information on historical discards. For this assessment, we assume no retention or discard of China in any commercial fisheries.

Oregon and California

Estimates of discarded China rockfish in commercial fisheries were provided by the West Coast Groundfish Observer Program (WCGOP). These were available for the years 2003-2013 north of 40°10′ N. latitude, and 2004-2013 to the south. WCGOP provided estimates with and without the depth-specific discard mortality rates applied. These estimates indicate that the nearshore fixed-gear fishery was the only sector with observed discards of China rockfish and there were strong differences in rates of discarding north and south of 40°10′ N. latitude, (Figure 11 and Table 3). The mortality of discarded China rockfish is estimated by WCGOP as a function of the fishing depth which varies by year (Table 3). The average mortality fraction south of 40°10′ across all years was 59%.

Discard rates were consistently low north of 40°10′ N. latitude, where no year had estimated mortality from discards greater than either 0.5 mt, or 5% of the landings. A linear regression relating discarded to retained catch (with intercept fixed at the origin) had a slope of 0.0269, indicating that discards on average represent 2.69% of the landings in this sector (Figure 12). This value is similar to a simple average of the discard fractions, which was 2.75%.

South of 40°10′ N. latitude, commercial landings were lower and estimated discards higher. The maximum discard mortality estimate was 1.8 mt for 2012 which was 126% of the 1.4 mt nearshore fixed gear landings in that area in that year. The total discard amount for that year, including fish estimated as surviving, was 2.7 mt, almost double the landed amount. There is also an increasing trend over the observed period (2004-2013) with an average for the first three years of 30% of all China rockfish catch discarded and an average over the final three years of 63% discarded.

Discard patterns in the area of Northern California between 40°10′ N. latitude, and 42° N. latitude appears to be more similar to Oregon than the rest of California (Table 4). Although expanded fleet-wide discard estimates were not available on this smaller spatial-scale, only 9% of observed trips between 40°10′ N. latitude to 42° N. latitude that were associated with any catch of China rockfish had any observed discards of China rockfish. South of 40°10′, 82%-100% of such trips had observed discards of China rockfish.

The patterns of the discards in commercial fisheries suggest that north of 40°10′ N. latitude discard mortality of China rockfish is small enough that it is more parsimonious to account for this mortality increasing the landed catch estimates by 2.69%. South of 40°10′ N. latitude, total discards are greater than landings in some years and discard mortality represents a large fraction of the total mortality of China rockfish. The discards are primarily fish below the minimum legal size of 12 inches (Figure 64). The discard process was modelled using a retention function in the pre-STAR panel base model, but this approach did not capture the increasing trend in discard rates, which may be an indication of changes in population size structure that should be accounted for in the assessment. The final southern base model treated discarded catch as a separate fleet, exactly matching removals that were dead discarded catch, and fitting length composition data from WCGOP in the model.

2.1.3 Fishery-Dependent Data: Recreational Landings and Discards

Washington

Historically, Washington's coastal recreational anglers have been salmon-orientated and most groundfish were considered "scrap fish" by anglers (Buckley 1967). Beginning in the mid-1970s, and particularly in the wake of the 1974 Boldt Decision, salmon fishing opportunities became increasingly restrictive; seasons were shortened and daily limits were reduced. The trend continued into the 1980s and 1990s. In 1994, and for the first time in the state's history, a one year moratorium on all ocean salmon fishing was implemented in response to dwindling salmon runs. As salmon fishing opportunities waned over time, recreational and commercial fishers began shifting their interests to other species. Many recreational coastal anglers shifted their efforts to rockfish. Prior to declines in salmon fishing opportunities, rockfish, though rarely discarded, were generally not targeted. The increased interest in rockfish and other groundfish can be linked directly to the decline in salmon fishing opportunities.

The coastal recreational fleet is composed of two sectors; privately owned vessels and charter vessels. Throughout the history of coastal charter boat fishing, Westport has remained the center of charter boat activity; however, as the salmon fishing industry declined, the charter fleet dispersed in search of more lucrative opportunities. Many of the vessels left the state, and some moved north where rockfish fishing was perceived as being more reliable. Even so, there are still more charter vessels operating at Westport than at Neah Bay and La Push.

The primary focus of coastal rockfish anglers is black rockfish. Black rockfish occur in greater abundance and closer to shore than other coastal rockfish species, and while generally regarded as a "bottom fish," they tend not to occupy crack and crevice habitat, thus making them more susceptible to hook-and-line fishing. As rockfish daily limits decreased, the likelihood of recreational anglers retaining smaller rockfish species, such as China, as part of their daily bag limit likely also decreased.

China rockfish are more common in northern Washington coast (Marine Catch Areas (MCAs) 3 and 4) from south of Tatoosh Island to Pt. Grenville inside of 15 fm and are rarely encountered south of the Point Grenville. Makah Bay and the Umatilla reef areas seem to have the largest populations in the area (Tom Burlingame, Excel Fishing Charters, pers comm). China rockfish are rare off of the central Washington coast (MCA 2) from the mouth of the Queets River to Leadbetter Point. Some chartered vessels from Westport have gone multiple seasons without encountering any China rockfish in MCA 2 (Mark Cedergreen, Westport Charterboat Association, pers comm). Suitable habitat is limited in MCA 1, from the mouth of the Leadbetter Point to the mouth of Columbia River.

Historical estimates of China rockfish catch during 1967 and 1975-1989 were based on historical sport catch report series published by Washington Department of Fisheries (Table 5, Figure 14). Catches for 1968-1974 and 1987-1989 were based on a linear interpolations between adjacent years. From 1990 to current, catch estimates were produced by the Washington Department of Fish and Wildlife (WDFW) Ocean Sampling Program based on a catch expansion procedure that includes a complete count of vessels leaving or entering a port and dockside angler interviews. The dockside interview program collects information on number of anglers fished, catch area, and target species. Shorebased fishing, other than major jetties, is not sampled and is considered negligible. Sampling and effort counts occur mainly from April to October. Winter fishing is also considered negligible.

We assumed an average weight of 0.88 kg/fish (RecFIN) to convert the estimates from number of fish to metric tons for all years. The split between charter and private vessels prior to 1990 was based on a ratio estimator using 1990-1994 data.

More than 90% of China rockfish were caught off the northern Washington coast on an annual basis (Table 5) and the catch by private vessels accounted for 70%-95% of the northern catches. In the southern area, harvest of China has been under 0.5 mt annually; and most of China rockfish were caught by charter vessels (Table 5, Figure 14).

Release information was not available until 2002. Number of released fish by species and the depth of release were added to OSP dockside questionnaire in 2002 and 2005, respectively. The number of released fish by depth is estimated using the same catch expansion algorithm for retained catch. Surface release mortalities adopted by the Groundfish Management Team (GMT) were then applied to the number of release estimates for a total mortality calculation. The average weight of 0.88 kg/fish was also used for released fish. For pre-2002 release, we applied proportions of released fish based on a ratio estimator using 2003-2007 data. For the split between charter and private vessels, the same algorithm used for splitting retained catch was applied.

Discard rates are higher in northern Washington than in southern Washington. Since 2011, more than 50% of the China rockfish caught were released by anglers. The release rates are lower in the southern area between 14% and 26% in recent years. This may due to the rare encountering of China off southern Washington coast.

Oregon Sport Fishery Removals 1973-2014

China rockfish have been a relatively minor contributor to historic Oregon sport groundfish landings (i.e., typically less than one percent of total catch), and have primarily been from incidental catches of anglers targeting intermixed schools of midwater rockfish species (e.g., black rockfish, blue rockfish, and yellowtail rockfish). China rockfish removals from the Oregon sport fishery ramped up relatively quickly during the 1970s (Table 6, Figure 15), and have since ranged between two and seven metric tons every year, with considerable inter-annual variation.

Total removals of China rockfish from the Oregon sport fisheries were obtained from estimates produced by the Oregon Recreational Boat Survey (ORBS). To produce total catch estimates, ORBS applies catch rates from a subsample of vessels (from dockside interviews) to total effort counts at fine levels of stratification (i.e., by week, port, fishery, and type of boat). For estimates of landings, catch rates are verified by biologists; however, estimates of discard mortality are based on angler-reported discards, and are further stratified by depth-dependent mortality rates associated with barotrauma. Since nearly all mortality of China rockfish has been from landed catch (i.e., typically less than 0.1 mt of estimated discard mortality per year), there is relatively high degree of certainty in sport fishery removals.

Since 2001, ORBS has produced comprehensive year-round estimates of catch and effort for all developed Oregon ports (and are available from RecFIN). However, prior to 2001, ORBS sampling was typically only conducted at major ports during the peak months of sport fishing activity, and no estimates of catch were made for unsampled ports and times. Accordingly, the Oregon Department of Fish and Wildlife (ODFW) reconstructed historic ORBS estimates of China rockfish to include catches from all ports and times (not yet available on RecFIN), as is done in recent years.

The sport reconstruction addressed four spatial and temporal coverage biases identified during an external review of ORBS by the RecFIN Statistical Subcommittee (Van Voorhees et al. 2000): (1) “major ports” that were sampled each year were not sampled during the win-

ter months; (2) "minor ports" were not sampled at all during some years; (3) effort counts for private boats excluded afternoon and night trips; and (4) undeveloped launch sites were never sampled (e.g., beaches). A fifth coverage bias, shoreline and estuary boat removals, was not relevant to China rockfish since landings were typically non-existent during years when sampling occurred.
The sport reconstruction utilized ratio estimators, based on years with complete sampling, to expand catches from years with partial sampling. For instance, the contribution of winter catch to total catch during years with complete sampling was used to the expand catches for years with missing winter catch. Similarly, the contribution of catch from a minor port to that of the major ports during years with complete sampling was used to expand catches of years that the minor port was not sampled.

California

In California, recreational fishing has accounted for over 70% of cumulative China rockfish removals statewide (1900-2014, landings and discard), and over 84% of statewide removals since 2005 (Table 7 and Figure 16). Almost all the removals are attributed to boat fishing modes (party/charter and private/rental fleets), with only a negligible contribution from shore-based fishing modes (RecFIN, 2015).

Estimates from the California Recreational Fisheries Survey (CRFS) were downloaded from the Recreational Fisheries Information Network (RecFIN). This survey covers the years 2004-2014, and estimates of retained plus discarded catch (catch types A and B1) were downloaded in numbers of fish as well as metric tons by year, boat mode ("PC" = party/charter, "PR"=private/rental), month, and CRFS district. In some strata, estimates of catch in numbers had no corresponding catch in weight due to missing average weight values in RecFIN. For these strata, catch in weight was estimated using the product of catch in numbers and average weight in the same year. Catches in weight (mt) were aggregated by year, boat mode, and CRFS district. As an approximation, removals in CRFS District 6 were assigned to the management area north of Cape Mendocino.

From 1980-2003, sampling of recreational fisheries in California was conducted as part of the Marine Recreational Fisheries Statistics Survey (MRFSS). Estimates of retained and discarded catch (A+B1) in numbers of fish and weight in metric tons were downloaded from the RecFIN website. Strata with estimates of catch in numbers, but no corresponding weight, were imputed using the same approach described above for the CRFS estimates. MRFSS sampling was not conducted from 1990-1992 due to lack of funding. Also, sampling of the PC boat mode north of Point Conception did not resume until 1996. Estimates for these missing years were calculated using linear interpolation, by region and boat mode.

The MRFSS program did not provide estimates of removals stratified north and south of Cape Mendocino. However, the California Department of Fish and Wildlife (CDFW) has maintained logbook records since 1957 of total rockfish catch by CDFW statistical block (Table 7) from the PC mode (a.k.a. the Commercial Passenger Fishing Vessel or "CPFV" fleet). Following the approach used in the last China rockfish assessment (Cope et al. 2015), we calculated the ratio of total rockfish catch (all species combined) for statistical blocks less than 233 (blocks north of Cape Mendocino) to total rockfish catch in the area north of Point Conception (34°27′ N. latitude) by year. The ratios were then scaled such that the percentage of catch north of Mendocino in 2003 matched the observed ratio of catch in CRFS District 6 to CRFS Districts 3-6 from 2004-2011. These adjusted ratios were applied to annual MRFSS estimates for the area north of Point Conception in order to estimate landings north and south of Cape Mendocino in the years 1980-2003.

Estimates of recreational removals (catch and discard) from 1928-1979 were reconstructed by Ralston et al. (2010) (Table 7). Similar to the MRFSS data, the estimates produced by Ralston et al. (2010) did not partition catch to areas north and south of Cape Mendocino, so CPFV logbook data was used to determine the fraction of removals north and south of Cape Mendocino. Adjusted annual percentages (Table 8) were applied to the reconstructed recreational catches back to 1957, and the average percentage in 1957-58 (0.74%) was applied to all previous years and assumed constant back to 1928.

2.1.4 Fishery-Dependent Data: Oregon Commercial Logbook

The ODFW has required nearshore commercial fishers (both nearshore permitted vessels and open access vessels) to submit fishing logbooks since 2004. Fisher compliance is generally high, averaging around 80%, but has varied through time ranging from 65% in 2007 to 95% in recent years. Although required to provide all requested information in the logbook per fishing gear set, there has been substantial variation in the quantity and quality of information reported in logbooks. Responses from submitted logbooks were entered into a central database and span the years 2004 through 2013. At the time of this assessment, 2014 logbook submissions were not fully processed and thus were not available. A map showing positive reports of China rockfish can be found in Figure 17.

Logbook information went through several data quality filters to attain as best as possible a consistent and representative data set through time to estimate a relative abundance trend. Results from the filtration algorithm are summarized in Table 9. Of note, only logbook submissions from black and blue rockfish permitted vessels with a nearshore endorsement were included in the analysis, because these vessels consistently fish in areas where China rockfish are encountered. To minimize temporal variation in reporting errors (or nuances), only vessels that fished all 10 years (2004 to 2013) were deemed the most likely to provide consistent responses through time. Operators of endorsed vessels may have changed through time. Individual observations of catch (kg) and effort (hook hour) were at the trip level, where multi-set trips were aggregated to the trip level. ODFW sets bimonthly trip landing limits for China rockfish and these have changed through time. However, trip limits have not generally been breached in the subset of logbook data used for China rockfish, and thus there was no need to exclude subsequent trips. The final subset of logbook data included 3,575 trips (14% of the full set of logbook data) from 10 vessels (Figure 20).

Preliminary data analyses identified levels or limits of filtering variables in order to preserve adequate sample sizes and representative trips for China rockfish. For example, gear type was restricted to hook-and-line (excluding longline gear) because this method accounted for 85% of all sets. The three main southernmost Oregon ports (Port Orford, Gold Beach, and Brookings) were the only locations that included a sufficient number of sets throughout the time series for nearshore endorsed vessels. Thus, this abundance index is most representative of southern Oregon nearshore waters. Fishing depth at the start of a set was restricted to within 30 fm (54.9 m), which included more than 99% of all sets by nearshore endorsed vessels, to ensure only CPUE in areas where China rockfish are commonly encountered was evaluated.

Covariates considered in the full model included *month, vessel, port, depth, and people* (Figure 18). All covariates were specified as categorical variables, except depth was a continuous variable. *Depth* was included to account for general differences in bathymetry and fishing depth restrictions associated primarily with limiting catch of yelloweye rockfish. *People* were included in an attempt to control for the potential oversaturation of hooks at a given fishing location and the interaction that multi-crew trips (# fishers onboard) may have on fishing efficiency. The selection of covariates included in final models were evaluated using standard information criterion for relative goodness of fit (AICc and BIC) in a backwards stepwise fashion, where a covariate remained in the model if model fit was improved relative to an otherwise identical model without the covariate.

CPUE was modeled using a delta-GLM approach, where the catch occurrence (binomial) component was modeled using a logit link function and the positive catch component was modeled according to a gamma distribution with a log link function. CPUE was calculated for each trip, where total catch was defined as the sum total of all reported retained catch (in weight) and released catch (numbers converted to weight by applying a median catch weight) and total effort was defined by hook-hours (number of hooks used multiplied by the number of hours fished). A lognormal distribution for the positive catch component was also evaluated, but graphical summary diagnostics of model adequacy slightly favored the gamma distribution. A delta-GLMM was also attempted to specify vessel-year interaction effects as stemming from a distribution (random effect) and to account for this added source of variation. However, the estimation procedure was unstable for the delta-GLMM approach, resulting in overinflated CVs.

Model selection procedures identified the covariates *vessel, port, depth and people* as important, and along with the categorical *year* factor of interest for the index were the variables included in both the catch occurrence and positive catch component models. Extracted, back-transformed and bias corrected estimates of the *year* effect were used for the abundance index (Table 10, Figure 19). A jackknife resampling routine was conducted to estimate the standard error (and CV) of the year effects. The relative effects of each covariate are shown in Figure 21 for the catch occurrence component and Figure 22 for the positive catch component. Standard model diagnostics show adequate fit and general consistency with GLM model assumptions for the positive catch component (Figure 23).

2.1.5 Fishery-Dependent Data: Recreational Dockside Surveys

Washington

The WDFW provided recreational dockside fisheries data from 1981 to 2014. These data went through several data quality filters to identify the best subset of the available data that are likely to be consistent over the time series and provide a representative relative index of abundance once standardized. Sample sizes from data filtering steps prior to implementing a delta-GLM CPUE standardization resulted in 10,248 records applying the Stephens-MacCall data filter (Stephens and MacCall 2004), 16,193 records applying the Stephens-MacCall data filter to the full data set and then retaining all of the positive records, and 54,285 without applying the Stephens-MacCall data filter (Table 11). The Stephens-MacCall method is an objective approach for identifying trip records of catch and effort data when fishing locations are unknown, based inference regarding the species composition of the catch identifying habitats where the target species is likely to occur (Stephens and MacCall 2004).

Since recreational fishing trips target a wide variety of species, standardization of the catch rates requires selecting trips that are likely to have fished in habitats containing China rockfish. The method of Stephens and MacCall (2004) was used to identify trips with a high probability of catching China rockfish, based on the species composition of the catch in a given trip. Prior to applying the Stephens-MacCall filter, we identified potentially informative "predictor" species, i.e., those with sufficient sample sizes and temporal coverage (at least 30 positive trips total, distributed across at least 10 years of the index) to inform the binomial model. Coefficients from the Stephens-MacCall analysis (a binomial GLM) are positive for species which co-occur with China rockfish, and negative for species that are not caught with China rockfish.

Covariates considered in the full model included *year, month, boat type, daily bag limits, and depth restrictions* (Figure 24). All covariates were specified as categorical variables. The stepwise selection of covariates included in the final model was evaluated using standard information criterion for relative goodness of fit (AIC). *Depth* was not included in the analysis because it was not uniformly recorded through time; depth data collection began during 2003. The covariates for *daily bag limits* and *depth restrictions* represent management changes. Summer fishing restrictions based on depth limitations were implemented during 2006 in WDFW areas 2, 3, an 4. The daily rockfish limit was 15 fish from 1961-1991, 12 fish from 1992-1994, and reduced to 10 fish in 1995 (see Appendix H for the history of recreational regulations, p.H-1).

CPUE was modeled using a delta-GLM approach, where the catch occurrence (binomial) component was modeled using a logit link function and the positive catch component was modeled after log-transformation of the response variable, according to a normal distribution with an identity link function. Data are collected at the trip level, with the number of fish landed and the number of anglers on each vessel being recorded. The amount of time fished by each angler is not recorded. Therefore, the units for CPUE are fish landed/angler-trip. A gamma distribution for the positive catch component was also explored, but model selection favored the lognormal model, although both models provided similar results.

Model selection procedures selected the covariates *month* and *boat type* as important for both the catch occurrence and positive catch component models for all data sets, along with the categorical year factor used for the index of abundance (Tables 12, 13 and 14). A bootstrap analysis (N=500) was used to estimate the standard errors (and CVs) of the year effects (Table 15). Standard model diagnostics show adequate fit and general consistency with GLM model assumptions for the positive catch component Figures 25, 26 and 27).

Due to the large number of records filtered out by the Stephens-MacCall method three sets of models were run: 1) applying the Stephens-MacCall data filter, which eliminates both zero and positive observations, 2) applying the Stephens-MacCall data filter but retaining all of the positive records, and 3) without applying the Stephens-MacCall data filter (Table 11). The resulting indices of China rockfish abundance using either data set subject to the Stephens-MacCall filter are similar (Figure 28). However, the index resulting from the dataset not subject to the Stephens-MacCall filter produces similar trends compared to the Stephens-MacCall filter through the mid-2000s then declines compared to the indices using the Stephens-MacCall filter from the late 2000s to present (Table 15). The model with the Stephens-MacCall filter that retained all positive encounters was the index selected for use in the assessment model (Figure 29).

Additional model sensitivities that did not impact the standardized index were:

1.The use of only area 4 data versus using all of the data with an area covariate. A strong majority of the positive data are from area 4, only these data are used in the standardized indices.

2.Splitting the time series in 2002 to model CPUE from 2002 to 2014 as total catch (discarded fish were recorded beginning in 2002) rather than landed catch.

Producing a model for just southern areas (1 and 2) was not successful due to a lack of positive data over the time series.

California MRFSS Dockside Charter Boat Index, South of 40°10′ N. latitude

From 1980 to 2003 the MRFSS program sampled landings at dockside (called an "intercept") upon termination of recreational fishing trips. The program was temporarily suspended from 1990-1992 due to lack of funding, and sampling of California charter boats north of San Luis Obispo County did not resume until 1995. For purposes of this assessment, the MRFSS time series is truncated at 2003 due to regulatory changes and an increasing fraction of trips sampled by onboard observers (see "Recreational Onboard Observer Surveys"). Although the program sampled various fishing modes, only the California party and charter boat (a.k.a. "PC mode," commercial passenger fishing vessel, or CPFV) samples are used in the present analysis due to availability of catch and effort data aggregated at the trip level. Each entry in the RecFIN Type 3 database corresponds to a single fish examined by a sampler at a particular survey site. Since only a subset of the catch may be sampled, each record also identifies the total number of that species possessed by the group of anglers being interviewed.

The number of anglers and the hours fished are also recorded. Unfortunately the Type 3 data do not indicate which records belong to the same boating trip. Because our aim is to obtain a measure of catch per unit effort (fish per angler hour), it is necessary to separate the records into individual trips. For this reason trips must be inferred from the RecFIN data. This is a lengthy process, and is outlined in Supplemental Materials ("Identifying Trips in RecFIN").

Since recreational fishing trips target a wide variety of species, standardization of the catch rates requires selecting trips that are likely to have fished in habitats containing China rockfish. The method of Stephens and MacCall (2004) was used to identify trips with a high probability of catching China rockfish, based on the species composition of the catch in a given trip. Prior to applying the Stephens-MacCall filter, we identified potentially informative "predictor" species, i.e., those with sufficient sample sizes and temporal coverage (at least 30 positive trips total, distributed across at least 10 years of the index) to inform the binomial model. Coefficients from the Stephens-MacCall analysis (a binomial GLM) are positive for species which co-occur with China rockfish, and negative for species that are not caught with China rockfish. As expected, positive indicators of China rockfish trips include several species of nearshore rockfish, and counter-indicators include several species of flatfish, salmon, and deep-water rockfish (Figure 30). One species (albacore, *Thunnus alalunga*) that met the requirement of 30 positive trips over at least 10 years never co-occurred with China rockfish. All trips catching albacore were excluded from the data set used to model CPUE. Records from 1993 and 1994 were also dropped from the index, due to poor spatial coverage (all trips were in San Luis Obispo county).

The percentage of trips that caught China rockfish was 13.6% prior to filtering, and 70.8% in the final, filtered data set (n=431; Table 16). The number of sampler-examined trips varies by year and county, and counties with small sample sizes were aggregated with adjacent counties into four *regions*. (Table 17). Samples from Humboldt and Del Norte counties were included with the Oregon MRFSS index.

CPUE (number of fish per angler hour) was modelled using a "delta-GLM"" model (Lo et al. 1992, Stefánsson 1996). Model selection using AIC supported inclusion of *year* and *region* effects in both the binomial and lognormal components of the index (Table 18). The addition of two-month *wave* effects (to allow for seasonal changes in CPUE) did not improve model fit. Data in the binomial component also supported inclusion of a distance from shore variable ($AREA\_X$). Residual-based model diagnostics for the positive component of the index suggest the data generally met the assumptions of the GLM (Figure 31). The resulting index is highly variable, but suggests a decline in catch rates after 1995 relative to preceding years (Table 19; Figure 32).

California North of 40°10′ and Oregon Dockside Charter Boat Indices (MRFSS and ORBS)

For the Oregon sport fisheries, three indices of abundance were used in the pre-STAR Panel base model: (1) catch rates from the onboard observer program, (2) catch rates from the dockside survey component of the ORBS, and (3) catch rates from the dockside MRFSS (see description of California MRFSS index, above). For the onboard observer index, all data elements were verified by a biologist, and thus there was a high degree of certainty in the catch, effort, and locations fished; however, there was limited spatial-temporal coverage and only charter boats were included (not private boats). In contrast, the ORBS dockside survey has more comprehensive coverage and much greater samples sizes (i.e., 50-70 times more trips than onboard observer program), but there was less confidence in the data elements, as only catch and the number of anglers were verified by biologists (all other trip details were angler-reported). The two dockside programs (ORBS and MRFSS) differ in terms of the measure of fishing effort (details below). A single fishing trip can be sampled in both by the onboard observer program and also dockside within ORBS. Because the onboard observer program data is at a much finer scale than the trip-based dockside data; we removed trips from the ORBS database that were double-sampled and chose to retain all onboard observer trips.

Index Standardization: MRFSS Dockside Charter Boat CPUE for California North of 40°10′ and Oregon

An index based on MRFSS data for northern California and Oregon was developed for the pre-STAR base model. Prior to the review meeting, it was discovered that the data were not trip-level data, and the index was removed from the final base model, with negligible effect on model results. The STAT recommends that future China rockfish assessments examine trip-level MRFSS catch and effort data as a potential index of abundance.

Index Standardization: Oregon Recreational Boat Survey (ORBS) Dockside Charter Boat CPUE

In order to provide estimates of total catch and effort for the Oregon sport fisheries, ORBS obtains catch rates from a portion of vessels via a dockside survey, and applies them to total effort counts. During the dockside survey, biologists intercept vessels returning from fishing trips and record catch, effort, and other trip-related details (e.g., grid area fished, target species, depth, port, etc.). Since catch and effort per sampled trip are both obtained, the dockside survey of ORBS was also used to develop an index of abundance for China rockfish.

Modifications had to be made to trip hours from the original ORBS dataset to create a standardized unit of effort. Since trip hours in ORBS are not hours fished, as in MRFSS, but rather the total duration of the trip (as measured from the time the boat crossed into the ocean until the time they were interviewed at the dock), travel times had to be determined and subtracted from trip hours in order to get a standardized measure of fishing effort per trip. Accordingly, a total distance function was created for each trip based on the river miles (distance along the navigable channel from the port to the bar (river mouth)) and ocean miles (i.e., straight distance from the river bar to the ocean grid fished, wrapping around obstructions if needed). Total distance was then converted to travel time based on generalized vessel speeds for private (i.e., 18 mph) and charter boats (i.e., 13 mph) provided by Wayne Butler (Oregon charter captain; personal communication). It is important to note that the original trips hours minus travel hours still does not equal hours fished because it does account for time needed to move from drift to drift; however, since the number of resets between drifts would be expected to be related to fish abundance (as with catch rates), the modified trips hours was deemed a viable effort unit for the assessment. Some trips had erroneous trips hours (discrepancies between values entered on paper and then entered electronically later). These were the steps taken to correct the issue:

1. Trip hours is computed automatically by the data logger based on the time the interview is entered electronically
2. If samplers write their interviews on paper and enter them electronically later when they have time (as believed to have happened despite being instructed not to), then the trip hours are inflated.
3. To potentially remove these errors, we computed time intervals between interviews. Pulses of interviews a minute or two apart are very likely to have been from bunches of paper interviews entered at electronically in one sitting, as normal interviews are somewhat sporadic and take more than a minute to complete.

The ORBS dockside charter boat records (years 2001-2014) include 36,752 trips in the unfiltered data set, of which 4,080 caught China rockfish (11%). As with the other trip-based CPUE data sets, the Stephens-MacCall method was used to identify trips with a high probability of catching China rockfish. Prior to using the Stephens-MacCall approach to select relevant trips, a number of other filters were applied to the data to minimize variability in CPUE estimates. Criteria for valid trips included vessels with 20+ sampled trips (13% of vessels accounted for 89% of trips) and trip hours <12. Trips targeting tuna and dive trips were excluded from the analysis (see Table 20 for other filters).

As with the MRFSS indices, potentially informative species for the Stephens-MacCall analysis were defined as those occurring in at least 30 unique trips, in 10 different years (Figure 33). Some of these never occurred with China rockfish (strong 'counter-indicators') and records with these species were removed from the data prior to estimation of the index. Strong counter-indicators for the ORBS data set included blue shark, white sturgeon, steelhead, and albacore. Trips in which at least 99% of the catch consisted of pelagic rockfish were also excluded, as anglers were likely targeting semi-pelagic rockfish (Table 20).

Coefficients from the Stephens-MacCall analysis identified several rockfish species (black, rosy, tiger, bocaccio, vermilion, yelloweye, copper, etc.) as indicators of positive China rockfish catch, along with lingcod, kelp greenling, and cabezon. Counter-indicators included deep-water rockfish, salmonids, and Pacific Halibut. Brown rockfish, another nearshore rockfish species, was among the counter-indicator species, reasons for which are unclear to the STAT at this time.

A total of 6232 trips were retained following the Stephens-MacCall filter (Table 21). Model selection with AIC proceeded as with the other dockside indices, but the ORBS data supported an interaction term in the lognormal component of the delta-GLM (Table 22). The interaction was not supported by the binomial model (although AIC retained a region effect), but the keeping the year-region interaction term in the positive model reduced the AIC by 38 points over a model with year and region alone (Table 22).

To account for this interaction, separate delta-GLM models (each with a year and wave effect) were fit to the regional data (Southern OR and Northern OR, split at Florence). The regional indices show little change in the northern region, but a decline in catch rates in the south (Figure 34). Residual diagnostics for the regional models did not show strong deviations from model assumptions in either area (Figures 35 and 36). Estimated area of rocky reefs off Oregon was generated using GIS (see description of onboard observer indices), and we calculated an area-weighted index based on the relative proportion of reef habitat in each region (total reef habitat distributed as 35.4% north, 64.6% south).

The final, area-weighted index (Table 23, Figure 37) shows a declining stock (on average, statewide), but the STAT emphasizes that this does not capture regional patterns in CPUE, and may underestimate the fishing impacts in the southern region, and overestimate impacts in the north.

2.1.6 Fishery-Dependent Data: Recreational Onboard Observer Surveys

The goal of the Observer Programs in California and Oregon is to collect data including charter boat fishing locations, catch and discard of observed fish by species, and lengths of discarded fish. Both states sample the commercial passenger fishing vessel (CPFV), i.e., charter boat or for-hire fleet. The onboard observer programs collect drift-specific information at each fishing stop on an observed trip. At each fishing stop recorded information includes start and end times, start and end location (latitude/longitude), start and end depth, number of observed anglers (a subset of the total anglers), and the catch (retained and discarded) by species of the observed anglers. Data for the onboard observer indices for the recreational CPFV fleet are from four sampling programs.

The CDFW conducted an onboard observer program in central California from 1987-1998 (Reilly et al. 1998). These data were previously used in the 2013 data moderate assessments (Cope et al. 2015), at the level of a fishing trip. Since the 2013 assessments, the original data sheets were acquired and data were keypunched to the level of fishing stop. One caveat of this data is that location data were recorded at a finer scale than the catch data. We aggregated the relevant location information (time and number of observed anglers) to match the available catch information. Between April 1987 and July 1992 the number of observed anglers was not recorded for each fishing stop, but the number of anglers aboard the vessel is available. We imputed the number of observed anglers using the number of anglers aboard the vessel and the number of observed anglers at each fishing stop from the August 1992-December 1998 data (see Appendix E for details, p.E-1). In 1987, trips were only observed in Monterey, CA and were therefore excluded from the analysis. CDFW collected lengths of both retained and discarded fish during this time period. All China rockfish measured were retained and lengths are used as length compositions for this index.

California implemented a statewide sampling program in 1999 (Monk et al. 2014). California Polytechnic State University (Cal Poly) has conducted an independent onboard sampling program as of 2003 for boats in Port San Luis and Morro Bay (Stephens et al. 2006), but follows the protocols established in Reilly et al. (1998), and modified to reflect sampling changes that CDFW has also adopted, e.g., observing fish as they are landed instead of at the level of a fisher's bag. Therefore, the Cal Poly data area incorporated in the same index as the CDFW data from 1999-2014. CalPoly collects lengths of both retained and discarded fish.

We generated separate relative indices of abundance in California for the 1987-1999 and 2000-2014 datasets due to the number of regulation changes occurring throughout the time period (see Appendix H, p.H-1). CDFW implemented a regulation of three hooks in 2000, which was reduced to (and remains at) two hooks in 2001.

The ODFW initiated an onboard observer program in 2001, which became a yearly sampling program in 2003 (Monk et al. 2013). Both California and Oregon provided onboard sampling data through 2014. Both of these programs only collected lengths of discarded fish, and the number of lengths of China rockfish from these studies is small (Figure 38).

All indices were standardized using a delta-GLM modeling approach (Lo et al. 1992). Data were analyzed at the drift level and catch was taken to be the sum of observed retained and discarded fish, i.e., number of fish encountered per angler hour. The onboard observer data from the CDFW 1999-2014 data between north of $40°10'$ N. latitude and the Oregon border were too sparse to include in the index. Therefore, indices used in the model with a break at $40°10'$ N. latitude remain the same as the state-specific onboard observer indices.

Data Filtering

Prior to any analyses, a preliminary data filter was applied.

Trips/drifts from the CDFW 1988-1998 meeting the following criteria were excluded from analyses:
1. Drift associated with a fishing location code that was not assigned to a reef
2. Drifts identified as having possible erroneous location, observed anglers, or time data
3. Trips encountering <50% groundfish species (number of fish)

Trips/drifts from the ODFW, CDFW 1999-2014, and Cal Poly databases meeting the following criteria were excluded from analyses:
1. ODFW halibut-targeted trips were excluded
2. Drifts south of Pt. Conception (only 2 China rockfish observed south of Pt. Conception)
3. Trips encountering <50% groundfish species
4. Drifts within the current Stonewall Bank Yelloweye Rockfish Conservation
5. Drifts within Arcata Bay, Humboldt Bay, South Bay, or San Francisco Bay
6. Drifts missing a starting location (latitude/longitude)
7. Drifts identified as having possible erroneous location or time data
8. Drifts missing both starting and ending depths
9. Drifts within the habitat data occurring farther than 83 m from a reef in Oregon and 34 m in California (see Appendix F (p. F-1) for details)
10. Drifts outside the habitat data in California occurring farther than 141 m from reef (see Appendix F (p. F-1) for details)

11. Drifts occurring on a reef with <3 positive encounters of China rockfish
12. Drifts occurring on a reef in which China rockfish was observed in <25% of years the reef was visited

Index standardization: Oregon

At the March 2015 Nearshore Stock Assessments Workshop the issue of hook saturation by black rockfish (*Sebastes melanops*) in Oregon was raised (Agenda Item D.8 Attachment 10, June 2015). The recreational fishery in Oregon specifically targets black rockfish. While black rockfish associate with rocky habitat, they are a schooling, midwater species. Fishermen specifically targeting black rockfish may not drop their lines to the seafloor, or may encounter black rockfish and other midwater species before their lines can reach the seafloor. To address this issue in the onboard observer data, we filtered out drifts for which the catch (retained plus discarded) consisted of at least 95% black, blue (*Sebastes mystinus*) and yellowtail (*Sebastes flavidus*) rockfishes, the most commonly occurring midwater rockfish species. This resulted in a decrease in the number of drifts by 4,092, only three of which observed China rockfish.

The filtered dataset included 6,038 drifts, of which 259 (4%) drifts with positive encounters (Table 24). The majority of drifts sampled (75%) were from north of Florence, although China rockfish were present in 6% of drifts in southern Oregon and 3% of drifts in the north. Covariates considered in the full model included *year, depth, month or 2-month wave* and, *region* (Figures 39 and 40). To increase sample sizes data from waves 2 and 3 were aggregated as well as from 4 and 5 (ODFW does not sample in waves 1 and 6). Depths greater than 20 m were also binned to 20-59 m.

The final selected dataset contained categorical variables for *year* (13 levels), *wave* (2 levels), *region* (2 levels, north and south of Florence), and three depth bins (*depth*: 0-19 m, and 20-59 m). A lognormal model was selected over a gamma for the positive encounters by a deltaAIC of 20.01. Model selection, using AIC, selected a lognormal model with *year, wave, depth, region*, and a *wave:depth* interaction, while a binomial with *year, region*, and *wave* was selected (Table 25). In the lognormal submodel, stepwise BIC retained the *year*. In the binomial model, stepwise BIC retained *region* and *wave*. The final *year* effects from the delta-GLM with main effects *year, region*, and *wave* are shown in Table 26 and Figure 41). The final model suggests that relative abundance was slightly higher in southern Oregon, and in waves 4 and 5. Standard model diagnostics show adequate fit and general consistency with GLM model assumptions for the positive catch component (Figure 42).

Index standardization: California

Central California 1988-1998

The filtered dataset included 5,557 drifts, of which 852 (15%) drifts with positive encounters (Table 24). To increase sample sizes, data from Regions 2 and 3 were aggregated as well as Regions 8 and 9. Samples north of Ten Mile River were too sparse to reliably include in the index.

Covariates considered in the full model included *year, depth, month or 2-month wave* and, *region* (Figures 43 and 44). The selected data contained categorical variables for *year* (13 levels), *wave* (6 levels), *region* (5 levels), and four depth bins (*depth*: 0-19 m, 20-39 m, 40-59 m, and 60-79 m). A lognormal model was selected over a gamma for the positive encounters by a deltaAIC of 125.06. Model selection, using AIC, selected a lognormal model with *year, depth, and region*, while a binomial with *year, region, depth, wave*, and a *year:region* interaction was selected. However, the standard errors of the binomial model with interactions were large, and suggested data were too sparse to explore the *year:region* interaction. For the lognormal submodel, stepwise BIC retained the *depth* and *region* (Table 27). For the binomial submodel, stepwise BIC retained *year, region*, and *depth*. The final *year* effects from the delta-GLM with main effects *year, region*, and *depth* are shown in Table 28 and Figure 45). The covariates in the final model suggest the relative abundance of China rockfish decreases with depth and increases north of Monterey, CA. Standard model diagnostics show adequate fit and general consistency with GLM model assumptions for the positive catch component (Figure 46)

California (north of Pt. Conception) 2000-2014

The filtered dataset included 13,993 drifts, of which 1,403 (10%) drifts with positive encounters (Table 24). CDFW began sampling Region 12 (Trinidad Head to the OR border) in 2008 and no trips from Region 11 (Cape Mendocino to the Eel River) were sampled from 2000-2014. From 2008-2014, only 10 drifts encountering China rockfish were observed in Region 12. Therefore, the following index only reflects the population south of Cape Mendocino. Further, to increase sample sizes drifts from Regions 2 and 3 were aggregated as well as Regions 7 and 8, and Regions 9 and 10.

Covariates considered in the full model included *year, depth, month or 2-month wave* and, *region* (Figures 47 and 48). The selected data contained categorical variables for *year* (15 levels), *wave* (6 levels), *region* (6 levels), and four depth bins (*depth*: 0-19 m, 20-39 m, 40-59 m, and 60-79 m). A lognormal model was selected over a gamma for the positive encounters by a deltaAIC of 115.91. Model selection, using AIC, selected a lognormal model with *year, depth, and region*, while a binomial with *year, region, depth*, and a *year:region* interaction was selected. However, the standard errors of the binomial model with interactions were large, and suggested data were too sparse to explore the *year:region* interaction. For the lognormal submodel, stepwise BIC retained the *year* and *region* (Table 29). For the binomial submodel, stepwise BIC retained *region*, and *depth*. The final *YEAR* effects from the delta-GLM with main effects *year, region*, and *depth* are shown in Table 30 and Figure 49). The covariates in the final model suggest the relative abundance of China rockfish decreases with depth, specifically in depths greater than 59 m, and increases south to north. Standard model diagnostics show adequate fit and general consistency with GLM model assumptions for the positive catch component (Figure 50)

2.1.7 Fishery-Independent Data: sources considered, but not used in assessment

Northwest Fisheries Science Center (NWFSC) slope survey
The NWFSC slope survey was conducted annually from 1999 to 2002. The depth range of this survey (100-700 fm) is outside the depth range of China rockfish, and was therefore not used in this assessment.

Northwest Fisheries Science Center (NWFSC) shelf-slope survey
This survey is referred to as the "combo," conducted annually since 2003. The survey consistently covered depths between 30 and 700 fm, and has never encountered a China rockfish. Therefore, the combo survey was not used in this assessment.

Alaska Fisheries Science Center (AFSC) shelf survey
The survey, often referred to as the "triennial" survey was conducted every third year between 1977 and (and conducted in 2004 by the NWFSC using the same protocols). The triennial survey trawls in depths (generally 30 to 275 fm) that are deeper the range and habitats of China rockfish, and was therefore not used in this assessment.

Pikitch study
The Pikitch study was conducted between 1985 and 1987 (Pikitch et al. 1988). The northern and southern boundaries of the study were 48°42′ N latitude and 42°60′ N. latitude respectively, which is primarily within the Columbia INPFC area (Pikitch et al. 1988 , Rogers and Pikitch 1992). Participation in the study was voluntary and included vessels using bottom, midwater, and shrimp trawl gears. Observers of normal fishing operations on commercial vessels collected the data, estimated the total weight of the catch by tow and recorded the weight of species retained and discarded in the sample. China rockfish are not targeted using trawl gear, and therefore we did not use data from this survey in the assessment.

Enhanced Data Collection Project (EDCP)
The EDCP was conducted by ODFW to collect information on bycatch and discard groundfish species off the coast of Oregon from late 1995 to early 1999. EDCP had limited spatial coverage in Oregon waters only. China rockfish are not targeted using trawl gear, and therefore we did not use data from this survey in the assessment.

Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)
A total of 59 China rockfish were observed in 17,657 SCUBA transects conducted in the southern and central survey regions. Transects were conducted in Northern California and Oregon for two years (2010-2011), with a higher occurrence of China rockfish (156 out of 956 transects).

2.1.8 Biological Data: Length and age compositions

Length compositions were provided from the following sources, by region, with brief descriptions below:

Southern model (south of 40°10′ *N. latitude)*

- Jeff Abrams' thesis (*research*,2010-2011)
- CALCOM (*commercial dead fish*,1992-2006, excluding 1999)
- CALCOM (*commercial live fish*,1997-2012)
- CDFW onboard observer (*recreational charter*, 1987-1998)
- California recreational sources combined (*charter mode*,1960,1978-2014)
  - Miller and Gotshall survey
  - CA rec. sampling (1978-1985)
  - MRFSS (1980-2003)
  - CRFS (2004-2014)
- California recreational sources combined (*private mode*, 1959 and 1980-2014)
  - Miller and Gotshall survey
  - CA recreational sampling (1978-1985)
  - MRFSS (1980-2003)
  - CRFS (2004-2014)
- CCFRP (*research*, Point Buchon to Año Nuevo, 2007-2013)
- WCGOP (*discards*, 2004-2013)

Central model (California north of 40°10′ *N. latitude to the OR/WA border)*

- ORBS north of Florence (*recreational, charter and private modes*, 1980-2014)
- ORBS south of Florence (*recreational, charter mode*, 1984-2014)
- ORBS south of Florence (*recreational, private mode*, 1980-2014)
- PacFIN Oregon (*commercial live fishery, sexes combined*, 1998-2014)
- PacFIN Oregon (*commercial dead fishery, sexes combined*, 1995-2014)
- CALCOM (*commercial dead fish*, 1992-2002)
- CALCOM (*commercial live fish*, 1997-2010)
- California recreational sources combined (*charter and private modes*, 1981-2014)
  - MRFSS (1981-2003)
  - CRFS (2004-2014)

Northern model (Washington state MCAs 1-4)

- Washington MCAs 3-4 (*recreational all modes*, 1979-2014)
- Washington MCAs 1-2 (*recreational all modes*, 1969-2014)

Recreational: Washington (WDFW)

Recreational length- and age- composition data were provided directly from WDFW during winter 2015. The WDFW routinely collected recreational biological samples for China rockfish between 1995 and 2014, with all but one year sampled during 1979 to 1983. These composition data lack information on the number of fish sampled out of those landed in a given trip, and therefore are used without expansion to the sample level. Unexpanded recreational composition data are frequently used in West Coast stock assessments for the above reason. Length and age data collected from dockside recreational samples WA are summarized by the number of fish sampled (Table 31). The WA recreational length- and age- compositions are shown in Figures 51, 52, 9, and 53.

Recreational: California MRFSS and CRFS length composition data

Individual fish lengths recorded by MRFSS (1980-2003) and CRFS (2004-2011) samplers were downloaded from the RecFIN website (www.recfin.org). CRFS data from 2012-2014 were obtained directly from CDFW. Fish were assigned to the northern and southern management areas based on county and interview site number. To examine finer scale spatial differences in size composition data, interview sites in each county were assigned to a CRFS district (including years prior to 2004). Distributions of lengths increased from south to north, with the largest change in mean length occurring between CRFS districts 5 & 6 (roughly around Cape Mendocino; Figure 54). This pattern was consistent across all years of CRFS sampling (2004-2014; Figure 55). Sizes of retained fish north of Cape Mendocino were more similar to fish caught in Oregon than fish caught south of Cape Mendocino. Since both biological (e.g. growth) and fishery-related (e.g. selectivity, retention) factors can influence the size compositions, length at age was estimated internal to the assessment models in all three areas.

Recreational: Oregon Recreational Boat Survey (ORBS)

Biological data from the ORBS program were provided by ODFW. The ORBS is a dockside sampling program for the both the recreational CPFV and private modes. Length composition samples from north of Florence for the CPFV and private fleets were provided from 1980-2014. Samples from south of Florence spanned 1984-2014. Distributions of length data from these southern and northern parts of Oregon were similar to each other, and across years (Figure 56).

Recreational: Miller and Gotshall (1965)

The Northern California Marine Sport Fish Survey conducted an assessment survey with goals that included estimation of annual fishing effort by all recreational fishing modes, catch by weight, CPUE, and collection of data to analyze length compositions. Lengths from 101 China rockfish were collected from 1959-1960. Lengths of China rockfish from 1959 primarily came from private/rental boats, and lengths from 1960 came from charter boats. These two years of data were not consistent with length composition data from later years, and were influential on model results (see model sensitivities to these data).

Commercial: PacFIN (Oregon and California)

Biological data from commercial fisheries for China rockfish were extracted from PacFIN (PSMFC) on May 18, 2015. Commercial landings and the biological characteristics of hook-and-line landings were sampled from 1995-2014 in Oregon and in 1991-2013 California. There is no commercial catch of China rockfish in the state of Washington. Currently, port biologists employed by each state fishery agency collect species-composition information and biological data from the landed catches. The monitoring programs currently in place vary between the states but are generally based on stratified, multistage sampling designs. The OR data were available by live fish fishery landings and dead fish fishery landings, but fish conditions were not available for PacFIN for the CA landings. Due to the lack of fish condition data for CA in PacFIN, the CA commercial fishery compositions were downloaded from the CALCOM database.

Annual commercial length- and age-frequency distributions were developed for each state for which observations were available, following the same bin structure as was used for research observations. For each fleet, the raw observations were expanded to the sample level, to allow for any fish that were not measured, then to the trip level to account for the relative size of the landing from which the sample was obtained. Length and age data collected from commercial landings for OR and CA are summarized by the number of port samples (Tables 32 and 33). Figures 57, 58, 59, 60, 61, and 62 show plots of the commercial length and age composition data for the central model. Figures 63, 64, and 65 show plots of the commercial length and age composition data for the southern model.

Research: NMFS groundfish ecology survey

From 2001-2005, the SWFSC Fisheries Ecology Division conducted longline surveys aboard a chartered commercial longline vessel at various stations between Monterey and Davenport, CA (36° N. latitude to 37.5° N. latitude)(pers. comm. Don Pearson, SWFSC). Longline gear was set in various depths from 10 meters to 700 meters, parallel to the depth contour. Each longline set consisted of 3-5 skates, each with about 250 2/0 circle hooks baited with squid. In nearshore habitats, we allowed the gear to soak for roughly 30 minutes. A small number of China rockfish length samples were available from this cruise, but were not included in the assessments due to sample size and potential differences in selectivity.

Research: California Collaborative Fisheries Research Program (CCFRP)

The California Collaborative Fisheries Research Program (CCFRP), created by Rick Starr (Sea Grant and Moss Landing Marine Laboratory) and Dean Wendt (Cal Poly San Luis Obispo), monitors marine protected areas (MPAs) and gathers information useful for fisheries management (Starr et al. 2015). This program has been running in Central California since 2007. Length compositions for China rockfish were included in this assessment (Figure 66).

Future research is planned to use CPUE information from this program, comparing relative abundance indices derived from fishery-dependent and fishery-independent monitoring programs. The CCFRP data provide a time series of fishery-independent catch and effort at fixed stations, collecting information at sample sites inside and outside of MPAs spanning about 200 miles of the California coast from Point Buchon to Año Nuevo. This fishery-independent information, combined with our current fishery-dependent information (i.e., CPFV onboard observer data), provides an opportunity for fine-scale spatial and temporal analysis of catch rates and species compositions, specifically addressing the research needs identified in nearshore rockfish stock assessments.

Research: Abrams Thesis

Jeff Abrams (2014) conducted a research study aboard recreational charter boats from Crescent City Harbor, Trinidad Bay and the Noyo River Harbor. Rocky habitat was identified from high resolution bathymetric data and gridded into 500 m by 500 m cells (California Seafloor Mapping Project, data available from: http://seafloor.otterlabs.org/index.html). During a sampling event, cells were randomly selected to fish. Fish were captured via hook-and-line by either researchers, students, or recreational fishers. The charter boat captain was not allowed to search and target fish within the cell. Fishing drifts started at the up-current/wind side of the cell and drifted to the opposite edge of the cell, then stopped the clock and reset for another drift (Jeff Abrams, pers. comm.) If it was certain that fishing was occurring over sand, the captain would generally reset. However, because cells were selected with a minimum area of rocky habitat, this was rare. This studied provided 138 individual China rockfish, which were used as Conditional Age-at-Length (CAAL) in the southern model (Figure 67).

2.1.9 Biological Data: Age structures

Age structure data were available from the following sources:

Southern model (California south of $40°10'$ *N latitude)*

- Jeff Abrams' thesis (*research*,2010-2011)
- CDFW (*recreational and research*, 1972-1985)
- CDFW (*recreational CPFV*, 1977-1986)
- CDFW (*recreational CPFV*, 1980-1984)
- NMFS groundfish ecology (*research*, 2003-2005)

Central model (California north of $40°10'$ *N latitude to the OR/WA border)*

- Oregon, majority south of Florence (*commercial dead landings*, 2001-2013)
- Oregon, north of Florence (*recreational, all modes combined*, 2005-2013)
- Oregon, south of Florence (*recreational, all modes combined*, 2005-2013)

Northern model (Washington state MCAs 1-4)

- Washington South (MCAs 1-2, *recreational, all modes combined*, 2014)
- Washington North (MCAs 3-4,*recreational, all modes combined*, 1998-2014)

The commercial ages from Oregon were extracted from PacFIN, and these data are uploaded by the states. The Washington state ages were provided by Tien-Shui Tsou (pers. comm.) and aged by WDFW. Otoliths from various CDFW sampling programs (1972-1985) were aged for this assessment. It is unclear whether the otoliths were obtained from recreational boat modes, research cruises, and diving modes. For this reason, these ages were not included in the assessment models, but were used for external estimation of size at age. Commercial port samplers in California sampled catch from recreational charter boats in the late 1970s and early 1980s.

A total of 3,963 fish were aged/re-aged for this assessment (Table 34), very few of which were small or young fish(Figure 69). Prior to this assessment, the only available growth curve for China rockfish was estimated from Lea et al. (1999). Lea et al. (1999) aged China rockfish via the surface aging method. Surface ages are biased towards younger ages; the break-and-burn method is preferred and more precise (Beamish 1979, Kimura et al. 1979). All ages for this assessment were aged using the break-and-burn method, either by WDFW or the NMFS NWFSC Aging Lab.

Length-at-age was initially estimated external to the population dynamics models using the von Bertalanffy growth curve (Bertalanffy 1938), $L_i = L_\infty e^{(-k[t-t_0])}$, where L_i is the length (cm) at age i, t is age in years, k is rate of increase in growth, t_0 is the intercept, and L_∞ is the asymptotic length. The unavailability of small fish results in unrealistic estimates of t_0, on the order of -9 to -20 depending on the subset of data modeled. For exploratory purposes, t_0 was fixed at 0, and for final estimates of growth the length of age-0 fish was fixed at 2 cm. The NMFS SWFSC conducts an annual rockfish recruitment and ecosystem assessment survey. Pelagic juvenile rockfish are collected at an average age of approximately 100 days. The mean size of all rockfish species at 1 month of age was roughly 2 cm. At this age, length-at-age is fairly consistent among species and therefore differences in growth among species are unlikely to introduce considerable bias. We approximated size-at-age zero in the assessment with a value of 2 cm.

Differences in growth between sexes, among fleets, and regions were explored. To remove biases introduced by region or fleet, we used data from the southern Oregon (south of Florence, OR) commercial (dead fish) fleet to look at the growth difference between males and females. Few fish were aged older than 37 years (5.8%). For ages in which there were fish aged older than 37 years, there was only one fish in each age. Including these fish in the model proved to bias the von Bertalanffy growth estimates (large (>1.5) standard errors in estimates of L_∞). Therefore, the following exploratory analyses exclude fish older than 37 years. Fixing t_0 at 0, the other parameters for males and females were similar and the differences were not biologically significant, (Males: $L_\infty = 37.14, k = 0.21$; Females: $L_\infty = 35.91, k = 0.23$). This result, estimating males having a larger asymptotic size of approximately 1 cm than females, is anomalous, as females are larger than males in all but one rockfish species (Love et al. 2002). This is also inconsistent with the analysis of Lenarz and Echeverria (1991), which identified no significant sexually dimorphic characters in China rockfish. Quillback rockfish (*Sebastes maliger*, also in the *Pteropdus* subgenus) are also long-lived and don't exhibit dimorphic growth until approximately age 30, with an estimated L_∞ of 0.5 cm greater for females than males (Love et al. 2002). Given the sparse data for older China rockfish and the unlikelihood of China rockfish being the only rockfish species where males are larger than females, growth is assumed the same for males and females in this assessment.

Using data from southern Oregon (south of Florence, OR), differences in growth among the commercial (dead fish) and the private recreational fleets were explored. There were significant differences in growth between the fleets (Commercial: $L_\infty = 36.23, k = 0.22$; Recreational: $L_\infty = 37.93, k = 0.22$), suggesting differing selectivity between the fleets. The commercial fleet has been restricted to a 12 in minimum size limit since 2000, with a preference for plate-sized fish. All of the age data from the southern Oregon commercial (dead fish) fleet are from 2001-2013. The recreational fleet has no minimum size limit and all samples are from 2005-2013.

Regional differences in growth were significant. In general, the asympotic size of fish were smallest in southern California (south of 40°10′ N. latitude), increased in northern California (north of 40°10′ N. latitude) to southern Washington (MCAs 1 & 2) and decreased again in northern Washington (Table 35 and Figure 70).

Stock Synthesis models growth as the Schnute parameterization of the von Bertalanffy growth model. The size of fish at age-0 was fixed at 2 cm with a CV of 0.1, and all other parameters estimated within the model.

2.1.10 Biological Data: Aging precision and bias

Ageing imprecision was estimated using a collection of 529 China rockfish otoliths with multiple age reads (Figures 71 - 73) . We analyzed this data set using the ageing error software provided by Andre Punt and Jim Thorson, publicly available at https://github.com/nwfsc-assess/nwfscAgeingError. The software estimated a bias in the age readings from some early samples read by a former NWFSC age reader and these were excluded from the compositions used in the model. The variability in age readings of the remaining readers was estimated under an assumption of a linear increase in standard deviation with age. The resulting estimate indicated a standard deviation in age readings increasing from 0.1 years at age 1 by about 1 year of uncertainty per 10 years of age to a standard deviation of 7.7 years at age 80.

2.1.11 Biological Data: Weight-Length

The weight-length relationship is based on the standard power function: $W = \alpha(L^{\beta})$ where W is individual weight (kg), L is length (cm), and α and β are coefficients used as constants.

This assessment uses weight-length parameters for females of $\alpha = 1.17x10^{-5}$ and $\beta = 3.177$, derived from Lea et al. (1999). A fit of the length-weight relationship to the Oregon ORBS data, $\alpha = 2.06x10^{-5}$ and $\beta = 3.02$, yielded a curve that was very similar to that reported in Lea et al. (1999)(Figure 74).

2.1.12 Biological Data: Maturity and Fecundity

China rockfish maturity-at-length data were sparse and was gathered from two available sources, one from California and one from Oregon. Echeverria (1987) collected 69 China rockfish from central and northern California, of which the age at first maturity was 3 years for males and females (26 cm). Both males and females exhibited 50% maturity at 4 years (27 cm) and 100% maturity at 6 years (30 cm).

In Oregon, Hannah and Blume (2011) determined a length at 50% maturity at 28.5 cm from a sample size of 239 China rockfish. Maturity was fit to a logistic curve, $p_l = \frac{e^{B_0+B_l 1}}{1+e^{B_0+B_l 1}}$, where p_l is the proportion of the natural fish at length l, and B_0 and B_1 are the regression coefficients. Parameter estimates from Hannah and Blume (2011) are $B_0 = -13.320$ and $B_1 = 0.467$.

The southern base model used the California estimate (50% mature at 27cm) while the central and northern draft based models used the Oregon estimate (50% mature at 28.5 cm). Fecundity is assumed proportional to female spawning biomass in the draft base models.

2.1.13 Biological Data: Natural Mortality

Natural mortality for wild fish populations is extremely difficult to estimate.

Dick and MacCall (2010) estimated natural mortality for 50 data poor stocks using Hoenig's (1983) method. The total mortality rate (Z, the sum of natural and fishing mortality rates), is estimated as, $log(Z) = 1.710 - 1.084log(A_{max})$, where A_{max} is the maximum observed age. The mortality rate was back-transformed to arithmetic space using a bias correction factor, log-scale standard deviation of 0.4.

Cope et al. (2015) used the maximum age for China rockfish of 79 years in the 2013 data moderate assessment, which produces a natural mortality rate of 0.055. The maximum age of China rockfish on the West Coast is now 83 years (age data for this assessment), which gives a natural mortality of 0.056 when calculated from Hoenig's method.

2.1.14 Biological Data: Sex ratios

The sex ratio from all of the aged China rockfish for this assessment were approximately 50% each males and females (WA:47%, OR:47%, and CA: 49% female). These fishes came from a mixture of recreational, commercial, and research collections.

2.2 History of Modeling Approaches Used for this Stock

2.2.1 Previous assessments

Dick and MacCall (2010) estimated the overfishing level (OFL) for China, which was adopted for the PFMC's 2011-12 and 2013-14 management cycles, as components of the stock complex OFLs associated with each species.

China rockfish was assessed as a data moderate species in 2013 (Cope et al. 2015). The accepted assessment modelled removal and index data using Extended Depletion-Based Stock Reduction Analysis (XDB-SRA) (Dick and MacCall 2011), which is a Bayesian surplus production model reparameterized in terms of MacCall's (2009) Depletion-Corrected Average

Catch method. The STAR panel favored regional models for China rockfish, north and south of $40°10'$ N. latitude.

The stock north of $40°10'$ N. latitude was found to be below target biomass, as a percentage of unfished biomass (a.k.a. "depletion"), but above the minimum stock size threshold (MSST). The median of the posterior northern spawning biomass in 2013 was estimated at 37% (84 mt), and the fishing mortality rate in 2012 was 21.5% of F_{MSY}.

The stock south of $40°10'$ N. latitude was found to be above target biomass, as a percentage of unfished biomass (a.k.a. "depletion"). The median of the posterior southern spawning biomass in 2013 was estimated at 66% (264 mt), and the fishing mortality rate in 2012 was 27% of F_{MSY}.

2.2.2 Spatial stock structure

The waters and biological communities of the California Current System tend to exhibit the greatest change at the major promontories along the West Coast, including Point Conception, Cape Mendocino, Cape Blanco and the northern tip of Vancouver Island (Checkley and Barth (2009); Hickey (1979); Gottscho (2014)). In particular, the waters off Cape Mendocino are a known biogeographical boundary along the West Coast of the U.S. and has been shown as a geographical boundary across a number of terrestrial and marine taxa (see Gottscho (2014) for a review). The waters off Cape Mendocino, CA are characterized by turbulent waters and some of the strongest winds and upwelling found within the California Current (Botsford and Lawrence 2002, Pacific Fishery Managment Council 2013).

The California Current is the equatorward surface flow that extends from the Vancouver Island, Canada (approx. 50° N. latitude) with equatorward flow to Baja California, Mexico (approx. $15° - 25°$ N. latitude) (Hickey 1979, Checkley and Barth 2009). Winds associated with the North Pacific High, the Aleutian Low, and a thermal low-pressure system drive the oceanographic dynamics that stretch from central California to northern Mexico (Checkley and Barth 2009). Seasonal winds drive the frequency and intensity of upwelling along the coast. Off the coast of Washington south to Cape Blanco, OR the winds and therefore upwelling is generally weak. Starting near Cape Blanco, OR the continental shelf narrows and winds and upwelling intensity increases (Francis et al. 2009). The winter environment south of Cape Mendocino is dominated by upwelling from southerly winds pushing water offshore through Ekman transport, whereas northward winds north of Cape Mendocino result in downwelling. Summer upwelling is dominant along the entire West Coast of the US from the northerly winds pushing the surface waters offshore via Ekman transport. South of Cape Mendocino upwelling conditions persist all year, with the northerly winds strongest from April-June. North of Cape Mendocino a low pressure system in the Gulf of Alaska produces westerly and southwesterly winds that blow surface waters towards shore and result in downwelling.

In addition to the oceanic conditions in the California Current, there is also a prominent submarine ridge off the coast of Cape Mendocino. The Mendocino Escarpment, a submarine ridge extending past the 200 nm EEZ boundary, is a dominant physical feature in the California Current (Fisk et al. 1993). Currents from the north and south converge around the Mendocino Escarpment creating an area of offshore transport, which may create a physical barrier to larval dispersal (Magnell et al. 1990, Cope 2004, Sivasundar and Palumbi 2010).

Gottscho (2014) completed a comprehensive review of the zoogeography literature worldwide and identified both Cape Mendocino and Point Conception as phylogeographic breakpoints on the West Coast. Specifically, coastal Oregon does not experience the intense upwelling and offshore transport as off the California coast south of Cape Mendocino, which allows increased larval retention in nearshore waters in Oregon (Gottscho 2014). Drake (2013) used simulation modelling to evaluate dispersal of spring spawning nearshore invertebrates and found that larval dispersal ranged from 175 km to 200 km from the release site (Bodega Bay, CA) when larvae remained below the surface boundary layer, allowing larvae to avoid offshore drifts. Larval retention in nearshore waters in California may be driven by the timing of relaxed upwelling and the ability of larvae to remain below the surface boundary layer (Sivasundar and Palumbi 2010, Drake and Edwards 2013). In simulations, larval dispersal ranged from 175 km to 200 km from the release site (Bodega Bay, CA) when larvae remained below the surface boundary layer, which allows larvae to avoid offshore advection (Drake and Edwards 2013). The majority of drifters released off the coast of Oregon (Newport and Coos Bay) from 1994-1999 remained north of Cape Mendocino within the first 40 days of deployment and none returned to coastal waters south of Point Arena, CA (Sotka et al. 2004). Trajectories of comparative drifters released in off the coast of Santa Barbara, CA never overlapped with the drifters released in Oregon.

Cape Blanco and Cape Mendocino have both been shown as transition zones to juvenile and adult fishes. Field and Ralston (2005) utilized landings and age data to elucidate year-class strength among a number of rockfish species along the West Coast. Spatial patterns in recruitment were heightened in vicinity Cape Mendocino and Cape Blanco versus comparison between regions further from these capes. Characterization of species assemblages in two of the trawl surveys conducted by the NMFS have also shown shifts around Cape Mendocino. Tolimieri (2006) found a shift in the species assemblage captured in the NMFS slope trawl survey near both Point Conception Cape Mendocino, CA and Cape Blanco, OR. The AFSC triennial shelf trawl surveys indicate a change in distribution around the Mendocino Escarpment; with the Mendocino Escarpment acting as a physical barrier to some species, e.g., blackgill rockfish, Pacific ocean perch, chilipepper, shortbelly rockfish, bocaccio, and greenspotted rockfish (Williams and Ralston 2002).

In addition to analyzing fisheries catch and survey trawl data, results from recent genetic studies of rockfish along the West Coast vary from finding genetic divergence along the coast to finding little evidence of genetic divergence along the coast. Genetic studies of blue rockfish, a nearshore midwater species with schooling tendency, show the species to have a genetic break around Cape Mendocino, CA (Cope 2004, Burford and Bernardi n.d.). A study by Sivasundar and Palumbi (2010) confirmed a genetic differentiation of blue rockfish between Oregon and Monterey, CA, with yellowtail rockfish exhibiting the same strong genetic differentiation. While Sivasundar and Palumbi (2010) did not specifically look at China rockfish, the *Pteropodus* subgenus was represented by copper, gopher and brown rockfishes, all three of which exhibited only moderate genetic differentiation along the coast. Additional genetic studies of copper, grass and brown rockfishes indicate limited larval dispersal and increasing genetic divergence with increasing geographic distance [Buonaccorsi (2002); Buonaccorsi et al. (2004); Buonaccorsi unpubl. data]. Much additional work is needed to fully understand the genetic differentiation of rockfish species along the west coast. However, these studies support the hypotheses that oceanographic and physical barriers are likely to limit larval dispersal along the coast.

California has managed the area from Cape Mendocino to the Oregon/California border as its own management area since 2000 (see Appendices G and H for details). The Pacific Fishery Management Council developed a Pacific Coast Fishery Ecosystem Plan in which the California Current Large Marine Ecosystem and recognizes the transitional zone between Cape Blanco, OR and Cape Mendocino, CA (Francis et al. 2009, Pacific Fishery Managment Council 2013).

The 2013 stock assessment of China rockfish consisted of two, independent models, north and south of 40°10′ N. latitude. Following the STAR panel, a request was made to stratify the assessment north and south of 42° N. latitude (the CA-OR border), based on concerns over spatial differences in exploitation history and insufficient trend data between 40°10′ N. latitude and 42° N. latitude (Agenda Item F.5.b Supplemental GMT Report, June 2013). In November 2013, after examining results from both area stratifications, the SSC concluded that there was no evidence in support of either stratification, and recommended that the Council retain the model stratified around the existing management boundary (Agenda Item H.5.b Supplemental SSC Report, November 2013).

The 2013 China rockfish assessment was a data-moderate assessment and therefore did not consider size and age composition data as part of the analysis. For this assessment, the STAT made efforts to examine all available data sources that might provide evidence of spatial stock structure. Data sets with sufficient sample sizes and spatial coverage included length frequency and length at age data.

The largest source of length composition data came from the recreational fleets in each state. In California, the California Recreational Fisheries Survey (CRFS) has collected length data by CRFS district since 2004. Distributions of length for sampled (retained) catch varied by district, with mean length smallest in the southernmost district with adequate samples (CFRS District 3), and largest in the northernmost district, CRFS District 6, roughly the area between Cape Mendocino and the California-Oregon border (Figure 55). There is some indication of a gradient in average length of retained fish, but the largest increase in mean length between adjacent CRFS Districts occurs between CFRS Districts 5 & 6 (roughly across Cape Mendocino).

Since length compositions of retained fish are affected by numerous processes (e.g., growth, recruitment, exploitation, selectivity), the STAT also compared growth curves fit to size at age data. External fits indicated differences in growth among regions, and these patterns were consistent with growth curves estimated within the assessment models (see base model results for details).

The stock was split at $40^{c}irc10^{p}rime$ base on the following evidence, 1) it is a zoogeographic boundary, 2) growth is more similar north and south of this boundary, with a jump at the boundary, and 3) the northern California area is remote from California population centers, and likely has a history of fishery development more similar to southern Oregon than south of Cape Mendocino.

The stock was split at the Oregon and Washington border, supported by 1) differential external and internal model fits to growth, 2) different exploitation histories between the two states, e.g., Washington does not have a commercial fishery, and, 3) latitudinal differences in the length compositions.

2.2.3 2013 Data Moderate Recommendations

Recommendation 1: Continued research on the uncertainty in the catch histories of all groundfishes. Reconstructions of historical catches are still needed for certain areas, time periods, and fisheries. Currently, reconstructed catches are available for California's commercial and recreational fisheries extending back to 1916 and 1928, respectively (Ralston et al. 2010). Oregon has completed a reconstruction for its commercial catch since 1876 (V. Gertseva, NMFS; pers. comm.), but recreational catch prior to 1980 is assumed to be zero in this analysis. Recreational catch in Washington was reconstructed to 1975 for these assessments, and interpolated back to 1960. A thorough reconstruction of historical commercial catches (prior to 1981) is urgently needed for Washington. Estimates of uncertainty in historical catch reconstructions are needed for all states.

2015 STAT response: Oregon completed a reconstruction of the recreational catches back to 1973. There is currently no reconstruction of the commercial catches in Washington, and no estimates of uncertainty are available for any catch reconstruction.

Recommendation 2: Single-species stock assessment models are still unable to address systematic changes in productivity due to external factors such as inter-species relationships and low-frequency aspects of climate change. Relatively simple data-moderate models may provide tractable linkages to ecosystem models, and are relatively easy to modify to reflect ecosystem forces.

2015 STAT response: No additional ecosystem or environmental data were included in the 2015 China rockfish assessment.

Recommendation 3: Exploration of trans-boundary assessments with Canada should be initiated, and would benefit all parties. This also requires development of data inputs including historical catch reconstructions. Due to their transparency, data-moderate assessments may play an especially useful role in promoting trans-boundary fishery science.

2015 STAT response: Canada has not conducted a stock assessment for China rockfish.

Recommendation 4: The data-moderate assessments assume known catches, but there is considerable uncertainty in historical catch reconstructions, particularly for the recreational fishery. This uncertainty has not been measured, and tools for incorporating this uncertainty in assessments are not well developed. This is an issue for all assessments.

2015 STAT response: See response to the first recommendation.

Recommendation 5: There are fundamental differences between XDB-SRA and exSSS in how stock productivity is modeled. For exSSS, FMSY increases as the ratio of BMSY/B0 decreases in a deterministic way, while there is no prior relationship between FMSY and the ratio of BMSY/B0 for XDB-SRA. It is unclear which of these assumptions is most appropriate. This is a broader issue than for just data-moderate assessments, since it questions the appropriateness of two-parameter curves such as Beverton-Holt to model the stock recruit relationship. Research to improve understanding of the relationship between the inputs of the XDB-SRA and exSSS productivity parameters is encouraged.

2015 STAT response: The 2015 China rockfish assessment assumes a Beverton-Holt stock-recruit relationship, with a fixed value for steepness in all three models. The STAT agrees with the recommendation, and considers this a priority for "off-year" research.

Recommendation 6: Different priors (uniform of q / uniform on log-q) for the additional variance term were used in the two assessment models. It is unclear which performs best, and, since this term affects the weights given to each index in the model fitting, the form of the prior will influence model results, particularly when the indices are in conflict.

2015 STAT response: Additional variance parameters were estimated for all indices in the China rockfish models, but no explicit prior was used in Stock Synthesis, apart from specifying parameter bounds.

Recommendation 7: Compare the standardized (onboard observer) indices from the proposed method with indices constructed by applying the Stephens--MacCall approach to the data aggregated by trip.

2015 STAT response: Time constraints have not allowed for this analysis and it is a priority research topic for the next off-cycle year.

Recommendation 8: The GMT representative also recommended expanding the analysis of CPUE data to additional sectors of the recreational fishery, such as private and rental boats. CPUE indices from these sectors may be useful in future assessments of nearshore stocks.

2015 STAT response: Time constraints did not allow a private-mode index for the California recreational dockside survey. Oregon and Washington both provided data for the private/rental and party/charter recreational fleets from dockside surveys. A private boat mode index was considered for Oregon, but rejected due to infrequent catches of China. The WA recreational index included boat mode (charter and private) as a categorical variable in the delta-GLM analysis.

Recommendation 9: The GMT representative noted that for certain nearshore species there is potential utility in using post-2003 RecFIN dockside data as well as onboard sampling data since depth restrictions have not constrained access to the adult population.

2015 STAT response: The 2015 China rockfish assessment utilizes data through 2014 for the onboard observer programs in California and Oregon. The California post-2003 dockside data were not used because a large percentage of the trips north of Pt. Conception were also sampled by the onboard observer program.

Recommendation 10: The Panel strongly emphasizes the value of conducting a data workshop during which catches, indices, biology, and other data inputs are reviewed.

2015 STAT response: The China STAT team participated in the Nearshore Stock Assessment Workshop held March 31-April 2, 2015 in Portland, OR.

Recommendation 11: The historical CPFV drift-specific data should be key-punched, which should allow the algorithm for developing CPFV-based data indices to be improved.

2015 STAT response: The SWFSC Fisheries Ecology Division key-punched and error-checked the CDFW 1987-1998 onboard observer survey data. These data were included in an onboard index.

Recommendation 12: Recommendation: Habitat maps should be developed so that structural rather than true zeros are designated using data which are independent from the data used to determine the indices.

2015 STAT response: Habitat maps and 'reefs' were defined by the SWFSC using the California Seafloor Mapping Project and the Oregon State waters Mapping Program mapping products. These habitat maps were used to select data for the onboard observer indices in both California and Oregon.

2.3 Response to the 2015 STAR Panel Requests

Request No. 1: Explore the utility of using California Recreational Fisheries Survey (CRFS) data from 2004-2007 to partition California catches in the early years based on the proportion of catch in the private recreational and charter modes north and south of $40°10'$ N latitude (concerns the southern and central models).

Rationale: This may be a better alternative to the current approach of using logbook data to partition the recreational catches north and south of $40°10'$ N latitude.

STAT Response: This request was not completed, and was repeated as request no. 13.

Request No. 2: Add the current assessment biomass trends for current base model to the plot in the draft assessment that compares the XDB-SRA and SS3 runs and plot an additional set of runs for all models where steepness and natural mortality are estimated with priors (add results from the northern and central models). This would be two sets of plots with spawning biomass and depletion (all models).

Rationale: To provide a comparison between the previous assessment results using XDB-SRA and the current assessment. XDB-SRA has more flexible productivity assumptions than SS3, so estimating h and M was regarded as a way to more closely mimic XDB-SRA using stock synthesis.

STAT Response: The plots were provided (Figures 75 and 76). Since XDB-SRA had knife-edge maturity at age 5, summary biomass for ages 5 and older was used in the plot to provide a common basis for comparison. For the southern model, the SS3 model with estimated h and M and XDB-SRA show similar results in absolute summary biomass and depletion. For the north plus central models, it was not possible to simultaneously estimate h and M, but again the results were similar.

Request No. 3: Compare the amount of available habitat for China rockfish in the area covered by northern and central models with estimates of R_0 for the northern and central models.

Rationale: Available habitat by region may provide an independent proxy for the relative abundance of the stock in each region.

STAT Response: Available rocky habitat was examined using two methods, and ratios of habitat between areas showed an increase in habitat from the northern area, to the central area, and to southern area with the most habitat. The Panel regarded this as a useful exercise for ranking assessment areas, but it cannot be used for determining relative abundance. There were a number of methodological issues that would need to be addressed to do this more rigorously, and ultimately its application to stock assessment would be indirect given the assumptions required. The Panel will consider making a research recommendation to examine the estimated area of reefs at more finely resolved scales.

Request No. 4: Provide a model run where historical discards for the live-fish fishery are modeled as a separate fleet. For the discard fleet, estimate actual tonnage of catch: apply the discard fraction for the earliest four years to estimate discards back to 2000 with a ramp from 1990 to 2000 (selectivity for this fleet is the determined from the discard length comps) (southern model only).

Rationale: Fits to discard amount for the live-fish fishery by the model since 2000 are poor, and the model structure does not allow flexibility to decrease the discards prior to 2000.

STAT Response: This was done. Fits generally improved and the estimated selectivity pattern for the discard fleet appeared reasonable. The STAR Panel and the STAT agreed that the base model should incorporate this new approach.

Request No. 5: Provide the proportion of trips removed using the Stephens--MacCall filter over time as a diagnostic for all area models.

Rationale: To evaluate potential bias in the filtering procedure.

STAT Response: This was done for the northern area, and proportion of trips retained showed a temporal pattern of a slight increase followed by a decline in number of trips retained. The STAT asked that this request be considered a low priority for the other areas because it was not clear what the patterns in proportion of trips retained would indicate, and the northern area model was not sensitive to index treatment. The

Panel agreed. Further investigation is needed and this will be added to the list of research recommendations. Examination of the characteristics of trips retained/removed using the Stephens-MacCall method should be a routine part of index standardization.

Request No. 6: For the central model, provide a run where the northern California size composition data are added to the model, estimate two selectivity parameters (i.e., the simpler selectivity function), and estimate M to understand how this affects fits to the length composition data. Provide residual plots.

Rationale: This may produce a selectivity pattern that has a more realistic peak (full selection of a reasonable portion of observed lengths).

STAT Response: The selectivity pattern improved but estimates a very high M (0.12) and produces an implausible estimate of biomass (>1000 times the base model). The model is not supportable as a change to the base model.

Request No. 7: Exclude the Marine Recreational Fisheries Statistics Survey (MRFSS) index in Oregon to define a new base case for the central model.

Rationale: It was learned that multiple intercept interviews were done for a single trip, so the index was not constructed from trip level data, as was intended. This only affects MRFSS index for Oregon.

STAT Response: Excluding this index had a minor effect on model results. This problem should be correctable so the STAR panel will list this as a research recommendation.

Request No. 8: Add in the northern California length composition data to central area model. The selectivity pattern for this fishery should mirror the southern Oregon selectivity pattern. Retune the length composition data.

Rationale: These data were inadvertently left out of the model.

STAT Response: This was done. Adding these data had a minor effect on model results.

Request No. 9: For the central area model, attempt to estimate the selectivity patterns for each fishery and determine which of the selectivity patterns provides plausible estimates. Take the mean of those estimates (peak and/or spread parameters) and use the mean as a prior for the poorly estimated selectivities. Consider using the mode of the observed length

distribution as a prior for the peak parameter.

Rationale: To provide a more objective means to reflect selectivity parameters for those fleets where those parameters cannot be estimated.

STAT Response: Alternative procedures resulted in models with small difference to the base case depletion, though scale is dependent on the choice of peak value for selectivity for parameters that were required to be fixed (highest estimated value that didn't hit the bound of 45 cm). The Panel agreed that the original procedure used for the base case was simple and more supportable from a methodological viewpoint.

Request No. 10: For the central area model, repeat Request No. 9 using a two parameter ascending logistic curve for selectivity.

Rationale: To examine the effect on model results of using a different functional form for asymptotic selectivity.

STAT Response: Logistic curves did not improve model results, and all the same issues remain.

Request No. 11: Turn on estimation of recruitment deviations for all models, and iteratively increase σ_R from a low value until the residual pattern stabilizes.

Rationale: To determine whether estimating recruitment deviations can be supported by any of the models.

STAT Response: All models estimated extremely large recruitments in the 1980s and early 1990s that seem implausible and are not obvious in size composition data. For the southern area model, the standard error of recruitment deviance is larger than σ_R for many early estimates, which is a nonsensical result. The likelihood components show slightly worse fit to indices, an improved fit for age composition data, and the most improvement for size composition data. This suggests that the estimated recruitment deviations are being driven by relatively subtle signals in the length composition data rather than improved ability to fit the trends in the indices. The Panel concluded that there was insufficient information to estimate recruitment deviations for all models. Therefore no changes were made to the base model. One potential area of research for data-moderate stocks would be evaluate the effect of assuming different levels autocorrelation in the stock-recruit relationship. This might help curb the tendency to estimate extreme recruitment with sparse datasets.

Request No. 12: For all models, explore alternative methods of reweighting the conditional age-at-length data, but do not increase the weight on any data set. Alternatives to evaluate are: the unmodified sample size (the method used for the base case), and Francis weighting method A and B (report the

values of A and B).

Rationale: Methods for weighting conditional age-at-length data are a current active area of research with no generally agreed procedures, so model sensitivity to each method requires examination.

STAT Response: For the southern area model the weights for both the Francis A and B methods were above one, so no reweighting was applied. For both the central and the northern area models, Francis method A for the most part strongly downweights the conditional age-at-length data. The situation is most extreme for the northern area model, where iterative application of Frances method A appeared to be leading to a zero weight being given to conditional age-at-length data. Weighting is highly influential on both absolute biomass and relative depletion.

The Francis method A appears to produce unrealistically small weights for conditional age-at-length data in some cases. Apparently Francis method A is the recommended approach in preference to method B (C. Francis, pers. comm.), but the Panel was unable to find clear rationale for this recommendation. The harmonic mean method has a history of use and theoretical basis in the multinomial distribution, and generally provides weightings that are intermediate to no weighting (unmodified initial otolith counts) and the Frances method A. The Panel recommended that the harmonic mean should be used for now as it provides a compromise between no weighting and Francis A, while noting that a workshop with a focus on these methods later this year may result in the general recommendation of one of the existing methods or a new procedure.

Request No. 13: Explore the utility of using California Recreational Fisheries Survey (CRFS) data from 2004-2007 to partition California catches in the early years based on the proportion of catch in the private recreational and charter modes north and south of $40°10'$ N latitude (this concerns the southern and central models). This is a repeat of Request No. 1.

Rationale: This may be a better alternative to the current approach of using logbook data to partition the recreational catches north and south of $40°10'$ N latitude.

STAT Response: This analysis was completed. South of $40°10'$ N latitude, the difference in model results between using CRFS data and logbook for the apportioning catches is small. North of $40°10'$ N latitude there is a greater difference, primarily a change in initial stock size. The logbook method was based on data collected over a long period of time, while the CRFS method is based only on recent data. The logbook method better captures temporal changes in fishery, while CRFS method provides better information on relative catches between private and charter boats. In Oregon, recreational fishing for nearshore rockfish began around 1970, and this should be indicative of northern California. The STAR panel and STAT agreed that the logbook method should be used because the reconstructed catches are more consistent with what is known about the gradual development of the recreational fishery in northern California. Nevertheless, the Panel flagged improved methods for reconstructing recreational catches as a research recommendation.

Request No. 14: A set of revised base models should be brought forward with the following recommended changes:

- **Use weight specific fecundity relationships from Dick (2009) for all models.**
- **Update 2011 and 2012 data in the onboard observer CPUE index (southern model).**
- **Change the years in the Abrams dataset to 2010-2011; remove observations N of $40°10'$ N latitude (southern model).**
- **Model discards as a separate fleet (southern model).**
- **Remove Oregon MRFSS index (central model).**
- **Add northern California length composition data (central model).**
- **Fix any selectivity parameters hitting upper bounds (central model).**

Rationale: All of these changes have been identified and agreed to as changes that need to be made to the base models.

STAT Response: The changes were implemented to establish a new set of base models for China rockfish.

Request No. 15: Tune all models using the harmonic mean method for the conditional age-at-length composition and marginal age composition data.

Rationale: The Panel recommended that the harmonic mean method be used to reweight the conditional age-at-length composition data, because it is a well-understood and frequently applied method that provided intermediate results compared to other alternatives.

STAT Response: This was done and considered appropriate as a new base model.

Request No. 16: Estimate M in the revised base models for southern and northern models, and use the average of those estimates as a fixed value for all models.

Rationale: The northern and southern area models (but not the central area model) provide some objective basis for the selection of an appropriate value for M.

STAT Response: Although the estimates of M for the northern and southern area models are reasonable, the estimate for the central area M (0.116) is difficult to support.

The age composition data are noisy, but fits suggest that more young fish are observed than would be expected for lower values of M, outweighing the effect of older fish on the fits, which results in the preference towards a higher M in this model. There are a good number of observations of older fish that arguably are more important in terms of stock status that should be fitted by the model, and only the lower M values provide a reasonable fit to the oldest age observations. Values of M of 0.09 and above lead to unrealistically high biomass and minimal effect of fishing, results which appear to conflict with the habitat-based relative biomass among models. The median of the prior for M is 0.05 for this stock, and it is unclear why the data are so informative about the value of M. The northern and southern area models have more age data than the central area model, and the abundance indices show contrast, which is not apparent in the central area indices. Consequently the northern and southern area models may provide more supportable values for M. The Panel's proposed approach is to use the average of the estimated M values for the southern and northern area models (0.07) as a fixed value for all assessments.

Request No. 17: Provide likelihood profiles for M in all revised base models; consider providing a combined likelihood profile in one graphic for all models.

Rationale: Since the estimated values for M may be used as fixed value in all assessments, the Panel would like the STAT to examine the likelihood profiles as a useful diagnostic.

STAT Response: Likelihood profiles for both the southern and northern area models appear quite reasonable, particularly the northern area model where both the index data and the age data support the estimated M value. It should be noted that since these models are not estimating recruitment deviations, they are highly constrained, and may provide misleadingly precise estimates compared to models with greater flexibility.

Request No. 18: Normalize all indices and provide time series plots in which groups of comparable indices are plotted together (southern and central models). Provide time series plots in which groups of comparable index residuals are plotted together.

Rationale: To assess the comparability of indices prior to incorporation in the assessment model.

STAT Response: This was done, see Figures 77 and 78. In the southern area model, overall trends are broadly consistent with the model biomass and show a decline to the late 1990s, followed by an increase. The model has the ability to scale the periods before and after 2000 due a lack of overlap of indices in this period. The observer CPFV index shows a sustained decline after 2005 that the model is unable to match, even when recruitment deviations are turned on. Because China rockfish is a very long-lived species, age-structured population dynamics precludes rapid changes in abundance when fishing is relatively stable, suggesting that there must be some other cause for this recent trend. Indices for the central area show similar pattern from 2000 to 2014 across three indices that are also difficult to account for with China rockfish population dynamics. The Panel discussed potential interactions with other species (e.g., black rockfish) due to hook competition, and regulatory changes as factors that could affect CPUE indices derived from a multi-species recreational fishery. Panel will add a research recommendation that these factors be investigated.

Request No. 19: Provide likelihood profiles on M for all base models, which now are using a fixed value of M of 0.07. Plot predicted spawning output on the M profile plots.

Rationale: To evaluate whether the profiles for M for the base models for the northern and southern area are well determined as a justification using a single fixed value across all models, and to also demonstrate the inadequacy of the central model for estimating M

STAT Response: This was done. The new base models behaved as expected (except for spawning output declining at very high M for southern area model).

Request No. 20: Provide bracketing model runs varying M (high and low Ms should be equidistant from the base M (high M =0.09; base M = 0.07; low M = 0.05 (set to the median of the prior)) for potential decision tables. Assume projected ACL removals for a category 2 stock (P* = 0.45, = 0.72, 40-10 adj. as needed) applied to high and low M scenarios. Also provide projected ACL removals under base case, and recent year catches (if different than base case ACLs).

Rationale: Development of a potential axis of uncertainty based on M.

STAT Response: This was done.

Request No. 21: Update the figures from Request No. 2 with the new base models (show summary biomass).

Rationale: To provide a comparison between the previous assessment results using XDB-SRA and the current assessment.

STAT Response: This was done (Figure 79). The current base models deviate more strongly from the results using XDB-SRA than the pre-STAR models, but results remain broadly consistent (i.e., biomass estimates differ by no more than a factor of two).

Request No. 22: Provide runs of for the central model treating all age compositions as marginal (fix growth parameters, and alternatively fix and estimate M).

Rationale: This may provide improved fits to composition data, and may also provide further evidence that large values for M above 0.1 for the central model are implausible.

STAT Response: Results were only very slightly different to the base model, so no additional information was provided for the assessment.

Request No. 23: Provide two runs from the base for the southern area model that bracket uncertainty in steepness. Use values of 0.6 and 0.9 which are close to the 12.5 and 87.5 percentiles from the Thorson prior. Provide projected biomass to compare with current bracketing models with M.

Rationale: To determine whether uncertainty in M sufficiently captures uncertainty for decision tables for the southern area model.

STAT Response: This was done. The bracketing model runs for steepness and M produced remarkably similar results, allowing the Panel to agree to use only M to bracket uncertainty for management advice for the southern area model, and to do the same for the northern and central area models.

Request No. 24: The STAR panel requested a detailed justification be provided for the decisions regarding stock structure assumed in the assessment(s) (i.e., growth differences, size composition, fishery discard rates, evidence of low larval drift, and management history and jurisdiction).

Rationale: This information was not provided in detail in the draft assessment document. This is just a bookkeeping request as the Panel had discussed with the STAT the importance of providing supporting information on stock structure decisions, but no formal request was forwarded to the STAT.

STAT Response: This information will be included in the final assessment document.

2.4 Model Description

2.4.1 Transition from the 2013 to 2015 stock assessment

The first formal assessment of China rockfish was conducted as a data moderate assessment in 2013 (Cope et al. 2015). The results of the 2013 assessment were based on catch histories and indices of abundance from onboard (OR and CA) and dockside (OR and CA) surveys of the recreational fishing fleet. Below, we describe the most important changes made since the last full assessment and explain rationale for each change. [Note: descriptions below apply to the pre-STAR base model, and were not modified to reflect the final base model in order to provide a record of events leading to selection of the final model]:

1. Population dynamics model changed from a Bayesian surplus production model (XDB-SRA) with two areas (U.S. waters north and south of 40°10′ N. latitude) to a length-based, age-structured statistical catch at age model (Stock Synthesis) with three areas (U.S. waters south of 40°10′ N. latitude, 40°10′ N. latitude to the OR-WA border, and from the OR-WA border to the U.S.-Canadian border). *Rationale*: The assessment is moving from a data moderate to a full assessment, incorporating new data sources, e.g. individual growth, age and length compositions of landed and discarded catch.

2. New point estimate for annual natural mortality rate (0.053). *Rationale*: median of a prior distribution derived from a method endorsed by the SSC (O. Hamel, NWFSC; pers. comm.).

3. Beverton-Holt stock-recruitment relationship with steepness fixed at 0.773. *Rationale*: when estimated, steepness in the model approaches implausible values (near 1). Although uncertainty in model results is greatly underestimated, steepness in each sub-model was fixed at the mean of a prior distribution derived from a meta-analysis of rockfish steepness parameters (J. Thorson, NWFSC; pers. comm.).

4. Revised catch histories for California, Oregon, and Washington. *Rationale*: agency representatives for each state either prepared (OR and WA) or reviewed (CA) revised catch histories for the commercial and recreational fisheries.

5. Updated indices of abundance through 2014. *Rationale*: following research recommendations from the last assessment, current indices include revised recreational CPUE based on spatially-referenced, onboard observer data combined with habitat data, as well as catch and effort data by fishing-stop from the 1988-1999 CDFW onboard observer program.

6. Two new recreational dockside CPUE indices for northern Washington (1981-2014) and Oregon (2004-2014). *Rationale*: previous assessment had no trend information for Washington state, and did not include CPUE from the high-intensity dockside sampling program in Oregon (ORBS).

7. New commercial logbook CPUE index for the southern Oregon nearshore fishery (2004-2013). *Rationale*: previous assessment contained no indices of abundance based on commercial fisheries data. This (primarily live-fish) nearshore fishery has expanded rapidly over the past two decades.

8. Models include new age data representing all three states. *Rationale*: allows growth to be estimated in each sub-model based on conditional-age-at-length composition data.

9. Discards modeled explicitly with selectivity and retention curves in the southern area model. *Rationale*: new length composition data for discarded catch permits explicit modeling of retention and selectivity in the southern commercial live-fish fishery.

Prior to the STAR Panel review meeting, age-structured production models (i.e., fit only to indices of abundance) were developed in Stock Synthesis to mimic the XDB-SRA models from the 2013 stock assessment. Trends in stock status and overall scale were similar among models for the northern substock (Figures 80 and 81), but the southern substock was estimated to have a larger unfished biomass and similar current biomass (i.e. a more depleted stock) when the data were fit in Stock Synthesis (Figures 82 and 83). The age-structured model makes different assumptions from the last assessment about production (Beverton-Holt stock-recruitment relationship, with steepness estimated at 0.88 and 0.89 in the northern and southern models, respectively) and growth, which may explain the differences between the two population dynamics models. See Request #2 from the 2015 STAR Panel for a comparison of final base model results to the 2013 assessment.

2.4.2 Definition of fleets and areas

We generated data sources for each of the models. Fleets include:

Northern Model
Recreational: All catch in the northern model is recreational. The recreational fleets include separate landings from the party/charter and private./rental modes in MCAs 3-4 and combined party/charter and private/rental modes for MCAs 1-2 (where catches and sample sizes were lower).

Central Model
Commercial: The commercial fleets include five separate fleets, one each for the live and dead commercial fishers in the following areas, California north of 40°10′ N. latitude, southern Oregon. Live and dead commercial fisheries were combined for northern Oregon as commercial landings were low in this area.

Recreational: The recreational fleets include six separate fleets, one each for the party/charter and private/rental modes in the following areas, California north of 40°10′ N. latitude, southern Oregon, and northern Oregon.

Southern Model
Commercial: The commercial fleets include separate catches for the live and dead fish fisheries, as well as discards from the live-fish fishery.

Recreational: The recreational fleets include landings from the party/charter and private/rental modes. There are three indices of abundance: CDFW 1989-1999 CPFV onboard observer, CDFW 2000-2014 CPFV onboard observer, MRFSS 1980-2003 CPFV dockside.

Research: Length compositions from Jeff Abrams thesis (Abrams 2014) and the CCFRP study.

2.4.3 Summary of data for fleets and areas

2.4.4 Modeling software

The STAT team used Stock Synthesis 3 version 3.24u by Dr. Richard Methot at the NWFSC. This most recent version (SS-V3.24u) was used, since it included improvements and corrections to older versions.

2.4.5 Data weighting

Length composition sample sizes for all models were tuned by the "Francis method" (also known as "TA1.8") (Francis 2011), as implemented in the r4ss package. This approach involves comparing the residuals in the model's expected mean length with respect to the observed mean length and associated uncertainty derived from the composition vectors and their associated input sample sizes. The sample sizes are then tuned so that the observed and expected variability are consistent. After adjustment to the sample sizes, models were not re-tuned as long as the bootstrap uncertainty value around the tuning factor overlapped 1.0.

Age compositions and conditional-age-at-length (CAAL) compositions were re-weighted using the Ianelli-McAllister harmonic mean method (McAllister and Ianelli 1997). Two variations on the Francis method were also considered for the CAAL data, dependent on whether or not the vectors of age at length are considered independent within each year. Data weighting in general, and the Francis method are topics of ongoing research and there is no clear guidance on a preferred method. In the southern model, both approaches indicated that the fit was already better than expected with the input sample sizes left in place. For the central and northern models, Francis method A suggested that the CAAL sample sizes should be greatly reduced to achieve reasonable fit (effectively down weighting the CAAL data out of the northern model) while Francis method B suggested little tuning was needed.

2.4.6 Priors

In the pre-STAR panel base models, the mean of the priors for Beverton-Holt steepness parameter (Dorn, M. and Thorson, J., pers. comm.) and natural mortality (Hamel 2015) were used as fixed values across the three models. The priors were applied in sensitivity analyses where these parameters were estimated.

The final base models also used the mean of the Beverton-Holt steepness prior, but fixed natural mortality at the mean of the estimated values from the northern and southern regions.

2.4.7 General model specifications

Stock synthesis has a broad suite of structural options available. Where possible, the 'default' or most commonly used approaches are applied to this stock assessment. The assessment is sex-aggregated, including the estimation of growth curves and selectivity.

This stock assessment is divided into three independent areas, the south (California south of 40°10′ N. latitude), the central (north of 40°10′ N. latitude to the Oregon-Washington border), and the north (Washington state) based on latitudinal patterns in the length composition data and fits to size at age data. The time-series of landings begins during 1900, and captures the inception of the fishery, so the stock is assumed to be in equilibrium at the beginning of the modeled period.

The internal population dynamics model tracks ages 0-80, where age 80 is the 'plus-group.' As there is little growth occurring at age 80, the data use a plus group of age 50; there are relatively few observations in the age compositions that are greater than age 50.

All models used the posterior predictive fecundity relationship from Dick (2009).

The following likelihood components are included: catch, indices, discards (south only), discarded catch (south only), length compositions, age compositions, parameter priors, and parameter soft bounds. See the SS technical documentation for details (Methot and Wetzel 2013).

Model data, control, starter, and forecast files can be found in Appendices A-D.

2.4.8 Estimated and fixed parameters

A full list of all estimated and fixed parameters is provided in Tables 36, 37, and 38. Time-invariant, sex-aggregated growth is estimated for all modeled areas in this assessment. Recruitment deviations are not estimated due to a lack of visible cohorts in either the length or age data. In the pre-STAR models natural mortality was fixed at 0.053, the median of the Hamel prior (Hamel 2015), and the stock-recruitment steepness is fixed at the SSC approved steepness prior of 0.773. However, post-STAR models fix M at 0.07 for all models, the average of the estimated M's from the northern and southern models (the central area model was unable to estimate M). Asymptotic selectivity is generally used in the base case models.

2.5 Model Selection and Evaluation

2.5.1 Key assumptions and structural choices

All structural choices for stock assessment models are likely to be important under some circumstances. In this assessment these choices are generally made to 1) be as objective as possible and 2) follow generally accepted methods of approaching similar models and data. The relative effect on assessment results of each of these choices is often unknown; however an effort is made to explore alternate choices through sensitivity analysis. Major choices in the structuring of this stock assessment model include the independent north, central and south area models that use disaggregated fleet structuring and mirrored selectivity for fleets with little or no length and age composition data. All of these models fix the values for natural mortality and stock-recruitment steepness as there is not enough information in the data to reliably estimate these important productivity parameters. Recruitment is assumed to be deterministic in all models, as the data do not contain sufficient information to resolve the strength of individual year classes.

2.5.2 Alternate models explored

Sensitivity analyses included a comparison of key model assumptions were based on nested models and included asymptotic vs. domed selectivity, alternative values of M, and alternative fleet mirroring structure for estimating selectivity. For the area North of 40°10′ N. latitude, an alternative model in which both Central and North areas were included in a single, spatially-explicit model. However, differences in growth found between Oregon and Washington supported independent models.

2.5.3 Convergence

Convergence testing through use of dispersed starting values often requires extreme values to actually explore new areas of the multivariate likelihood surface. Jitter is a SS option that generates random starting values from a normal distribution logistically transformed into each parameter's range (Methot 2015). Table 39 shows the results of running 100 jitters for each pre-STAR base model. The northern model, which has the least amount of data and the fewest number of estimating parameters (8), returned to the same base case solution every time. The central model, with 14 parameters had 6% of the starting values cause errors in the likelihood but the remaining runs returned to the base model. The southern model, which had the most estimated parameters (16), had some jitters converge to a local minimum with worse likelihood, but the majority returned to the base model.

2.6 Base-Model(s) Results

Base models for all three areas (northern, central, and southern) are combined sex models, based on lack of evidence for sexually dimorphic growth in the available size-at-age data as well as in previous studies. Key productivity parameters are fixed at measures of central tendency from prior distributions endorsed by the PFMC's SSC due to the models' inabilities to estimate reasonable parameter values. Specifically, steepness of the assumed Beverton-Holt stock-recruitment relationship was fixed at 0.773. In the final base models the instantaneous rate of annual natural mortality was fixed at $0.07 yr^{-1}$, the average between the estimated natural mortality from the northern and southern models. Estimated parameters in each model vary, and are described in the area-specific results sections, below.

Northern

The northern base-case model produces reasonable estimates of growth parameters, with China rockfish in northern Washington reaching a maximum length of 35.4 cm (Table 36, Figure 84). The northern base-case model was able to fit the northern Washington recreational index of abundance with an estimated additional standard deviation of 0.13 (Table 36). However, there are runs of years in which the model consistently either over or under fits the data (Figure 85). The model fit to the index estimates a declining trend in the fit between the 1980s and 1990s, followed by a flat trend through recent years.

Fits to the time aggregated southern Washington recreational length distributions are poor, where data are sparse, with the model expecting more fish sized approximately 27 cm to 34 cm and fewer fish greater than 40 cm than are present in the data (Figure 86). However, fits to the time aggregated northern Washington recreational length distributions, the area with most of the data and landings, are good (Figures 86 and 87). The model fits the recreational conditional age-at-length data reasonably (Figures 88 and 89). There are a few outliers, including two 15-year-old fish in the 22 cm bin in 2005 and one 14-year-old fish in the 20 cm bin in 2010 but there are no strong patterns in the residuals.

Estimated selectivity curves for the Washington recreational southern and northern fleets suggest different ascending width parameters, resulting in the southern fleet selecting smaller China rockfish than the northern fleet (Figure 90). The southern fleet asymptote was unable to be estimated so it was fixed to the estimate from the northern fleet.

Central

The central base-case model produces reasonable estimates of growth parameters, with China rockfish in the central area reaching a length of 37.44 cm at age 30 (Table 37, Figure 84). The central base-case model fits to the indices of abundance are generally flat to slightly declining, with many model fits showing runs of years in which the model consistently either over or under fits the data (Figures 91, 92, 93). Each of the central model indices of abundance except the Oregon southern commercial live fish fishery were fit estimating additional standard deviations of 0.15, 0.50, and 0.08 for the Oregon commercial logbook index, the Oregon onboard recreational index, and the Oregon ORBS index, respectively (Table 37).

Fits to the central model length distributions are reasonable given the small samples sizes, particularly during the early years, and the constraints applied to selectivity parameters (Figures 94, and 95). The model fits the Oregon southern commercial fishery best, shifts the peak of the fitted distribution to the left for the Oregon southern recreational private/rental, Oregon southern recreational party/charter, and Oregon northern recreational private/rental fleets, and under fits the peak of the time aggregated length distributions for the Oregon southern commercial live fish and Oregon northern recreational party/charter fleets. The model fits the conditional age-at-length data from the southern Oregon commercial dead-fish fishery poorly with clusters in the residuals and fewer observations in the age-50+ bin than expected by the model (Figure 96). The residual patterns are less notable in the fit to conditional age-at-length data from the southern Oregon recreational party/charter (Figure 97). For both these datasets, the largest residuals are associated with young fish at large sizes, including commercial catch of fish aged 10 years and younger in the 35-40cm range in 2002 through 2004 and a recreational observation in 2011 in the 44 cm length bin estimated at 10 years old. In many years the model expects more fish in the plus group (age 50) than are actually present in the data, but years where 50+ age fish were observed, this observations is typically larger than the expectation. The fit to the marginal age compositions from the northern Oregon recreational fishery are reasonable given the low sample sizes of this fleet (which is the reason it was not represented as conditioned on length) although generally more fish in the 5-10 year old range were observed than expected by the model (Figure 98).

The central model does not explicitly model discards due to low discard rates and the limited availability of discard data. However, a discard fraction of 2.69% of the annual commercial landings has been added to the commercial landings to account for the total removals by the commercial fisheries.

Asymptotic selectivity curves are estimated for all fleets with length compositions (Figure 99). The exceptions included the northern Oregon commercial fishery which shared the selectivity curve for the southern Oregon life-fish commercial fishery, and the northern Oregon private/rental fleet that was assumed to share the selectivity with the party/charter fleet in this same area. Many of the recreational has estimates of peak selectivity that hit the upper bound of 45 cm, well above the estimated asymptotic size. These parameters were all reduced to (fixed at) the highest peak selectivity parameter among the recreational fleets that was not hitting a bound: 39.9 cm. The ascending width parameters showed small differences among all fleets (Table 37). The commercial selectivity parameters generally had peak values estimated at a lower point than the recreational selectivities.

Southern

The model for the area south of 40°10′ N. latitude produces reasonable values of estimated growth parameters in the base-case model, with China rockfish in the southern management area reaching an asymptotic length (converted from Schnute parameterization) of 31.5 cm, with von Bertalanffy growth coefficient, $k = 0.144$, and a coefficient of variation of 12% for length at age 30 (Figure 84). The southern base-case model best fit the southern area recreational dockside index of abundance with an estimated additional standard deviation of 0.12, and the two recreational onboard indices (1988-1999 and 2000-2014) with additional SDs of 0.15 and 0.18, respectively (Table 38). However, in all three indices there are runs of positive or negative residuals. The model is able to capture a decline in catch rates from the 1980s to the late 1990s / early 2000s in the dockside recreational CPUE index (Figure 100), but slightly underestimates a declining trend in the 1988-1999 onboard observer index (Figure 101). The model is consistent with an observed increasing trend from 2000-2012 in the more recent onboard observer index, but was not able to capture a recent drop in catch rates in recent years (Figure 102).

Fits to the time-aggregated southern recreational private and charter boat length distributions, the fleets with most of the data and landings, are most consistent with the observed data (Figure 103). Length data from the commercial fisheries (live-fish fishery and fish landed dead) are fit reasonably well by the model (Figure 103).

Fits to the length compositions from the central California onboard observer and CCFRP surveys (fleets observing whole, retained plus discarded, catch) are good for the onboard observer data (which mirrors the selectivity of the recreational charter boat fishery), but the model a larger variance and smaller mode in time-aggregated lengths relative to the data from the CCFRP survey (Figure 104).

The model fits the conditional age-at-length data from Jeff Abrams' thesis (Abrams 2014) reasonably well (Figure 105), particularly for years with larger sample sizes.

Length-based selectivity parameters estimated in the southern base model include, for each fleet, the size at 100% vulnerability ('peak' parameter), and the 'width' of the ascending limb of the selectivity curve (a cumulative normal distribution, Figure 68). Peak values ranged from 27.6 cm (commercial discards) to 35.5 cm (commercial live-fish fishery). The recreational catches represent both retained and discarded fish, the composition data in the base model represents only retained fish. Recreational length composition data for discarded fish are available from the onboard charter boat observer programs, and could potentially be used to model retention and selectivity separately. The STAT was not able to attempt this analysis for the southern model due to time constraints (see research recommendations).

Discards in the pre-STAR base model were estimated in the southern area model for the commercial live-fish fishery. This model did not fit the length composition data for the commercial live-fish fishery well, and did not capture the increasing trend in the proportion of discarded catch south of Cape Mendocino. During the STAR panel, the STAT adopted a recommendation made by the panel to treat discarded commercial catch as a separate "fleet" in Stock Synthesis, which greatly improved the fits to the discard length composition data and greatly improved the fits to the length composition of retained catch in the commercial live-fish fishery.

2.7 Uncertainty and Sensitivity Analyses

The base-case assessment model includes parameter uncertainty from a variety of sources, but underestimates the considerable uncertainty in recent trend and current stock status. For this reason, in addition to asymptotic confidence intervals (based upon the model's analytical estimate of the variance near the converged solution), two alternate states of nature (low and high values of M) are presented in a decision table. Much additional exploration of uncertainty was performed prior the STAR panel. Some of that exploration of other sources of uncertainty is provided below. Specifically, for each pre-STAR area model, the following sensitivity runs were performed:

1. “Drop-one” analyses: remove single data types from the model – indices, discards, length compositions (down-weighted by scaling Francis weights by factor of 0.25), and age compositions.

2. Alternative data-weighting criterion. The base model length compositions are tuned based on the Francis method (Francis2011), as implemented in the r4ss package. An alternative method based on the harmonic mean effective sample size (McAllister and Ianelli 1997).

3. Free up size at age 0 (1 run) and CV at A_min (1 run)

4. Fix growth at external estimate (1 run)

Northern Model

Tabular results for the northern area pre-STAR model sensitivity runs can be viewed here: 40, and associated figures are here: Figures 106 and 107. The model for the northern management area was not sensitive to dropping the index of abundance, data weighting methods, downweighting length comps (75% reduction in Francis weights, i.e. weights multiplied by 0.25). The pre-STAR models that attempted to estimate the size at age 0 and CV at Age minimum growth parameters resulted parameters going to bounds, producing unrealistic estimates for these parameter values. The pre-STAR model was highly sensitive to the exclusion of age the com- position data and fixing growth the the externally estimated values. Lack of age data and fixing growth to the external estimates produced an approximate doubling in the estimates of the stock size and in the status of the population. Removal of the age composition data, modeled as conditional age-at-length, impacts the scale of the pre-STAR model, in part because the pre-STAR model is no longer able to estimate reasonable values of growth parameters. Fixing growth to the externally estimated values is problematic because the data lack small/young fish, resulting in high sensitivity to the k estimate.

When estimated with their respective prior distributions, both steepness and natural mortality are larger than the fixed values in the pre-STAR base model (h = 0.95, and M = 0.07). However, the higher estimate of M contradicts the observed maximum age of 83 and the higher h estimate is inconsistent with the current understanding of rockfish productivity.

Additional sensitivities conducted during the STAR panel are described in the section “Response to the 2015 STAR Panel Requests.”

Central Model

Tabular results for the central area pre-STAR model sensitivity runs can be viewed here: Table 41, and associated figures are here: Figures 108 and 109. The pre-STAR model for the central management area was not sensitive to dropping the index of abundance, data weighting methods, downweighting length comps (75% reduction in Francis weights, i.e. weights multiplied by 0.25). The pre-STAR models that attempted to estimate the size at age 0 and CV at Age minimum growth parameters resulted parameters going to bounds, producing unrealistic estimates for these parameter values. The pre-STAR model was highly sensitive to the exclusion of age the composition data and fixing growth the externally estimated values. Lack of age data resulted in an inability to estimate R_0, leading to unrealistic model results. Fixing growth to the external estimates produced an approximate doubling in the estimates of the stock size and in the status of the population. Fixing growth to the externally estimated values is problematic because the data lack small/young fish, resulting in high sensitivity to the k estimate.

The central pre-STAR base model is unable to estimate M but when h is estimated it goes to a value of 0.75, very close to the fixed value from the pre-STAR base model of 0.773, indicating that the data do not contain much information about stock productivity.

Additional sensitivities conducted during the STAR panel are described in the section "Response to the 2015 STAR Panel Requests."

Southern Model

The pre-STAR base model for the southern management area was not very sensitive to dropping indices or discard data, or to downweighting length comps (75% reduction in Francis weights, i.e. weights multiplied by 0.25). However, exclusion of age composition data significantly altered estimates of the scale and status of the population (Table 42; Figures 110 and 111). Removal of marginal age composition data and conditional age-at-length data had a dramatic effect on model results, in part because the model is no longer able to estimate credible values of growth parameters (e.g. von Bertalanffy k = 0.027; Figure 112).

Weighting of data types (e.g. composition data vs. indices) in the pre-STAR base models was based on the method of Francis (2011), as implemented in the r4ss package. An alternative method based on the harmonic mean effective sample size (McAllister and Ianelli 1997) was applied, and results were consistent with the Francis method (Figures 113 and 114).

The pre-STAR base model fixes length at age zero at 2 cm, with a CV of 0.1. Separate attempts to estimate these parameters in the model failed, with both going to unrealistic boundaries, i.e. size at age 0 years of 10 cm, and a CV of 0.01 (results not shown). If growth is estimated external to the model and fixed at those estimates, fits to the model degrade (increased negative log likelihoods) and the stock is more depleted, with biomass is 2015 at 23% of unfished biomass, below the minimum stock size threshold (Figures 115, 116, and 117).

The southern pre-STAR base model fixed parameters that determine stock productivity (steepness and natural mortality) at point estimates derived from prior distributions (see prior distributions section for details). When estimated with their respective prior distributions, both steepness and natural mortality are larger than the fixed values in the base model (h = 0.92, and M = 0.1). As noted in the profile likelihood analyses, the length and age composition data appear to support higher M values, but this contradicts the observed maximum age of 83. The data appear to have little information about steepness, and the estimated value is near the mode of the prior distribution (Figure 118). Higher values of steepness and natural mortality result in a smaller, less-depleted stock (Figures 119 and 120).

The estimated growth curve also changes, with a lower value of k and higher asymptotic size (Figure 121).

Additional sensitivities conducted during the STAR panel are described in the section "Response to the 2015 STAR Panel Requests."

2.7.1 Retrospective analysis

Retrospective analyses were conducted for each pre-STAR base model by conducting model runs that sequentially remove the last year of data over the last 5 base model years. The southern model showed very little change in estimated spawning biomass trajectory as a result of this data removal (Figure 122). The central and northern models, however, showed that the each additional year of data added to the model has resulted in a higher initial spawning biomass (Figures 123 and 124). These results are consistent with the dependence of the central and northern models on more recently collected data as compared to the southern model where the catch history began earlier.

2.7.2 Likelihood profiles

Pre-STAR base model likelihood profiles

Likelihood profiles for equilibrium recruitment (R_0), natural mortality (M), and steepness (h), were completed to investigate the uncertainty in these parameters and their influence on the fit to different data sources. For all models, the age data had the largest influence on the scale of the population as indicated by the data type most influenced by R_0 (Figures 125, 126, and 127). In the southern model, the length and index data also had the best fit at a similar scale, showing consistency in these data sources about the population size. In the central model, lower R_0 values caused the model to fit the length data less well but higher values had little influence. The index data was most influential on the R_0 estimates in the northern model, where they were best fit with a higher equilibrium recruitment.

Profiles over natural mortality showed length and age data best fit by high M values (greater than 0.10) in the central and south models (Figures 128 and 129), while the value among those in the profile with best likelihood in the northern model was $M = 0.08$ (Figure 130). As in the profile over R_0, the index data in the northern model showed a larger influence on M than the index data in the central and southern models.

Likelihood profiles were conducted over four values for the steepness of the stock-recruit curve ($h = 0.3$, 0.6, 0.773, and 0.9), where 0.773 is the mean of the prior distribution and chosen as a fixed value in the three base models. These profiles indicated that for the southern and northern models (Figures 131 and 132), length and age data were best fit by high steepness values, with the index in the northern model also showing a better fit at higher steepness. The central model, however, showed the best combined fit to all data sources at an intermediate value of steepness, with an MLE estimate when the parameter was estimated of $h = 0.753$, which is close to the prior mean (Figure 133). This estimate represents a balance between the age data and steepness prior, which were best fit at higher steepness values, and the length data, which was best fit at lower steepness values. The index data in the central model showed less change in likelihood as a result of the steepness profile than the other data types, but it was the only type that was best fit at an intermediate value, $h = 0.6$.

Final base model likelihood profiles

Likelihood profiles over natural mortality were conducted for all of the final base models, and sensitivities to those models (Figures 134, 135, and 136). The northern model had the best combined fit at the estimated value of natural mortality. The southern model showed a good fit to the estimated value of natural mortality for the index data and the priors. The length data in the souther model indicated a better fit at a lower value of natural mortality whereas the age data indicated the best fit towards the upper bound of the profile, M=0.12. The central model was not able to estimate a reasonable value for natural mortality, with all data sources indicating the best fit to the data towards the upper bound of natural mortality in the profile.

3 Reference Points

Northern Model

This stock assessment estimates that China rockfish in the north are well above the biomass target. The spawning biomass of the stock declined between the 1960s and 1990s but has largely been stable during the past few decades (Table 43; Figure 137). The estimated relative depletion level in 2015 is 73.4% (~95% asymptotic interval: ± 63.6% - 83.2%), corresponding to an unfished spawning output of 17.9 billion eggs (~95% asymptotic interval: 8.8 – 27.1 billion eggs) of spawning output in the base model (Table b; Figure 138). Unfished spawning output was estimated to be 24.4 billion eggs in the base case model. The target spawning output based on the biomass target ($SB_{40\%}$) is 9.8 billion eggs, which gives a catch of 6.2 mt. Equilibrium yield at the proxy F_{MSY} harvest rate corresponding to $SPR_{50\%}$ is 5.8 mt. Table k shows the full suite of estimated reference points for the northern area model and Figure 139 shows the equilibrium yield curve.

Central Model

This stock assessment estimates that central area China rockfish are just above the biomass target (Table 44; Figure 140). The rate of spawning output decline is estimated to be steepest during the 1980s to 1990s and has continued to decline since the 1990s at a slower rate (Figure 141). The estimated relative depletion level in 2015 is 61.5% (~95% asymptotic interval: ± 53.8% - 69.2%), corresponding to an unfished spawning output of 65.1 billion eggs (~95% asymptotic interval: 51.8 – 78.4 billion eggs) of spawning output in the base model (Table c). Unfished age 5+ biomass was estimated to be 591.5 mt in the base case model.

The target spawning output based on the biomass target ($SB_{40\%}$) is 26 billion eggs, which gives a catch of 15.7 mt. Equilibrium yield at the proxy F_{MSY} harvest rate corresponding to $SPR_{50\%}$ is 14.5 mt. Table l shows the full suite of estimated reference points for the central area model and Figure 142 shows the equilibrium yield curve.

Southern Model

This stock assessment estimates that China rockfish south of 40°10′ N. latitude are below the biomass target, but above the minimum stock size threshold, and have been increasing over the last 15 years (Table 45; Figure 143). The estimated relative depletion level in 2015 is 27.9% (~95% asymptotic interval: ± 21.2% - 34.7%), corresponding to an unfished spawning output of 66.5 billion eggs (~95% asymptotic interval: 49.6 - 83.4 billion eggs) of spawning output in the base model (Table d). Unfished age 5+ biomass was estimated to be 768.6 mt in the base case model (Figure 144). The target spawning output based on the biomass target ($SB_{40\%}$) is 26.6 billion eggs, which gives a catch of 21.1 mt. Equilibrium yield at the proxy F_{MSY} harvest rate corresponding to $SPR_{50\%}$ is 19.5 mt. Table m shows the full suite of estimated reference points for the southern area model and Figure 145 shows the equilibrium yield curve.

4 Harvest Projections and Decision Tables

The forecasts of stock abundance and yield were developed using the final base models. The total catches in 2015 and 2016 are set to the PFMC adopted China rockfish contribution ACLs in the northern and central models (Table n). The southern model total catches in 2015 and 2016 are set to the average annual catch from 2012-2014. The exploitation rate for 2017 and beyond is based upon an SPR harvest rate of 50%, adjusted by the default 40-10 harvest control rule. The average of 2010-2014 catch by fleet was used to distribute catches in forecasted years.

Northern Model Current medium-term projections of expected China spawning biomass from the northern base model suggests slight declines from the current levels as the stock moves towards the current target stock size under the default harvest control rule (Table 46, Figures 146 and 147). The stock is expected to remain above the target stock size during the projection period, assuming stationarity in the stock-recruitment assumptions.

Uncertainty in the forecasts is based upon the three states of nature agreed upon at the STAR panel and are based on a low value of M, 0.05, and a high value, 0.09. Current medium-term forecasts based on the alternative states of nature project that the stock, under the current control rule as applied to the base model, will decline towards the target stock size Table p. The current control rule under the low state of nature results in a stock decline into the precautionary zone, while the high state of nature maintains the stock at near unfished levels. Removing the catches resulting from the low M state of nature, assuming the base and high values of M both maintain the stock at well above the current target stock size, as does removing the recent average catches under all states of nature. Removing the high M catches under the base model M and high M states of nature results in the population going to extremely low levels during the projection period, spawning biomass and stock depletion values are not reported for years in which the stock goes to these very low levels.

Central Model

Current medium-term projections of expected China spawning biomass from the central base model suggests stable catches near current levels as the stock is just above the current target stock size under the default harvest control rule (Table 47, Figures 146 and 147). The stock is expected to remain just above the target stock size, increasing slightly, during the projection period, assuming stationarity in the stock-recruitment assumptions.

Uncertainty in the forecasts is based upon the three states of nature agreed upon at the STAR panel and are based on a low value of M, 0.05, and a high value, 0.09. Current medium-term forecasts based on the alternative states of nature project that the stock, under the current control rule as applied to the base model, will decline towards the target stock size Table q. The current control rule under the low state of nature results in a stock in the precautionary zone, while the high state of nature maintains the stock increasing from 40% to 50% depletion from 2017 - 2026. Removing the catches resulting from the low M state of nature, assuming the base and high values of M both maintain the stock at well above the current target stock size. Removing the high M catches under the base model M and low M states of nature results in the population going to extremely low levels during the projection period. Removing average catches under the base M and high M states of nature result in the stock remaining above the current target stock size, and an ending depletion of 37% in 2026 for the low M state of nature.

Southern Model

Assuming that catches in 2015 and 2016 equal recent average catch, and that catches beginning in 2017 follow the default ACL harvest control rule, projections of expected China spawning output from the southern base model suggest the stock will be at roughly 30% of unfished spawning output in 2017, and increase to 38% by 2026 (Table 48, Figures 146 and 147). The stock is expected to remain below the target stock size (40% of unfished spawning output) in the base model and "low M" states of nature through 2026, and to exceed target size in the "high M" scenario, assuming stationarity in the stock-recruitment assumptions.

Uncertainty in the forecasts is based upon the three states of nature agreed upon at the STAR panel: a low value of M, 0.05, the base model value, M=0.07, and a high value, M=0.09. Stock status under the alternative states of nature ranges from an overfished state in 2017 for the low-M scenario (21% of unfished spawning output) to a stock at target biomass (40% of unfished) in the high-M scenario (Table r). Annual catches based on the low-M state of nature increase from 5 to 10 mt over the projection period, and result in an increasing stock under all three states of nature. Catches derived from the base model increase from 11 mt in 2017 to 15 mt in 2026, and also produce increasing trends (at different rates) in spawning output under all three states of nature. Catches under the high-M state of nature produce very little change in spawning output over the projection period for all three states of nature.

5 Regional Management Considerations

China rockfish is currently managed as part of the nearshore rockfish stock complex, and as such, does not have a species-specific ACL. The complex is divided into northern and southern components around the PFMC management line at $40°10'$ N. latitude (near Cape Mendocino, California). This management boundary is consistent with observed spatial patterns in the data (e.g. length compositions, size at age, commercial discard rates), and OFL estimates for the northern and southern management regions can be calculated directly from the base model runs and projections (southern model = OFL for southern nearshore rockfish complex, central + northern models = OFL for northern nearshore rockfish complex).

6 Research Needs

1. The number of hours fished in Washington should be recorded for each dockside sample (vessel) so that future CPUE can be measured as angler hours rather than just number of anglers per trip. This will allow for a more accurate calculation of effort.

2. The number of hours fished in Oregon should be recorded for each dockside sample (vessel), instead of the number of the start and end times of the entire trip. This will allow for a more accurate calculation of effort.

3. Compare the habitat-based methods used to subset data for the onboard observer indices to Stephens-MacCall and other filtering methods.

4. Explore the sensitivity of Stephens-MacCall when the target species is "rare" or not common encountered in the data samples.

5. A standardized fishery independent survey sampling nearshore rockfish in all three states would provide a more reliable index of abundance than the indices developed from catch rates in recreational and commercial fisheries. However, information value of such surveys would depend on the consistency in methods over time and space and would require many years of sampling before an informative index could be obtained.

6. A coastwide evaluation of genetic structure of China rockfish is a research priority. Genetic samples should be collected at sites spaced regularly along the coast throughout the range of the species to estimate genetic differences at multiple spatial scales (i.e., isolation by distance).

7. Difficulties were encountered when attempting to reconstruct historical recreational catches at smaller spatial scales, and in distinguishing between landings from the private and charter vessels. Improved methods are needed to allocate reconstructed recreational catches to sub-state regions within each fishing mode.

8. There was insufficient time during the STAR Panel review to fully review the abundance indices used in the China rockfish assessments. Consideration should be given to scheduling a data workshop prior to STAR Panel review for review of assessment input data and standardization procedures for indices, potentially for all species scheduled for assessment. The nearshore data workshop, held earlier this year, was a step in this direction, but that meeting did not deal with the modeling part of index development.

9. The Marine Recreational Fisheries Statistics Survey (MRFSS) index in Oregon was excluded from the assessment model because it was learned that multiple intercept interviews were done for a single trip. Evaluate whether database manipulations or some other approach can resolve this issue and allow these data to be used in the assessment.

10. Many of the indices used in the China rockfish assessment model used the Stephens-MacCall (2004) approach to subset the CPUE data. Research is need to evaluate the performance of the method when there are changes in management restrictions and in relative abundance of different species. Examination of the characteristics of trips retained/removed should be a routine part of index standardization, such as an evaluation of whether there are time trends in the proportion of discarded trips.

11. Fishery-dependent CPUE indices are likely to be the only trend information for many nearshore species for the foreseeable future. Indices from a multi-species hook-and-line fishery may be influenced by regulatory changes, such as bag limits, and by interactions with other species (e.g. black rockfish) due to hook competition. It may be possible to address many of these concerns if a multi-species approach is used to develop the indices, allowing potential interactions and common forcing to be evaluated.

12. Consider the development of a fishery-independent survey for nearshore stocks. As the current base model structure has no direct fishery-independent measure of stock trends, any work to commence collection of such a measure for nearshore rockfish, or use of existing data to derive such an index would greatly assist with this assessment.

13. Basic life history research may help to resolve assessment uncertainties regarding appropriate values for natural mortality and steepness.

14. Examine length composition data of discarded fish from recreational onboard observer programs in California and Oregon. Consider modeling discarded catch using selectivity and retention functions in Stock Synthesis rather than combining retained and discarded catch and assuming they have identical size compositions. Another option would be to model discarded recreational catch as a separate fleet, similar to the way commercial discards were treated in the southern model.

15. Ageing data were influential in the China rockfish stock assessments. Collection and ageing of China rockfish otoliths should continue. Samples from younger fish not typically selected by the fishery are needed to better define the growth curve.

16. Consider evaluating depletion estimators of abundance using within season CPUE indices. This approach would require information on total removals on a reef-by-reef basis.

17. The extensive use of habitat information in index development is a strength of the China rockfish assessment. Consideration should be given to how to further incorporate habitat data into the assessment of nearshore species. The most immediate need seems to be to increase the resolution of habitat maps for waters off Oregon and Washington, and standardization of habitat data format among states.

18. Although all the current models for China rockfish estimated implausibly large recruitment deviations when allowed to do so, particularly early in the modeled time period, further exploration of available options in stock synthesis could produce acceptable results. In addition, this work may provide guidance on any additional options that could be added to stock synthesis to better handle this situation. For example, assuming different levels autocorrelation in the stock-recruit relationship for data-moderate stocks may help curb the tendency to estimate extreme recruitment with sparse datasets.

19. Research is needed on data-weighting methods in stock assessments. In particular, a standard approach for conditional age-at-length data is needed. The Center for the Advancement of Population Assessment Methodology (CAPAM) data weighting workshop, scheduled for later this year, should make important progress on this research need.

7 Acknowledgments

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8 Tables

Table 1: Commercial removals (mt) from the Oregon live and dead commercial fisheries, north and source of Florence, OR.

Year	Southern Dead	Northern Dead	Southern Live	Northern Live	Total Removals	Source
1900	0.01	0.01			0.02	Karnowski et al.
1901	0.00	0.00			0.00	Karnowski et al.
1902	0.00	0.00			0.00	Karnowski et al.
1903	0.00	0.00			0.00	Karnowski et al.
1904	0.00	0.00			0.00	Karnowski et al.
1905	0.00	0.00			0.00	Karnowski et al.
1906	0.00	0.00			0.00	Karnowski et al.
1907	0.00	0.00			0.00	Karnowski et al.
1908	0.00	0.00			0.00	Karnowski et al.
1909	0.00	0.00			0.00	Karnowski et al.
1910	0.00	0.00			0.00	Karnowski et al.
1911	0.00	0.00			0.00	Karnowski et al.
1912	0.00	0.00			0.00	Karnowski et al.
1913	0.00	0.00			0.00	Karnowski et al.
1914	0.00	0.00			0.00	Karnowski et al.
1915	0.00	0.00			0.00	Karnowski et al.
1916	0.00	0.00			0.00	Karnowski et al.
1917	0.00	0.00			0.00	Karnowski et al.
1918	0.00	0.00			0.00	Karnowski et al.
1919	0.00	0.00			0.00	Karnowski et al.
1920	0.00	0.00			0.00	Karnowski et al.
1921	0.00	0.00			0.00	Karnowski et al.
1922	0.00	0.00			0.00	Karnowski et al.
1923	0.00	0.00			0.00	Karnowski et al.
1924	0.00	0.00			0.00	Karnowski et al.
1925	0.00	0.00			0.00	Karnowski et al.
1926	0.00	0.00			0.00	Karnowski et al.
1927	0.00	0.00			0.00	Karnowski et al.
1928	0.00	0.00			0.01	Karnowski et al.
1929	0.01	0.01			0.01	Karnowski et al.
1930	0.00	0.00			0.01	Karnowski et al.
1931	0.00	0.00			0.01	Karnowski et al.
1932	0.00	0.00			0.00	Karnowski et al.
1933	0.00	0.00			0.01	Karnowski et al.
1934	0.00	0.00			0.01	Karnowski et al.
1935	0.00	0.00			0.00	Karnowski et al.

Table 1: Commercial removals (mt) from the Oregon live and dead commercial fisheries, north and source of Florence, OR.

Year	Southern Dead	Northern Dead	Southern Live	Northern Live	Total Removals	Source
1936	0.00	0.00			0.01	Karnowski et al.
1937	0.00	0.00			0.01	Karnowski et al.
1938	0.00	0.00			0.01	Karnowski et al.
1939	0.00	0.00			0.00	Karnowski et al.
1940	0.01	0.01			0.01	Karnowski et al.
1941	0.01	0.01			0.02	Karnowski et al.
1942	0.01	0.01			0.03	Karnowski et al.
1943	0.04	0.04			0.07	Karnowski et al.
1944	0.01	0.01			0.01	Karnowski et al.
1945	0.04	0.04			0.08	Karnowski et al.
1946	0.05	0.05			0.11	Karnowski et al.
1947	0.01	0.01			0.02	Karnowski et al.
1948	0.01	0.01			0.02	Karnowski et al.
1949	0.07	0.07			0.13	Karnowski et al.
1950	0.00	0.00			0.01	Karnowski et al.
1951	0.00	0.00			0.00	Karnowski et al.
1952	0.00	0.00			0.00	Karnowski et al.
1953	0.00	0.00			0.00	Karnowski et al.
1954	0.00	0.00			0.00	Karnowski et al.
1955	0.00	0.00			0.00	Karnowski et al.
1956	0.00	0.00			0.00	Karnowski et al.
1957	0.00	0.00			0.00	Karnowski et al.
1958	0.00	0.00			0.00	Karnowski et al.
1959	0.00	0.00			0.00	Karnowski et al.
1960	0.00	0.00			0.00	Karnowski et al.
1961	0.00	0.00			0.00	Karnowski et al.
1962	0.00	0.00			0.00	Karnowski et al.
1963	0.00	0.00			0.00	Karnowski et al.
1964	0.01	0.01			0.02	Karnowski et al.
1965	0.00	0.00			0.00	Karnowski et al.
1966	0.00	0.00			0.00	Karnowski et al.
1967	0.00	0.00			0.00	Karnowski et al.
1968	0.00	0.00			0.00	Karnowski et al.
1969	0.00	0.00			0.01	Karnowski et al.
1970	0.00	0.00			0.00	Karnowski et al.
1971	0.00	0.00			0.00	Karnowski et al.
1972	0.00	0.00			0.00	Karnowski et al.
1973	0.00	0.00			0.01	Karnowski et al.

Table 1: Commercial removals (mt) from the Oregon live and dead commercial fisheries, north and source of Florence, OR.

Year	Southern Dead	Northern Dead	Southern Live	Northern Live	Total Removals	Source
1974	0.01	0.01			0.02	Karnowski et al.
1975	0.00	0.00			0.01	Karnowski et al.
1976	0.00	0.00			0.00	Karnowski et al.
1977	0.09	0.09			0.17	Karnowski et al.
1978	0.01	0.01			0.03	Karnowski et al.
1979	0.13	0.13			0.26	Karnowski et al.
1980	0.07	0.07			0.13	Karnowski et al.
1981	0.07	0.07			0.14	Karnowski et al.
1982	0.32	0.32			0.64	Karnowski et al.
1983	0.35	0.35			0.69	Karnowski et al.
1984	0.23	0.23			0.45	Karnowski et al.
1985	0.21	0.21			0.41	Karnowski et al.
1986	0.14	0.14			0.28	Karnowski et al.
1987	0.88	0.84			1.72	Karnowski et al.
1988	0.85	1.11			1.97	Karnowski et al.
1989	1.05	0.81			1.86	Karnowski et al.
1990	1.13	0.53			1.66	Karnowski et al.
1991	0.66	0.64			1.30	Karnowski et al.
1992	0.86	0.64			1.50	PacFIN
1993	0.82	0.01			0.82	PacFIN
1994	6.16				6.16	PacFIN
1995	6.35				6.35	PacFIN
1996	5.62				5.62	PacFIN
1997	5.31		5.31		10.63	PacFIN
1998	9.54		9.15		18.69	PacFIN
1999	8.39		14.92		23.31	PacFIN
2000	2.54		9.51		12.05	PacFIN
2001	3.83		15.47		19.31	PacFIN
2002	3.06		17.06		20.12	PacFIN
2003	1.88		8.16		10.04	PacFIN
2004	1.08		5.84		6.92	PacFIN
2005	0.63		3.39		4.02	PacFIN
2006	0.54		4.11		4.64	PacFIN
2007	1.15	0.01	4.88		6.03	PacFIN
2008	1.45	0.04	6.28	0.00	7.76	PacFIN
2009	1.12	0.02	6.70	0.04	7.88	PacFIN
2010	0.52	0.02	4.30	0.00	4.84	PacFIN
2011	1.37	0.02	6.59		7.98	PacFIN

Table 1: Commercial removals (mt) from the Oregon live and dead commercial fisheries, north and source of Florence, OR.

Year	Southern Dead	Northern Dead	Southern Live	Northern Live	Total Removals	Source
2012	1.29	0.04	7.41	0.02	8.76	PacFIN
2013	1.55	0.02	5.41	0.00	6.98	PacFIN
2014	0.72	0.01	3.62	0.02	4.38	PacFIN

Table 2: Commercial removals (mt) from the California live and dead commercial fisheries.

Year	South of 40°10′ Dead	South of 40°10′ Live	North of 40°10′ Dead	North of 40°10′ Live	Total Removals	Source
1900	0.00				0.00	Ralston et al. 2010
1901	0.38				0.38	Ralston et al. 2010
1902	0.77				0.77	Ralston et al. 2010
1903	1.15				1.15	Ralston et al. 2010
1904	1.53				1.53	Ralston et al. 2010
1905	1.92				1.92	Ralston et al. 2010
1906	2.30				2.30	Ralston et al. 2010
1907	2.68				2.68	Ralston et al. 2010
1908	3.06				3.06	Ralston et al. 2010
1909	3.45				3.45	Ralston et al. 2010
1910	3.83				3.83	Ralston et al. 2010
1911	4.21				4.21	Ralston et al. 2010
1912	4.60				4.60	Ralston et al. 2010
1913	4.98				4.98	Ralston et al. 2010
1914	5.36				5.36	Ralston et al. 2010
1915	5.75				5.75	Ralston et al. 2010
1916	6.13		0.00		6.13	Ralston et al. 2010
1917	9.52		0.00		9.52	Ralston et al. 2010
1918	11.13		0.00		11.13	Ralston et al. 2010
1919	7.74		0.00		7.74	Ralston et al. 2010
1920	7.89		0.00		7.90	Ralston et al. 2010
1921	6.52		0.00		6.52	Ralston et al. 2010
1922	5.61		0.00		5.61	Ralston et al. 2010
1923	6.07		0.00		6.07	Ralston et al. 2010
1924	3.51		0.00		3.52	Ralston et al. 2010
1925	4.39		0.00		4.39	Ralston et al. 2010
1926	7.08		0.00		7.09	Ralston et al. 2010
1927	6.02		0.00		6.02	Ralston et al. 2010

Table 2: Commercial removals (mt) from the California live and dead commercial fisheries.

Year	South of 40°10′ Dead	South of 40°10′ Live	North of 40°10′ Dead	North of 40°10′ Live	Total Removals	Source
1928	7.27		0.00		7.27	Ralston et al. 2010
1929	6.01		0.01		6.03	Ralston et al. 2010
1930	8.52		0.01		8.53	Ralston et al. 2010
1931	3.63				3.63	Ralston et al. 2010
1932	9.27		0.03		9.30	Ralston et al. 2010
1933	3.33		0.09		3.42	Ralston et al. 2010
1934	7.09		0.96		8.04	Ralston et al. 2010
1935	6.31		0.80		7.11	Ralston et al. 2010
1936	6.22		1.20		7.42	Ralston et al. 2010
1937	5.60		0.76		6.36	Ralston et al. 2010
1938	3.26		3.00		6.26	Ralston et al. 2010
1939	0.72		5.79		6.51	Ralston et al. 2010
1940	0.30		3.43		3.73	Ralston et al. 2010
1941	0.85		0.96		1.81	Ralston et al. 2010
1942	0.52		0.70		1.22	Ralston et al. 2010
1943	1.75		0.01		1.76	Ralston et al. 2010
1944	0.49				0.49	Ralston et al. 2010
1945	0.55		0.00		0.56	Ralston et al. 2010
1946	1.45		0.06		1.51	Ralston et al. 2010
1947	1.48		0.08		1.57	Ralston et al. 2010
1948	3.25		0.09		3.34	Ralston et al. 2010
1949	4.43		0.01		4.44	Ralston et al. 2010
1950	1.81		0.11		1.92	Ralston et al. 2010
1951	2.65		0.14		2.79	Ralston et al. 2010
1952	2.42		0.00		2.42	Ralston et al. 2010
1953	2.29				2.29	Ralston et al. 2010
1954	0.75				0.75	Ralston et al. 2010
1955	0.34				0.34	Ralston et al. 2010
1956	0.19		0.00		0.20	Ralston et al. 2010
1957	0.41		0.09		0.50	Ralston et al. 2010
1958	0.24				0.24	Ralston et al. 2010
1959	0.63		0.01		0.64	Ralston et al. 2010
1960	0.47				0.47	Ralston et al. 2010
1961	1.00		0.00		1.01	Ralston et al. 2010
1962	0.38				0.38	Ralston et al. 2010
1963	0.81		0.00		0.81	Ralston et al. 2010
1964	0.03				0.03	Ralston et al. 2010
1965	0.18		0.02		0.20	Ralston et al. 2010

Table 2: Commercial removals (mt) from the California live and dead commercial fisheries.

Year	South of 40°10′ Dead	South of 40°10′ Live	North of 40°10′ Dead	North of 40°10′ Live	Total Removals	Source
1966	0.25		0.08		0.33	Ralston et al. 2010
1967	0.12		0.01		0.13	Ralston et al. 2010
1968	0.01				0.01	Ralston et al. 2010
1969	1.57		0.00		1.57	CALCOM
1970	1.84		0.00		1.84	CALCOM
1971	1.26		0.00		1.26	CALCOM
1972	2.10		0.01		2.11	CALCOM
1973	3.42		0.00		3.42	CALCOM
1974	2.53		0.01		2.54	CALCOM
1975	2.72		0.01		2.73	CALCOM
1976	3.81		0.01		3.82	CALCOM
1977	3.07		0.02		3.10	CALCOM
1978	1.45		0.11		1.56	CALCOM
1979	7.95		0.02		7.97	CALCOM
1980	5.01		0.01		5.02	CALCOM
1981	0.76		0.00		0.77	CALCOM
1982	0.56		0.00		0.56	CALCOM
1983	1.66				1.66	CALCOM
1984	3.34		0.00		3.35	CALCOM
1985	1.09		0.00		1.09	CALCOM
1986	1.06		0.00		1.06	CALCOM
1987	3.36				3.36	CALCOM
1988	4.22		0.01		4.23	CALCOM
1989	6.01		0.22		6.23	CALCOM
1990	6.16		2.46		8.61	CALCOM
1991	11.51		0.70		12.21	CALCOM
1992	20.99		2.80		23.79	CALCOM
1993	14.87	0.17	0.83		15.86	CALCOM
1994	21.46	11.07	0.99		33.52	CALCOM
1995	14.94	9.14	4.62		28.70	CALCOM
1996	8.78	6.16	3.78	0.01	18.73	CALCOM
1997	23.31	6.50	1.97	1.74	33.52	CALCOM
1998	5.31	5.39	1.43	0.83	12.96	CALCOM
1999	2.34	3.80	0.60	1.57	8.31	CALCOM
2000	0.67	2.29	0.59	2.04	5.58	CALCOM
2001	0.77	2.44	0.42	1.05	4.68	CALCOM
2002	0.68	2.11	0.46	1.82	5.06	CALCOM
2003	0.27	0.72	0.09	0.49	1.57	CALCOM

Table 2: Commercial removals (mt) from the California live and dead commercial fisheries.

Year	South of 40°10′ Dead	South of 40°10′ Live	North of 40°10′ Dead	North of 40°10′ Live	Total Removals	Source
2004	0.57	1.41	0.21	0.28	2.46	CALCOM
2005	0.71	1.62	0.14	0.58	3.06	CALCOM
2006	0.53	1.49	0.15	0.83	3.00	CALCOM
2007	0.73	1.47	0.40	1.60	4.21	CALCOM
2008	0.77	1.57	0.26	1.56	4.15	CALCOM
2009	0.44	1.54	0.05	0.60	2.63	CALCOM
2010	0.76	1.05	0.04	0.26	2.11	CALCOM
2011	0.43	1.12	0.09	0.35	1.99	CALCOM
2012	0.71	0.67	0.08	0.38	1.83	CALCOM
2013	0.38	0.83	0.05	0.17	1.43	CALCOM
2014	0.25	1.33	0.02	0.09	1.69	CALCOM

Table 5: Recreational removals (mt) from the Washington party/charter (PC) and private (PR) vessels. Northern WA represents MCAs 3 and 4 and soutern WA represents MCAs 1 and 2. WDFW provided all data. Note: A discard mortality rate was applied to removals presented in this table.

Year	Southern PC	Southern PR	Northern PC	Northern PR	Total Removals
1967	0.00	0.00	0.27	1.04	1.30
1968	0.02	0.00	0.32	1.25	1.58
1969	0.04	0.00	0.37	1.45	1.87
1970	0.06	0.00	0.43	1.66	2.15
1971	0.07	0.00	0.48	1.87	2.43
1972	0.09	0.00	0.53	2.08	2.71
1973	0.11	0.00	0.59	2.29	2.99
1974	0.13	0.00	0.64	2.49	3.27
1975	0.15	0.00	0.69	2.70	3.55
1976	0.02	0.00	0.38	1.48	1.88
1977	0.01	0.00	0.29	1.12	1.42
1978	0.06	0.00	0.78	3.02	3.86
1979	0.01	0.00	0.62	2.40	3.02
1980	0.02	0.00	0.53	2.04	2.59
1981	0.06	0.00	0.47	1.83	2.37
1982	0.05	0.00	0.56	2.18	2.79
1983	0.00	0.00	0.62	2.42	3.04
1984	0.11	0.00	0.67	2.62	3.40
1985	0.06	0.00	0.68	2.64	3.38

Table 5: Recreational removals (mt) from the Washington party/charter (PC) and private (PR) vessels. Northern WA represents MCAs 3 and 4 and soutern WA represents MCAs 1 and 2. WDFW provided all data. Note: A discard mortality rate was applied to removals presented in this table.

Year	Southern PC	Southern PR	Northern PC	Northern PR	Total Removals
1986	0.16	0.00	0.78	3.02	3.96
1987	0.19	0.00	1.03	3.73	4.96
1988	0.23	0.01	1.28	4.45	5.97
1989	0.26	0.01	1.54	5.16	6.97
1990	0.30	0.01	1.79	5.88	7.98
1991	0.23	0.00	0.51	3.58	4.31
1992	0.35	0.01	1.46	5.81	7.63
1993	0.32	0.00	1.13	5.08	6.54
1994	0.31	0.00	1.18	3.24	4.74
1995	0.10	0.01	0.60	3.43	4.13
1996	0.12	0.01	0.45	2.29	2.86
1997	0.18	0.00	0.40	2.13	2.71
1998	0.19	0.07	0.08	1.65	1.99
1999	0.06	0.00	0.09	2.35	2.50
2000	0.10	0.00	0.41	2.51	3.02
2001	0.25	0.00	0.25	3.13	3.63
2002	0.10	0.00	0.23	2.17	2.50
2003	0.08	0.01	0.12	2.18	2.39
2004	0.07	0.04	0.14	1.97	2.23
2005	0.03	0.01	0.19	2.46	2.68
2006	0.02	0.00	0.08	2.20	2.31
2007	0.07	0.00	0.14	2.73	2.94
2008	0.16	0.01	0.31	2.68	3.16
2009	0.07	0.00	0.17	2.55	2.79
2010	0.15	0.04	0.13	3.36	3.68
2011	0.07	0.00	0.16	3.02	3.26
2012	0.07	0.01	0.26	2.63	2.96
2013	0.05	0.02	0.27	3.06	3.39
2014	0.03	0.02	0.30	2.68	3.03

Table 3: Estimated discarded and retained China rockfish in the Nearshore Fixed-gear Fishery provided by the West Coast Groundfish Observer Program (WCGOP). For the area South of 40°10′, where discards are higher, bootstraping was used to estimated a coefficient of variation (CV) of the total discard amount. The mortality of discarded China rockfish is estimated by WCGOP as a function of the fishing depth which varies by year. The average mortality fraction south of 40°10′ across all years was 59%.

Year	Area	Estimated total discard (mt)	CV of total discard	Estimated dead discard (mt)	Estimated mortality fraction	Estimated landings (mt)	Estimated dead discard + landings	Ratio of dead discard:total dead
2003	N of 40′10′	0.54	-	0.25	47%	10.62	10.87	2%
2004	N of 40′10′	0.54	-	0.24	45%	7.28	7.52	3%
2005	N of 40′10′	0.38	-	0.17	45%	4.56	4.73	4%
2006	N of 40′10′	0.47	-	0.21	44%	5.62	5.83	4%
2007	N of 40′10′	0.20	-	0.08	43%	7.99	8.08	1%
2008	N of 40′10′	1.02	-	0.42	41%	9.40	9.81	4%
2009	N of 40′10′	0.70	-	0.29	41%	8.53	8.82	3%
2010	N of 40′10′	0.34	-	0.13	38%	5.15	5.28	2%
2011	N of 40′10′	0.28	-	0.12	44%	8.42	8.54	1%
2012	N of 40′10′	0.61	-	0.23	38%	9.15	9.39	2%
2013	N of 40′10′	0.26	-	0.12	45%	7.20	7.32	2%
2004	S of 40′10′	0.61	51%	0.35	57%	1.96	2.31	15%
2005	S of 40′10′	1.40	51%	0.65	46%	2.35	3.00	22%
2006	S of 40′10′	0.87	48%	0.48	55%	2.02	2.50	19%
2007	S of 40′10′	1.06	19%	0.61	57%	2.20	2.81	22%
2008	S of 40′10′	1.35	77%	0.81	60%	2.28	3.09	26%
2009	S of 40′10′	1.77	64%	0.96	54%	1.97	2.92	33%
2010	S of 40′10′	2.68	69%	1.68	63%	1.80	3.49	48%
2011	S of 40′10′	2.92	45%	1.38	47%	1.55	2.93	47%
2012	S of 40′10′	2.73	82%	1.81	66%	1.44	3.25	56%
2013	S of 40′10′	1.61	53%	1.28	79%	1.20	2.47	52%

Table 4: Total number of observed trips associated with catch of China rockfish and trips with observed discards of China rockfish aggregated by 2° latitude bins. Range of years is 2003-2013 North of 40°10′ and 2004 2013 to the south. Note: No observed catch of China rockfish occurred between 40° and 40°10′.

Latitude range	Trips observed	Trips with discards	Percent with discards
$44° - 46°$	46	10	22%
$42° - 44°$	875	324	37%
$40° - 42°$	144	13	9%
$38° - 40°$	55	45	82%
$36° - 38°$	146	133	91%
$34° - 36°$	26	26	100%

Table 6: Recreational removals (mt) from the Oregon party/charter and private vessels. North and South refer to north and south of Florence, OR.

Year	Charter North	Charter South	Private North	Private South	Total North	Total South	OR Total	Source
1973	0.44	0.16	0.07	0.19	0.51	0.34	0.86	ODFW Reconstruction
1974	0.75	0.27	0.13	0.32	0.88	0.59	1.47	ODFW Reconstruction
1975	0.37	0.13	0.06	0.16	0.43	0.29	0.72	ODFW Reconstruction
1976	1.08	0.38	0.27	0.47	1.35	0.85	2.20	ODFW Reconstruction
1977	1.15	0.41	0.29	0.49	1.44	0.90	2.34	ODFW Reconstruction
1978	1.50	0.53	0.25	0.64	1.75	1.18	2.93	ODFW Reconstruction
1979	1.52	2.94	0.98	1.53	2.51	4.47	6.98	ODFW Reconstruction
1980	1.63	0.91	0.90	0.53	2.54	1.44	3.98	ODFW Reconstruction
1981	2.18	1.56	0.97	0.89	3.15	2.45	5.60	ODFW Reconstruction
1982	2.14	1.42	0.95	0.82	3.09	2.24	5.33	ODFW Reconstruction
1983	2.69	1.36	1.20	0.81	3.89	2.17	6.07	ODFW Reconstruction
1984	2.71	1.43	1.21	0.48	3.92	1.90	5.82	ODFW Reconstruction
1985	1.38	1.04	0.62	0.59	2.00	1.63	3.62	ODFW Reconstruction
1986	1.58	0.99	0.70	0.57	2.28	1.56	3.84	ODFW Reconstruction
1987	1.03	1.29	0.46	0.69	1.49	1.99	3.48	ODFW Reconstruction
1988	1.44	0.38	0.29	0.45	1.73	0.82	2.55	ODFW Reconstruction
1989	2.21	1.04	0.31	1.57	2.52	2.61	5.13	ODFW Reconstruction
1990	2.19	1.29	0.49	1.81	2.68	3.10	5.78	ODFW Reconstruction
1991	1.44	0.52	0.31	0.68	1.75	1.19	2.94	ODFW Reconstruction
1992	2.41	0.76	0.65	0.88	3.06	1.64	4.70	ODFW Reconstruction
1993	3.03	0.90	0.99	1.12	4.02	2.02	6.04	ODFW Reconstruction
1994	2.13	0.97	0.73	1.21	2.86	2.19	5.05	ODFW Reconstruction
1995	1.09	0.68	0.51	0.94	1.60	1.62	3.22	ODFW Reconstruction
1996	1.74	0.84	0.26	0.71	2.00	1.55	3.55	ODFW Reconstruction
1997	2.04	1.08	0.47	1.00	2.51	2.09	4.60	ODFW Reconstruction
1998	1.56	0.79	0.47	0.76	2.03	1.55	3.58	ODFW Reconstruction
1999	2.11	1.78	0.45	1.26	2.56	3.04	5.60	ODFW Reconstruction
2000	1.71	0.85	0.39	0.59	2.10	1.45	3.54	ODFW Reconstruction
2001	1.41	0.32	1.41	0.36	2.83	0.69	3.51	RecFIN
2002	1.40	0.32	1.40	0.38	2.79	0.70	3.49	RecFIN
2003	1.12	0.26	1.12	0.32	2.23	0.58	2.81	RecFIN
2004	0.99	0.23	0.99	0.40	1.98	0.62	2.60	RecFIN
2005	0.77	0.26	0.77	0.51	1.53	0.77	2.31	RecFIN
2006	1.11	0.35	1.11	0.50	2.22	0.85	3.07	RecFIN
2007	1.40	0.38	1.40	0.48	2.79	0.87	3.66	RecFIN
2008	1.25	0.26	1.25	0.45	2.50	0.72	3.22	RecFIN
2009	0.95	0.12	0.95	0.49	1.89	0.60	2.50	RecFIN
2010	1.02	0.20	1.02	0.61	2.05	0.80	2.85	RecFIN
2011	1.56	0.31	1.56	0.60	3.12	0.91	4.02	RecFIN
2012	1.68	0.37	1.68	0.41	3.36	0.78	4.14	RecFIN
2013	1.48	0.25	1.48	0.64	2.96	0.89	3.85	RecFIN
2014	0.51	0.18	0.51	0.48	1.01	0.66	1.67	RecFIN

Table 7: Recreational removals (mt) from the California party/charter (PC) and private (PR) vessels.

Year	South of 40°10′ PC	South of 40°10′ PR	North of 40°10′ PC	North of 40°10′ PR	Total Removals	Source
1928	0.10	0.31	0.00	0.00	0.42	Ralston et al. 2010
1929	0.21	0.62	0.00	0.00	0.84	Ralston et al. 2010
1930	0.24	0.72	0.00	0.00	0.96	Ralston et al. 2010
1931	0.32	0.95	0.00	0.01	1.28	Ralston et al. 2010
1932	0.40	1.19	0.00	0.01	1.60	Ralston et al. 2010
1933	0.48	1.43	0.00	0.01	1.92	Ralston et al. 2010
1934	0.56	1.67	0.00	0.01	2.24	Ralston et al. 2010
1935	0.64	1.91	0.00	0.01	2.56	Ralston et al. 2010
1936	0.72	2.15	0.00	0.02	2.88	Ralston et al. 2010
1937	0.85	2.55	0.01	0.02	3.42	Ralston et al. 2010
1938	0.83	2.50	0.01	0.02	3.36	Ralston et al. 2010
1939	0.73	2.19	0.01	0.02	2.94	Ralston et al. 2010
1940	1.05	3.15	0.01	0.02	4.23	Ralston et al. 2010
1941	0.97	2.91	0.01	0.02	3.91	Ralston et al. 2010
1942	0.52	1.55	0.00	0.01	2.08	Ralston et al. 2010
1943	0.49	1.48	0.00	0.01	1.99	Ralston et al. 2010
1944	0.40	1.21	0.00	0.01	1.63	Ralston et al. 2010
1945	0.54	1.62	0.00	0.01	2.17	Ralston et al. 2010
1946	0.93	2.79	0.01	0.02	3.74	Ralston et al. 2010
1947	0.74	2.21	0.01	0.02	2.98	Ralston et al. 2010
1948	1.48	4.43	0.01	0.03	5.95	Ralston et al. 2010
1949	1.91	5.74	0.01	0.04	7.70	Ralston et al. 2010
1950	2.33	6.99	0.02	0.05	9.39	Ralston et al. 2010
1951	2.73	8.20	0.02	0.06	11.01	Ralston et al. 2010
1952	2.38	7.15	0.02	0.05	9.60	Ralston et al. 2010
1953	2.04	6.11	0.01	0.05	8.20	Ralston et al. 2010
1954	2.55	7.66	0.02	0.06	10.29	Ralston et al. 2010
1955	3.07	9.21	0.02	0.07	12.38	Ralston et al. 2010
1956	3.43	10.30	0.03	0.08	13.84	Ralston et al. 2010
1957	3.42	10.25	0.03	0.10	13.80	Ralston et al. 2010
1958	5.62	16.85	0.03	0.08	22.58	Ralston et al. 2010
1959	4.36	13.07	0.02	0.06	17.50	Ralston et al. 2010
1960	3.63	10.90	0.01	0.04	14.59	Ralston et al. 2010
1961	3.16	9.49	0.01	0.04	12.71	Ralston et al. 2010
1962	2.98	8.93	0.00	0.01	11.92	Ralston et al. 2010
1963	3.72	11.17	0.01	0.02	14.91	Ralston et al. 2010
1964	2.52	7.55	0.01	0.02	10.10	Ralston et al. 2010

Table 7: Recreational removals (mt) from the California party/charter (PC) and private (PR) vessels.

Year	South of 40°10′ PC	South of 40°10′ PR	North of 40°10′ PC	North of 40°10′ PR	Total Removals	Source
1965	4.13	12.38	0.01	0.04	16.55	Ralston et al. 2010
1966	4.65	13.96	0.00	0.01	18.63	Ralston et al. 2010
1967	6.03	18.10	0.02	0.05	24.20	Ralston et al. 2010
1968	5.28	15.85	0.01	0.02	21.16	Ralston et al. 2010
1969	4.49	13.48	0.02	0.05	18.05	Ralston et al. 2010
1970	7.59	22.76	0.00	0.01	30.37	Ralston et al. 2010
1971	5.57	16.72	0.01	0.02	22.31	Ralston et al. 2010
1972	7.84	23.52	0.02	0.05	31.43	Ralston et al. 2010
1973	8.67	26.02	0.01	0.03	34.73	Ralston et al. 2010
1974	9.84	29.52	0.00	0.01	39.38	Ralston et al. 2010
1975	9.51	28.52	0.00	0.01	38.04	Ralston et al. 2010
1976	10.28	30.83	0.00	0.01	41.12	Ralston et al. 2010
1977	9.30	27.90	0.00	0.01	37.22	Ralston et al. 2010
1978	7.33	21.99	0.03	0.08	29.44	Ralston et al. 2010
1979	8.34	25.02	0.03	0.10	33.49	Ralston et al. 2010
1980	10.94	21.85	0.04	0.08	32.90	RecFIN
1981	4.75	10.99	0.04	0.10	15.89	RecFIN
1982	5.68	25.00	0.03	0.14	30.84	RecFIN
1983	5.10	10.82	0.08	0.16	16.17	RecFIN
1984	1.05	12.17	0.00	0.06	13.28	RecFIN
1985	3.28	23.87	0.02	0.14	27.31	RecFIN
1986	7.75	31.95	0.12	0.49	40.31	RecFIN
1987	18.35	34.12	0.28	0.53	53.29	RecFIN
1988	8.28	26.83	0.11	0.35	35.56	RecFIN
1989	9.55	22.43	0.06	0.14	32.17	RecFIN
1990	8.46	22.74	0.23	0.61	32.03	RecFIN
1991	7.57	23.49	0.20	0.64	31.89	RecFIN
1992	6.74	24.48	0.12	0.42	31.75	RecFIN
1993	5.78	25.02	0.15	0.66	31.61	RecFIN
1994	4.88	25.25	0.14	0.70	30.97	RecFIN
1995	3.98	20.01	0.12	0.60	24.71	RecFIN
1996	3.12	14.77	0.06	0.28	18.23	RecFIN
1997	3.60	3.54	0.06	0.06	7.26	RecFIN
1998	0.84	6.40	0.02	0.17	7.44	RecFIN
1999	2.97	11.71	0.10	0.40	15.18	RecFIN
2000	5.64	11.24	0.25	0.50	17.63	RecFIN
2001	6.51	9.19	0.31	0.43	16.44	RecFIN

Table 7: Recreational removals (mt) from the California party/charter (PC) and private (PR) vessels.

Year	South of 40°10′ PC	South of 40°10′ PR	North of 40°10′ PC	North of 40°10′ PR	Total Removals	Source
2002	5.14	10.00	0.27	0.52	15.92	RecFIN
2003	4.40	12.12	0.33	0.91	17.77	RecFIN
2004	3.72	4.09	0.08	0.44	8.33	RecFIN
2005	8.48	4.90	0.15	0.37	13.91	RecFIN
2006	4.86	5.86	0.14	0.49	11.35	RecFIN
2007	4.40	6.79	0.64	0.87	12.70	RecFIN
2008	5.24	7.58	0.20	0.81	13.82	RecFIN
2009	7.03	11.14	0.66	0.89	19.72	RecFIN
2010	7.81	9.13	0.27	0.64	17.85	RecFIN
2011	7.46	6.61	0.16	1.06	15.29	RecFIN
2012	6.15	6.26	0.37	1.02	13.80	RecFIN
2013	4.53	4.27	0.26	0.97	10.03	RecFIN
2014	4.34	5.25	0.08	0.66	10.32	RecFIN

Table 8: Estimated percentages of California recreational removals north of Point Conception (numbers of total rockfish in CPFV logbooks) taken north of Cape Mendocino, 1957-2003.

Year	Pt Conc. To Cape Mendocino	Cape Mendocino To CA-OR border	% of catch north of Cape Mendocino	% adjusted to match CRFS data
1957	633942	3388	0.5%	1.0%
1958	1043547	2786	0.3%	0.5%
1959	872489	2134	0.2%	0.5%
1960	675870	1379	0.2%	0.4%
1961	510629	1132	0.2%	0.4%
1962	585544	537	0.1%	0.2%
1963	603016	549	0.1%	0.2%
1964	457779	622	0.1%	0.3%
1965	712922	1072	0.2%	0.3%
1966	767130	302	0.0%	0.1%
1967	756345	1092	0.1%	0.3%
1968	796635	589	0.1%	0.1%
1969	838879	1733	0.2%	0.4%
1970	1042951	349	0.0%	0.1%
1971	800620	452	0.1%	0.1%
1972	1091050	1311	0.1%	0.2%
1973	1385090	753	0.1%	0.1%
1974	1461828	401	0.0%	0.1%
1975	1393389	192	0.0%	0.0%
1976	1575447	230	0.0%	0.0%
1977	1379412	315	0.0%	0.0%
1978	1190453	2377	0.2%	0.4%
1979	1315420	2753	0.2%	0.4%
1980	1329375	2494	0.2%	0.3%
1981	1597924	7694	0.5%	0.9%
1982	1621139	4732	0.3%	0.5%
1983	1515401	12197	0.8%	1.5%
1984	1291340	3400	0.3%	0.5%
1985	1197297	3638	0.3%	0.6%
1986	1063522	8705	0.8%	1.5%
1987	1147014	9427	0.8%	1.5%
1988	1216914	8500	0.7%	1.3%
1989	1437152	4853	0.3%	0.6%
1990	1517596	21458	1.4%	2.6%
1991	1286523	18387	1.4%	2.6%
1992	1465874	13385	0.9%	1.7%
1993	1213593	16975	1.4%	2.6%
1994	913140	13439	1.5%	2.7%
1995	769021	12163	1.6%	2.9%
1996	641306	6404	1.0%	1.8%
1997	790977	6976	0.9%	1.6%
1998	783588	11298	1.4%	2.7%
1999	784390	14079	1.8%	3.3%
2000	438816	10175	2.3%	4.2%
2001	390885	9686	2.4%	4.5%
2002	385765	10430	2.6%	4.9%
2003	386823	15064	3.7%	7.0%

Table 9: Commerical logbook filtering criteria and resulting sample sizes used for China rockfish. Bold value indicates the final trip-level sample size used for delta-GLM analysis.

Filter	Criteria	Sample size	Level
Full data set	All data	26592	Set
Gear type	Hook and line only	22735	Set
Port	Port Orford/Gold Beach/Brookings	17100	Set
Depth	Valid set starting depth ($\leq$ 30 fm; 54.9 m)	15663	Set
Hooks	Valid hook count (1 - 100)	16	Set
Hours	Valid hours fishing (0.1 - 20)	15180	Set
People	Valid number of fishers onboard ($\geq$ 1)	14976	Set
Nearshore Endorsed	Nearshore endorsed vessel only	13262	Set
Vessel	Completed at least one set in all 10 years (2004 - 2013)	3823	Set
Trip	Aggregate multi-set trip to trip level	3575	Trip

Table 10: Abundance indices for China rockfish based on least square means from the delta-GLM model and associated standard errors from the final subset of Oregon commercial nearshore logbook submissions.

Year	Index	Log-scale SE
2004	0.0364	0.2112
2005	0.0281	0.1918
2006	0.0323	0.1997
2007	0.0382	0.2127
2008	0.0429	0.2038
2009	0.0264	0.2066
2010	0.0244	0.2536
2011	0.0395	0.2026
2012	0.0320	0.2063
2013	0.0180	0.2283

Table 11: WDFW recreational dockside data sample sizes at each data filtering step. The bold value indicates the final sample size used for delta-GLM analysis.

Filter	Criteria	Sample size with Stephens-MacCall filter	Sample size with Stephen-MacCall filter, retaining all positive observations	Sample size without Stephens-MacCall filter
Full data set	All data	736271		
Trip type	Retain only bottomfish trips	109619		
Punch Card Areas	Remove non-rockfish areas (0,5,20,42,51,55,99 (1981-1989); 0,5,6,20,41,42,51,53:56, 61 (1990-2014))	107762		
Boat Type	Remove shore-based trips	106063		
Boat Type	Remove records with missing values	106052		
Remove NAs	1980-1989 Anglers	106026		
Stephens-MacCall	Remove trips not in China habitat	12819	20608	-
Months	Remove months with little to no data (3,10)	12755	20518	104615
Sampling Area	Remove area 52, very few records	12738	20499	102267
Area	Retain only area 4	**10428**	**16193**	**54285**

Table 12: AIC values for each model using the data with Stephens-MacCall filtering for the Washington dockside index.

Model	Binomial	Lognormal
Year	14279.1	9990.2
Year+Month	13920.0	9850.0
Year+Month+BoatType	**13905.3**	**9830.2**
Year+Month+BoatType+BagLimits	13905.3	9838.2
Year+Month+BoatType+BagLimits+DepthRestrict	13905.3	9840.2

Table 13: AIC values for each model using the data with Stephens-MacCall filtering and retaining all positive observations for the Washington dockside index.

Model	Binomial	Lognormal
Year	20428.0	17741.0
Year+Month	20062.3	17458.3
Year+Month+BoatType	**20057.7**	**17442.5**
Year+Month+BoatType+BagLimits	20057.7	17450.5
Year+Month+BoatType+BagLimits+DepthRestrict	20057.7	17452.5

Table 14: AIC values for each model using the data without Stephens-MacCall filtering Washington dockside index.

Model	Binomial	Lognormal
Year	52916.0	17741.0
Year+Month	52081.0	17458.3
Year+Month+BoatType	**51847.9**	**17442.5**
Year+Month+BoatType+BagLimits	51847.9	17450.5
Year+Month+BoatType+BagLimits+DepthRestrict	51847.9	17518.6

Table 15: Washington (Area 4 only) recreational dockside CPUE indices for China rockfish.

	Area 4 with Stephens MacCall			Area 4 with Stephens-MacCall, retain all positive records			Area 4 without Stephens-MacCall		
Year	Index	SE	CV	Index	SE	CV	Index	SE	CV
1981	0.4810	0.1580	0.2820	0.6940	0.1230	0.1540	0.3010	0.0570	0.1660
1982	0.3830	0.0600	0.1690	0.5400	0.0600	0.1050	0.2300	0.0260	0.1060
1983	0.4550	0.0600	0.1340	0.6430	0.0650	0.0980	0.2520	0.0300	0.1130
1984	0.4820	0.0480	0.0930	0.5000	0.0400	0.0710	0.1790	0.0150	0.0720
1985	0.6910	0.0690	0.0920	0.7360	0.0490	0.0590	0.2830	0.0210	0.0650
1986	0.5620	0.0590	0.0960	0.6160	0.0530	0.0770	0.3070	0.0290	0.0830
1987	0.4540	0.0360	0.0750	0.4860	0.0310	0.0600	0.2550	0.0170	0.0620
1988	0.5590	0.0500	0.0810	0.5870	0.0410	0.0640	0.3090	0.0220	0.0650
1989	0.7130	0.0480	0.0650	0.6660	0.0360	0.0510	0.4140	0.0230	0.0520
1990	0.7810	0.0570	0.0710	0.8010	0.0490	0.0560	0.4260	0.0260	0.0560
1991	0.5970	0.0630	0.1000	0.6650	0.0470	0.0660	0.3490	0.0270	0.0710
1992	0.7030	0.0470	0.0680	0.7040	0.0880	0.1090	0.3760	0.0510	0.1180
1993	0.6030	0.0490	0.0790	0.6300	0.0380	0.0570	0.3180	0.0210	0.0620
1994	0.5670	0.0470	0.0750	0.6480	0.0380	0.0540	0.3270	0.0200	0.0560
1995	0.5490	0.0360	0.0640	0.5900	0.0310	0.0510	0.2640	0.0150	0.0540
1996	0.3320	0.0260	0.0810	0.3890	0.0230	0.0600	0.1690	0.0110	0.0640
1997	0.3240	0.0270	0.0880	0.3680	0.0240	0.0670	0.1550	0.0100	0.0660
1998	0.3210	0.0280	0.0970	0.4020	0.0290	0.0750	0.1390	0.0110	0.0810
1999	0.3490	0.0420	0.1190	0.4030	0.0340	0.0810	0.1560	0.0150	0.0940
2000	0.4580	0.0450	0.1030	0.5200	0.0370	0.0710	0.2060	0.0170	0.0810
2001	0.5680	0.0580	0.1010	0.5940	0.0430	0.0680	0.2670	0.0210	0.0730
2002	0.4150	0.0560	0.1310	0.5210	0.0420	0.0770	0.1780	0.0160	0.0880
2003	0.3540	0.0620	0.1610	0.4720	0.0430	0.0870	0.1870	0.0180	0.0940
2004	0.2910	0.0480	0.1690	0.4350	0.0390	0.0930	0.1660	0.0150	0.0970
2005	0.2970	0.0300	0.1050	0.4270	0.0280	0.0650	0.1480	0.0110	0.0770
2006	0.3430	0.0500	0.1450	0.4800	0.0390	0.0810	0.1580	0.0140	0.0880
2007	0.4590	0.0880	0.1770	0.6550	0.0850	0.1130	0.2260	0.0310	0.1200
2008	0.5240	0.0740	0.1260	0.6550	0.0530	0.0700	0.2500	0.0220	0.0780
2009	0.5100	0.0600	0.1160	0.6350	0.0580	0.0810	0.2130	0.0220	0.0930
2010	0.6430	0.1230	0.1490	0.7110	0.1060	0.1110	0.1940	0.0300	0.1170
2011	0.6800	0.0770	0.1160	0.7260	0.0590	0.0750	0.2290	0.0230	0.0920
2012	0.5830	0.1070	0.1600	0.6310	0.0770	0.1040	0.1650	0.0240	0.1210
2013	0.7100	0.0890	0.1180	0.7130	0.0610	0.0780	0.1890	0.0190	0.0920
2014	0.6170	0.1200	0.1650	0.6030	0.0710	0.1030	0.1390	0.0190	0.1180

Table 16: CA South recreational MRFSS dockside data sample sizes at each data filtering step. The bold value indicates the final sample size used for delta-GLM analysis.

Filter	Criteria	Sample size (no. of trips)
Full data set	CPFV trips including counties from San Luis Obispo to Sonoma	2297
Stephens-MacCall	Retain all positive China trips, plus False Positives (trips predicted to be in China habitat, but with no China retained)	446
Poor spatial coverage in year	Drop 1993, 1994 (trips in SLO county only)	**431**

Table 17: Number of trips by year and region in the CA South recreational MRFSS index.

Year	San Luis Obispo	Monterey-Santa Cruz	S.F. Bay Area	Mendocino-Sonoma
1980	8	10	5	4
1981	4	0	2	5
1982	2	2	3	6
1983	4	4	1	3
1984	7	5	1	4
1985	7	15	17	7
1986	13	11	12	4
1987	8	2	11	5
1988	7	3	9	0
1989	6	3	14	3
1995	4	3	4	8
1996	19	12	24	18
1998	3	5	5	0
1999	17	7	10	4
2000	3	0	7	0
2001	2	5	5	2
2002	6	5	2	3
2003	2	6	1	2

Table 18: AIC values for each model in the CA South MRFSS dockside index.

Model	Binomial	Lognormal
Year	518.90	813.90
Year + Area X	520.90	814.70
Year + Area X + Wave	528.70	822.40
Year + Area X + Wave + Region	518.80	808.20
Year + Area X + Region	510.90	800.90
Year + Region	509.10	804.90
Year + Region + Year:Region	537.40	817.20

Table 19: Year effects for the CA South MRFSS dockside index.

Year	Index	Log-scale SE
1980	0.06	0.26
1981	0.05	0.39
1982	0.08	0.32
1983	0.09	0.31
1984	0.05	0.30
1985	0.06	0.25
1986	0.08	0.18
1987	0.13	0.25
1988	0.12	0.28
1989	0.07	0.27
1995	0.09	0.21
1996	0.04	0.14
1998	0.04	0.27
1999	0.02	0.18
2000	0.04	0.35
2001	0.06	0.30
2002	0.06	0.29
2003	0.05	0.40

Table 20: Sample sizes at each data filtering step for the Oregon Recreational Boat Survey data. The bold value indicates the final sample size used for delta-GLM analysis.

Filter	Criteria	Sample size (no. of trips)
Full data set	Charter boat trips from Oregon (statewide)	36752
Highliners	Retain vessels with 20+ trips;(13% of vessels made 89% of trips)	32394
Missing Effort	Delete records with TripHours=NULL	32387
Remove Multi-day	Delete trips with TripHours>12	31247
No tuna or dive trips	Drop TripType=(T or D); no China caught on tuna trips; CPUE not comparable for dive trips	30665
Extreme counter-indicators	Drop trips with common species that never co-occur with China (Blue shark, white sturgeon, steelhead and albacore)	30004
Delete catch = NA	Delete 3 trips with catch=NA	30001
Pelagic Rockfish Target	Delete trips in which >99% of catch is pelagic rockfish (silvergray, widow, yellowtail, black, blue)	28215
Stephens-MacCall	Retain all positive China trips, plus False Positives (trips predicted to be in China habitat, but with no China retained)	**6232**

Table 21: Number of trips by year and subregion in the Oregon Recreational Boat Survey (ORBS) charter boat index. Southern Oregon is defined as ports south of Florence. Northern Oregon includes the port of Florence and all ports to the OR-WA border.

Year	Southern Oregon	Northern Oregon
2001	210	176
2002	330	206
2003	270	241
2004	251	120
2005	298	181
2006	274	170
2007	291	151
2008	420	157
2009	256	116
2010	271	155
2011	354	137
2012	329	166
2013	300	171
2014	122	109

Table 22: AIC values for each model in the Oregon Recreational Boat Survey (ORBS) charter boat index. (*) The binomial model with interaction between year and wave did not converge.

Model	Binomial	Lognormal
Year	8184.0	8791.0
Year + Wave	8119.3	8797.6
Year + Region	8184.6	8688.9
Year + Wave + Region	**8118.8**	8695.1
Year + Wave + Region + Year:Region	8120.8	8659.3
Year + Wave + Region + Year:Wave	*	8736.8
Year + Region + Year:Region	8189.5	**8650.9**

Table 23: . The Oregon Recreational Boat Survey (ORBS) charter boat index (area-weighted).

Year	Index	Log-scale SE
2001	0.02	0.08
2002	0.02	0.08
2003	0.02	0.08
2004	0.02	0.09
2005	0.01	0.10
2006	0.02	0.08
2007	0.03	0.08
2008	0.02	0.07
2009	0.01	0.09
2010	0.02	0.09
2011	0.02	0.08
2012	0.02	0.09
2013	0.02	0.08
2014	0.01	0.11

Table 24: Onboard observer dataset filtering criteria and resutling sample sizes used for China rockfish.

Dataset	Filter	Criteria	Positive drifts	Total drifts
Oregon (2001, 2003-2014)	Entire dataset		325	14415
	General data filters	Filters 1-9, section 2.1.6	269	11009
	Depth	< 180 ft (<30 fm)	269	10671
	Midwater drifts	<95% midwater species	266	6579
	Reef	Reefs with China rockfish	259	6038
California (1989-1999)	Entire dataset		881	7712
	General data filters	Filters 1-3, section 2.1.6	880	7050
	Depth	< 360 ft (<60 fm)	880	6495
	Reef	Reefs with China rockfish	852	5557
California (2000-2014)	Entire dataset		1468	62207
	General data filters	Filters 1-9, section 2.1.6	1431	15912
	Depth	< 240 ft (< 40 fm)	1427	15381
	Reef	Reefs with China rockfish	1403	13993

Table 25: AIC and BIC values for each model considered for the Oregon onboard observer index.

Model	AIC	BIC
Logormal submodel		
Year + Wave + Depth + Region + Year:Region + Region:Wave + Wave:Depth	461.20	568.03
Year + Wave + Depth + Region + Wave:Region + Wave:Depth	458.93	522.95
Wave + Depth + Region + Wave:Region + Wave:Depth	445.96	467.3
Wave + Depth + Region + Wave:Depth	444.18	461.97
Wave + Depth + Region		458.48
Wave + Region		**452.99**
Wave		449.85
1		447.43
Binomial submodel		
Year + Depth + Region + Wave + Year:Region	2121.11	2308.88
Year + Depth + Region + Wave	2116.09	2223.39
Year + Region + Wave	2114.25	
Depth + Region + Wave		2148.49
Region + Wave		**2140.20**

Table 26: Year effects for the Oregon onboard observer index

Year	Index	Log-scale SE
2001	0.0503	0.2462
2003	0.0386	0.2096
2004	0.0306	0.2646
2005	0.0290	0.2871
2006	0.0364	0.2538
2007	0.0582	0.1901
2008	0.0295	0.2450
2009	0.0452	0.2361
2010	0.0128	0.4352
2011	0.0506	0.2890
2012	0.0436	0.2591
2013	0.0256	0.2925
2014	0.0170	0.4147

Table 27: AIC and BIC values for each model considered for the California 1988-1999 onboard observer index.

Model	AIC	BIC
Logormal submodel		
Year + Wave + Depth + Region + Year:Region + Region:Wave + Depth:Wave	599.29	1077.61
Year + Wave + Depth + Region + Wave:Region + Wave:Depth	565.35	844.77
Year + Wave + Depth + Region + Wave:Depth	552.56	737.25
Year + Wave + Depth + Region	540.09	653.74
Year + Depth + Region	532.50	
Depth + Region + Wave		611.27
Depth + Region		**580.73**
Binomial submodel		
Year + Depth + Region + Wave	4059.48	4217.86
Year + Depth + Region		**4201.99**

Table 28: Year effects for the California 1988-1999 onboard observer index

Year	Index	Log-scale SE
1988	0.0889	0.1264
1989	0.0770	0.1426
1990	0.1394	0.2216
1991	0.0693	0.2013
1992	0.0422	0.1498
1993	0.0406	0.1427
1994	0.0506	0.1351
1995	0.0332	0.1547
1996	0.0378	0.1208
1997	0.0246	0.1293
1998	0.0206	0.1614
1999	0.0446	0.2663

Table 29: AIC and BIC values for each model considered for the California 2000-2014 onboard observer index.

Model	AIC	BIC
Logormal submodel		
Year + Wave + Depth + Region + Year:Region + Region:Wave + Depth:Wave	2348.95	2927.52
Year + Wave + Depth + Region + Wave:Region + Wave:Depth	2316.05	2571.45
Year + Wave + Depth + Region + Wave:Depth	2308.72	2493.08
Year + Wave + Depth + Region	2301.14	2372.95
Year + Depth + Region	**2299.87**	**2273.95**
Year + Region		2339.58
Binomial submodel		
Depth + Region + Wave + Year	8025.34	8219.59
Depth + Region + Wave		8165.79
Depth + Region + Year	**8023.65**	
Depth + Region		8144.34

Table 30: Year effects for the California 2000-2014 onboard observer index

Year	Index	Log-scale SE
2000	0.0199	0.0198
2001	0.0465	0.0465
2002	0.0850	0.0849
2003	0.0691	0.0690
2004	0.0665	0.0665
2005	0.0694	0.0693
2006	0.0669	0.0668
2007	0.0774	0.0773
2008	0.0988	0.0985
2009	0.1266	0.1261
2010	0.0964	0.0961
2011	0.0925	0.0923
2012	0.0653	0.0652
2013	0.0457	0.0457
2014	0.0464	0.0464

Table 31: The annual number of China rockfish sampled by WDFW for ages and lengths.

Year	N fish lengths	N fish ages
1979	40	0
1980	2	0
1981	24	0
1983	2	0
1995	36	0
1996	16	0
1997	9	0
1998	58	50
1999	180	55
2000	55	55
2001	38	26
2002	69	11
2003	60	0
2004	223	171
2005	363	206
2006	277	89
2007	220	119
2008	143	73
2009	118	22
2010	78	22
2011	182	50
2012	76	24
2013	172	11
2014	441	414

Table 32: Number of length and age port samples and fish sampled in Oregon. Source:PacFIN.

Year	State	Fish condition	N port samples with lengths	N fish length samples	N port samples with ages	N fish age samples
1998	OR	Alive	23	100	0	0
1999	OR	Alive	74	93	0	0
2000	OR	Alive	196	1095	0	0
2001	OR	Alive	239	1858	13	16
2002	OR	Alive	294	1339	0	0
2003	OR	Alive	196	794	0	0
2004	OR	Alive	170	586	0	0
2005	OR	Alive	93	194	0	0
2006	OR	Alive	121	408	0	0
2007	OR	Alive	156	680	0	0
2008	OR	Alive	117	348	0	0
2009	OR	Alive	144	348	32	1
2010	OR	Alive	174	454	0	0
2011	OR	Alive	260	688	0	0
2012	OR	Alive	161	446	0	0
2013	OR	Alive	194	423	0	0
2014	OR	Alive	175	355	0	0
1995	OR	Dead	33	102	0	0
1996	OR	Dead	45	118	0	0
1998	OR	Dead	23	38	0	0
1999	OR	Dead	74	37	0	0
2000	OR	Dead	196	137	0	0
2001	OR	Dead	239	196	13	47
2002	OR	Dead	294	253	55	121
2003	OR	Dead	196	200	74	181
2004	OR	Dead	170	115	21	55
2005	OR	Dead	93	23	7	14
2006	OR	Dead	121	30	7	29
2007	OR	Dead	156	44	14	40
2008	OR	Dead	117	28	13	26
2009	OR	Dead	144	82	32	79
2010	OR	Dead	174	75	40	65
2011	OR	Dead	260	309	103	307
2012	OR	Dead	161	156	59	152
2013	OR	Dead	194	265	86	260
2014	OR	Dead	175	165	0	0

Table 33: Number of length samples and fish sampled in California, south of 40°10′. Source:CALCOM.

	Year	Number of clusters	Number of fish
Dead fish	1992	26	207
	1993	22	158
	1994	54	313
	1995	10	59
	1996	16	63
	1997	19	81
	1998	2	23
	2006	1	-
Live fish	1997	11	47
	1999	24	48
	2000	31	85
	2001	17	72
	2002	8	57
	2003	6	26
	2004	29	85
	2005	28	90
	2006	13	26
	2007	22	95
	2008	9	67
	2009	22	142
	2010	12	84
	2011	13	17
	2012	5	12

Table 34: Sample sizes of available length at age data by region and fleet. California North/South is defined as north/south of 40°10′, Oregon North/South is defined as north/south of Florence, OR, and Washington North/South is defined as south=MCAs 1-2 and north=MCAs 3-4.

Region	Comm. dead	Comm. live	Rec. mode unknown	Rec. party/ charter	Rec. private	Research	Rec./ Research
California North	0	0	0	0	0	19	0
California South	0	0	0	83	0	159	113
Oregon North	7	0	0	0	439	0	0
Oregon South	1371	17	0	1	359	0	0
Washington North	0	0	266	27	1088	0	0
Washington South	0	0	0	14	0	0	0

Table 35: von Bertalanffy growth parameters for each region, with age-0 fixed at 2 cm.

Region	L_∞	Standard Error	k	Standard Error	t_0	Sample size
Califronia South	33.62	0.23	0.23	0.01	-0.26	339
California North	39.44	1.48	0.14	0.02	-0.36	19
Oregon South	36.58	0.09	0.22	0.00	-0.26	1668
Oregon North	36.94	0.20	0.23	0.01	-0.24	432
Washignton South	41.37	1.63	0.13	0.04	-0.37	11
Washington North	34.77	0.10	0.22	0.01	-0.27	1261

Table 36: Description of model parameters in the northern base-case assessment model.

Parameter	Number estimated	Bounds (low,high)	Prior (Mean, SD) Type	Estimate
Natural mortality (M)	0	-	-	0.070
L(R_0)	1	(2,12)	-	3.531
Steepness (h)	0	-	-	0.773
Growth				
Length at age 0	0	-	-	2.000
Length at age 30	1	(20,50)	(34,10) Normal	35.410
von Bertalanffy k	1	(0.01,0.3)	(0.1,0.8) Normal	0.147
CV of length at age 0	0	-	-	0.100
CV of length at age 30	1	(0.01,0.25)	-	0.080
Indices				
Extra SD - northern WA recreational private	1	(0,2)	-	0.126
Selectivity				
Length at peak selectivity for northern WA recreational CPFV	1		-	34.890
Ascending width - northern WA recreational CPFV	1	(0,9)	-	3.970
Length at peak selectivity for southern WA recreational	1		-	34.860
Ascending width - southern WA recreational	1	(0,9)	-	2.920

Table 37: Description of model parameters in the central base-case assessment model.

Parameter	Number estimated	Bounds (low,high)	Prior (Mean, SD) Type	Estimate
Natural mortality (M)	0		-	0.070
L(R_0)	1	(3,12)	-	4.270
Steepness (h)	0	-	-	0.773
Growth				
Length at age 0	0	-	-	2.000
Length at age 30	1	(20,50)	(34,10) Normal	36.850
von Bertalanffy k	1	(0.01,0.3)	-	0.159
CV of length at age 0	0	-	-	0.100
CV of length at age 30	1	(0,2)	-	0.080
Indices				
Extra SD - southern OR commercial live-fish fishery	1	(0,2)	-	0.020
Extra SD - northern OR recreational private	1	(0,2)	-	0.500
Extra SD - southern OR recreational ORBS	1	(0,2)	-	0.090
Selectivity				
Length at peak selectivity - northern CA commercial dead-fish fishery	1	(19,45)	-	33.340
Ascending width - northern CA commercial live-fish fishery	1	(0,9)		2.710
Length at peak selectivity - northern CA commercial live-fish fishery	1	(19,45)	-	32.700
Ascending width - northern CA commercial dead-fish fishery				2.680
Length at peak selectivity - northern CA recreational party/charter	0	-	-	39.900
Ascending width - northern CA recreational party/charter	1	(0,9)	-	3.430
Length at peak selectivity - northern CA recreational private	0	-	-	39.900
Ascending width - northern CA recreational private	1	(0,9)	-	3.840
Length at peak selectivity - Southern OR commercial dead-fish fishery	1	(0,9)	-	33.680
Ascending width - southern OR commercial dead-fish fishery	1	(19,45)	-	2.180
Length at peak selectivity - Southern OR commercial live-fish fishery			-	32.360
Ascending width - southern OR commercial live-fish fishery			-	1.080
Length at peak selectivity - southern OR recreational party/charter	0		-	39.900
Ascending width - southern OR recreational party/charter	1	(0,9)	-	3.660
Length at peak selectivity - southern OR recreational private	0		-	39.900
Ascending width - southern OR recreational private	1	(0,9)	-	3.590

Table 38: Description of model parameters in the southern base-case assessment model.

Parameter	Number estimated	Bounds (low,high)	Estimate
Natural mortality (M)	0	-	0.070
L(R_0)	1	-	5.040
Steepness (h)	0	-	0.773
Growth			
Length at age 0	0	-	2.000
Length at age 30	1	(25, 45)	31.500
von Bertalanffy k	1	(0.05, 0.3)	0.144
CV of length at age 0	0	-	0.100
CV of length at age 30	1	(0.03,0.2)	0.120
Indices			
Extra SD - Recreational dockside CPFV	1	(0,2)	0.120
Extra SD - Recreational onboard CPFV 1988-1999	1	(0,2)	0.150
Extra SD - Recreational onboard CPFV 2000-2014	1	(0,2)	0.180
Selectivity			
Length at peak selectivity - Commercial dead-fish fishery	1	(19, 45)	32.660
Ascending width - Commercial dead-fish fishery	1	(0,9)	3.314
Length at peak selectivity - Commercial live-fish fishery	0	(20,40)	35.540
Ascending width - Commercial live-fish fishery	1	(0,9)	2.457
Length at peak selectivity - Recretaional dockside CPFV	1	(19,45)	33.190
Ascending width - Recreational dockside CPFV	1	(0,9)	3.519
Length at peak selectivity - Recreational dockside private	1	(19,45)	34.500
Ascending width - Recreational dockside private	1	(0,9)	3.513
Length at peak selectivity - Commercial discard	1	(19,45)	27.640
Ascending width - Commercial discard	1	(0,9)	3.443
Descending width - Commercial discard	1	(0,9)	2.665

Table 39: results from 100 jitters from each of the three models.

Status	North	Central	South
Returned to base case	100	94	67
Found local minimum	0	0	32
Found better solution	0	0	0
Error in likelihood	0	6	1
Total	100	100	100

Table 40: Sensitivity of the northern model to dropping or down-weighting data sources and alternative assumptions about growth.

Label	Base (Francis weights)	Harmonic mean weights	Drop index	Drop ages	Down-weight lengths	Free size Age0	Free CV Amin	External growth
TOTAL_like	1011.10	1062.10	1043.50	13.20	976.00	991.10	993.40	1214.70
Catch_like	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equil_catch_like	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Survey_like	-32.80	-33.30	0.00	-36.90	-32.60	-31.00	-32.20	-36.90
Length_comp_like	45.90	95.60	46.20	44.60	12.30	46.20	45.90	46.70
Age_comp_like	992.50	994.20	991.70	0.00	990.70	969.40	974.30	1199.50
Parm_priors_like	5.60	5.60	5.60	5.60	5.60	6.60	5.60	5.60
SSB_Unfished_thousand_mt	0.06	0.07	0.06	0.13	0.06	0.06	0.06	0.12
TotBio_Unfished	152.30	155.90	146.30	298.50	150.80	155.50	150.00	285.20
SmryBio_Unfished	149.80	153.50	143.90	289.50	148.30	146.70	147.90	277.50
Recr_Unfished_billions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SSB_Btgt_thousand_mt	0.03	0.03	0.02	0.05	0.03	0.02	0.03	0.05
SPR_Btgt	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Fstd_Btgt	0.05	0.05	0.05	0.06	0.05	0.04	0.05	0.06
TotYield_Btgt_thousand_mt	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
SSB_SPRtgt_thousand_mt	0.03	0.03	0.03	0.06	0.03	0.03	0.03	0.06
Fstd_SPRtgt	0.04	0.04	0.04	0.05	0.04	0.04	0.04	0.05
TotYield_SPRtgt_thousand_mt	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
SSB_MSY_thousand_mt	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.03
SPR_MSY	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Fstd_MSY	0.08	0.08	0.08	0.10	0.08	0.08	0.08	0.10
TotYield_MSY_thousand_mt	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
RetYield_MSY	3.70	3.70	3.60	7.90	3.70	3.40	3.50	7.40
Bratio_2015	0.52	0.52	0.50	0.78	0.52	0.47	0.49	0.76
F_2015	1.03	1.03	1.02	1.07	1.04	1.01	1.02	1.06
SPRratio_2015	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Recr_2015	13.30	13.40	12.80	24.60	13.20	12.40	12.90	22.90
Recr_Virgin_billions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L_at_Amin_Fem_GP_1	2.00	2.00	2.00	2.00	2.00	16.10	2.00	2.00
L_at_Amax_Fem_GP_1	35.10	35.30	35.00	34.30	34.90	35.40	35.70	34.90
VonBert_K_Fem_GP_1	0.15	0.15	0.15	0.24	0.16	0.08	0.13	0.22
CV_young_Fem_GP_1	0.10	0.10	0.10	0.10	0.10	0.10	0.25	0.10
CV_old_Fem_GP_1	0.08	0.08	0.08	0.09	0.08	0.09	0.07	0.10

Table 41: Sensitivity of the central model to dropping or down-weighting data sources and alternative assumptions about growth.

Label	Base (Francis weights)	Harmonic mean weights	Drop index	Drop ages	Down-weight lengths	Free size Age0	Free CV Amin	External growth
TOTAL_like	1840.01	1936.34	1884.28	132.68	1662.40	1837.61	1826.10	2188.79
Catch_like	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Equil_catch_like	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Survey_like	-44.27	-44.32	0.00	-42.71	-43.88	-44.15	-44.01	-44.05
Length_comp_like	214.50	299.23	214.82	169.79	69.28	224.63	216.25	196.77
Age_comp_like	1664.16	1675.82	1663.83	0.00	1631.38	1651.29	1648.23	2030.47
Parm_priors_like	5.62	5.61	5.62	5.59	5.61	5.83	5.62	5.60
SSB_Unfished_thousand_mt	0.20	0.21	0.20	786.00	0.19	0.20	0.19	0.41
TotBio_Unfished	455.75	468.05	454.45	1813900.00	420.14	449.69	428.12	891.43
SmryBio_Unfished	449.09	460.76	447.81	1793850.00	414.36	438.68	422.33	866.34
Recr_Unfished_billions	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00
SSB_Btgt_thousand_mt	0.08	0.08	0.08	314.40	0.07	0.08	0.08	0.16
SPR_Btgt	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Fstd_Btgt	0.05	0.05	0.05	0.04	0.05	0.05	0.05	0.06
TotYield_Btgt_thousand_mt	0.01	0.01	0.01	34.75	0.01	0.01	0.01	0.02
SSB_SPRtgt_thousand_mt	0.09	0.10	0.09	361.86	0.09	0.09	0.09	0.19
Fstd_SPRtgt	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
TotYield_SPRtgt_thousand_mt	0.01	0.01	0.01	32.32	0.01	0.01	0.01	0.02
SSB_MSY_thousand_mt	0.09	0.10	0.09	361.86	0.09	0.09	0.09	0.19
SPR_MSY	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Fstd_MSY	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05
TotYield_MSY_thousand_mt	0.01	0.01	0.01	32.32	0.01	0.01	0.01	0.02
RetYield_MSY	8.76	9.05	8.74	32323.80	8.28	8.42	8.15	18.92
Bratio_2015	0.42	0.44	0.42	1.00	0.38	0.40	0.38	0.73
F_2015	0.99	0.99	0.98	1.15	0.95	0.97	0.95	1.04
SPRratio_2015	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00
ForeRecr_2015_billions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recr_2015	31.98	33.31	31.88	162746.00	29.73	30.71	29.97	60.47
Recr_Virgin_billions	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00
L_at_Amin_Fem_GP_1	2.00	2.00	2.00	2.00	2.00	8.46	2.00	2.00
L_at_Amax_Fem_GP_1	37.44	37.18	37.44	36.65	37.32	37.55	37.67	36.57
VonBert_K_Fem_GP_1	0.14	0.15	0.14	0.11	0.14	0.12	0.13	0.23
CV_young_Fem_GP_1	0.10	0.10	0.10	0.10	0.10	0.10	0.25	0.10
CV_old_Fem_GP_1	0.08	0.07	0.08	0.06	0.08	0.08	0.07	0.10

Table 42: Sensitivity of the southern model to dropping or down-weighting data sources and alternative assumptions about growth.

Label	Base (Francis weights)	Drop indices	Drop dis-card	Down-weight lengths	Drop ages	No data weight-ing	Harmonic mean weights	External growth	Estimate h and M
TOTAL_like	616.21	637.67	570.09	341.55	329.65	1409.01	487.91	831.09	590.51
Survey_like	-21.51		-21.48	-21.28	-18.42	-22.01	-21.66	-21.34	-18.99
Length_comp_like	362.17	362.35	321.64	95.76	339.29	1143.33	290.39	469.57	348.49
Age_comp_like	268.94	268.81	269.92	264.06		277.06	213.54	357.30	253.04
Parm_priors_like	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57
R0_billions	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SR_BH_steep	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.92
NatM_p_1_Fem_GP_1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10
NatM_p_1_Mal_GP_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L_at_Amax_Fem_GP_1	31.60	31.57	31.40	32.54	25.10	32.06	32.17	33.62	33.28
L_at_Amax_Mal_GP_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VonBert_K_Fem_GP_1	0.16	0.16	0.16	0.16	0.03	0.14	0.15	0.23	0.14
VonBert_K_Mal_GP_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SPB_Virgin_thousand_mt	0.38	0.38	0.35	0.41	0.57	0.37	0.39	0.43	0.30
Bratio_2015	0.30	0.30	0.28	0.29	0.42	0.24	0.28	0.23	0.58
SPRratio_2014	0.99	0.97	1.00	1.00	0.83	1.12	1.02	1.11	0.53

Table 43: Time-series of population estimates from the northern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1900	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1901	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1902	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1903	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1904	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1905	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1906	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1907	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1908	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1909	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1910	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1911	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1912	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1913	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1914	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1915	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1916	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1917	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1918	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1919	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1920	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1921	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1922	240.81	24.44	0.00	71.27	0.00	0.00	1.00
1923	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1924	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1925	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1926	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1927	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1928	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1929	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1930	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1931	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1932	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1933	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1934	240.81	24.45	0.00	71.27	0.00	0.00	1.00
1935	240.81	24.45	0.00	71.26	0.00	0.00	1.00
1936	240.81	24.45	0.00	71.25	0.00	0.00	1.00

Table 43: Time-series of population estimates from the northern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1937	240.81	24.45	0.00	71.24	0.00	0.00	1.00
1938	240.81	24.45	0.00	71.23	0.00	0.00	1.00
1939	240.81	24.45	0.00	71.21	0.00	0.00	1.00
1940	240.81	24.45	0.00	71.15	0.00	0.00	1.00
1941	240.81	24.45	0.00	71.12	0.00	0.00	1.00
1942	240.81	24.45	0.00	71.12	0.00	0.00	1.00
1943	240.81	24.45	0.00	71.12	0.00	0.00	1.00
1944	240.81	24.45	0.00	71.12	0.00	0.00	1.00
1945	240.81	24.45	0.00	71.13	0.00	0.00	1.00
1946	240.81	24.45	0.00	71.14	0.00	0.00	1.00
1947	240.81	24.45	0.00	71.14	0.00	0.00	1.00
1948	240.81	24.45	0.00	71.15	0.00	0.00	1.00
1949	240.81	24.45	0.00	71.15	0.00	0.00	1.00
1950	240.81	24.45	0.00	71.16	0.00	0.00	1.00
1951	240.81	24.45	0.00	71.16	0.00	0.00	1.00
1952	240.81	24.45	0.00	71.17	0.00	0.00	1.00
1953	240.81	24.45	0.00	71.17	0.00	0.00	1.00
1954	240.81	24.45	0.00	71.18	0.00	0.00	1.00
1955	240.81	24.45	0.00	71.18	0.00	0.00	1.00
1956	240.81	24.45	0.00	71.19	0.00	0.00	1.00
1957	240.81	24.45	0.00	71.19	0.00	0.00	1.00
1958	240.81	24.45	0.00	71.19	0.00	0.00	1.00
1959	240.81	24.45	0.00	71.20	0.00	0.00	1.00
1960	240.81	24.45	0.00	71.20	0.00	0.00	1.00
1961	240.81	24.45	0.00	71.20	0.00	0.00	1.00
1962	240.81	24.45	0.00	71.21	0.00	0.00	1.00
1963	240.81	24.45	0.00	71.21	0.00	0.00	1.00
1964	240.81	24.45	0.00	71.21	0.00	0.00	1.00
1965	240.81	24.45	0.00	71.22	0.00	0.00	1.00
1966	240.81	24.45	0.00	71.22	0.00	0.00	1.00
1967	223.10	24.45	0.00	71.22	1.31	0.00	0.91
1968	219.59	24.30	0.99	71.22	1.59	0.00	0.89
1969	216.26	24.14	0.99	71.23	1.86	0.17	0.87
1970	212.77	23.94	0.98	71.23	2.15	0.20	0.86
1971	209.43	23.73	0.97	71.23	2.43	0.23	0.84
1972	206.14	23.49	0.96	71.23	2.71	0.26	0.82
1973	202.90	23.24	0.95	71.23	2.99	0.29	0.80

Table 43: Time-series of population estimates from the northern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1974	199.78	22.97	0.94	71.23	3.26	0.32	0.79
1975	196.57	22.68	0.93	71.22	3.54	0.35	0.77
1976	214.30	22.37	0.92	71.21	1.88	0.19	0.86
1977	220.01	22.26	0.91	71.19	1.42	0.14	0.89
1978	192.86	22.22	0.91	71.17	3.86	0.39	0.75
1979	200.66	21.91	0.90	71.15	3.03	0.31	0.79
1980	205.14	21.70	0.89	71.08	2.59	0.27	0.82
1981	207.54	21.56	0.88	71.05	2.36	0.24	0.83
1982	202.51	21.45	0.88	71.01	2.79	0.29	0.80
1983	199.61	21.30	0.87	70.96	3.04	0.32	0.79
1984	195.44	21.13	0.86	70.90	3.40	0.36	0.77
1985	195.36	20.93	0.86	70.85	3.38	0.36	0.77
1986	189.14	20.74	0.85	70.83	3.96	0.42	0.73
1987	179.59	20.50	0.84	70.81	4.96	0.53	0.69
1988	170.71	20.16	0.82	70.77	5.97	0.65	0.64
1989	162.49	19.73	0.81	70.74	6.97	0.77	0.60
1990	154.63	19.20	0.79	70.69	7.98	0.90	0.56
1991	181.08	18.60	0.76	70.60	4.32	0.50	0.69
1992	154.69	18.41	0.75	70.57	7.62	0.89	0.56
1993	160.67	17.89	0.73	70.50	6.53	0.78	0.59
1994	174.30	17.50	0.72	70.44	4.74	0.58	0.66
1995	179.99	17.33	0.71	70.33	4.13	0.51	0.69
1996	194.01	17.24	0.71	70.19	2.86	0.35	0.76
1997	195.80	17.29	0.71	70.07	2.72	0.33	0.77
1998	205.73	17.37	0.71	69.87	1.99	0.24	0.82
1999	199.21	17.52	0.72	69.58	2.50	0.30	0.79
2000	192.84	17.61	0.72	69.16	3.02	0.37	0.75
2001	185.80	17.64	0.72	68.95	3.63	0.44	0.72
2002	199.49	17.61	0.72	68.64	2.49	0.30	0.79
2003	200.97	17.69	0.72	68.28	2.39	0.29	0.80
2004	203.26	17.79	0.73	68.19	2.23	0.27	0.81
2005	197.68	17.89	0.73	68.19	2.68	0.32	0.78
2006	202.56	17.94	0.73	68.27	2.31	0.28	0.80
2007	194.62	18.03	0.74	68.31	2.95	0.35	0.76
2008	192.08	18.04	0.74	68.26	3.16	0.38	0.75
2009	196.57	18.03	0.74	68.20	2.79	0.33	0.77
2010	186.33	18.06	0.74	68.17	3.68	0.44	0.72

Table 43: Time-series of population estimates from the northern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
2011	190.94	17.99	0.74	68.22	3.26	0.39	0.74
2012	194.38	17.97	0.74	68.17	2.96	0.35	0.76
2013	189.33	17.98	0.74	68.09	3.40	0.41	0.74
2014	193.65	17.94	0.73	68.06	3.02	0.36	0.76
2015	207.26	17.95	0.73	68.15			

Table 44: Time-series of population estimates from the central base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1900	591.21	65.10	0.00	71.27	0.02	0.00	1.00
1901	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1902	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1903	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1904	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1905	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1906	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1907	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1908	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1909	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1910	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1911	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1912	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1913	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1914	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1915	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1916	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1917	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1918	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1919	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1920	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1921	591.52	65.10	1.00	71.27	0.00	0.00	1.00
1922	591.52	65.11	1.00	71.27	0.00	0.00	1.00
1923	591.52	65.11	1.00	71.27	0.00	0.00	1.00

Table 44: Time-series of population estimates from the central base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1924	591.52	65.11	1.00	71.27	0.00	0.00	1.00
1925	591.52	65.11	1.00	71.27	0.00	0.00	1.00
1926	591.52	65.11	1.00	71.27	0.00	0.00	1.00
1927	591.52	65.11	1.00	71.27	0.00	0.00	1.00
1928	591.52	65.11	1.00	71.27	0.00	0.00	1.00
1929	590.91	65.11	1.00	71.27	0.04	0.00	1.00
1930	590.91	65.10	1.00	71.27	0.04	0.00	1.00
1931	591.37	65.10	1.00	71.27	0.01	0.00	1.00
1932	590.90	65.10	1.00	71.27	0.04	0.00	1.00
1933	589.96	65.09	1.00	71.27	0.10	0.00	1.00
1934	576.20	65.08	1.00	71.27	1.00	0.04	0.97
1935	578.59	64.97	1.00	71.26	0.84	0.03	0.97
1936	572.04	64.87	1.00	71.25	1.28	0.05	0.96
1937	578.72	64.73	0.99	71.24	0.83	0.03	0.97
1938	546.27	64.65	0.99	71.23	3.11	0.11	0.91
1939	510.29	64.30	0.99	71.21	5.98	0.22	0.84
1940	539.47	63.62	0.98	71.15	3.57	0.13	0.90
1941	575.21	63.26	0.97	71.12	1.04	0.04	0.97
1942	579.63	63.21	0.97	71.12	0.75	0.03	0.98
1943	589.79	63.21	0.97	71.12	0.11	0.00	1.00
1944	591.05	63.29	0.97	71.12	0.03	0.00	1.00
1945	590.11	63.37	0.97	71.13	0.09	0.00	1.00
1946	588.55	63.45	0.97	71.14	0.19	0.01	0.99
1947	589.48	63.52	0.98	71.14	0.13	0.00	1.00
1948	589.18	63.59	0.98	71.15	0.15	0.01	1.00
1949	588.45	63.66	0.98	71.15	0.20	0.01	0.99
1950	588.43	63.72	0.98	71.16	0.20	0.01	0.99
1951	588.12	63.77	0.98	71.16	0.22	0.01	0.99
1952	590.50	63.82	0.98	71.17	0.07	0.00	1.00
1953	590.50	63.89	0.98	71.17	0.07	0.00	1.00
1954	590.36	63.95	0.98	71.18	0.08	0.00	1.00
1955	590.22	64.00	0.98	71.18	0.09	0.00	1.00
1956	589.93	64.06	0.98	71.19	0.11	0.00	1.00
1957	588.22	64.10	0.98	71.19	0.22	0.01	0.99
1958	589.94	64.13	0.99	71.19	0.11	0.00	1.00
1959	590.21	64.18	0.99	71.20	0.09	0.00	1.00
1960	590.79	64.22	0.99	71.20	0.05	0.00	1.00

Table 44: Time-series of population estimates from the central base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1961	590.80	64.27	0.99	71.20	0.05	0.00	1.00
1962	591.09	64.31	0.99	71.21	0.03	0.00	1.00
1963	591.09	64.35	0.99	71.21	0.03	0.00	1.00
1964	590.78	64.39	0.99	71.21	0.05	0.00	1.00
1965	590.48	64.43	0.99	71.22	0.07	0.00	1.00
1966	590.10	64.46	0.99	71.22	0.09	0.00	1.00
1967	590.36	64.48	0.99	71.22	0.08	0.00	1.00
1968	591.09	64.51	0.99	71.22	0.03	0.00	1.00
1969	590.52	64.54	0.99	71.23	0.07	0.00	1.00
1970	591.23	64.57	0.99	71.23	0.02	0.00	1.00
1971	591.09	64.59	0.99	71.23	0.03	0.00	1.00
1972	590.36	64.62	0.99	71.23	0.08	0.00	1.00
1973	578.63	64.64	0.99	71.23	0.90	0.03	0.97
1974	569.95	64.56	0.99	71.23	1.53	0.06	0.96
1975	580.81	64.42	0.99	71.22	0.74	0.03	0.98
1976	560.72	64.37	0.99	71.21	2.22	0.08	0.94
1977	556.23	64.16	0.99	71.19	2.55	0.09	0.93
1978	548.50	63.91	0.98	71.17	3.16	0.12	0.91
1979	502.84	63.61	0.98	71.15	7.38	0.27	0.82
1980	534.51	62.85	0.97	71.08	4.24	0.16	0.89
1981	515.89	62.48	0.96	71.05	5.88	0.22	0.85
1982	511.82	61.94	0.95	71.01	6.16	0.23	0.84
1983	501.86	61.39	0.94	70.96	7.01	0.26	0.82
1984	507.75	60.78	0.93	70.90	6.37	0.24	0.83
1985	532.57	60.27	0.93	70.85	4.22	0.16	0.88
1986	526.29	60.03	0.92	70.83	4.73	0.18	0.87
1987	510.84	59.75	0.92	70.81	6.02	0.23	0.84
1988	520.90	59.34	0.91	70.77	5.01	0.19	0.86
1989	493.93	59.07	0.91	70.74	7.45	0.29	0.80
1990	458.94	58.53	0.90	70.69	10.84	0.43	0.73
1991	509.33	57.63	0.89	70.60	5.83	0.23	0.83
1992	466.45	57.34	0.88	70.57	9.64	0.39	0.75
1993	478.27	56.63	0.87	70.50	8.55	0.35	0.77
1994	432.68	56.09	0.86	70.44	13.23	0.54	0.68
1995	412.03	55.03	0.85	70.33	15.20	0.63	0.64
1996	422.65	53.78	0.83	70.19	13.55	0.57	0.66
1997	376.65	52.77	0.81	70.07	19.41	0.83	0.57

Table 44: Time-series of population estimates from the central base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploita-tion rate	SPR
1998	338.53	51.13	0.79	69.87	25.30	1.12	0.50
1999	302.11	48.88	0.75	69.58	32.27	1.48	0.42
2000	358.64	45.92	0.71	69.16	19.38	0.94	0.54
2001	322.70	44.59	0.68	68.95	24.75	1.23	0.46
2002	307.76	42.70	0.66	68.64	26.49	1.36	0.44
2003	381.77	40.72	0.63	68.28	14.35	0.77	0.58
2004	420.97	40.23	0.62	68.19	10.19	0.55	0.66
2005	455.05	40.26	0.62	68.19	7.45	0.40	0.73
2006	435.82	40.64	0.62	68.27	9.03	0.48	0.69
2007	395.91	40.85	0.63	68.31	12.84	0.68	0.61
2008	386.54	40.63	0.62	68.26	13.70	0.73	0.59
2009	396.64	40.31	0.62	68.20	12.63	0.68	0.61
2010	438.29	40.12	0.62	68.17	8.76	0.47	0.69
2011	390.59	40.38	0.62	68.22	13.30	0.72	0.60
2012	378.64	40.11	0.62	68.17	14.55	0.79	0.57
2013	398.85	39.71	0.61	68.09	12.25	0.67	0.61
2014	459.21	39.57	0.61	68.06	7.04	0.39	0.73
2015	496.73	40.03	0.61	68.15			

Table 45: Time-series of population estimates from the southern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploita-tion rate	SPR
1900	768.57	66.51	0.00	154.47	0.00	0.00	1.00
1901	763.29	66.51	0.00	154.47	0.38	0.00	0.99
1902	758.09	66.48	1.00	154.46	0.77	0.00	0.98
1903	752.96	66.41	1.00	154.45	1.15	0.03	0.97
1904	747.89	66.32	1.00	154.43	1.53	0.04	0.97
1905	742.88	66.19	1.00	154.41	1.92	0.05	0.96
1906	737.90	66.03	0.99	154.39	2.30	0.06	0.95
1907	732.99	65.85	0.99	154.35	2.68	0.08	0.94
1908	728.10	65.64	0.99	154.32	3.06	0.09	0.93
1909	723.25	65.41	0.98	154.28	3.45	0.10	0.92
1910	718.43	65.15	0.98	154.23	3.83	0.11	0.92

Table 45: Time-series of population estimates from the southern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1911	713.64	64.88	0.98	154.18	4.21	0.12	0.91
1912	708.86	64.58	0.97	154.13	4.60	0.13	0.90
1913	704.10	64.26	0.97	154.07	4.98	0.14	0.89
1914	699.36	63.93	0.96	154.01	5.36	0.16	0.88
1915	694.62	63.57	0.96	153.95	5.75	0.17	0.88
1916	689.90	63.21	0.95	153.88	6.13	0.18	0.87
1917	653.53	62.82	0.94	153.81	9.52	0.28	0.81
1918	636.92	62.16	0.93	153.68	11.13	0.33	0.78
1919	669.92	61.39	0.92	153.53	7.74	0.23	0.84
1920	667.66	60.95	0.92	153.44	7.89	0.24	0.83
1921	682.38	60.51	0.91	153.35	6.52	0.20	0.86
1922	692.68	60.22	0.91	153.30	5.61	0.17	0.87
1923	687.06	60.03	0.90	153.26	6.07	0.18	0.86
1924	718.52	59.82	0.90	153.21	3.51	0.11	0.92
1925	707.29	59.84	0.90	153.22	4.39	0.13	0.90
1926	675.04	59.79	0.90	153.21	7.08	0.22	0.84
1927	687.04	59.51	0.89	153.15	6.02	0.18	0.86
1928	667.94	59.34	0.89	153.11	7.68	0.24	0.83
1929	677.13	59.04	0.89	153.05	6.85	0.21	0.85
1930	648.16	58.82	0.88	153.00	9.47	0.29	0.80
1931	700.01	58.38	0.88	152.91	4.90	0.15	0.89
1932	633.64	58.36	0.88	152.91	10.86	0.34	0.78
1933	695.43	57.83	0.87	152.79	5.24	0.16	0.88
1934	648.67	57.80	0.87	152.78	9.32	0.29	0.80
1935	653.13	57.44	0.86	152.70	8.85	0.28	0.81
1936	650.27	57.12	0.86	152.63	9.08	0.29	0.80
1937	650.94	56.81	0.85	152.56	8.99	0.29	0.80
1938	677.75	56.52	0.85	152.49	6.60	0.21	0.85
1939	715.44	56.44	0.85	152.48	3.64	0.12	0.91
1940	704.74	56.63	0.85	152.52	4.50	0.14	0.89
1941	701.66	56.75	0.85	152.55	4.73	0.15	0.89
1942	730.21	56.85	0.85	152.57	2.58	0.08	0.94
1943	714.57	57.13	0.86	152.63	3.72	0.12	0.91
1944	737.08	57.30	0.86	152.67	2.11	0.07	0.95
1945	728.89	57.60	0.87	152.74	2.71	0.09	0.93
1946	697.21	57.85	0.87	152.79	5.16	0.16	0.88
1947	706.17	57.87	0.87	152.80	4.44	0.14	0.90

Table 45: Time-series of population estimates from the southern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1948	652.17	57.94	0.87	152.81	9.15	0.29	0.81
1949	622.88	57.62	0.87	152.74	12.07	0.38	0.76
1950	631.71	57.04	0.86	152.61	11.13	0.35	0.77
1951	608.04	56.58	0.85	152.51	13.58	0.43	0.73
1952	621.47	55.92	0.84	152.35	11.95	0.39	0.75
1953	635.21	55.42	0.83	152.24	10.43	0.34	0.78
1954	629.98	55.07	0.83	152.16	10.96	0.36	0.77
1955	613.58	54.71	0.82	152.07	12.62	0.41	0.74
1956	600.78	54.22	0.82	151.95	13.92	0.46	0.72
1957	598.01	53.65	0.81	151.80	14.08	0.47	0.72
1958	531.30	53.09	0.80	151.66	22.71	0.76	0.61
1959	560.62	51.84	0.78	151.34	18.05	0.62	0.65
1960	583.40	51.03	0.77	151.11	15.01	0.52	0.69
1961	593.94	50.51	0.76	150.97	13.66	0.48	0.71
1962	606.30	50.14	0.75	150.86	12.28	0.43	0.73
1963	574.33	49.90	0.75	150.79	15.70	0.55	0.68
1964	627.12	49.40	0.74	150.65	10.10	0.36	0.76
1965	564.85	49.39	0.74	150.65	16.68	0.59	0.66
1966	545.95	48.85	0.73	150.49	18.86	0.68	0.63
1967	506.38	48.15	0.72	150.28	24.26	0.88	0.57
1968	523.68	47.03	0.71	149.93	21.14	0.78	0.59
1969	532.14	46.21	0.69	149.66	19.55	0.73	0.61
1970	452.71	45.56	0.68	149.44	32.19	1.22	0.48
1971	496.17	43.90	0.66	148.86	23.55	0.92	0.55
1972	437.26	43.01	0.65	148.53	33.45	1.32	0.46
1973	409.94	41.36	0.62	147.89	38.11	1.55	0.41
1974	387.68	39.39	0.59	147.06	41.88	1.77	0.38
1975	382.96	37.20	0.56	146.06	40.75	1.80	0.37
1976	359.26	35.21	0.53	145.04	44.92	2.07	0.33
1977	365.91	32.97	0.50	143.77	40.27	1.95	0.34
1978	399.26	31.20	0.47	142.67	30.77	1.55	0.40
1979	348.00	30.27	0.46	142.04	41.31	2.12	0.32
1980	352.25	28.58	0.43	140.81	37.79	2.02	0.32
1981	475.79	27.24	0.41	139.75	16.51	0.91	0.52
1982	378.69	27.62	0.42	140.06	31.23	1.71	0.36
1983	463.14	26.90	0.40	139.47	17.59	0.98	0.50
1984	475.80	27.25	0.41	139.76	16.56	0.91	0.52

Table 45: Time-series of population estimates from the southern base case model.

Year	Total biomass (mt)	Spawning biomass (mt)	Depletion	Age-0 recruits	Total catch (mt)	Relative exploitation rate	SPR
1985	395.06	27.70	0.42	140.12	28.24	1.54	0.39
1986	336.55	27.26	0.41	139.77	40.76	2.25	0.30
1987	283.50	25.87	0.39	138.57	55.84	3.21	0.22
1988	318.38	23.36	0.35	136.11	39.32	2.44	0.27
1989	314.51	22.12	0.33	134.74	37.98	2.45	0.27
1990	309.96	21.02	0.32	133.40	37.36	2.50	0.26
1991	284.22	19.99	0.30	132.05	42.75	2.95	0.22
1992	248.89	18.62	0.28	130.07	52.53	3.80	0.17
1993	251.37	16.58	0.25	126.67	46.27	3.62	0.18
1994	211.76	15.07	0.23	123.71	64.20	5.35	0.13
1995	219.17	12.46	0.19	117.43	49.66	4.66	0.13
1996	244.94	10.95	0.16	112.88	34.18	3.46	0.17
1997	223.69	10.52	0.16	111.40	38.67	4.00	0.14
1998	302.93	9.85	0.15	108.98	19.14	2.06	0.25
1999	288.07	10.43	0.16	111.08	22.29	2.32	0.23
2000	293.00	10.85	0.16	112.52	21.75	2.22	0.24
2001	301.58	11.30	0.17	113.98	21.07	2.12	0.25
2002	317.02	11.77	0.18	115.42	19.68	1.95	0.27
2003	329.63	12.28	0.18	116.93	18.75	1.83	0.29
2004	431.25	12.81	0.19	118.36	10.13	0.97	0.45
2005	367.72	13.85	0.21	120.98	16.37	1.50	0.35
2006	408.52	14.43	0.22	122.32	13.22	1.19	0.41
2007	407.40	15.17	0.23	123.93	14.00	1.22	0.41
2008	392.92	15.82	0.24	125.23	15.97	1.35	0.39
2009	354.49	16.29	0.24	126.13	21.10	1.76	0.33
2010	356.28	16.36	0.25	126.27	20.45	1.70	0.33
2011	386.08	16.44	0.25	126.42	17.01	1.41	0.38
2012	400.64	16.76	0.25	126.99	15.60	1.27	0.40
2013	458.34	17.17	0.26	127.71	11.29	0.90	0.49
2014	450.56	17.90	0.27	128.94	12.45	0.96	0.48
2015	446.54	18.57	0.28	129.99			

Table 46: Projection of potential China rockfish OFL, spawning biomass, and depletion for the northern base case model.

Year	OFL contriubtion (mt)	ACL landings (mt)	Age 5+ biomass (mt)	Spawning Biomass (mt)	Depletion
2015	9.51	1.97	182.58	17.95	0.73
2016	9.57	2.03	183.59	18.07	0.74
2017	9.63	8.81	184.50	18.18	0.74
2018	9.29	8.50	179.23	17.55	0.72
2019	8.98	8.22	174.48	16.98	0.69
2020	8.69	7.96	170.21	16.47	0.67
2021	8.43	7.72	166.38	16.00	0.65
2022	8.20	7.51	162.98	15.58	0.64
2023	7.99	7.31	159.93	15.20	0.62
2024	7.80	7.14	157.22	14.86	0.61

Table 47: Projection of potential China rockfish OFL, spawning biomass, and depletion for the central base case model.

Year	OFL contriubtion (mt)	ACL landings (mt)	Age 5+ biomass (mt)	Spawning Biomass (mt)	Depletion
2015	19.80	4.64	381.29	40.03	0.61
2016	20.17	4.78	387.10	40.75	0.63
2017	20.52	18.79	392.54	41.44	0.64
2018	20.05	18.36	384.93	40.52	0.62
2019	19.62	17.96	377.97	39.66	0.61
2020	19.21	17.58	371.64	38.87	0.60
2021	18.84	17.24	365.94	38.15	0.59
2022	18.50	16.93	360.84	37.49	0.58
2023	18.19	16.65	356.26	36.90	0.57
2024	17.91	16.40	352.17	36.38	0.56

Table 48: Projection of potential China rockfish OFL, spawning biomass, and depletion for the southern base case model.

Year	OFL contriubtion (mt)	ACL landings (mt)	Age 5+ biomass (mt)	Spawning Biomass (mt)	Depletion
2015	12.48	13.11	280.18	18.57	0.28
2016	12.89	13.11	287.26	19.19	0.29
2017	13.31	10.81	294.24	19.82	0.30
2018	13.84	11.46	303.00	20.63	0.31
2019	14.34	12.07	311.12	21.38	0.32
2020	14.80	12.64	318.62	22.09	0.33
2021	15.24	13.17	325.53	22.74	0.34
2022	15.63	13.65	331.90	23.34	0.35
2023	16.00	14.10	337.78	23.90	0.36
2024	16.34	14.51	343.23	24.40	0.37

9 Figures

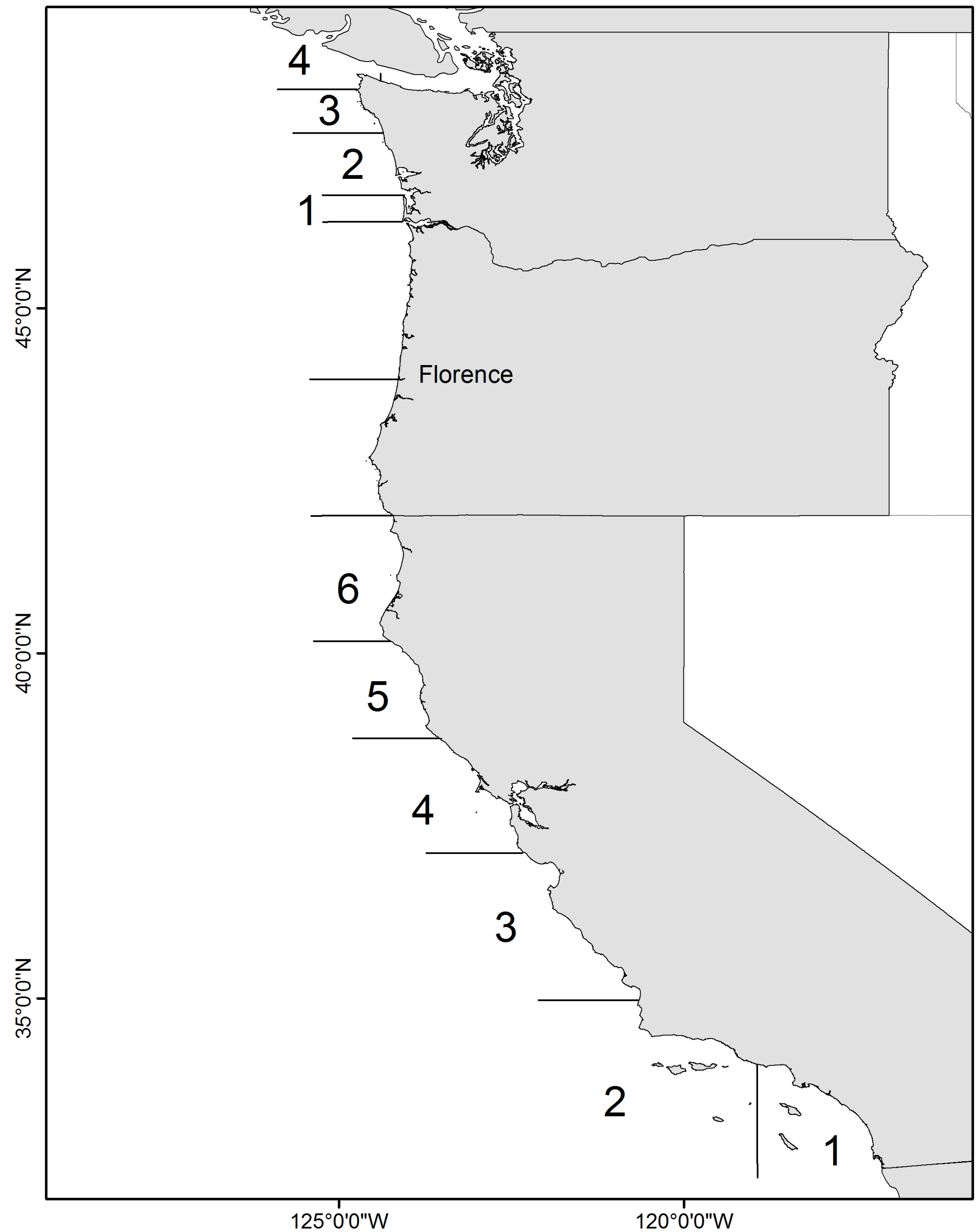


Figure 1: Map showing the state boundary lines for management of the recreational fishing fleets. CRFS Districts 1-6 in California are presented as well as the WDFW Recreational Management Areas in Washington. Florence, OR is shown as a potential location of model stratification.

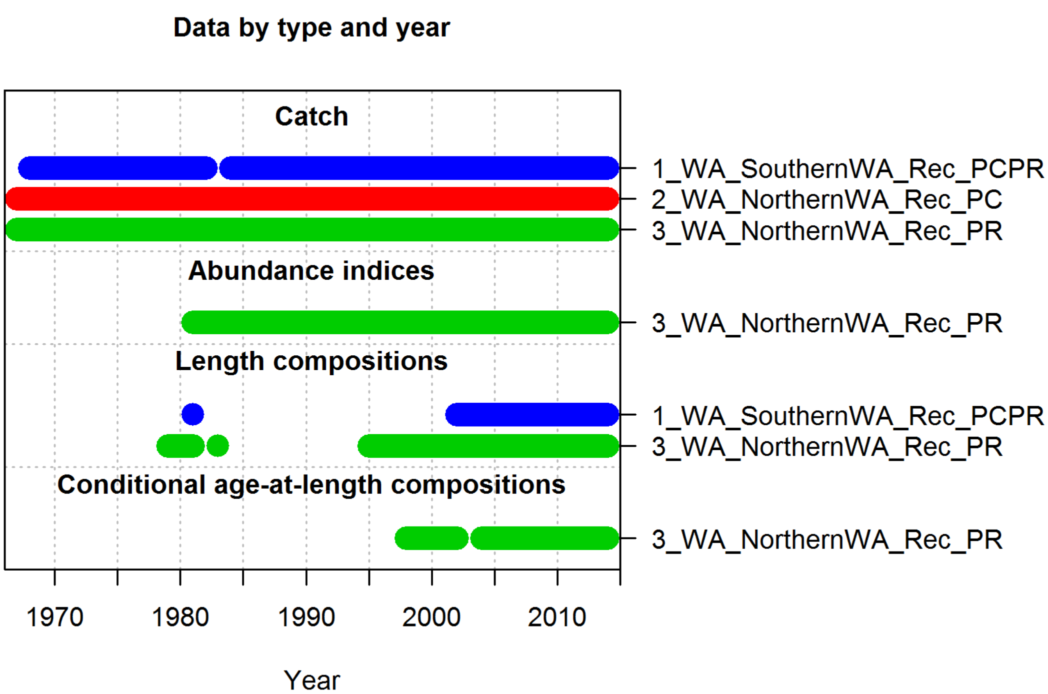


Figure 2: Summary of data sources used in the northern assessment.

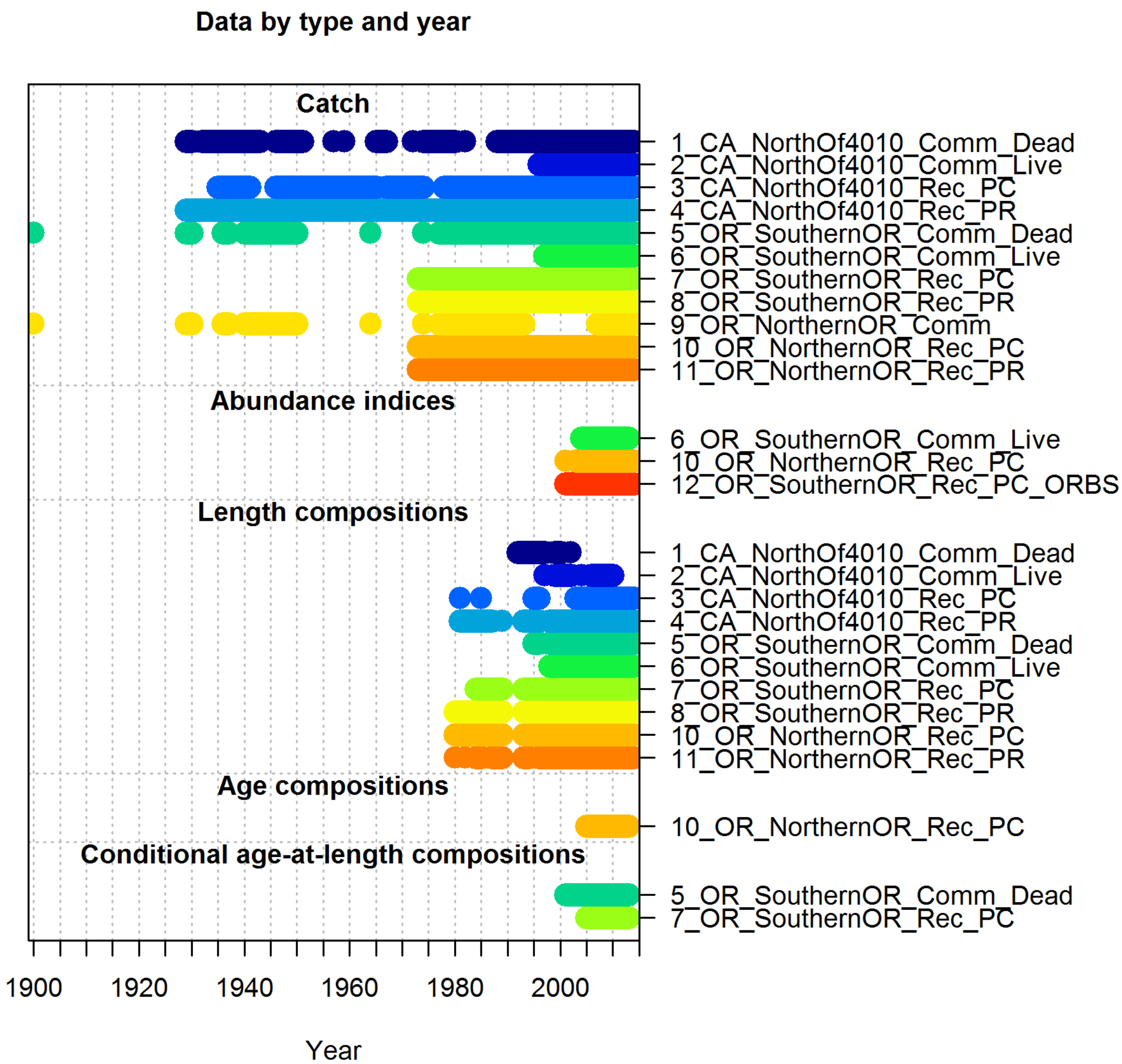


Figure 3: Summary of data sources used in the central assessment.

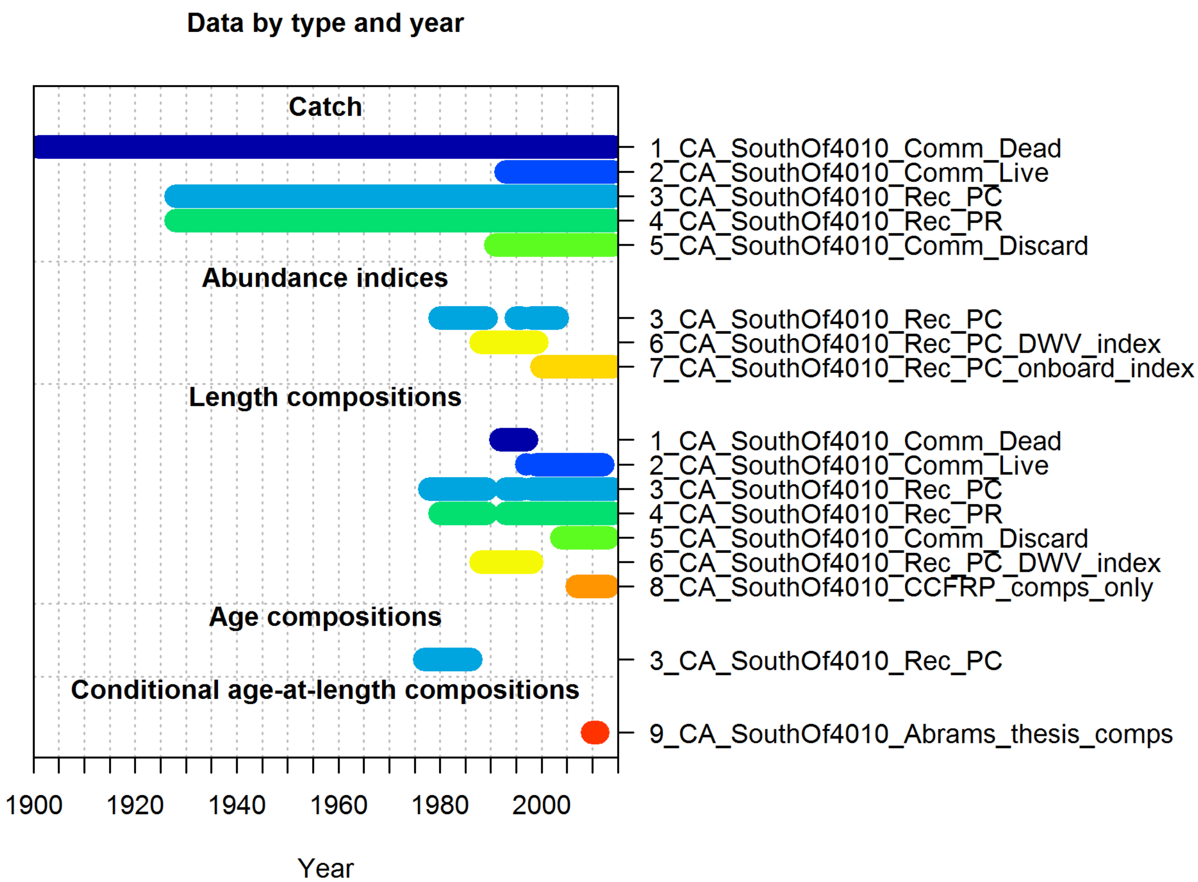


Figure 4: Summary of data sources used in the southern assessment.

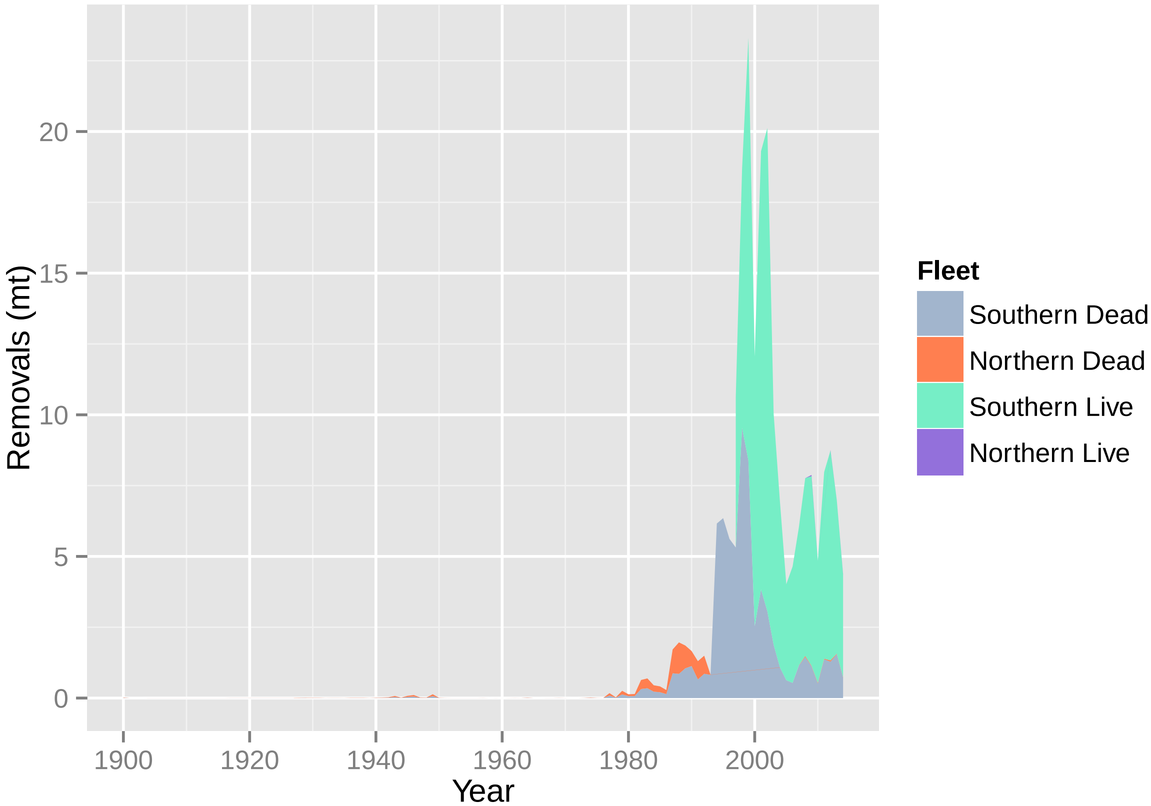


Figure 5: Removals (mt) from the Oregon commercial fleet, north and south of Florence, OR.

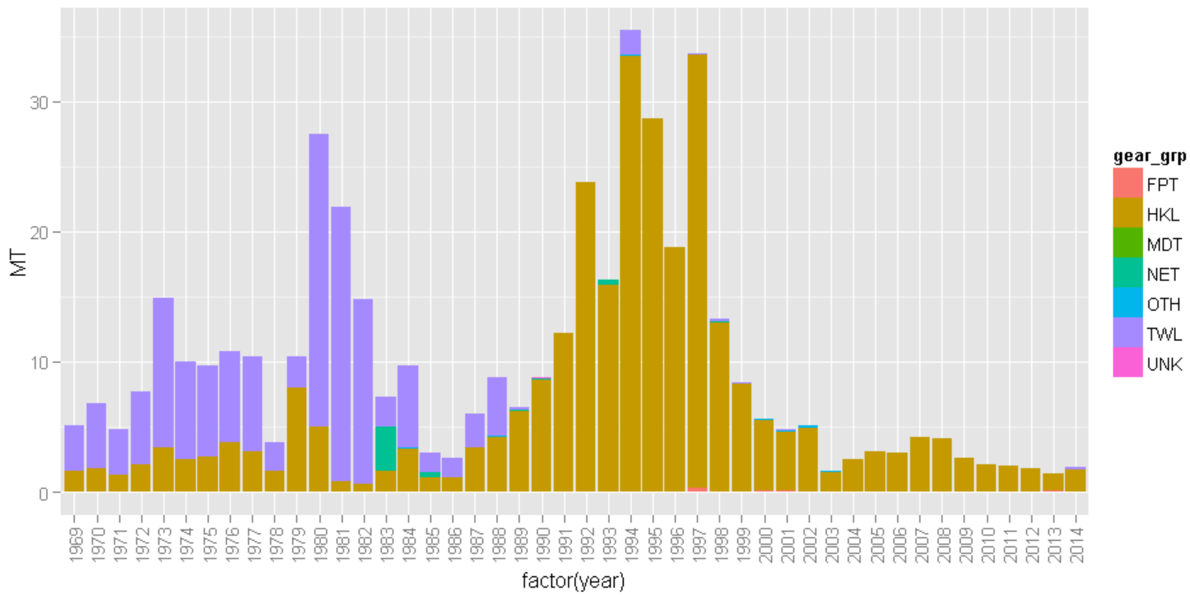


Figure 6: Estimated commercial landings of China rockfish (mt) in California by year and gear group (Source: CALCOM).

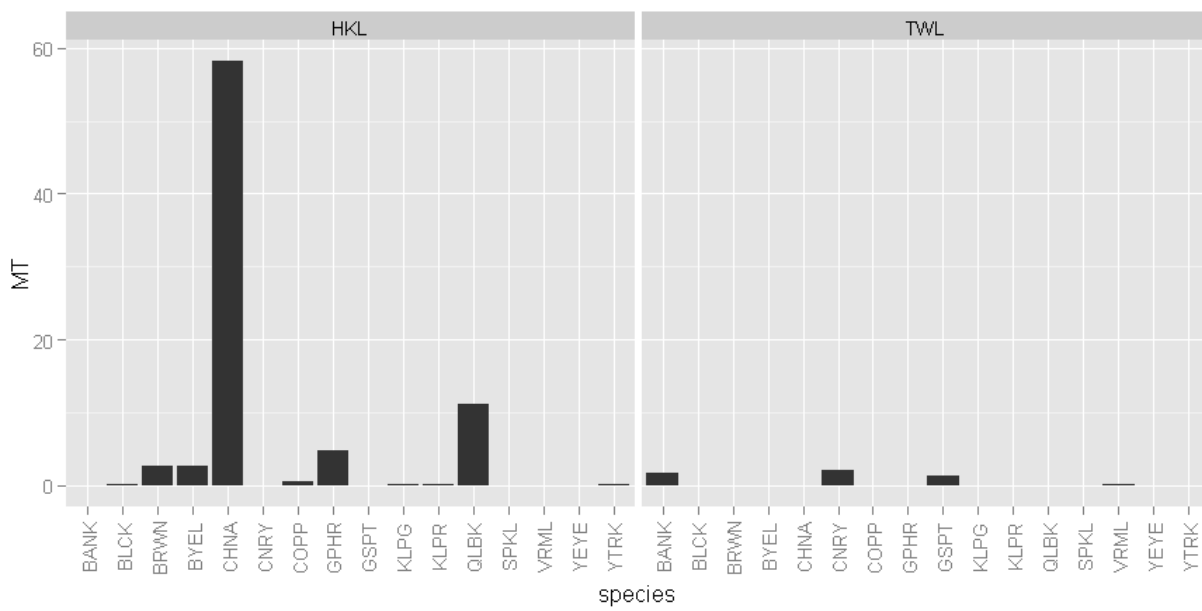


Figure 7: California commercial landings (mt) based on port samples in the China rockfish market category (258) by species and gear group, 1969-2014. hook-and-line ("HKL") gears are landing nearshore species in this category, mainly China rockfish, whereas trawl ("TWL") gears landed species with a deeper depth distribution, and no China rockfish.

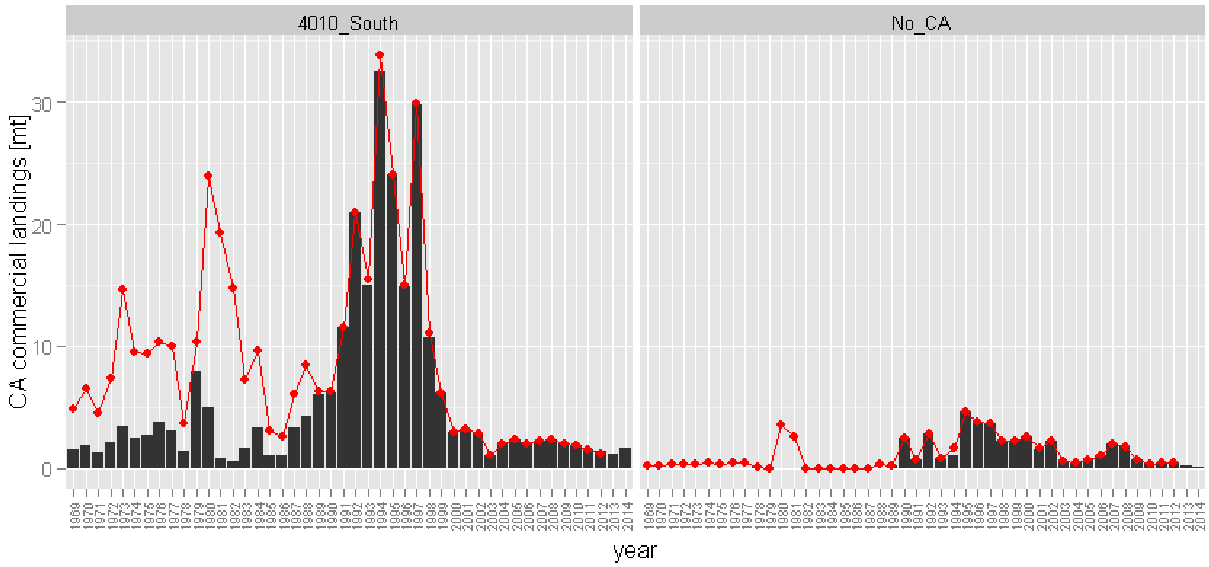


Figure 8: Revised California commercial landing estimates (mt) of China rockfish, north and south of Cape Mendocino, 1969-2014 (black bars). Estimates of California's annual landed commercial catch used in the 2013 stock assessment are plotted for comparison (red line).

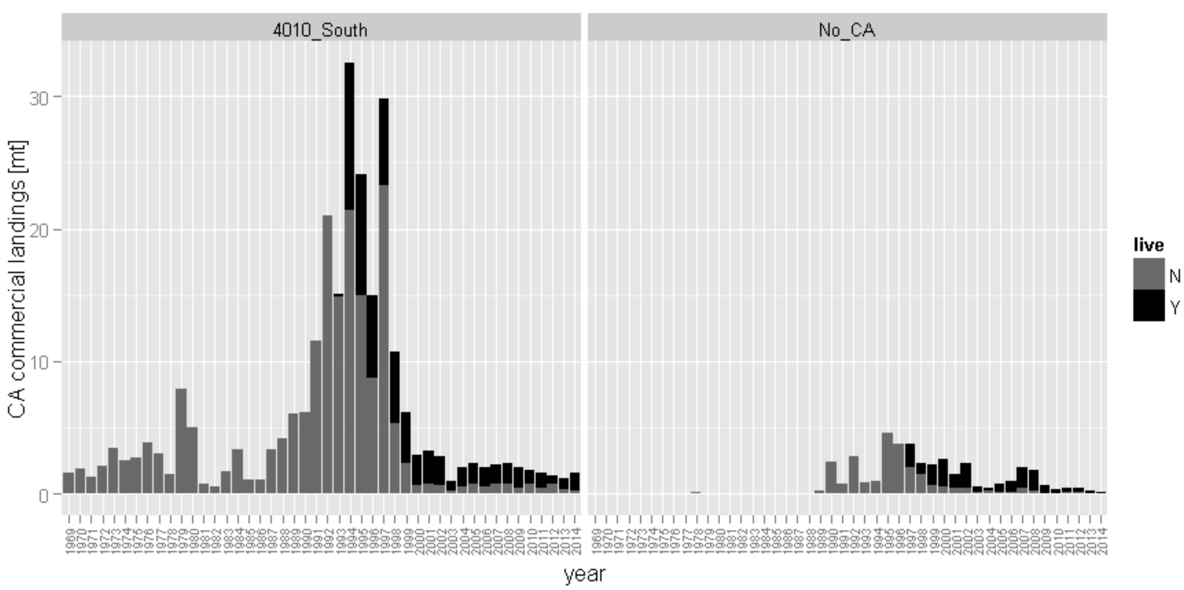


Figure 9: Revised commercial landing estimates (mt) of China rockfish landed live and dead, north and south of Cape Mendocino, 1969-2014.

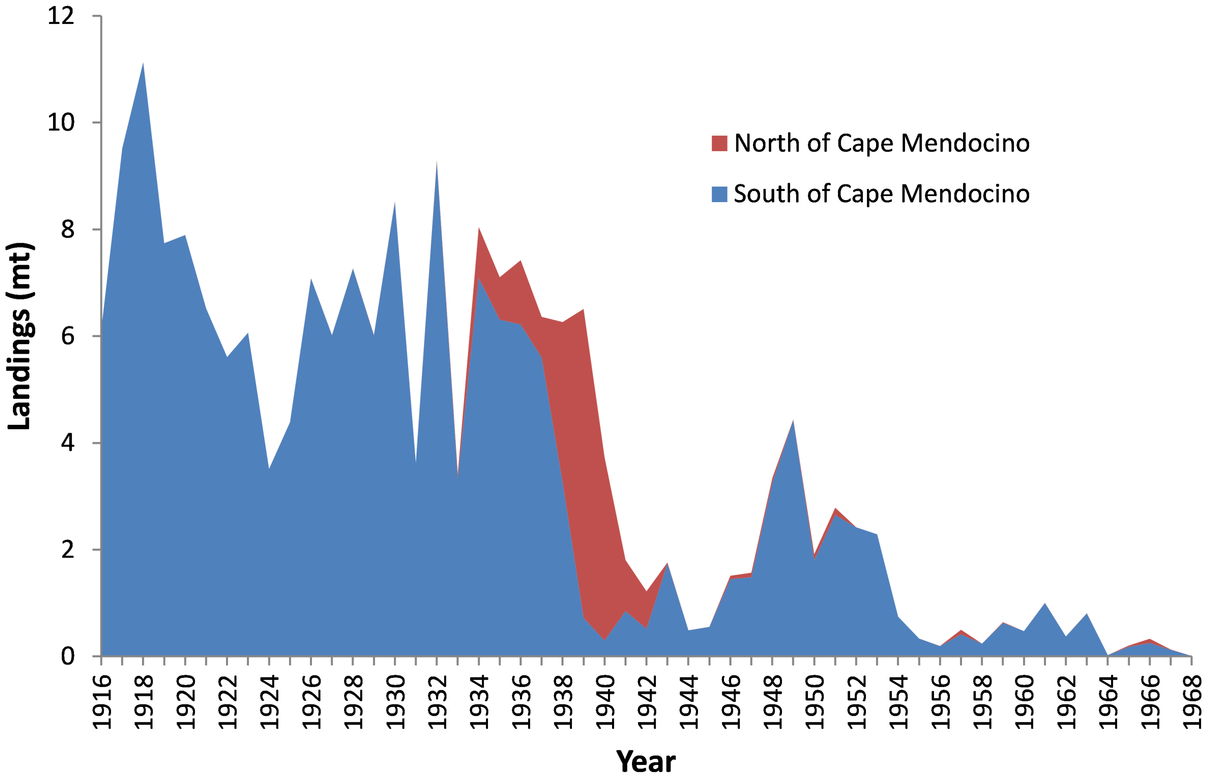


Figure 10: Reconstructed historical commercial landings of China rockfish in California, excluding trawl gear landings, 1916-1968. Source: Ralston et al. 2010

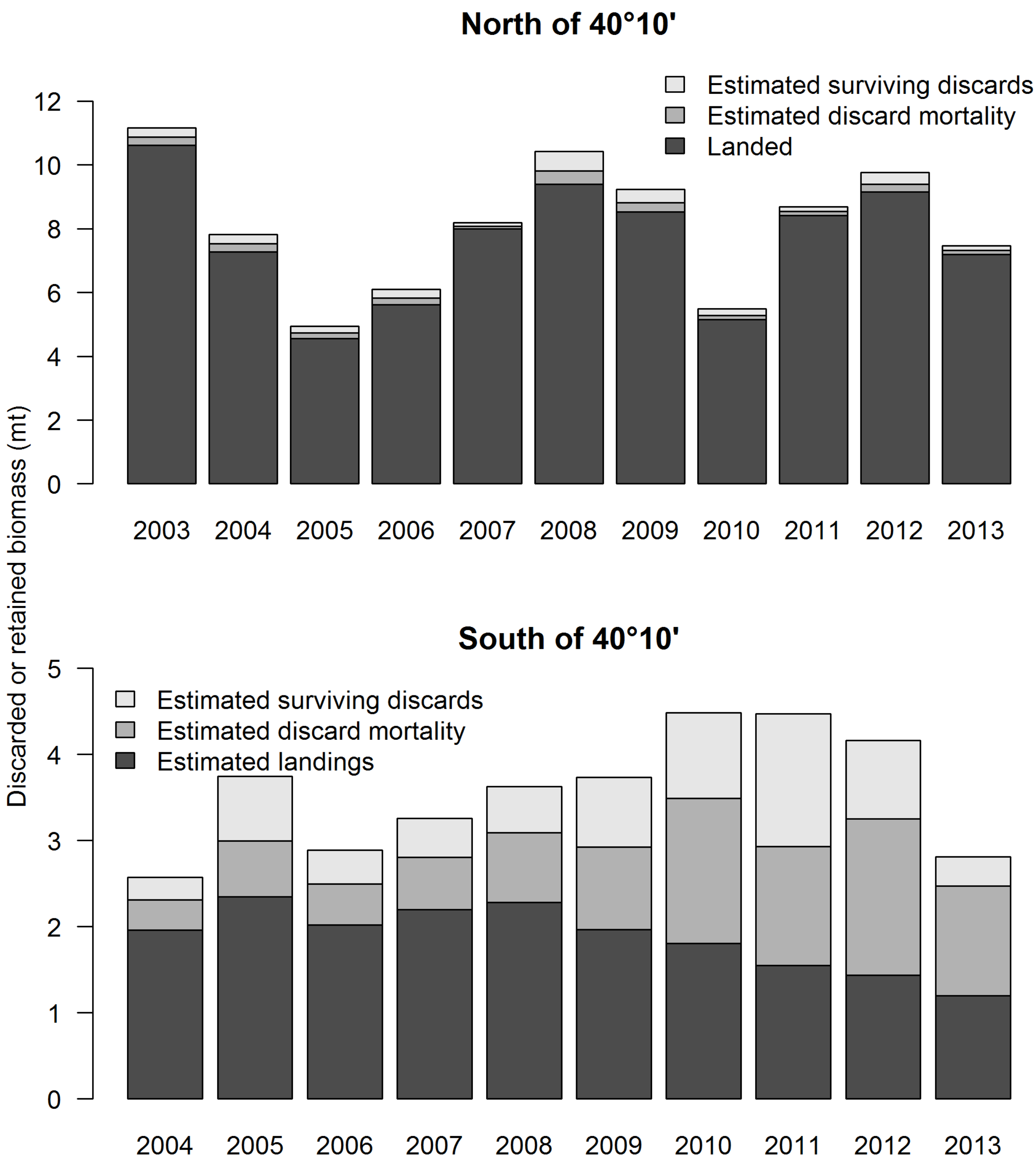


Figure 11: Estimates of discarded and retained China rockfish north and south of 40°10′ in the commercial Nearshore Fixed-gear fishery. Note that the y-axis limits and range of years differ between panels.

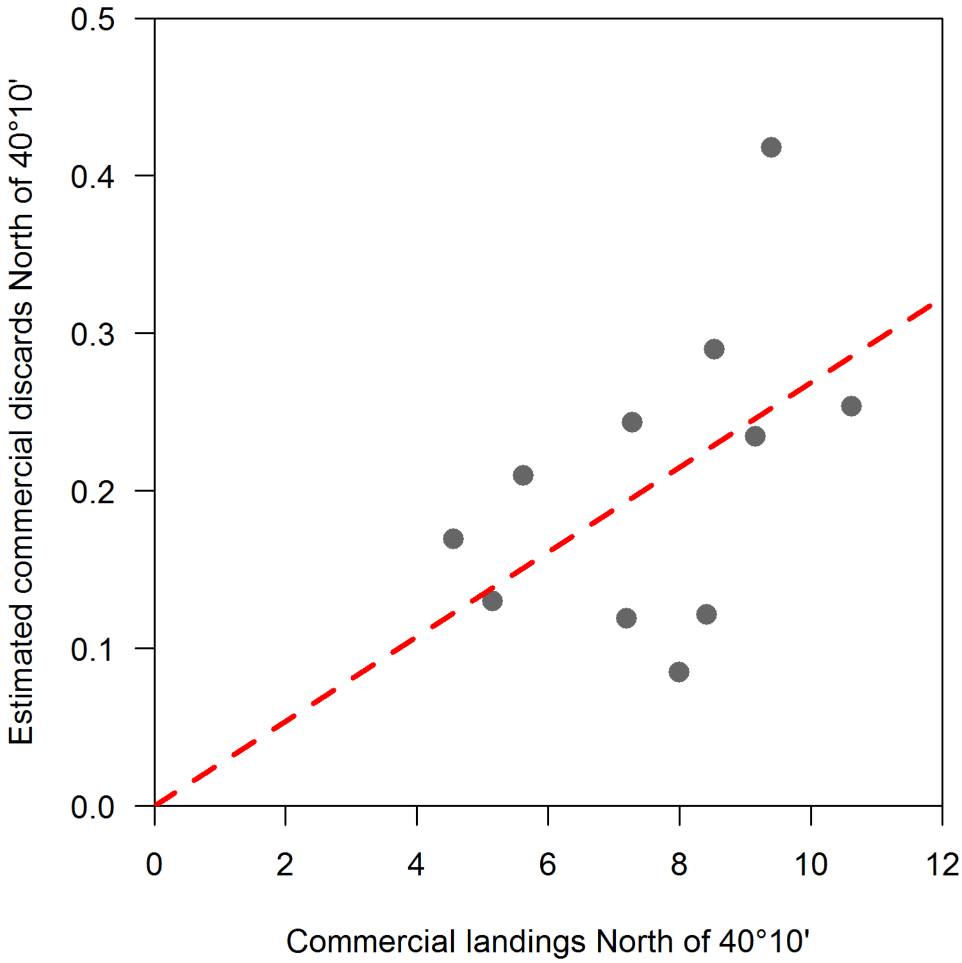


Figure 12: Relationship between estimated discards and landings of China rockfish in the Nearshore Fixed-gear fishery north of 40°10′. The gray points indicate estimates from individual years and the red line is a linear regression through those estimates with intercept fixed at 0. The slope of the linear regression is 0.0269, indicating that discards on average represent 2.69% of the landings in this sector.

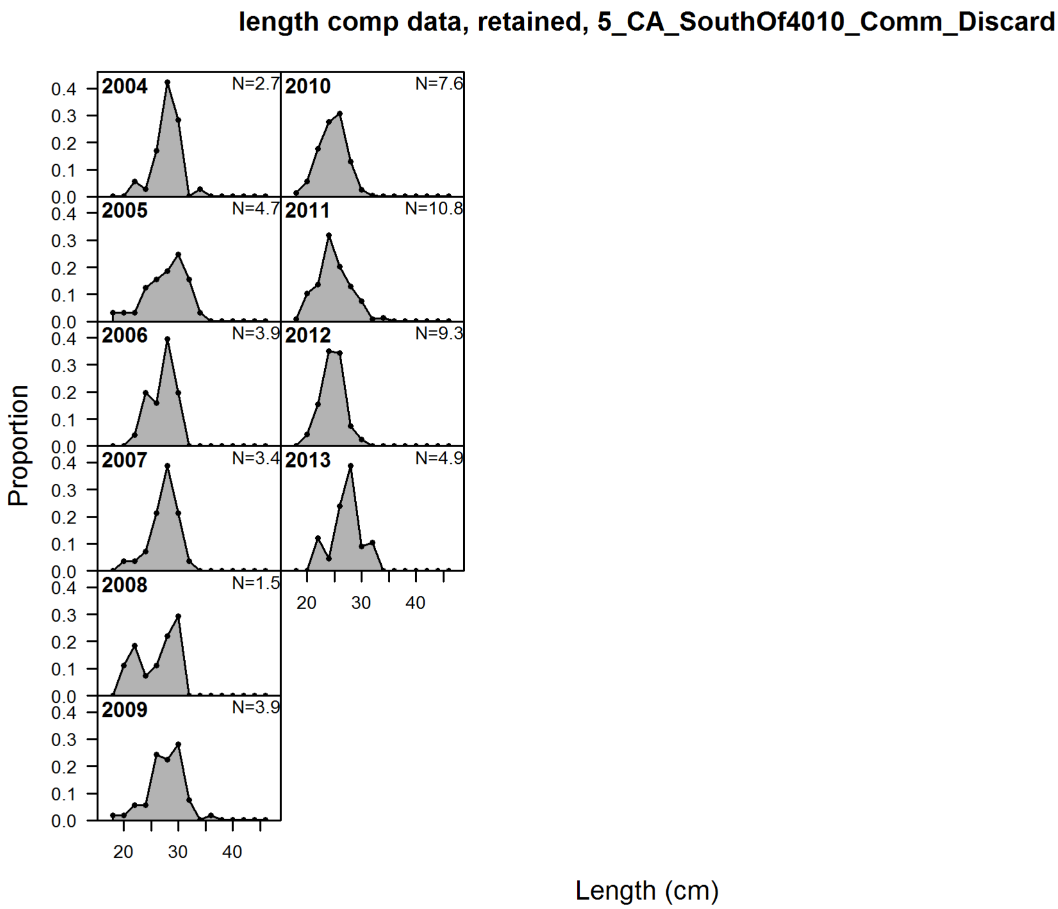


Figure 13: Length compositions by year for discarded fish in the California commercial fishery south of 40°10′.

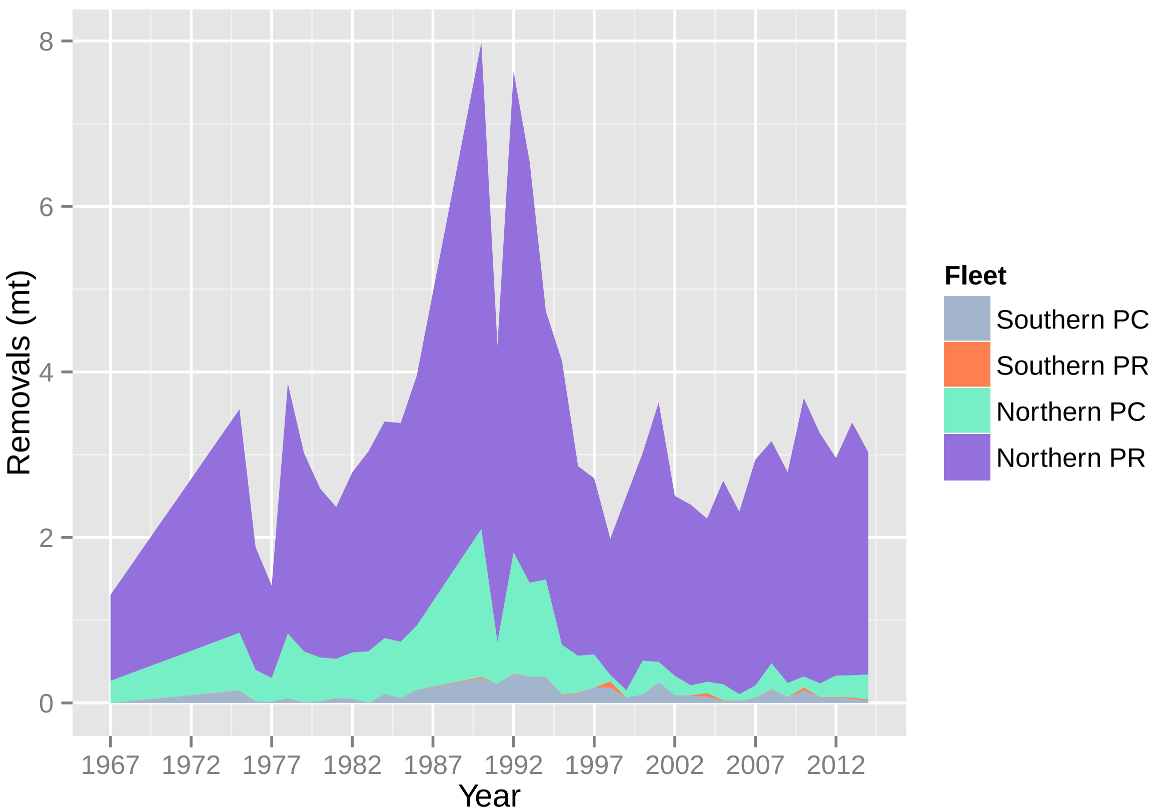


Figure 14: Removals (mt) from the Washington recreational party/charter and private sectors. Northern WA represents MCAs 3 and 4 and soutern WA represents MCAs 1 and 2.

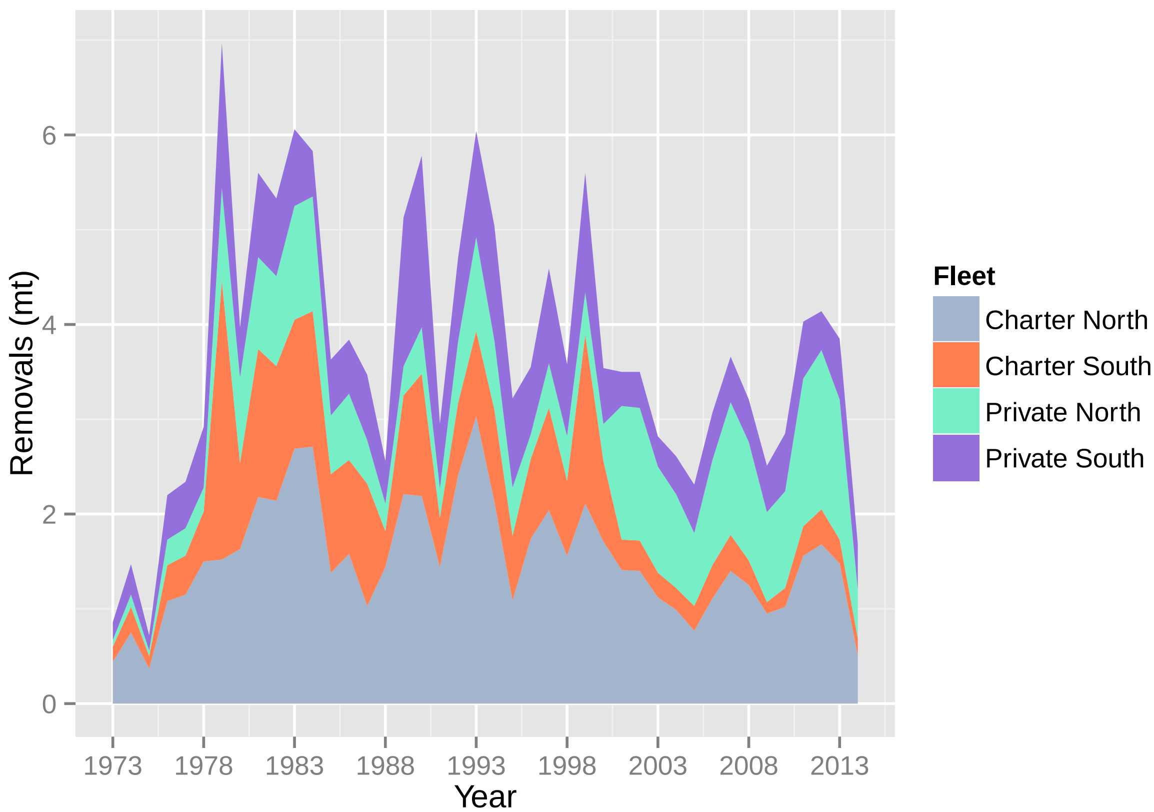


Figure 15: Removals (mt) from the Oregon recreational party/charter and private sectors, north and south of Florence, OR.

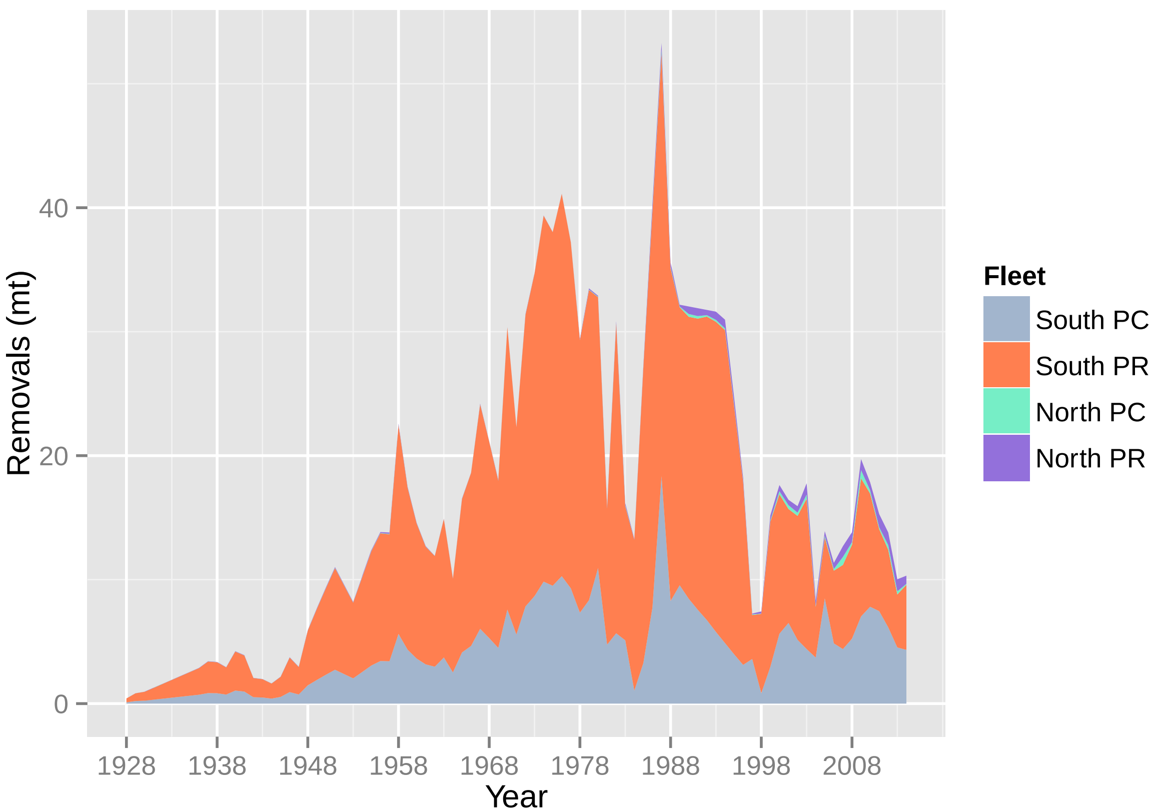


Figure 16: Removals (mt) from the California recreational party/charter and private sectors, north and south of 40°10′.

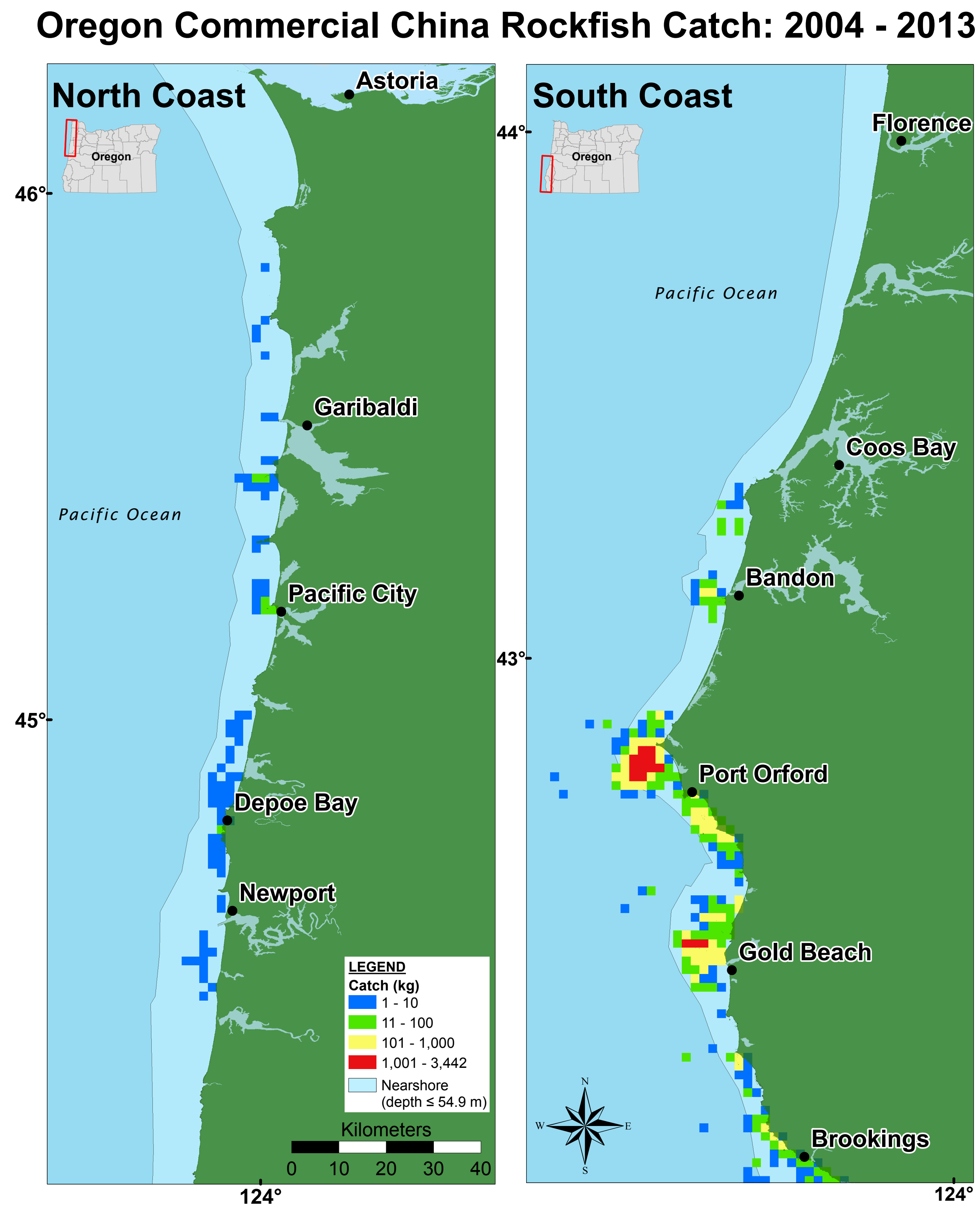


Figure 17: Landings from the commercial fishery logbooks in Oregon. All fishing locations follow the confidentiality guidelines and were fished by at least three vessels during the study.

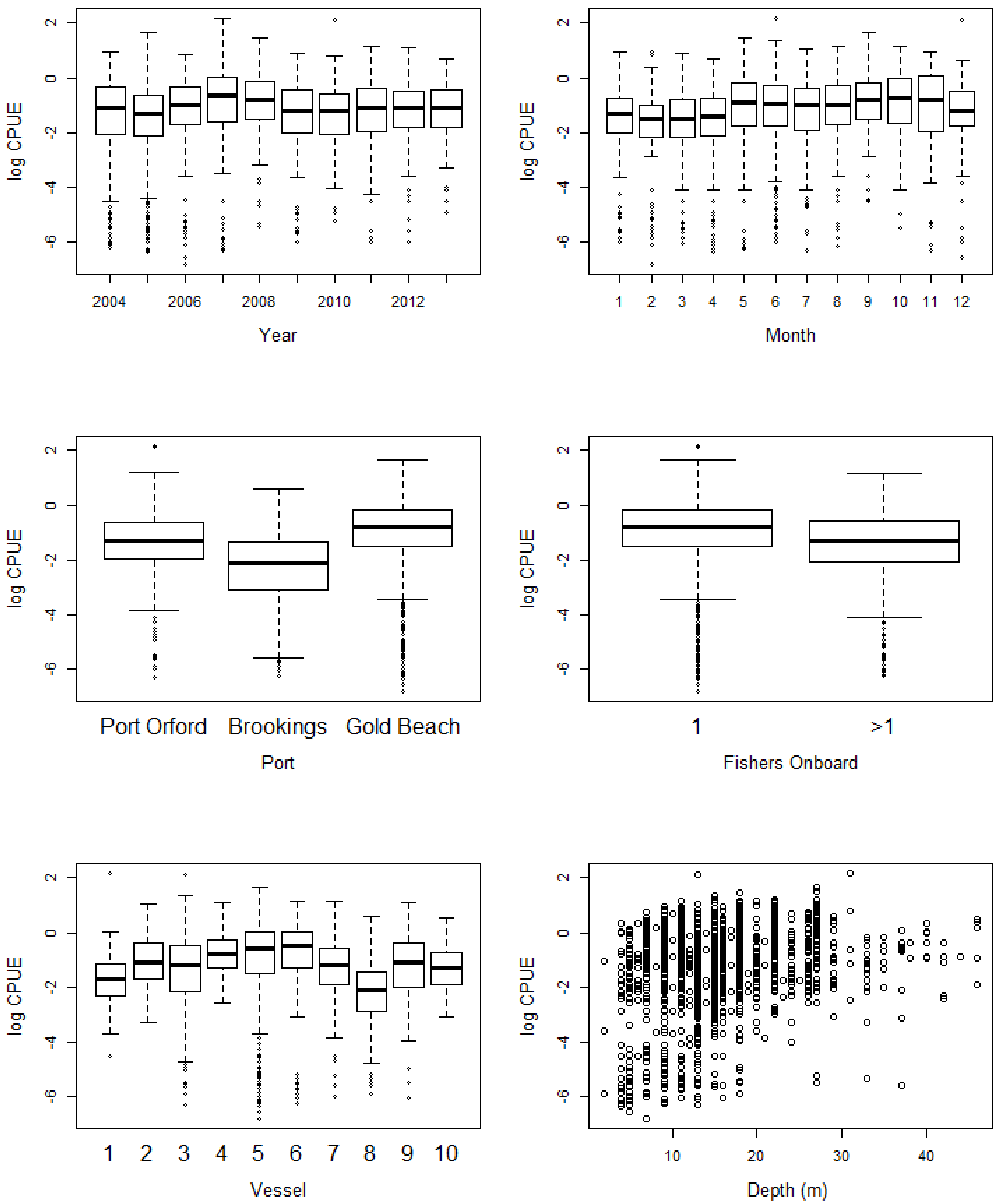


Figure 18: The distribution of set-level raw positive catch CPUE data relative to potential covariates evaluated in the China rockfish Oregon commercial logbook delta-GLM analysis.

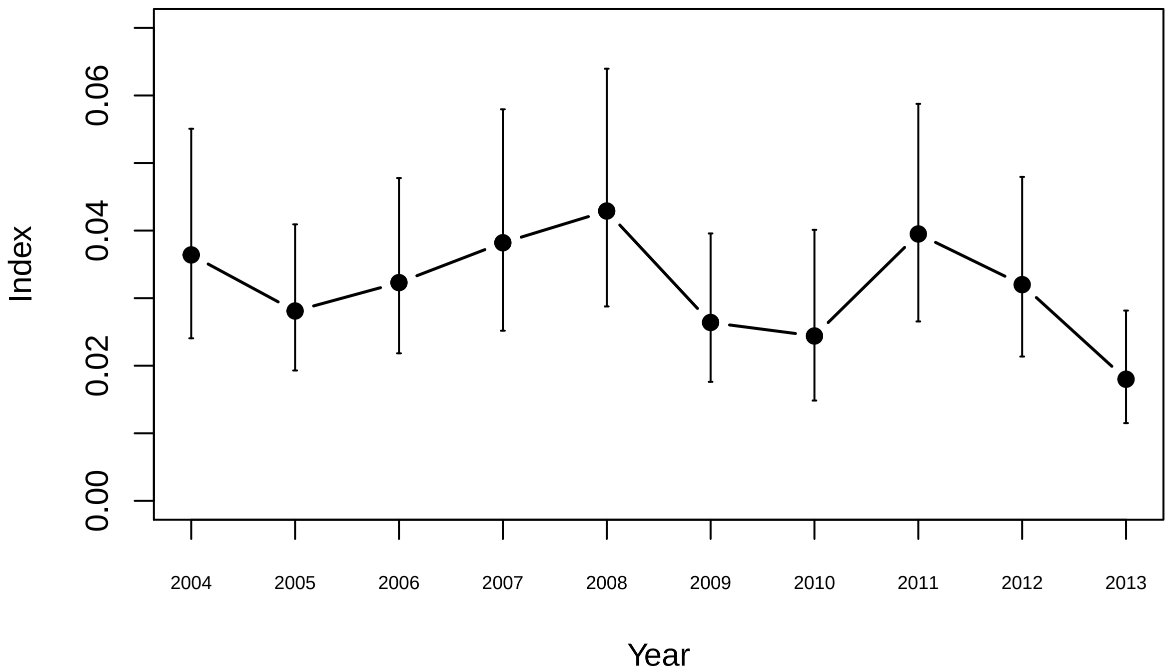


Figure 19: Index for the Oregon commercial logbook, with 95% lognormal confidence intervals.

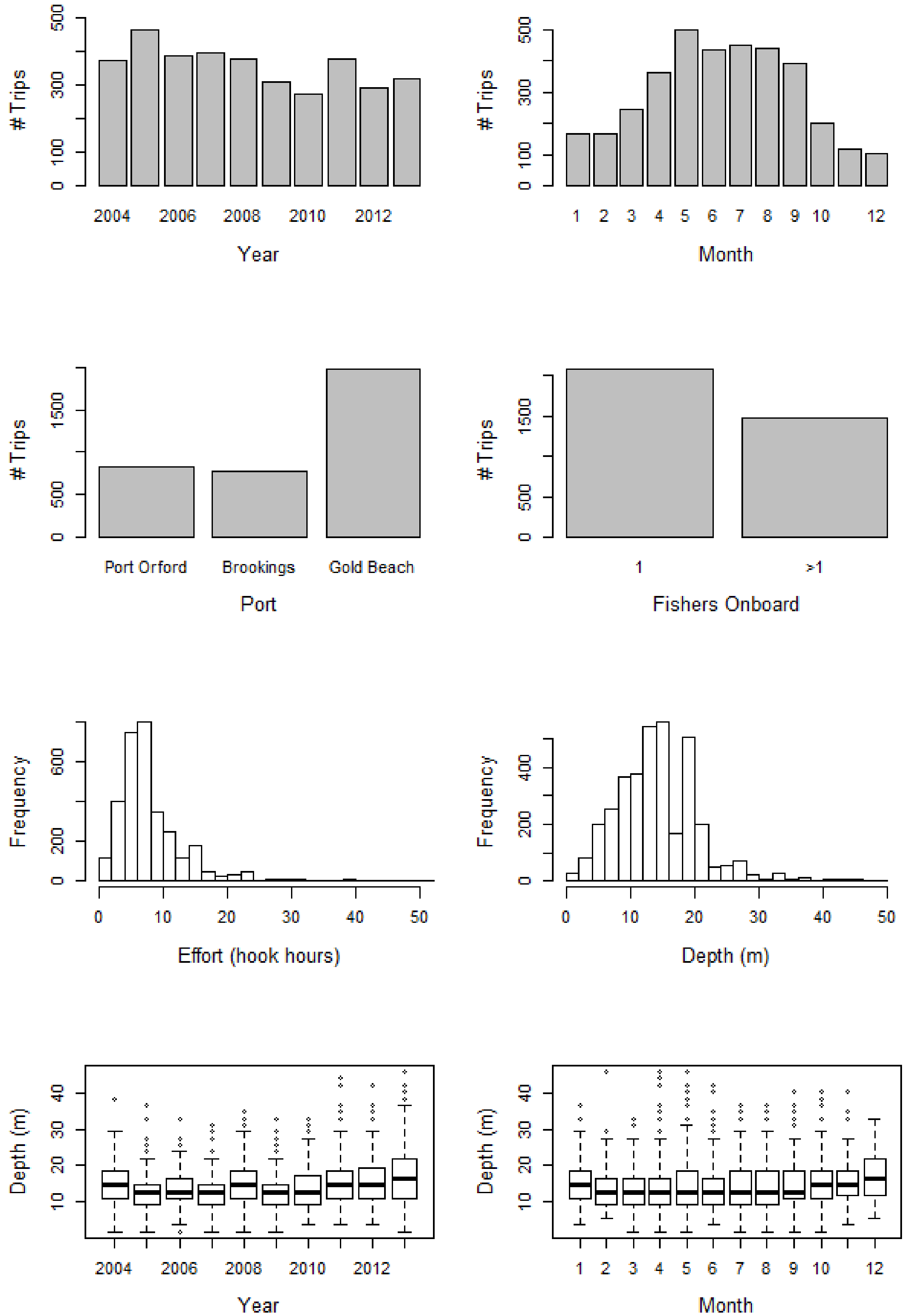


Figure 20: Characterization of the final subset of Oregon commercial logbook data used in delta-GLM analyses for China rockfish.

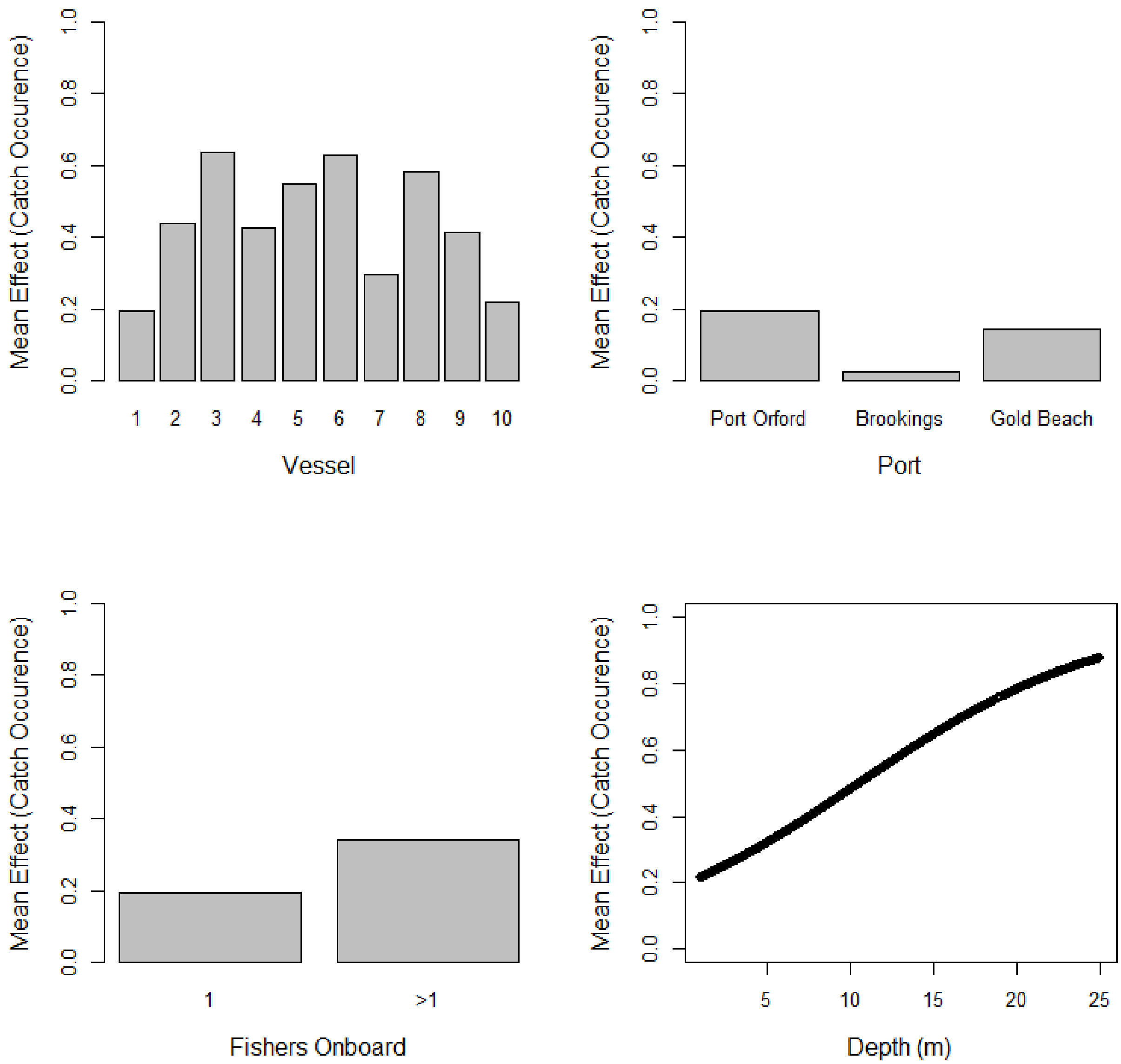


Figure 21: Summary of the relative effects of each covariate in the catch occurrence model component for the Oregon commercial logbook index.

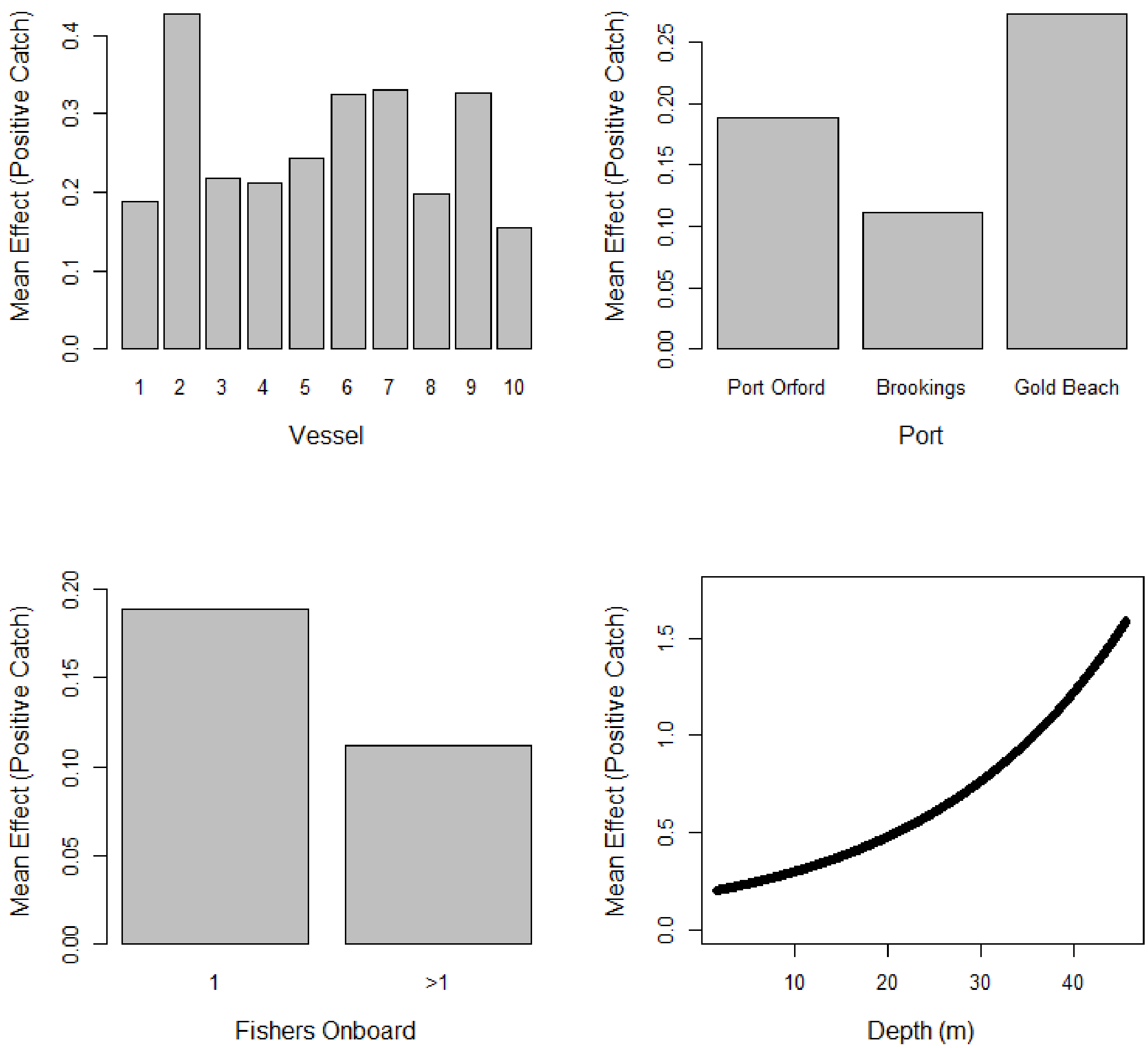


Figure 22: Summary of the relative effects of each covariate in the positive catch model component for China rockfish in the Oregon commercial logbook index.

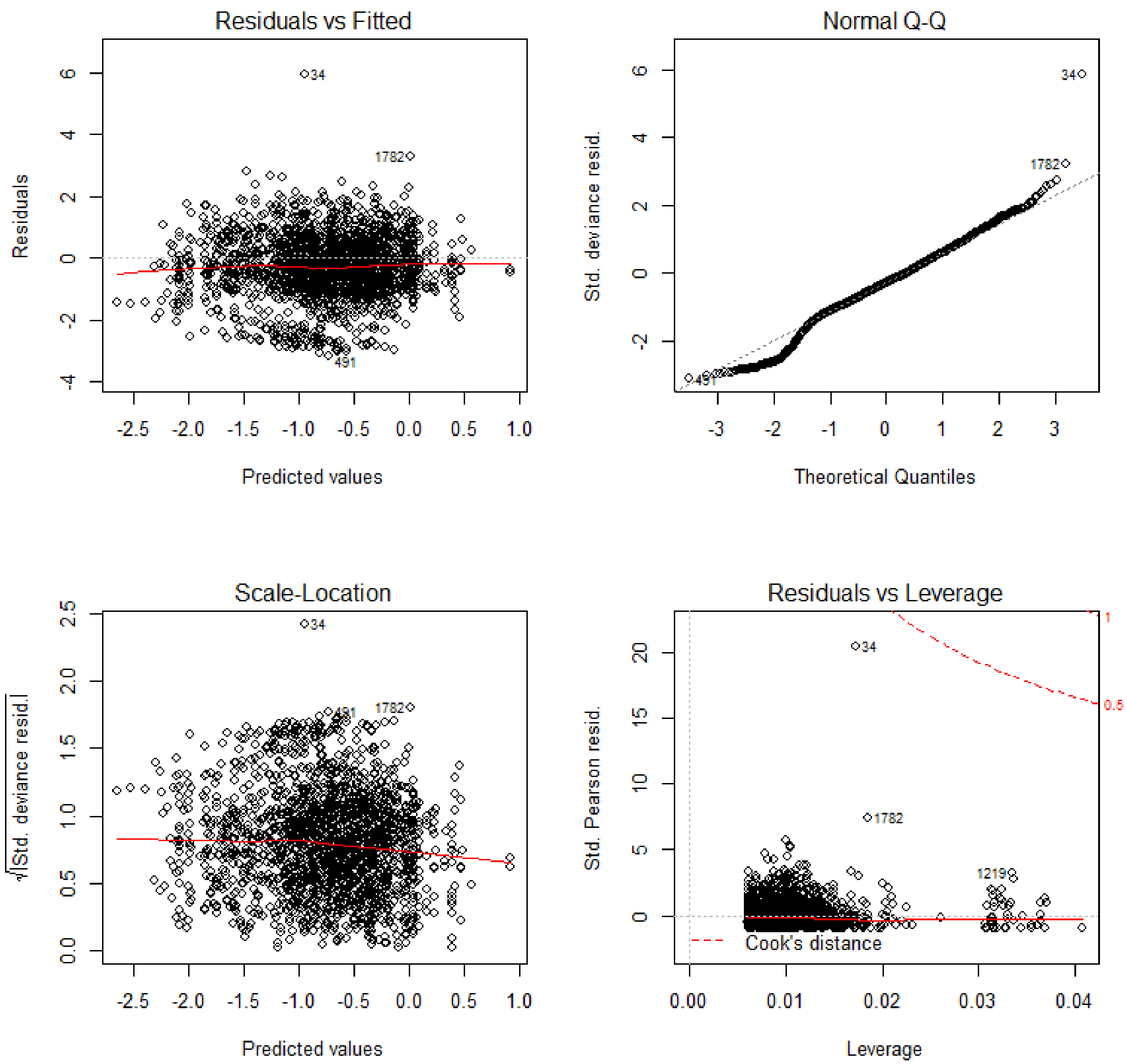


Figure 23: Diagnostic plots for the China rockfish positive catch component delta-GLM model for the Oregon commercial logbook index. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

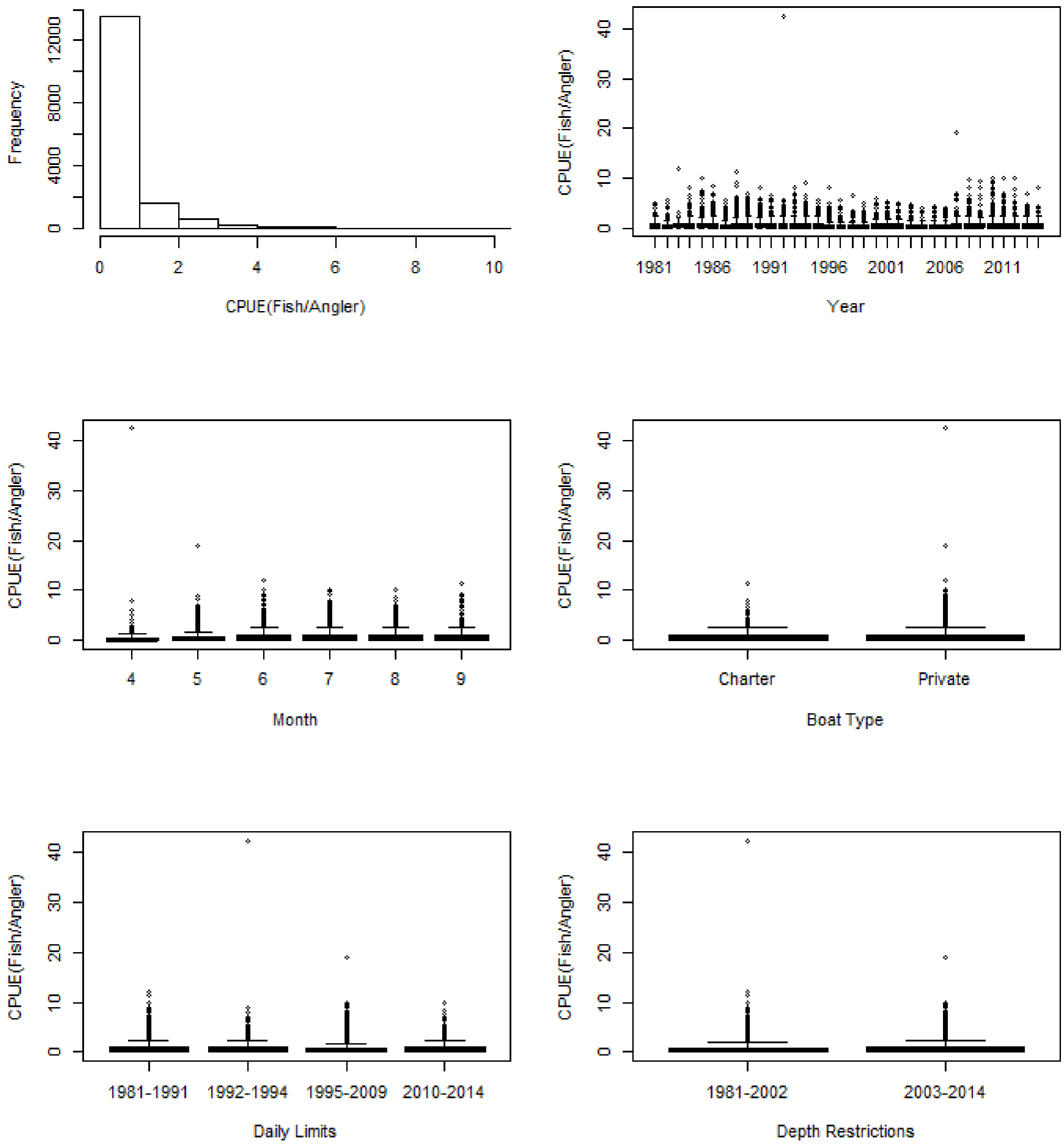


Figure 24: Summary data plots for the data set with Stephens-MacCall filtering for the Washington dockside index.

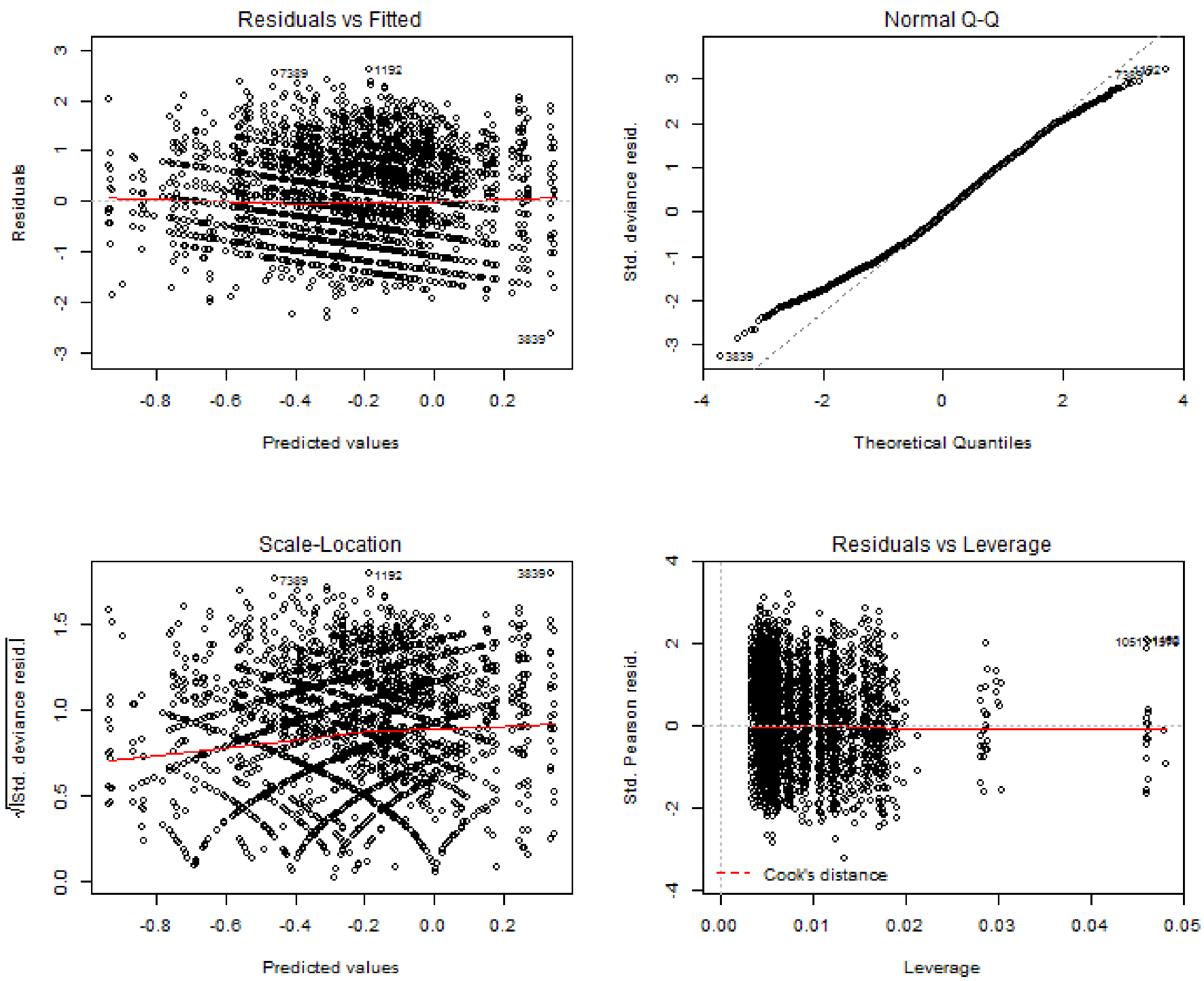


Figure 25: Diagnostic plots for the China rockfish positive catch component longnormal delta-GLM model for the dataset applying the Stephens-MacCall data filter for the Washington dockside index. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

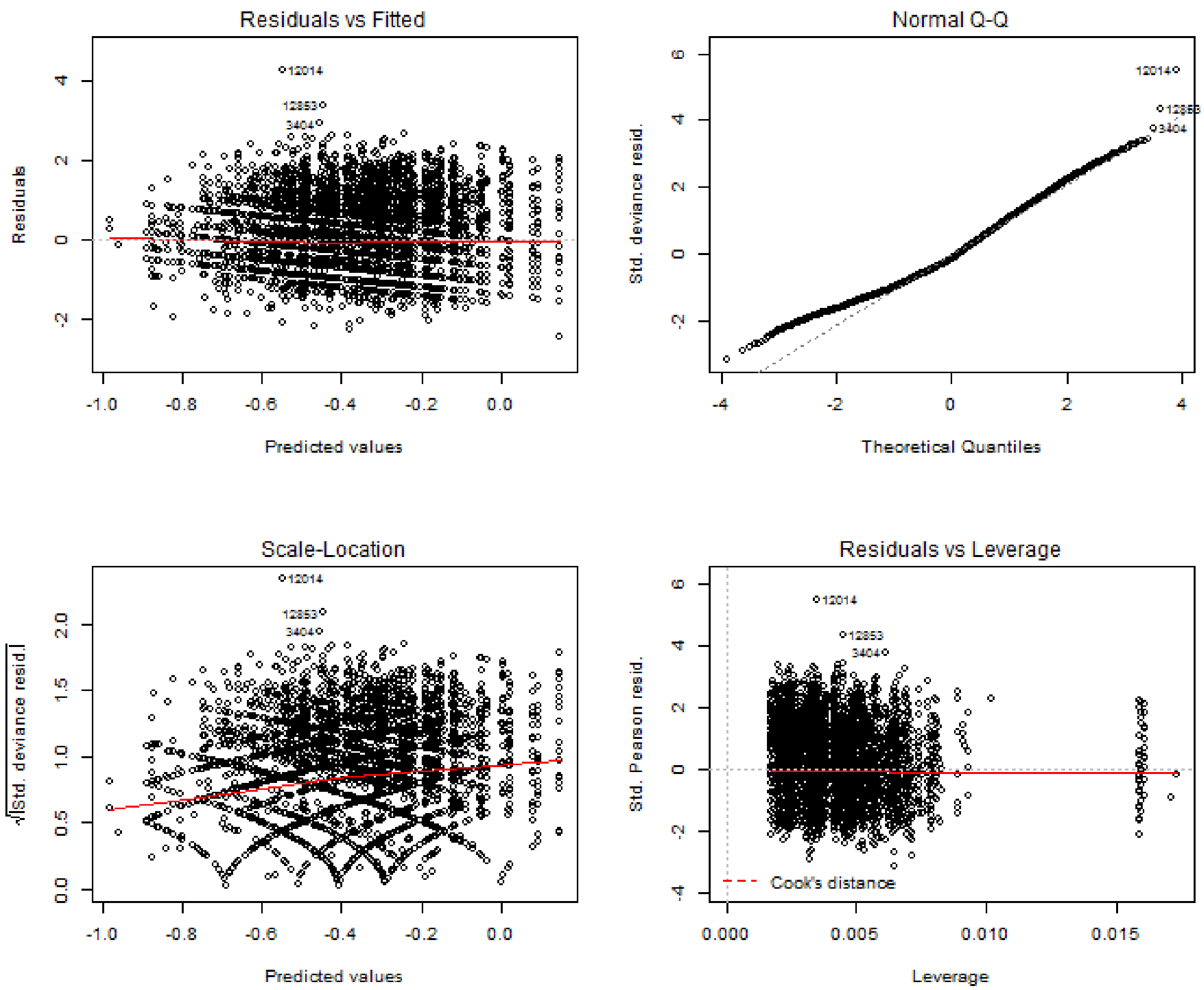


Figure 26: Diagnostic plots for the China rockfish positive catch component longnormal delta-GLM model for the dataset applying the Stephens-MacCall data filter, but retaining all of the positive records for the Washington dockside index. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

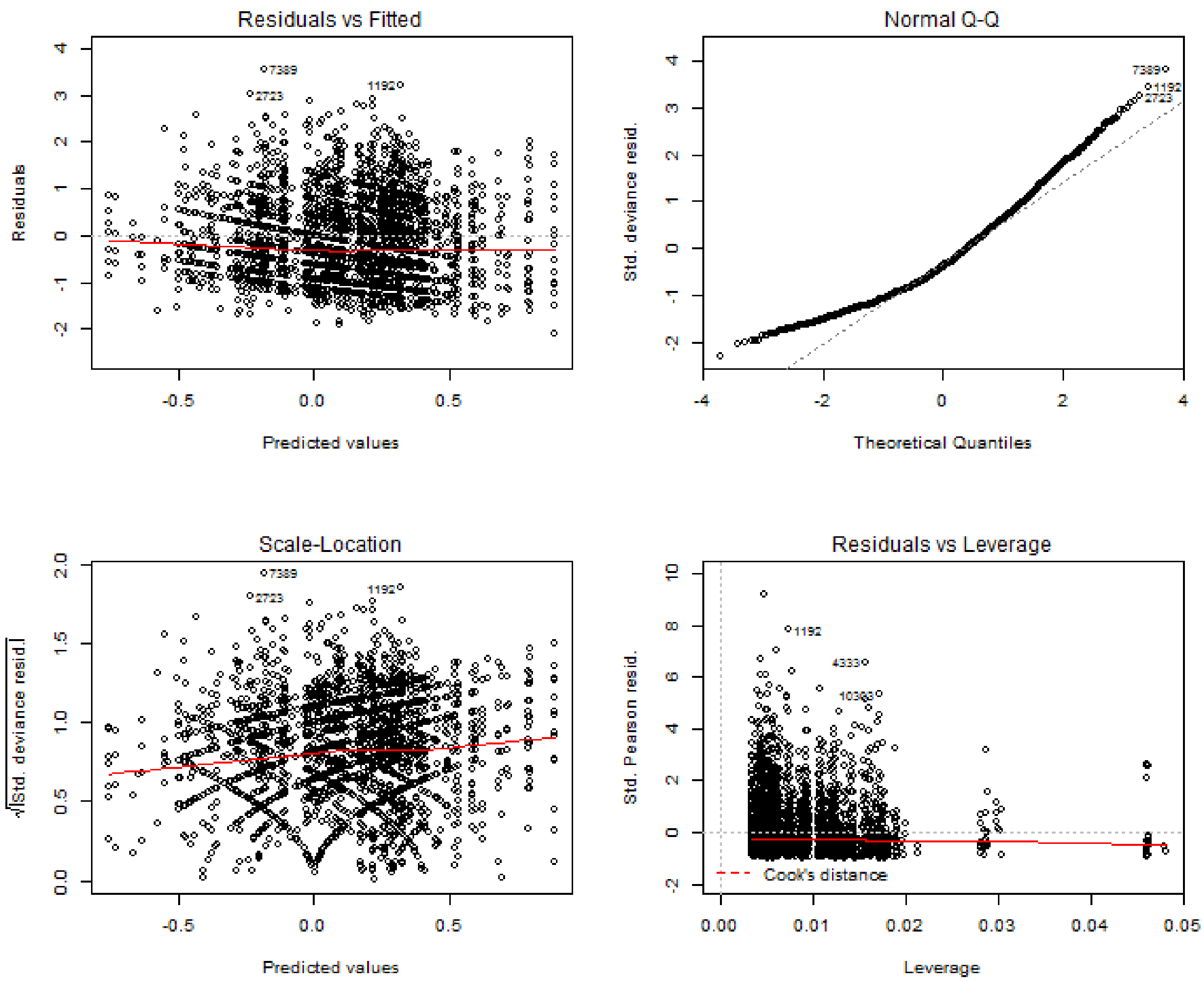


Figure 27: Diagnostic plots for the China rockfish positive catch component gamma delta-GLM model for the dataset without Stephens-MacCall filtering for the Washington dockside index. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

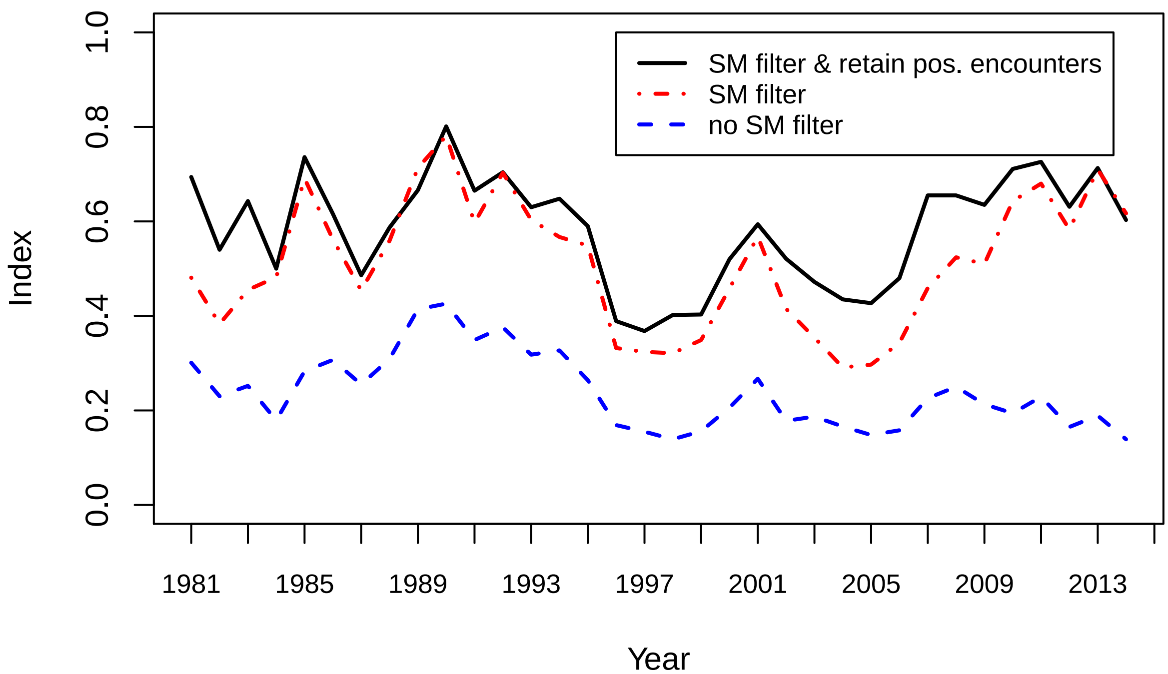


Figure 28: Three indices considered for the Washington dockside program, applying the Stephens-MacCall filters and retaining all positive encounters (black),applying the Stephens-MacCall filter and retaining only those trips above the threshold value (red), and the index with no Stephens-MacCall filter applied.

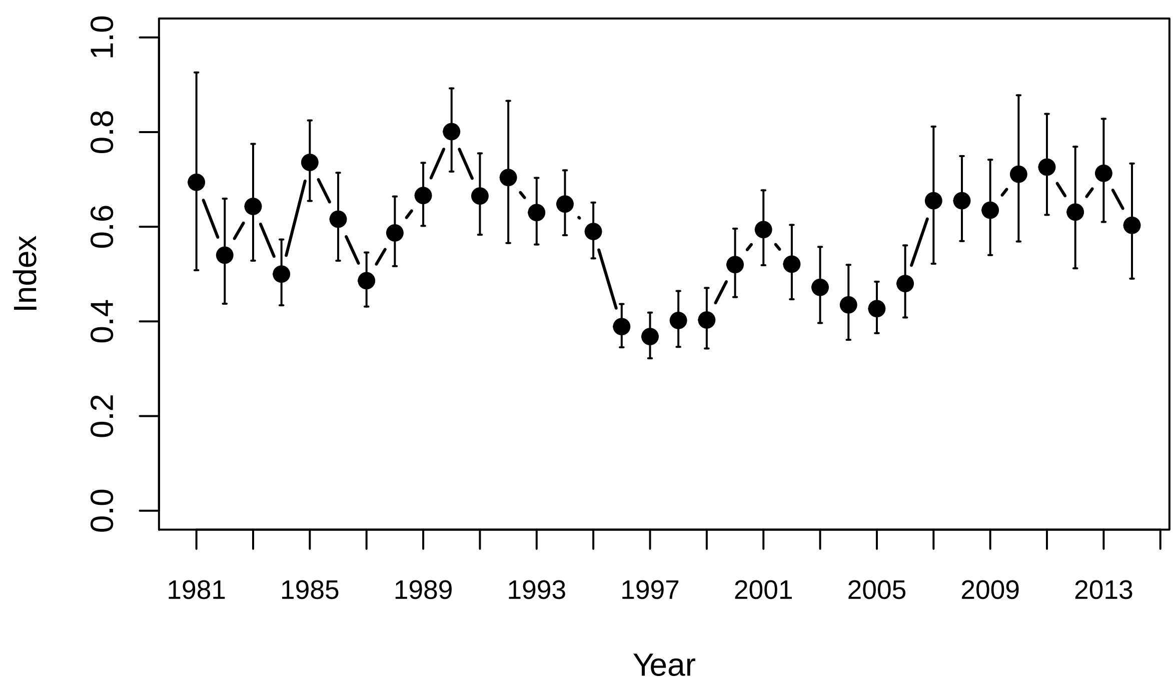


Figure 29: Index for the Washington dockside program, with 95% lognormal confidence intervals, applying the Stephens-MaCall data filter and retaining all positive observations.

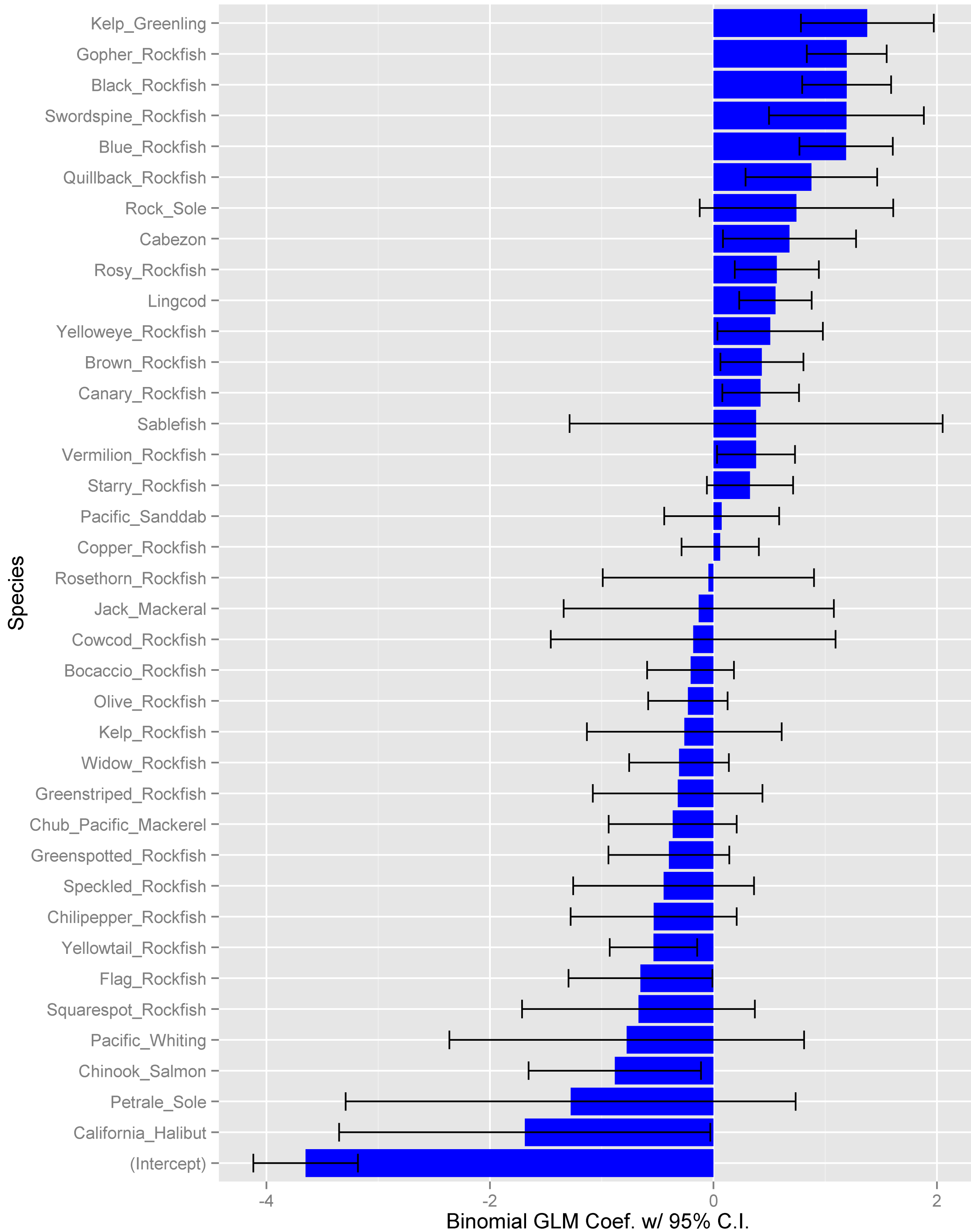


Figure 30: Species coefficients from the binomial GLM for presence/absence of China rockfish in the MRFSS data for California south of 40°10′ N. latitude. Horizontal bars are 95% confidence intervals. Albacore coefficient (<-10) excluded for scale.

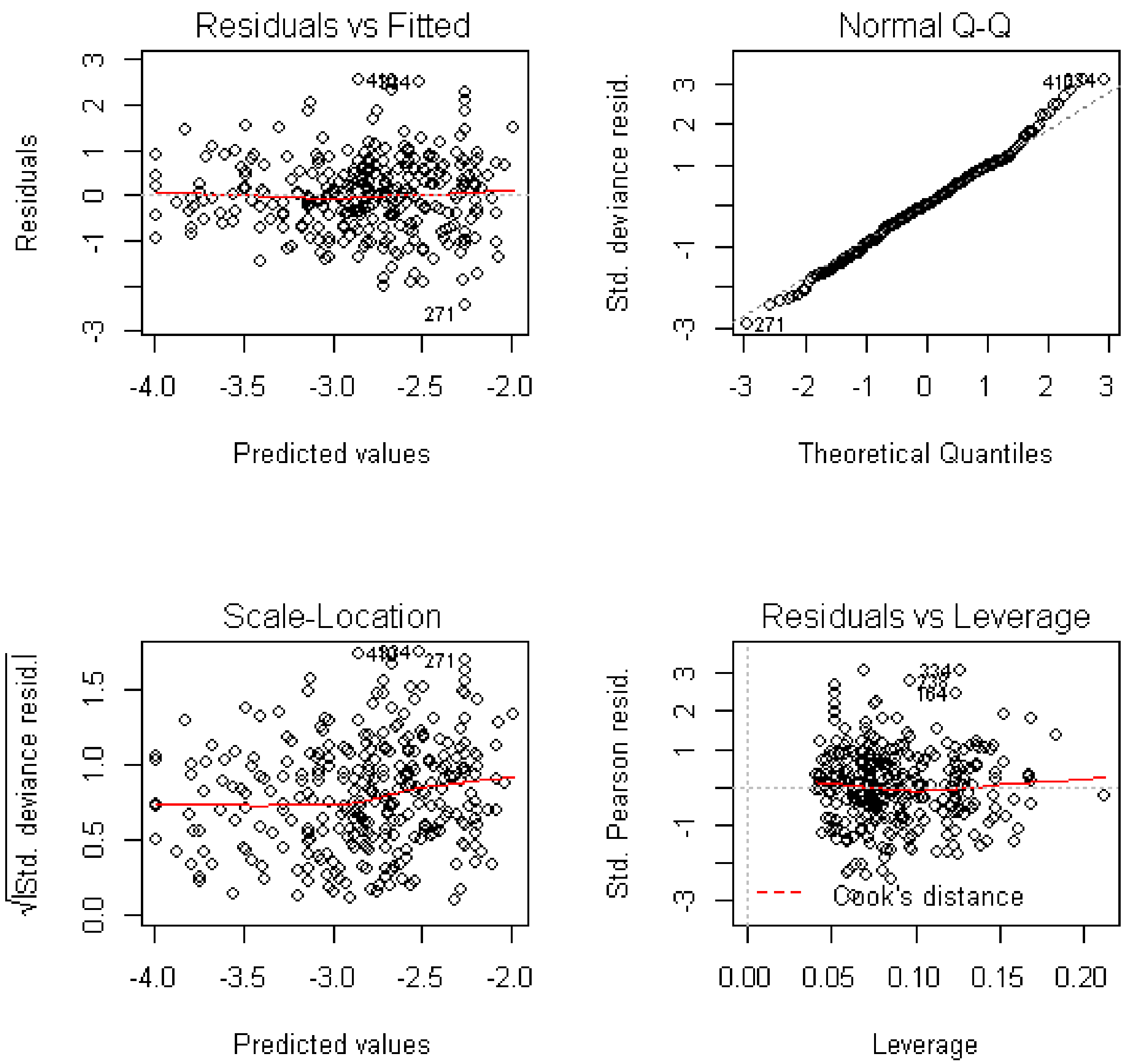


Figure 31: Diagnostic plots for the China rockfish delta-GLM index (lognormal component) for the MRFSS data for California south of 40°10′ N. latitude. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

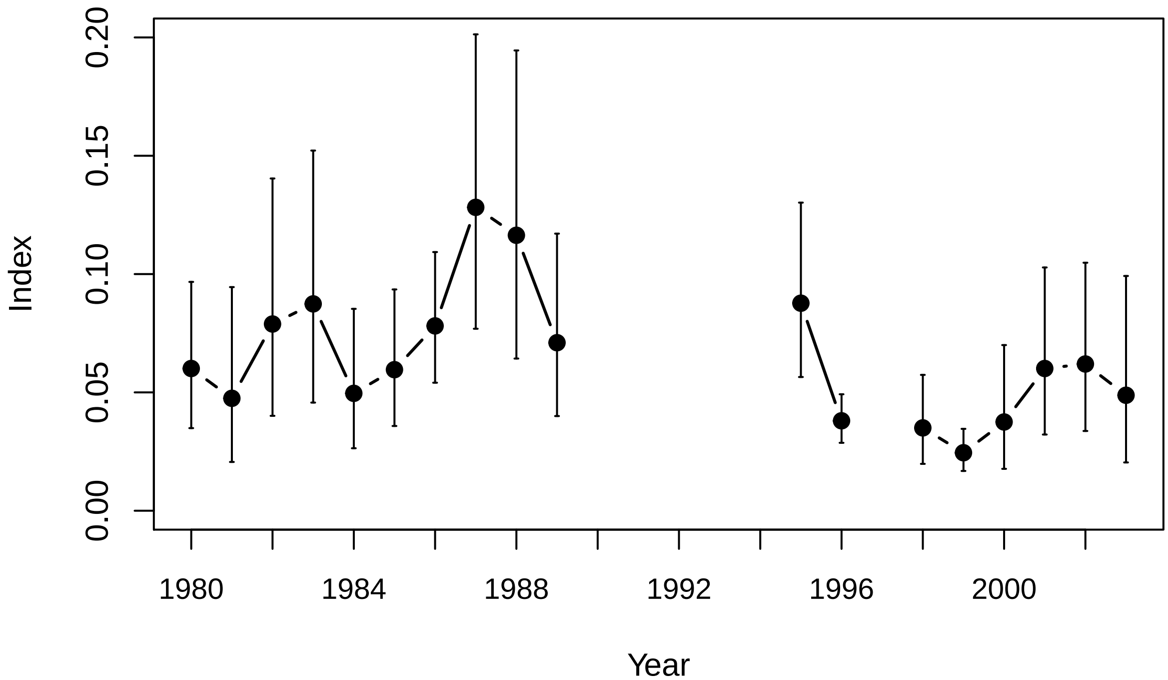


Figure 32: Index for the MRFSS data for California south of 40°10′ N. latitude, with 95% lognormal confidence intervals.

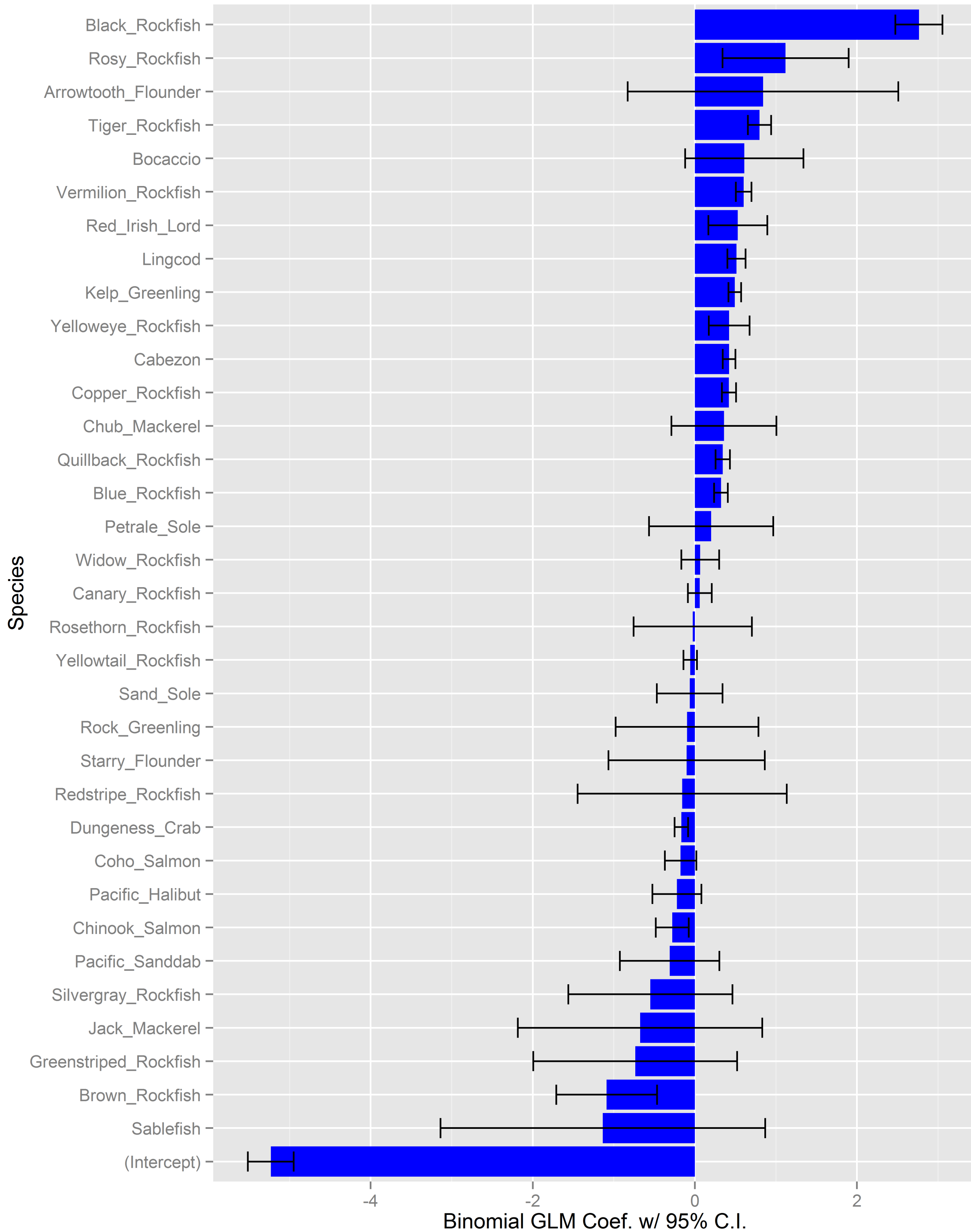


Figure 33: . Species coefficients from the binomial GLM for presence/absence of China rockfish in the Oregon Recreational Boat Survey (ORBS) data set. Horizontal bars are 95% confidence intervals.

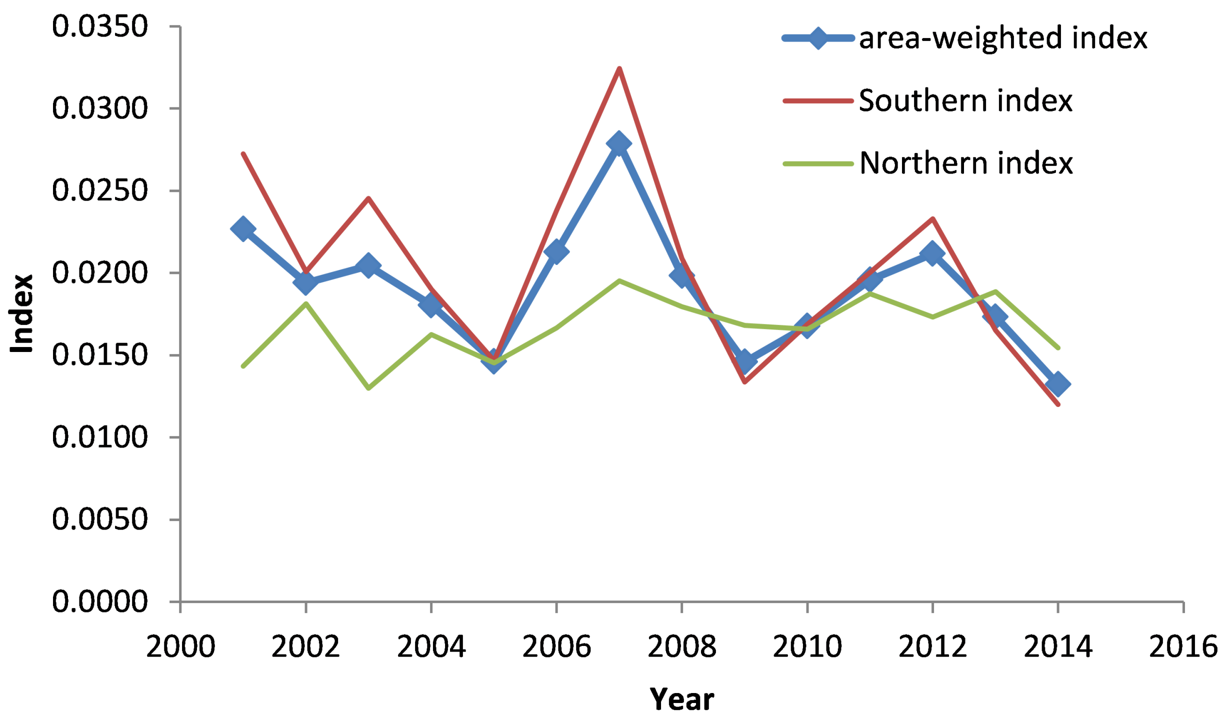


Figure 34: . Comparison of delta-GLM index trends in Southern Oregon, Northern Oregon, and a habitat area-weighted index.

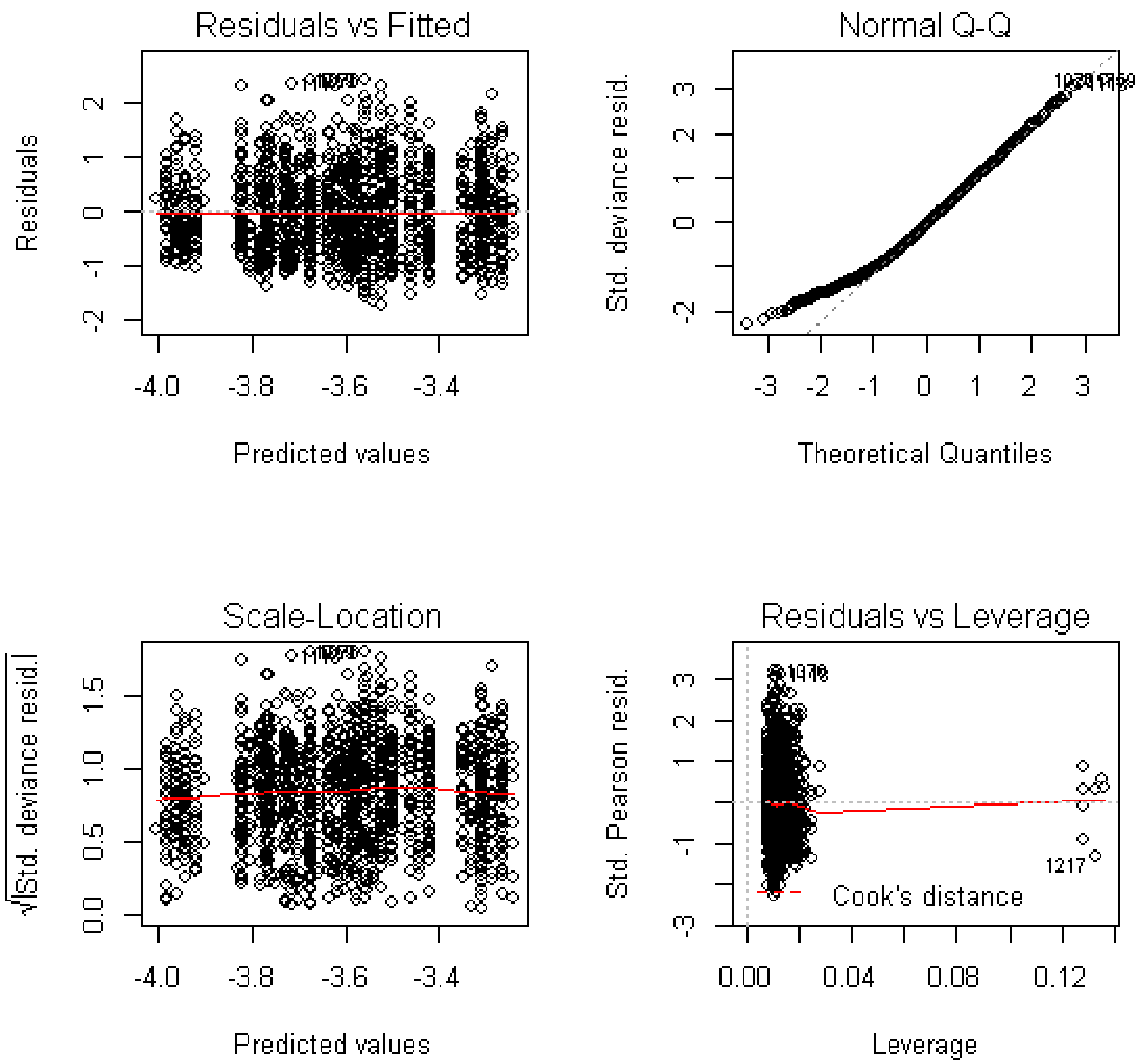


Figure 35: . Diagnostic plots for the China rockfish delta-GLM index (lognormal component) for the Southern Oregon Recreational Boat Survey (ORBS) data set. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

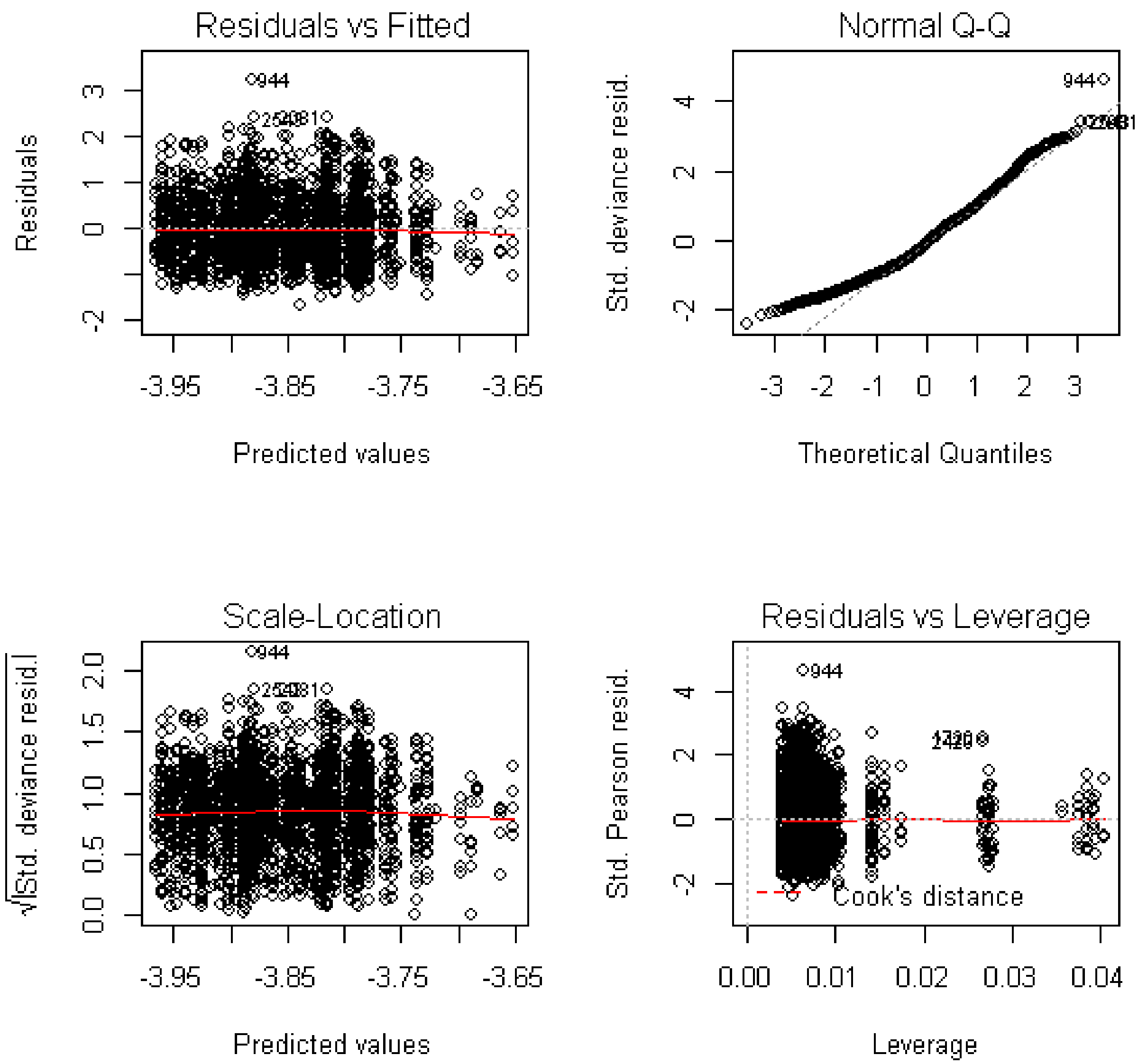


Figure 36: Diagnostic plots for the China rockfish delta-GLM index (gamma component) for the Northern Oregon Recreational Boat Survey (ORBS) data set. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

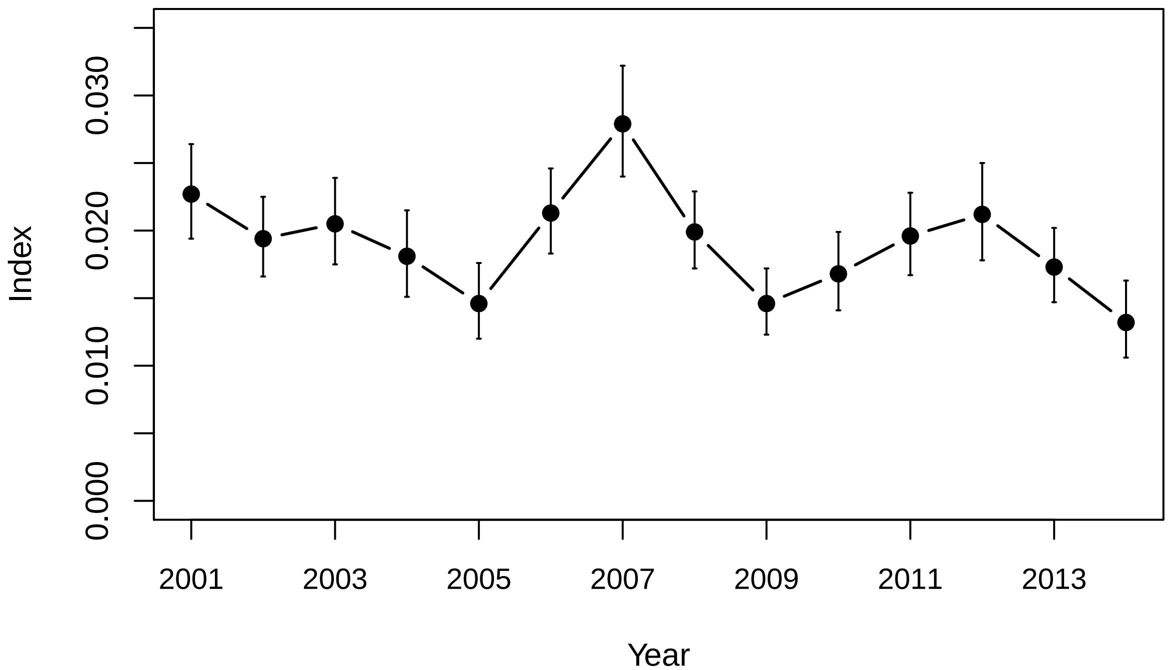


Figure 37: Oregon Recreational Boat Survey (ORBS) charter boat index (area-weighted), with 95% lognormal confidence intervals.

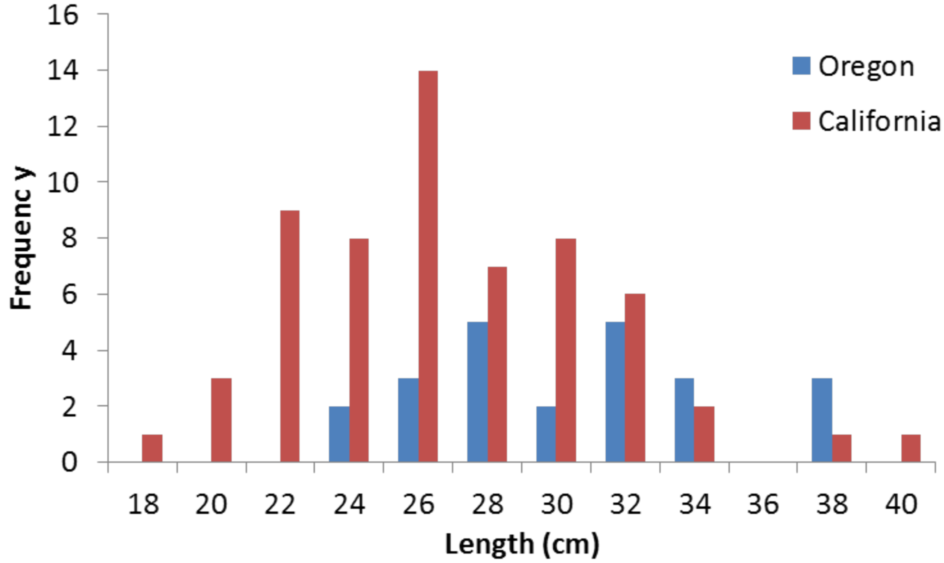


Figure 38: Frequencies of the discard lengths from the Oregon (ODFW 2001,2003-2014) and California (CDFW 1999-2014 and CalPoly 2001-2014) onboard observer programs.

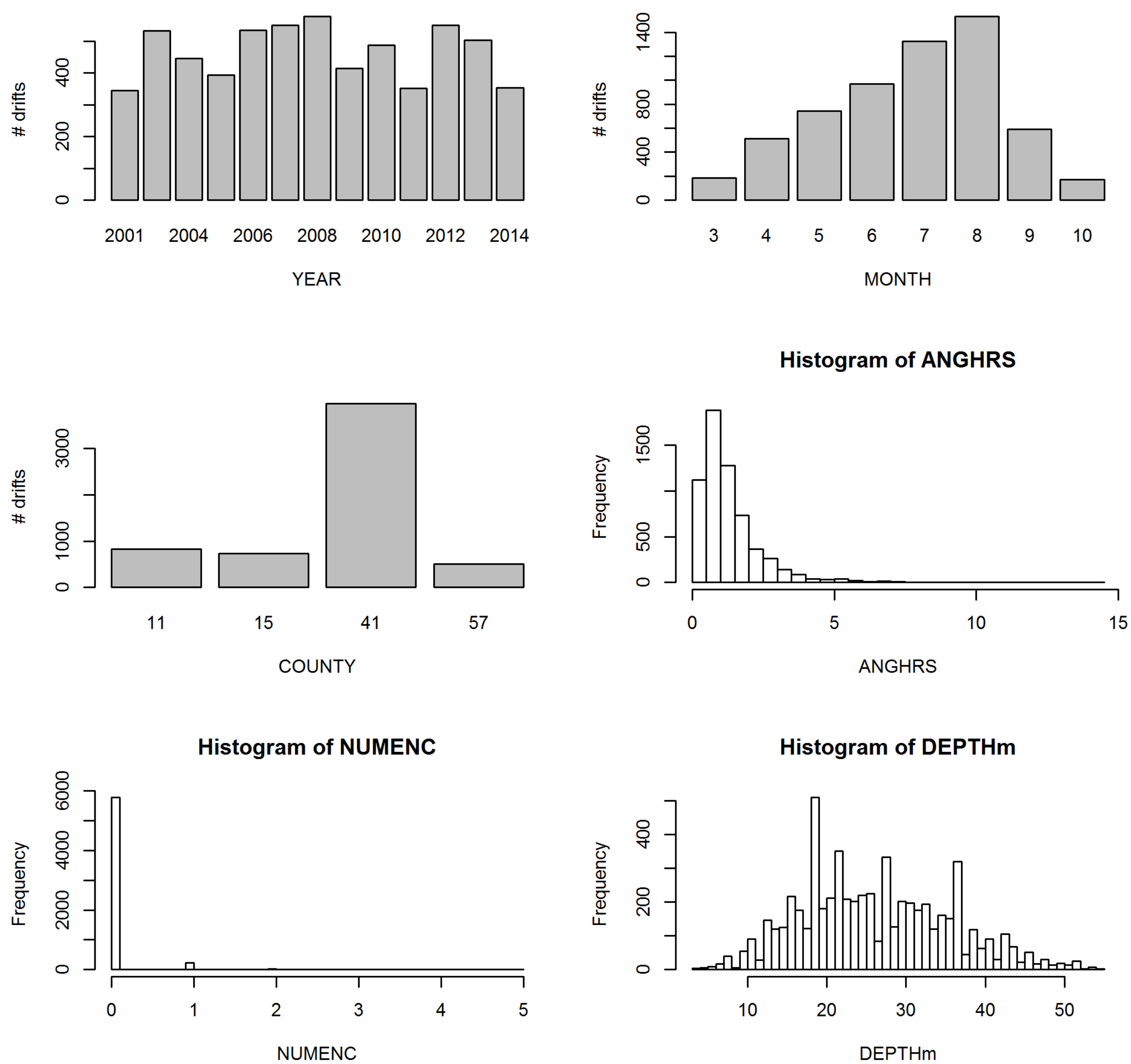


Figure 39: Characterization of the final subset of Oregon onboard observer data used in delta-GLM analyses for China rockfish.

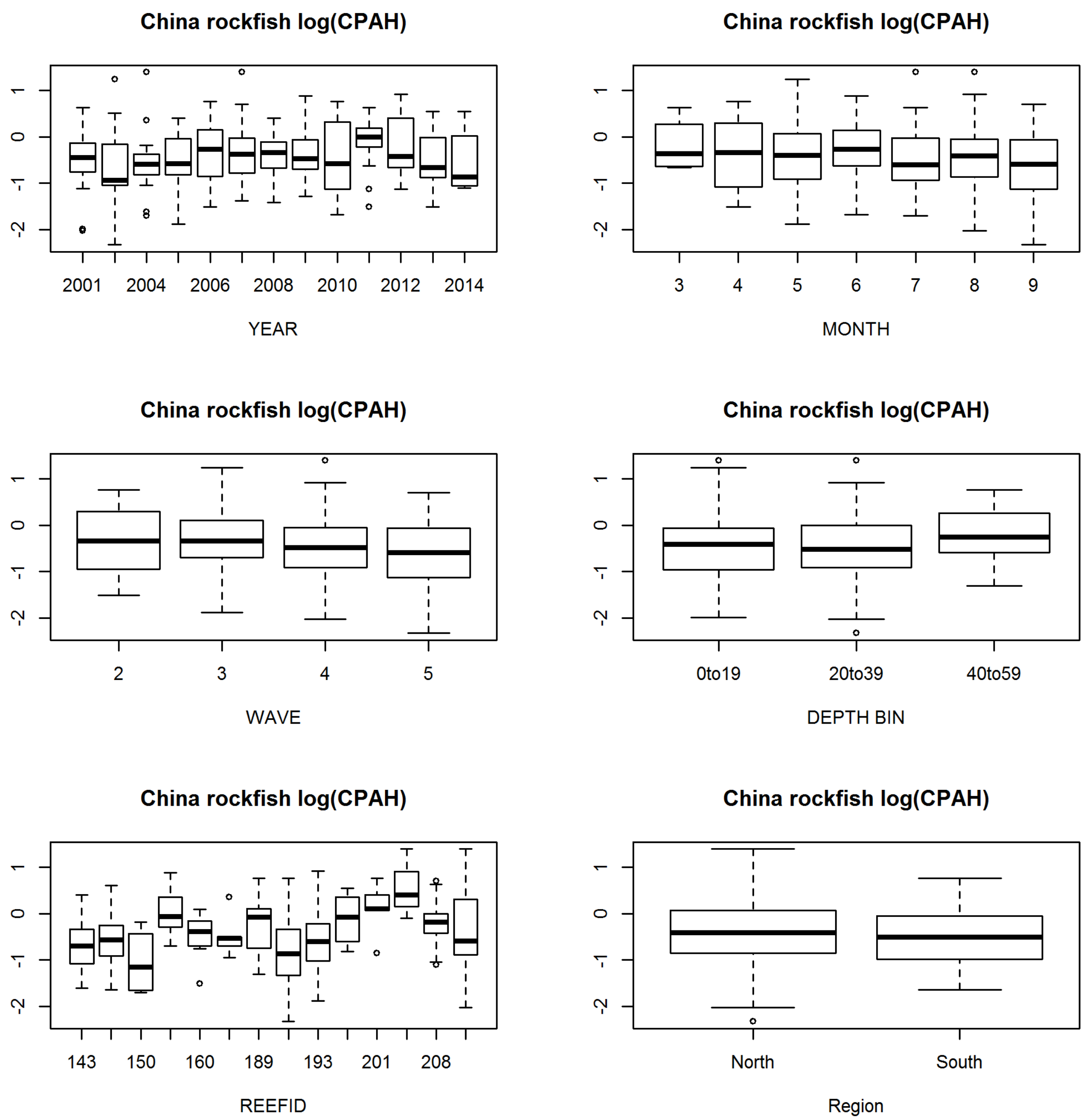


Figure 40: The distribution of drift-level CPUE data relative to potential covariates evaluated in the China rockfish Oregon onboard observer delta-GLM analysis(positive encounters only).

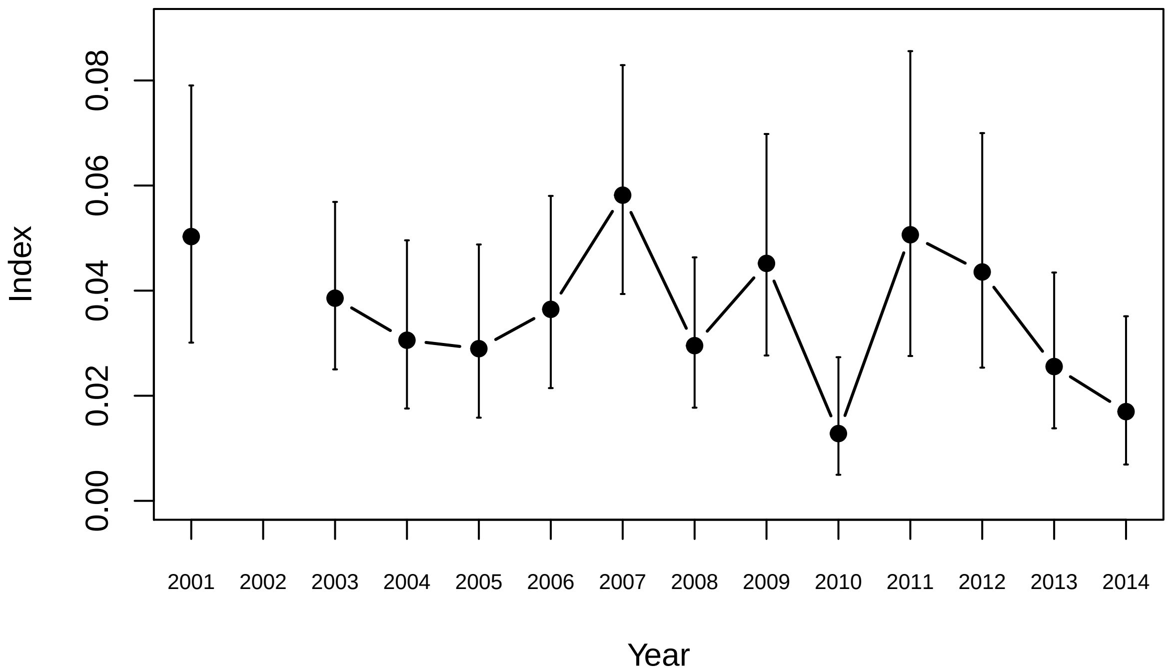


Figure 41: Index for the Oregon onboard observer program, with 95% lognormal confidence intervals.

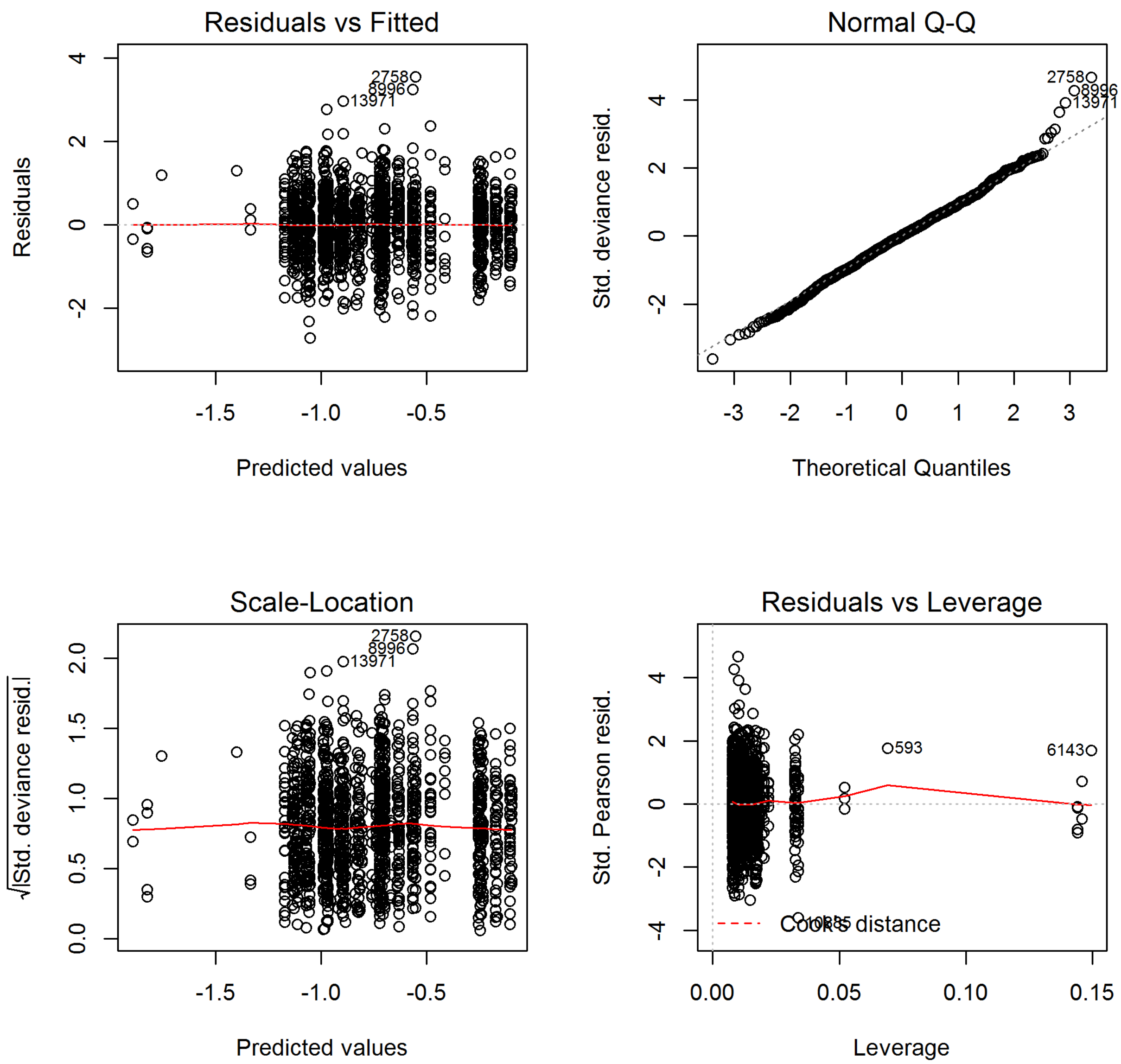


Figure 42: Diagnostic plots for the China rockfish positive catch component lognromal delta-GLM model for the Oregon onboard observer index. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

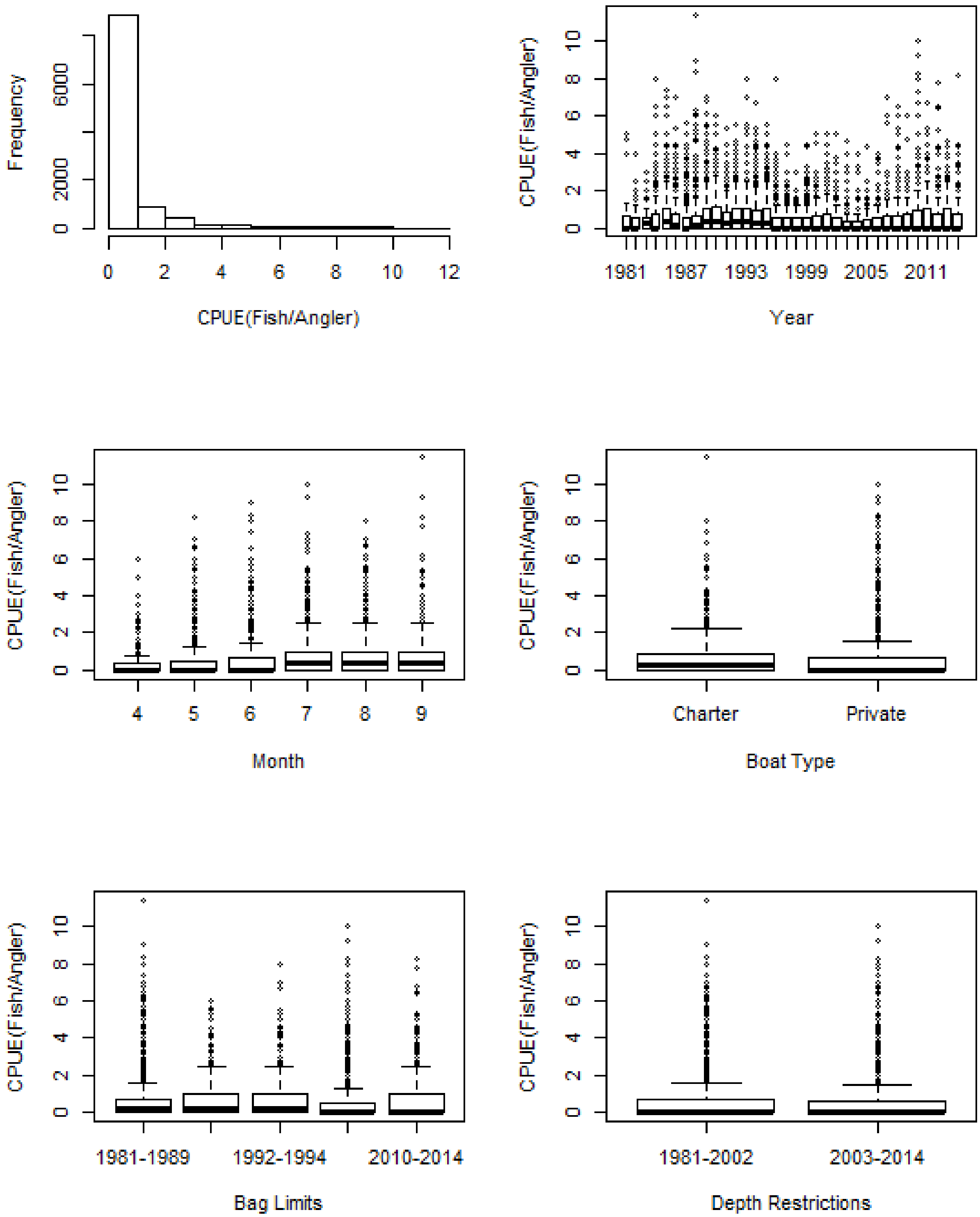


Figure 43: Characterization of the final subset of 1988-1999 California onboard observer data used in delta-GLM analyses for China rockfish.

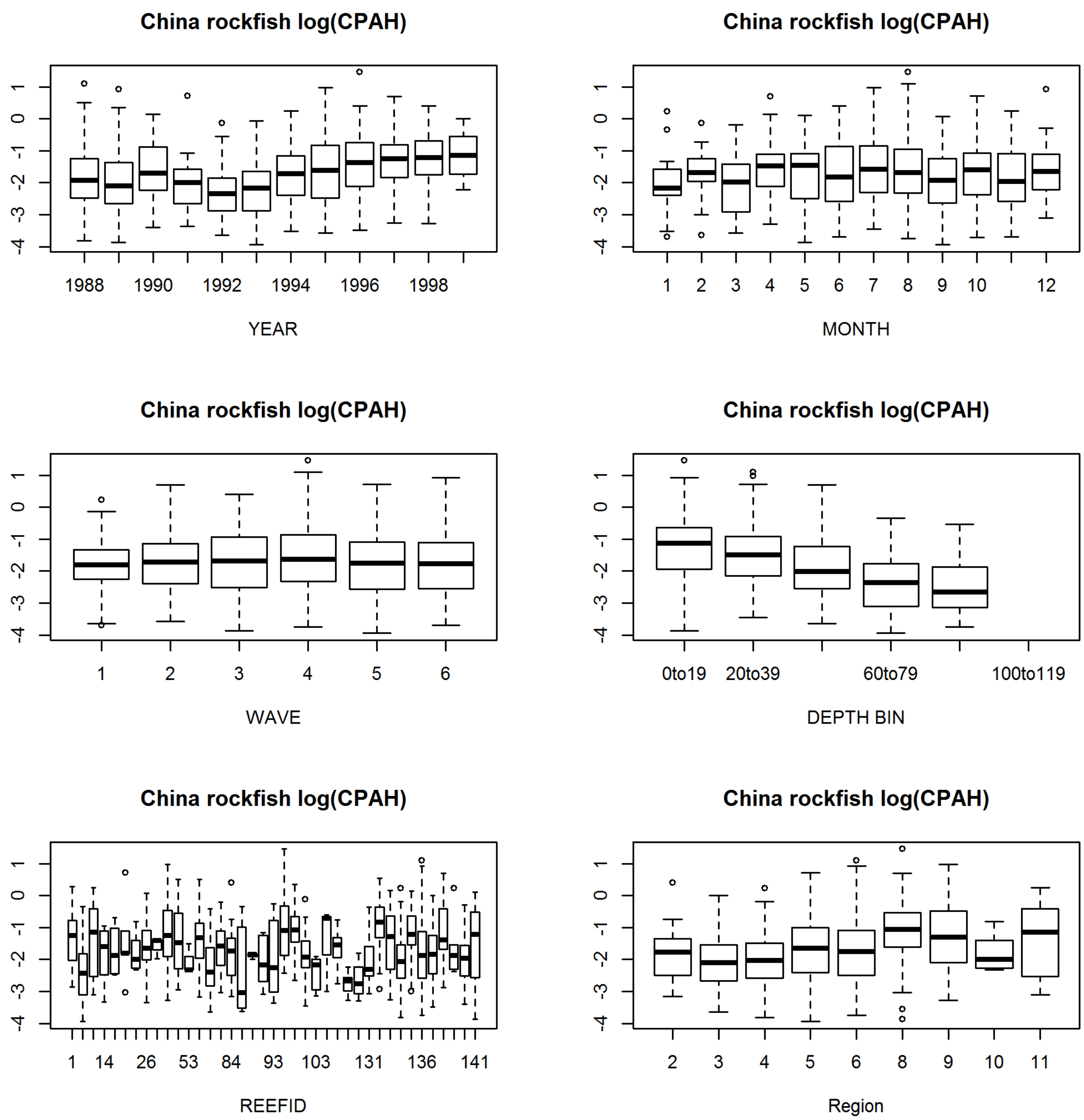


Figure 44: The distribution of drift-level CPUE data relative to potential covariates evaluated in the China rockfish 1988-1999 California onboard observer delta-GLM analysis (positive encounters only).

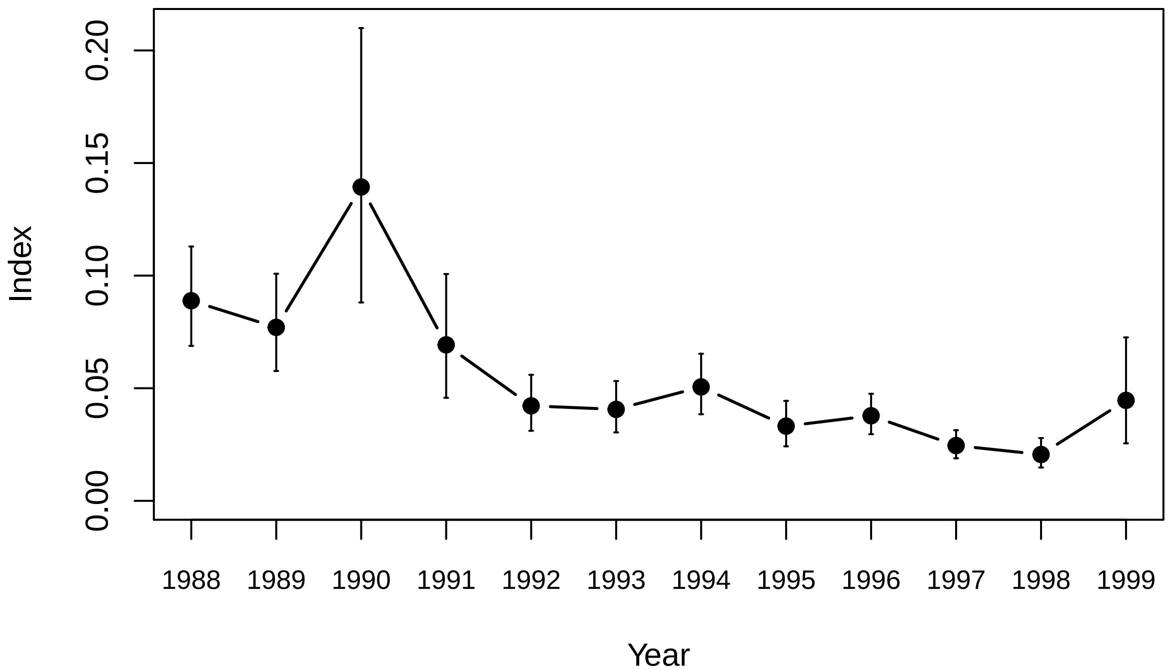


Figure 45: Index for the California 1988-1999 onboard observer program, with 95% lognormal confidence intervals.

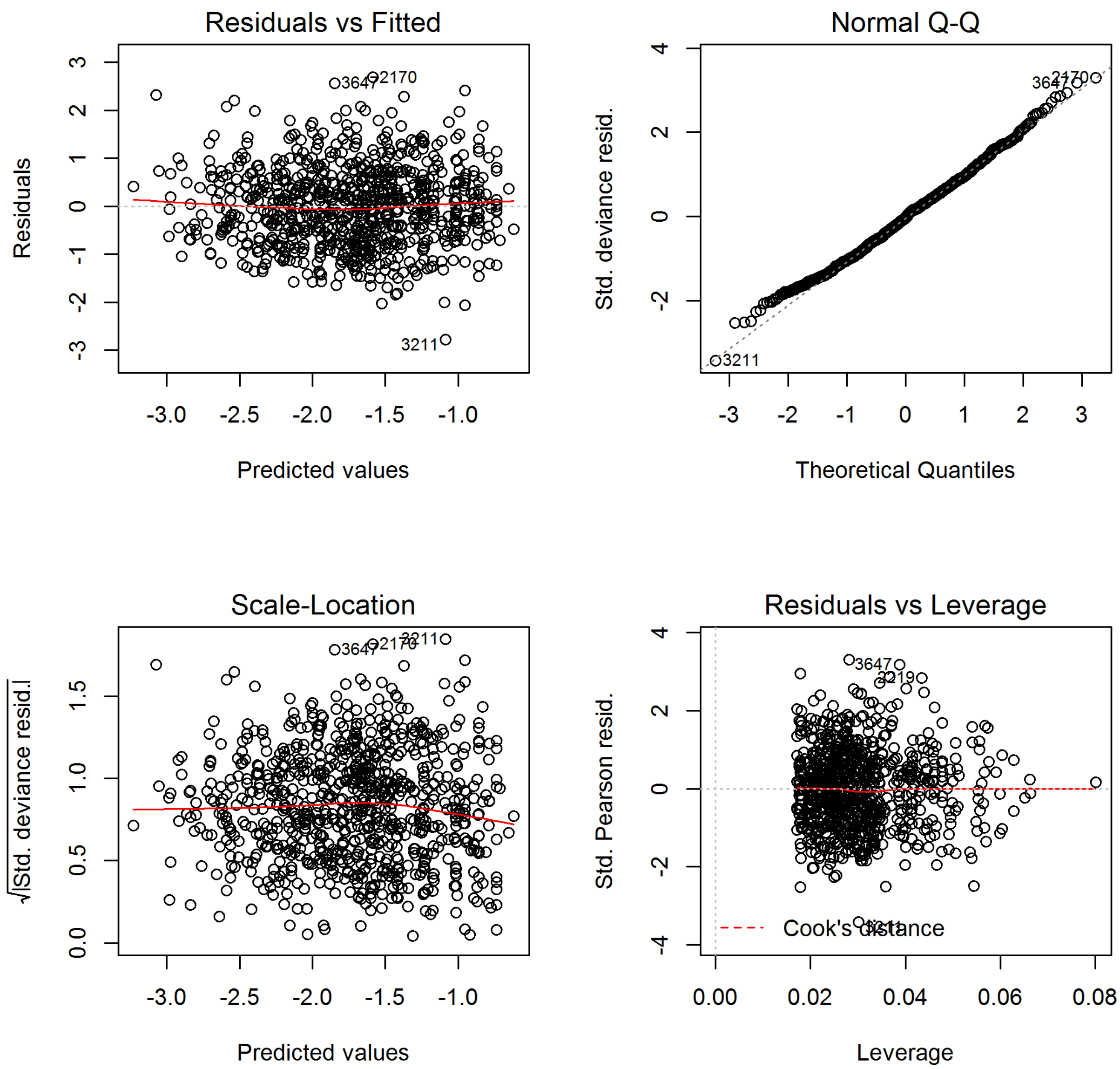


Figure 46: Diagnostic plots for the China rockfish positive catch component lognromal delta-GLM model for the 1988-1999 California onboard observer index. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

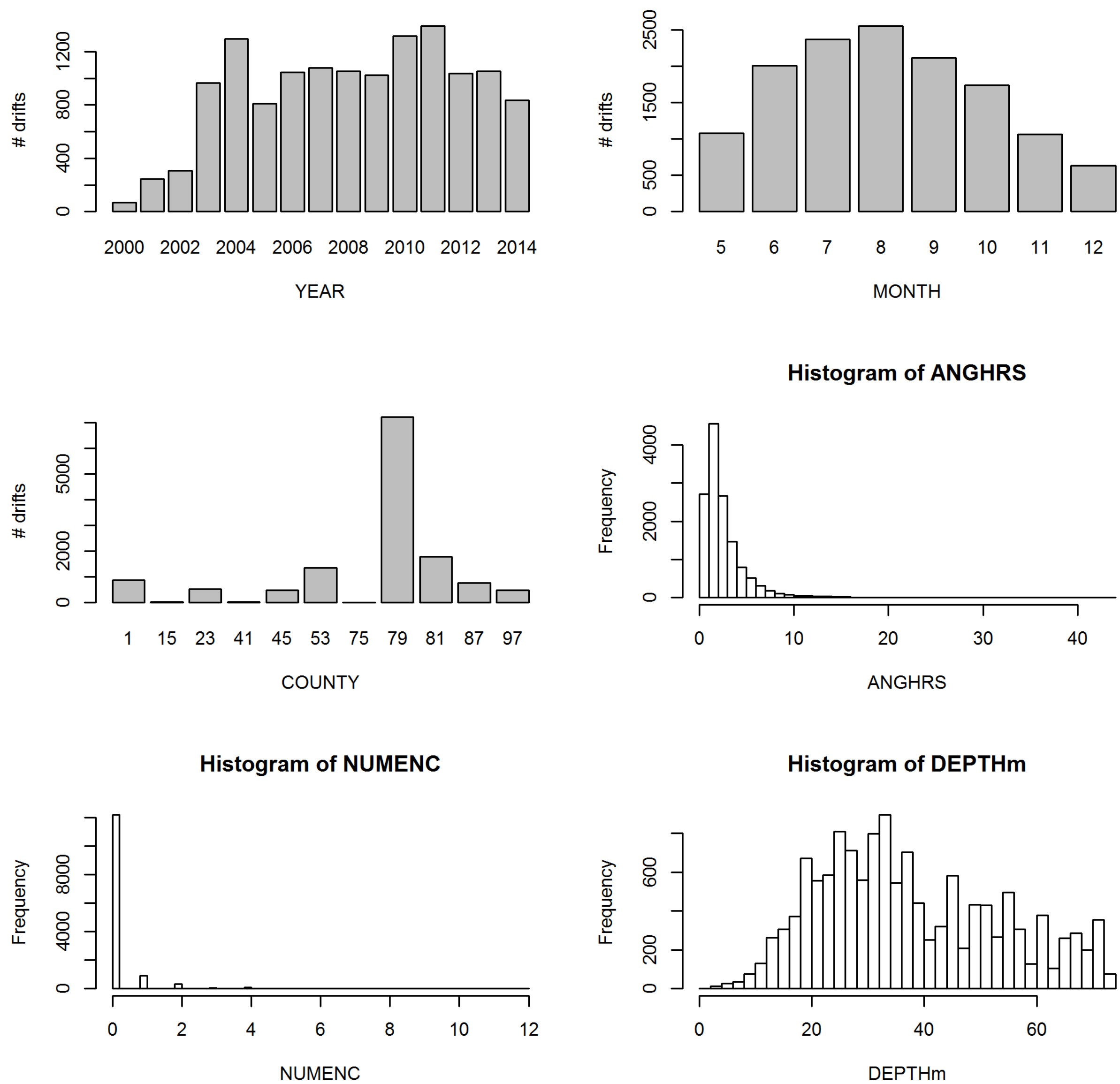


Figure 47: Characterization of the final subset of 2000-2014 California onboard observer data used in delta-GLM analyses for China rockfish.

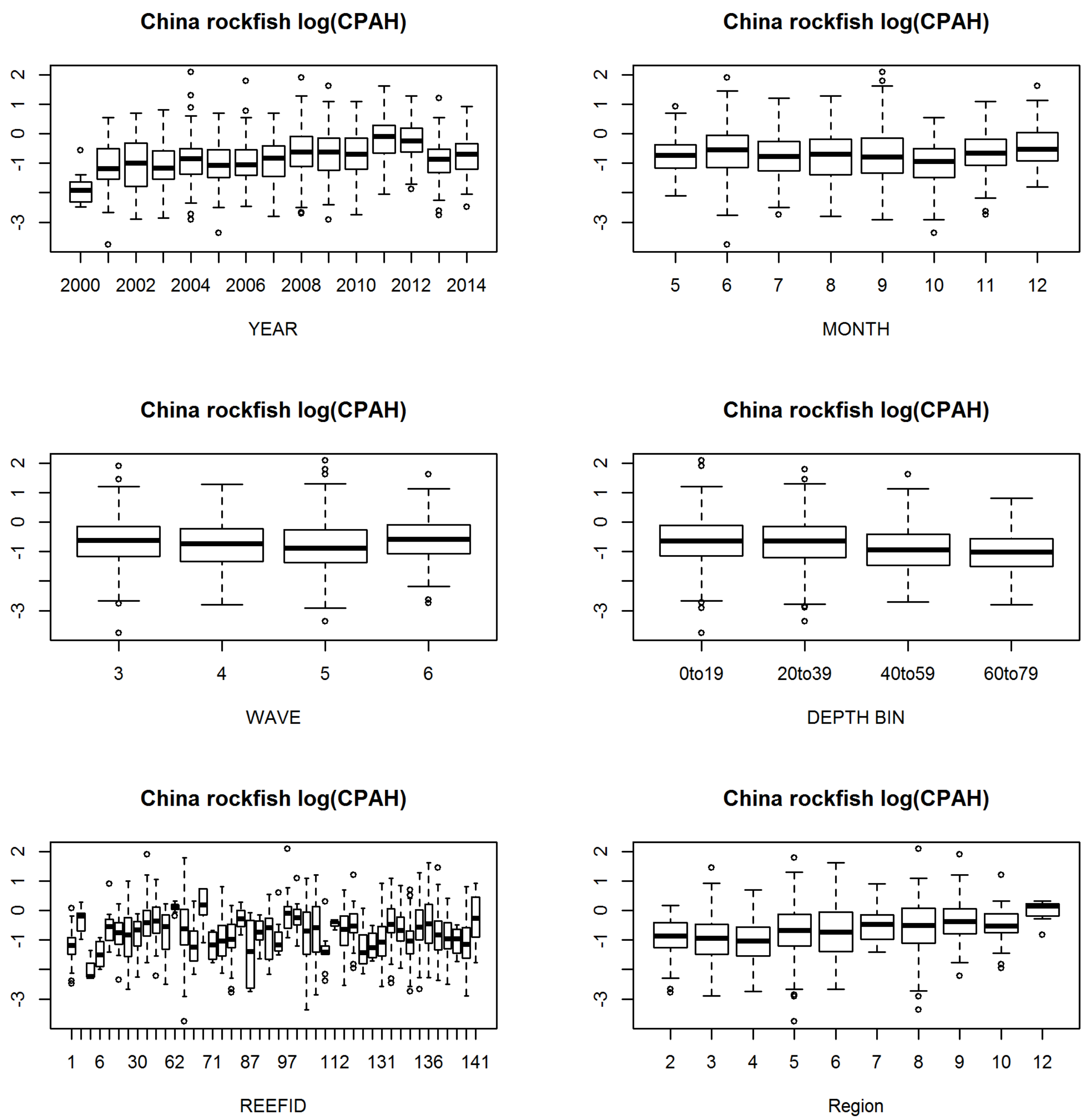


Figure 48: The distribution of drift-level CPUE data relative to potential covariates evaluated in the China rockfish 2000-2014 California onboard observer delta-GLM analysis (positive encounters only).

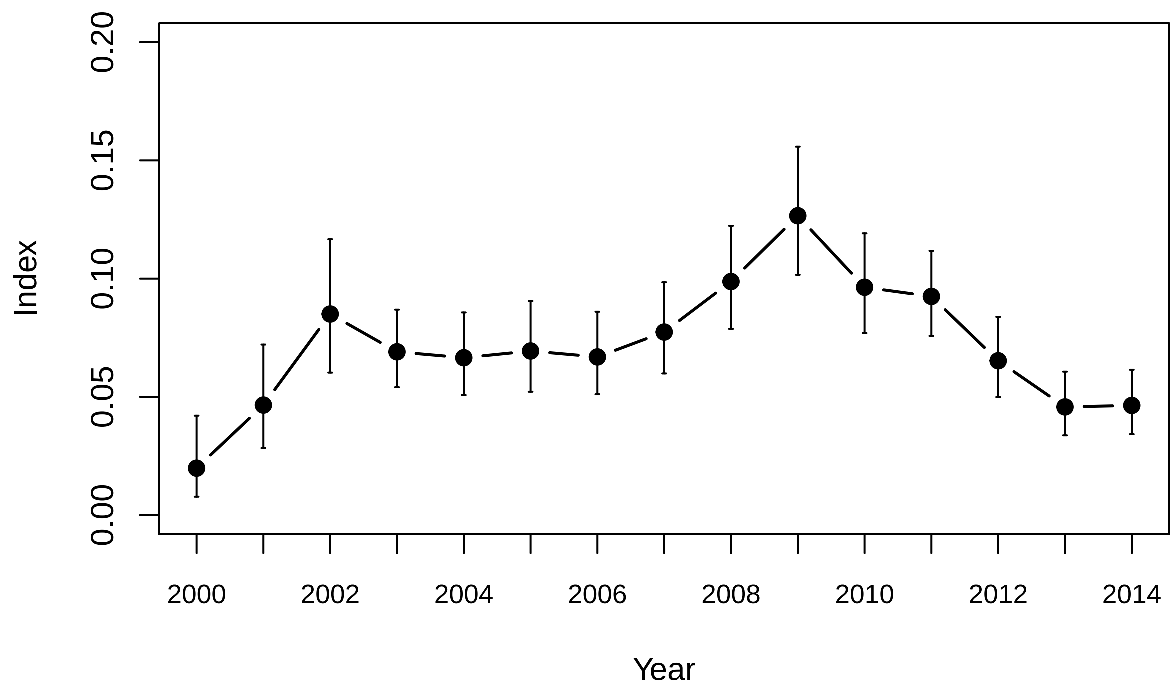


Figure 49: Index for the California 2000-2014 onboard observer program, with 95% lognormal confidence intervals.

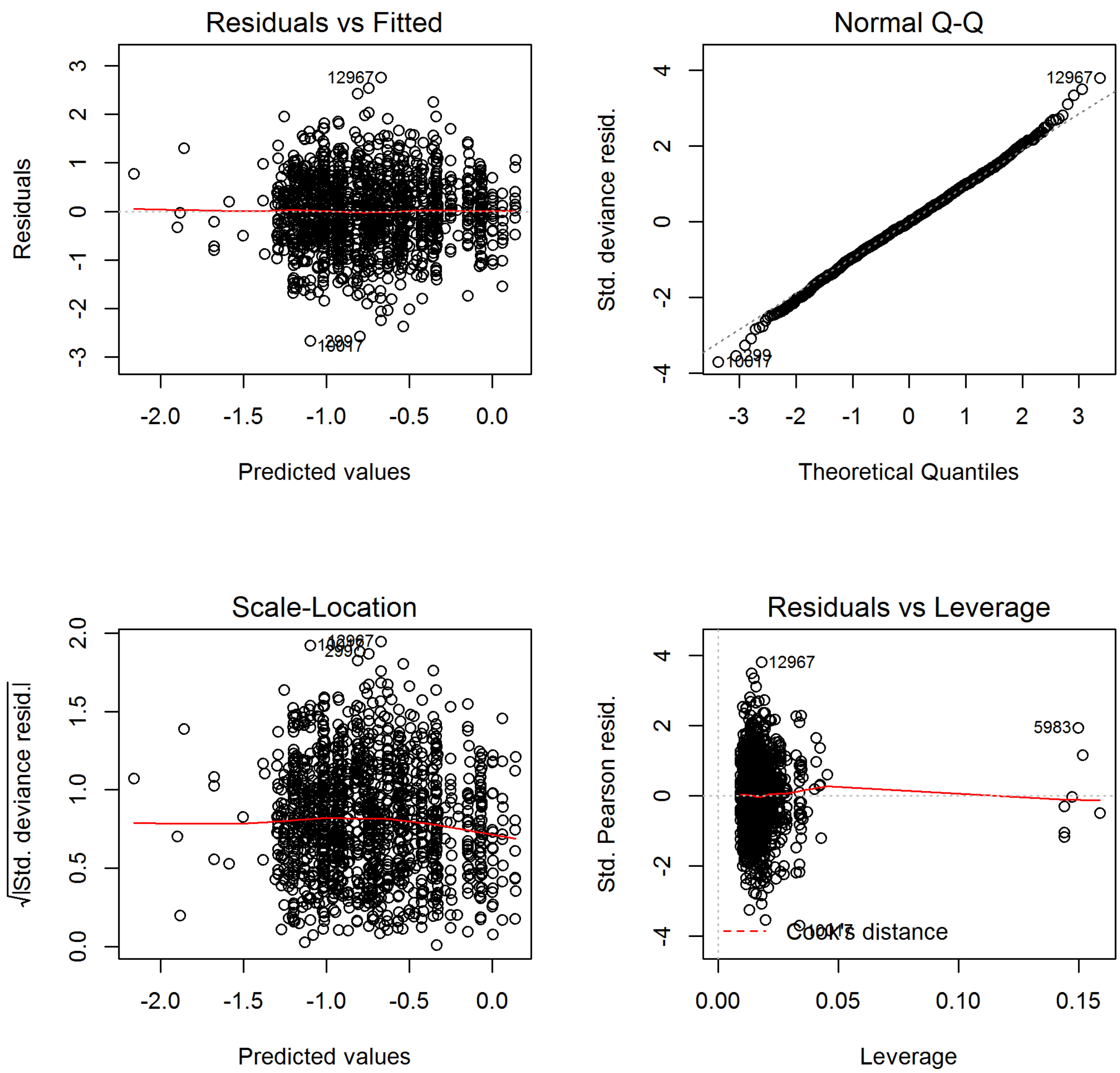


Figure 50: Diagnostic plots for the China rockfish positive catch component lognromal delta-GLM model for the 2000-2014 California onboard observer index. These are used to evaluate model fit (top left), assumptions of normality (top right), assumptions of constant variance (bottom left), and the presence of outliers (bottom right).

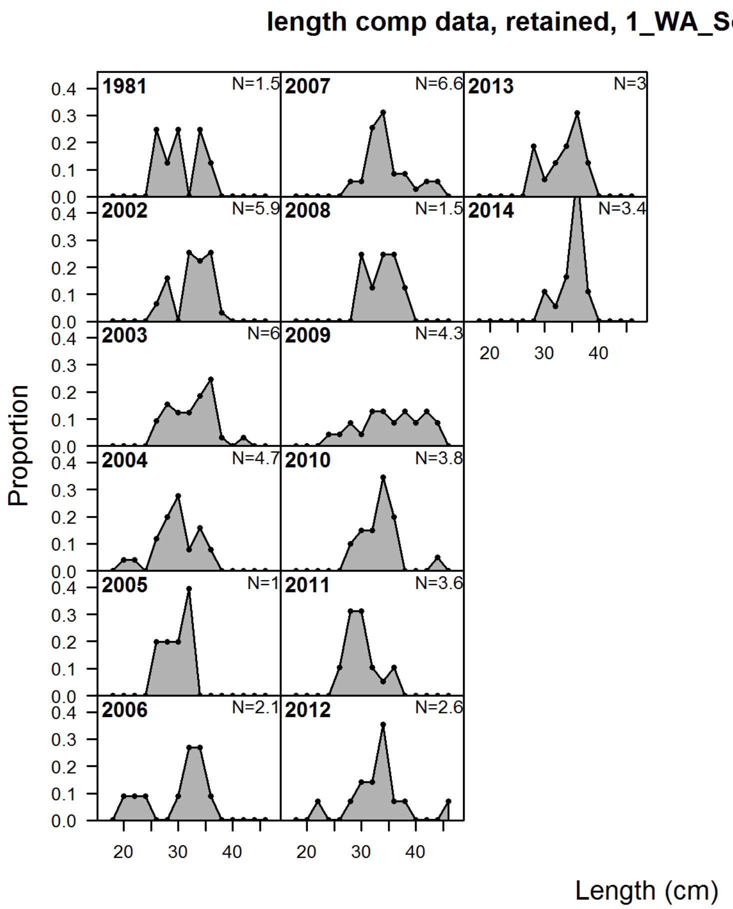


Figure 51: WDFW length compositions for the southern Washington recreational fleet, all modes.

[Length compositions for northern model.](r4ss/plots_N/(r4ss/plots_N/comp_lendat_sex1mkt2_multi-fleet_comparison.png)

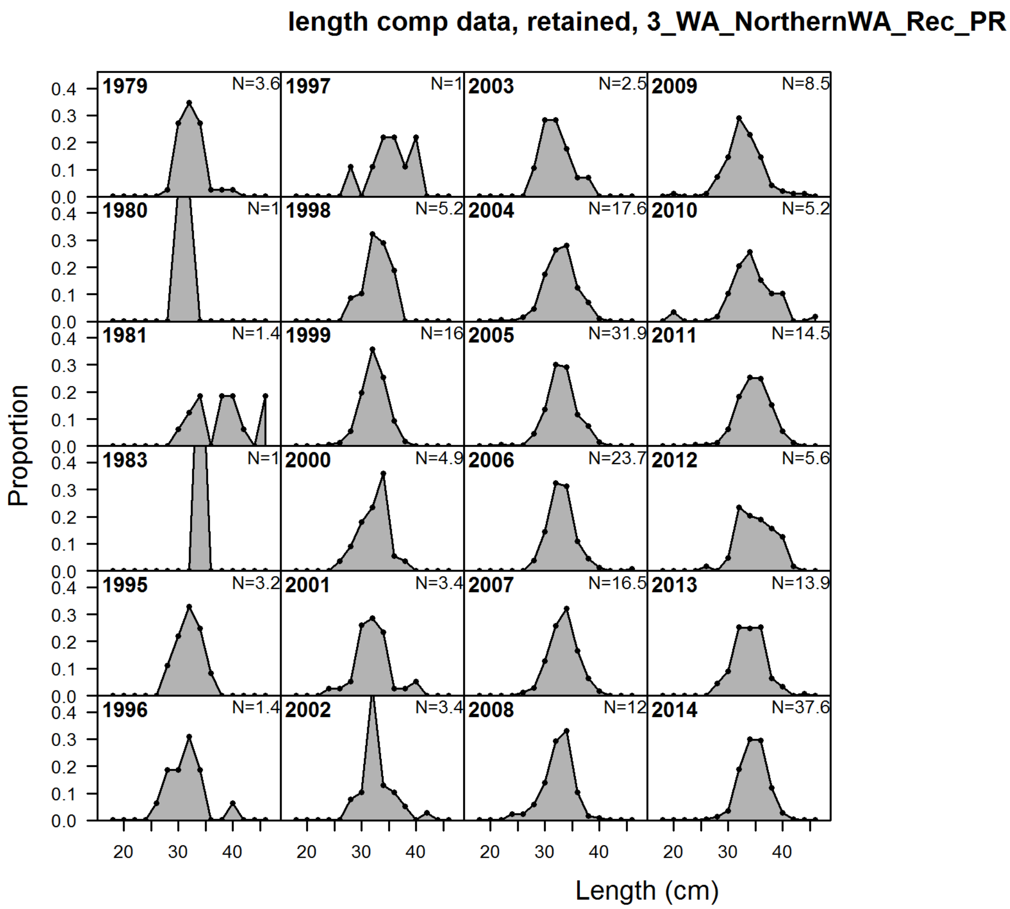


Figure 52: WDFW length compositions for the northern Washington recreational CPFV fleet.

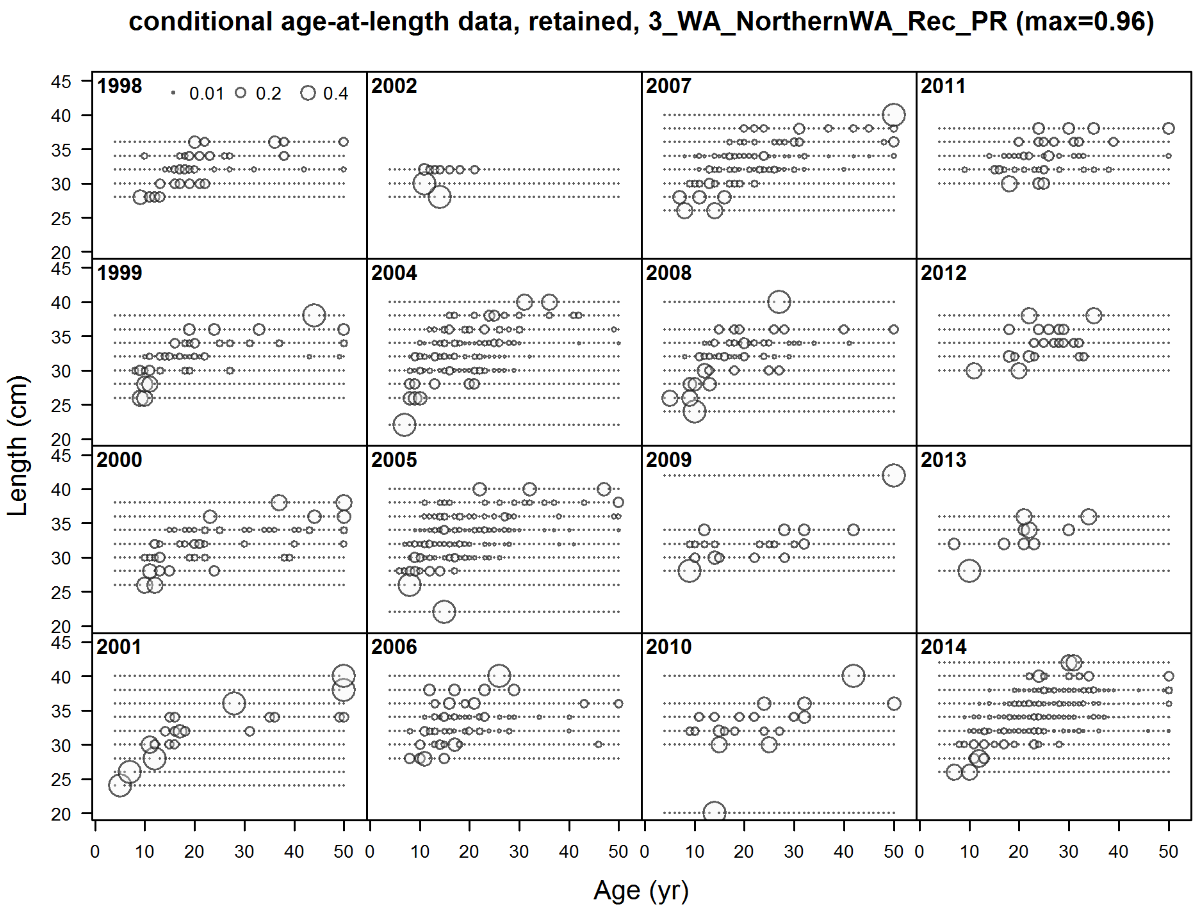


Figure 53: Conditional age-at-length compositions for recreational private/rental catch in northern WA in the northern model.

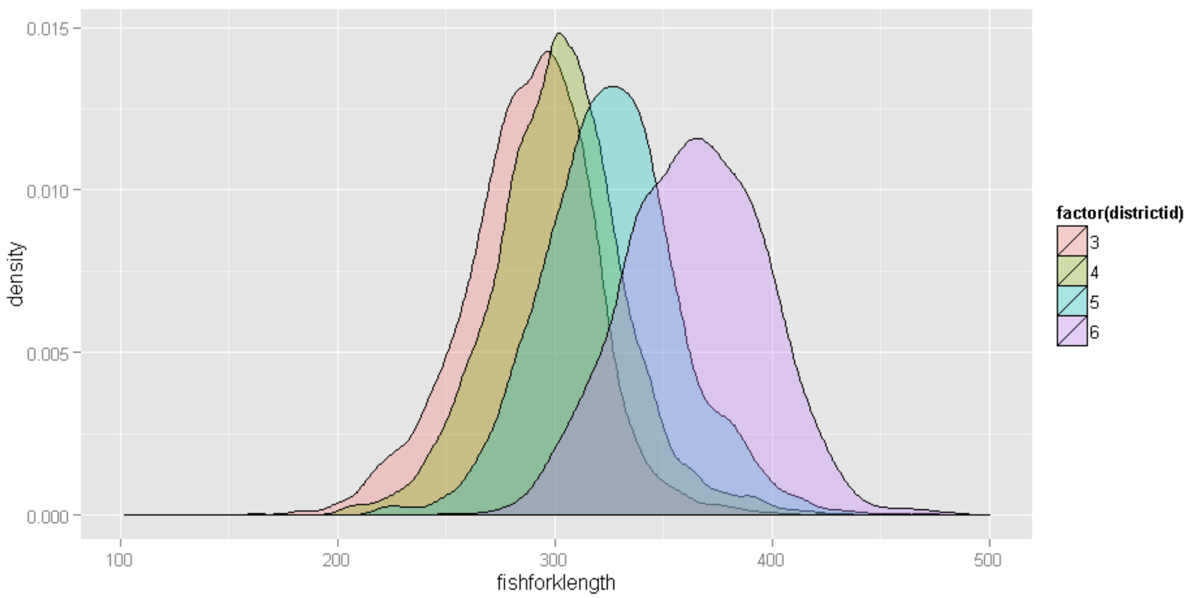


Figure 54: Distribution of lengths by CRFS district from CDFW, south of Cape Mendocino.

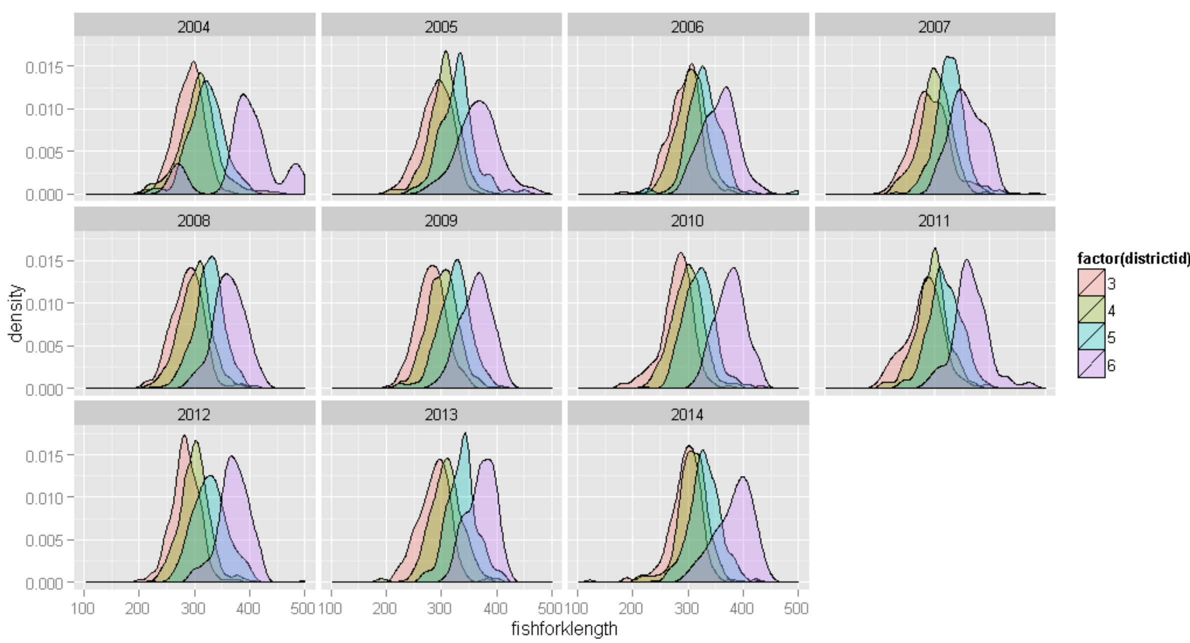


Figure 55: Distribution of lengths from the CDFW CRFS survey south of Cape Mendocino, by year and district.

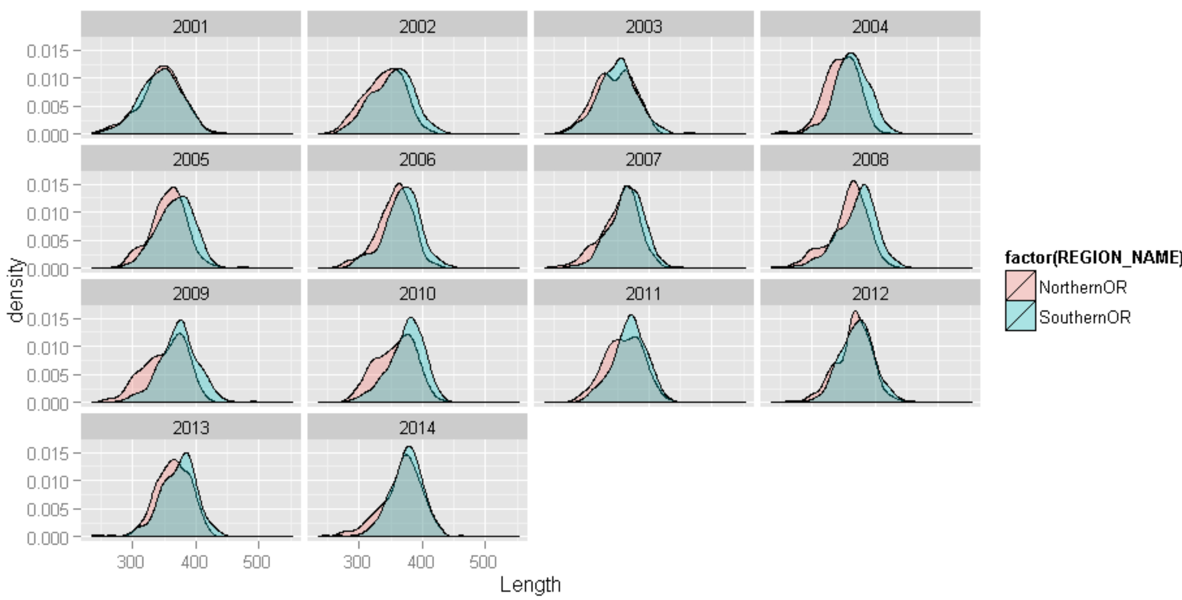


Figure 56: Oregon (ORBS) recreational CPFV fleet length distributions by region and year.

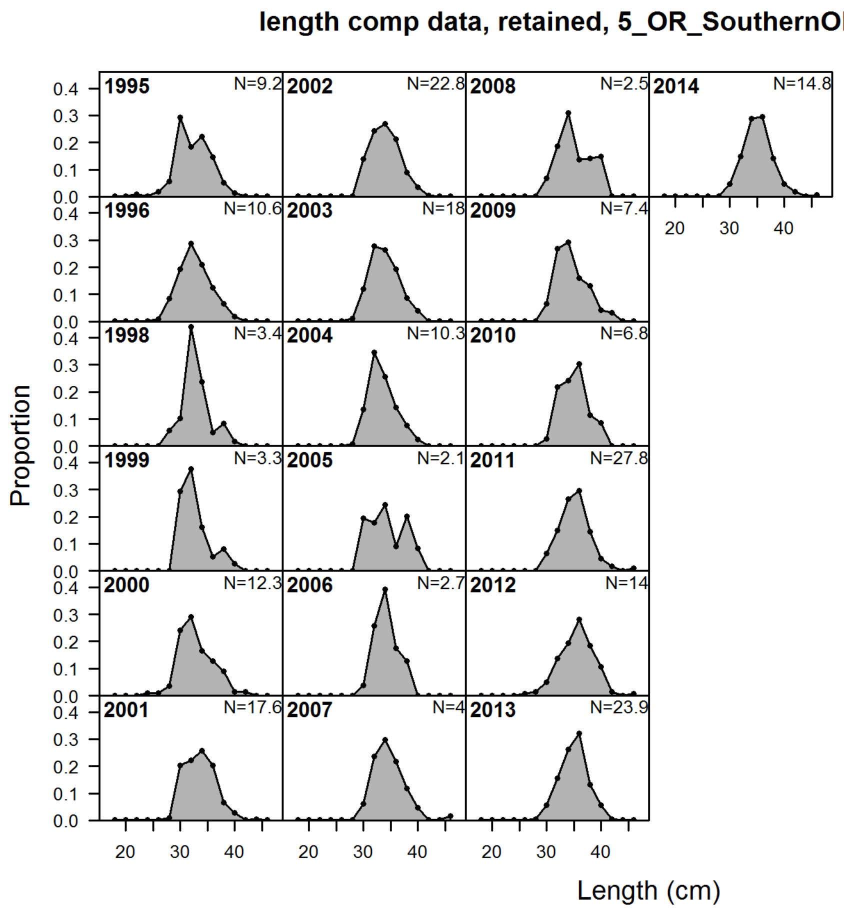


Figure 57: Length compositions for retained fish from the southern Oregon commercial dead-fish fishery.

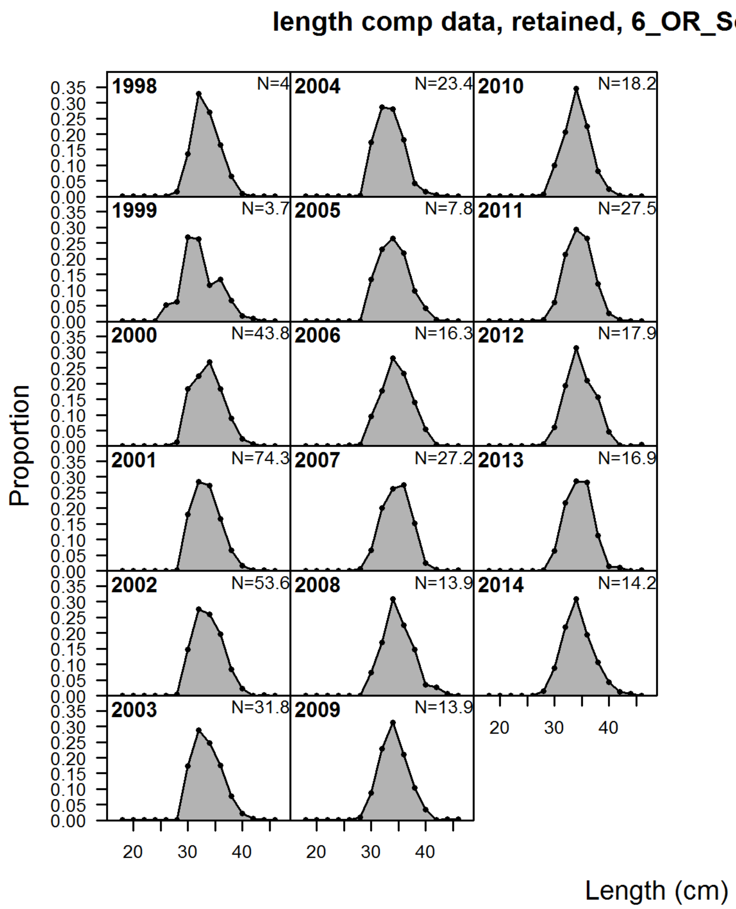


Figure 58: Length compositions for retained fish from the southern Oregon commercial live-fish fishery.

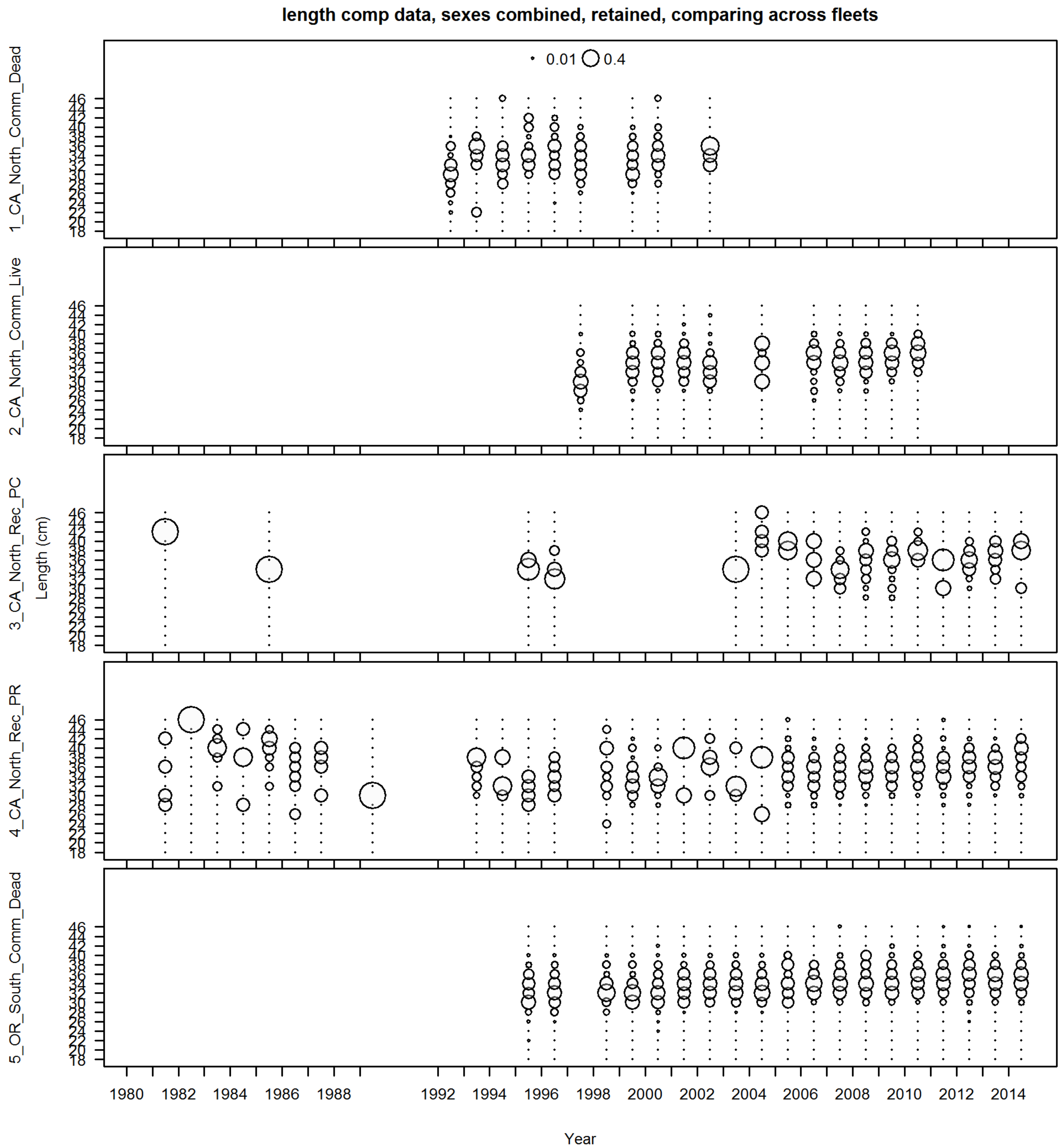


Figure 59: Length compositions for central model, figure 1 of 2.

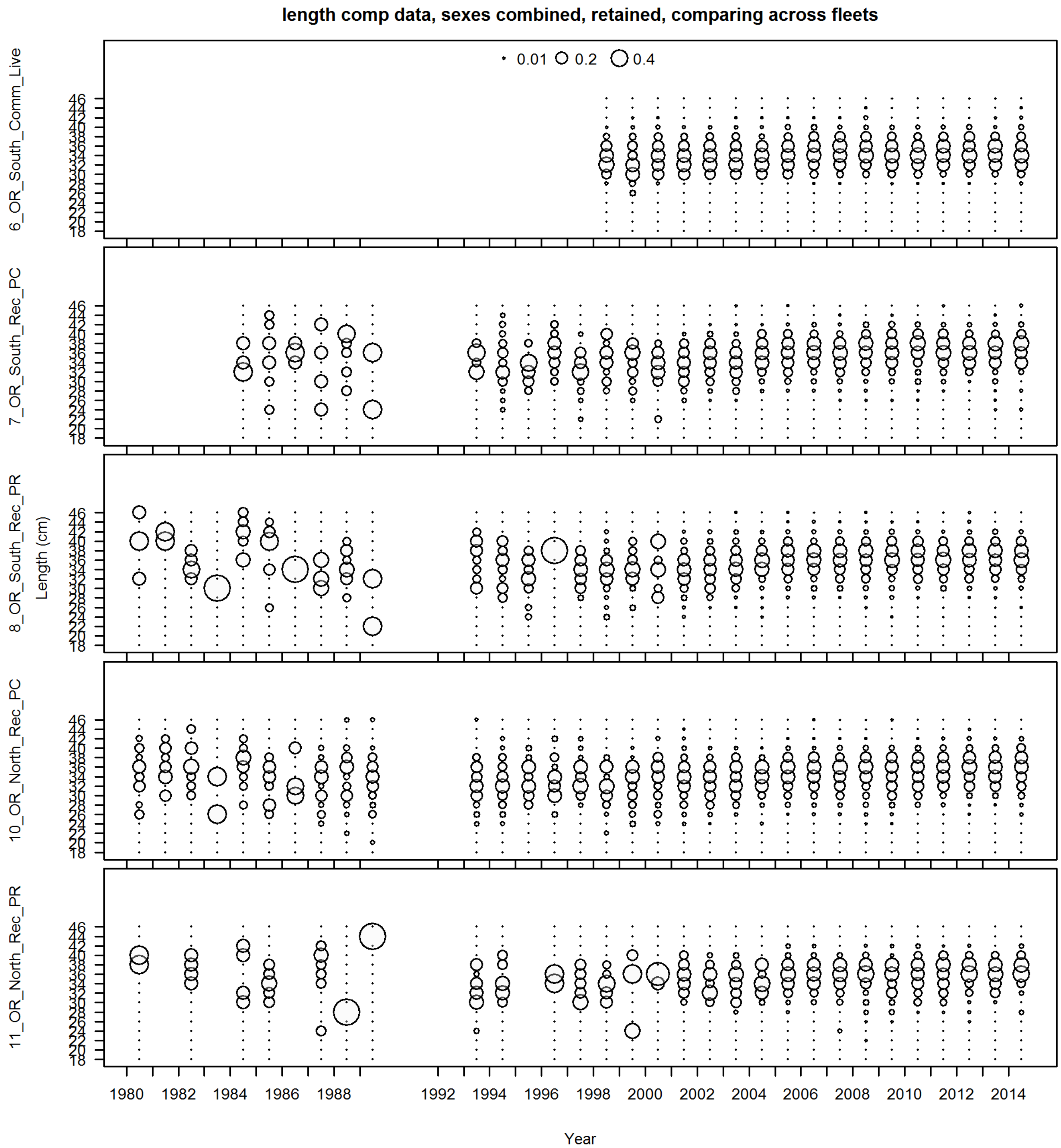


Figure 60: Length compositions for central model continued, figure 2 of 2.

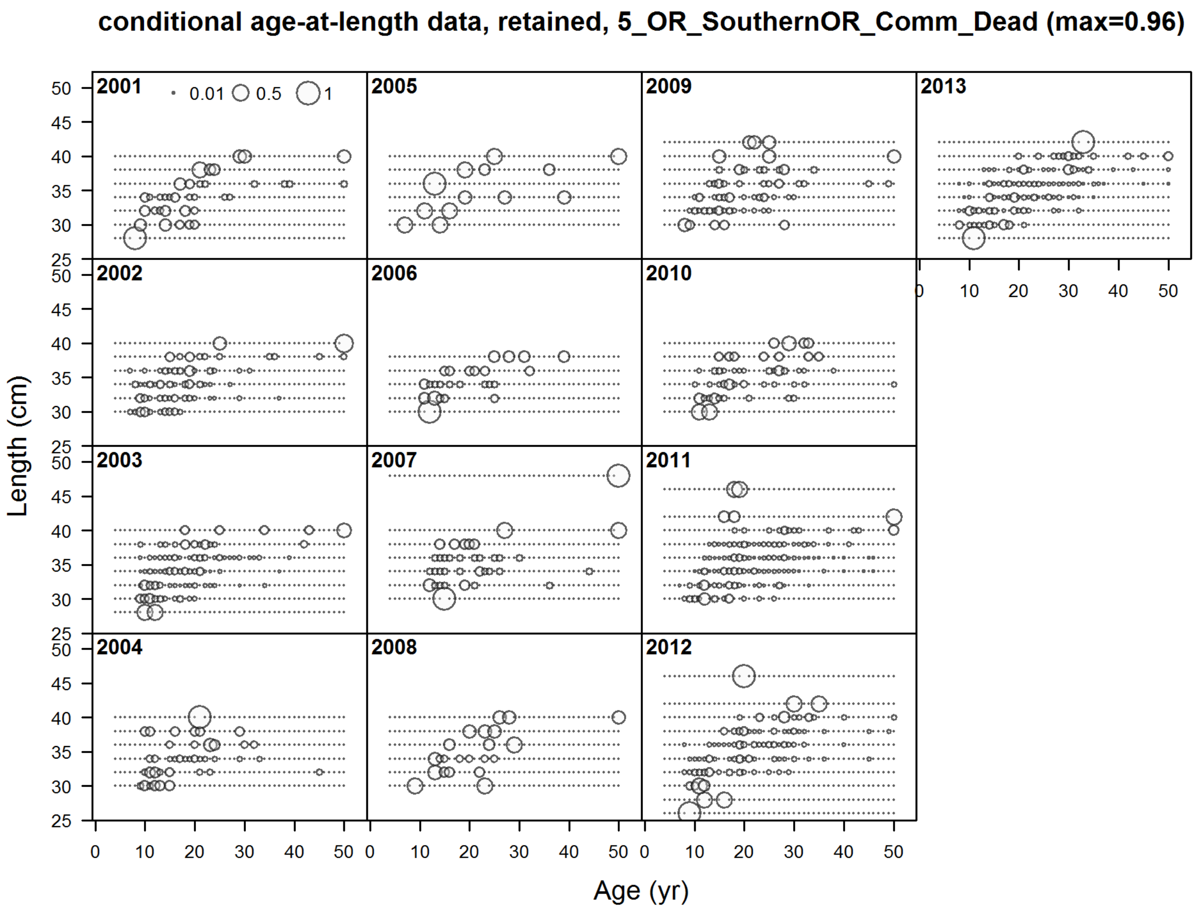


Figure 61: Conditional age-at-length data for retained fish from the southern Oregon commercial dead-fish fishery.

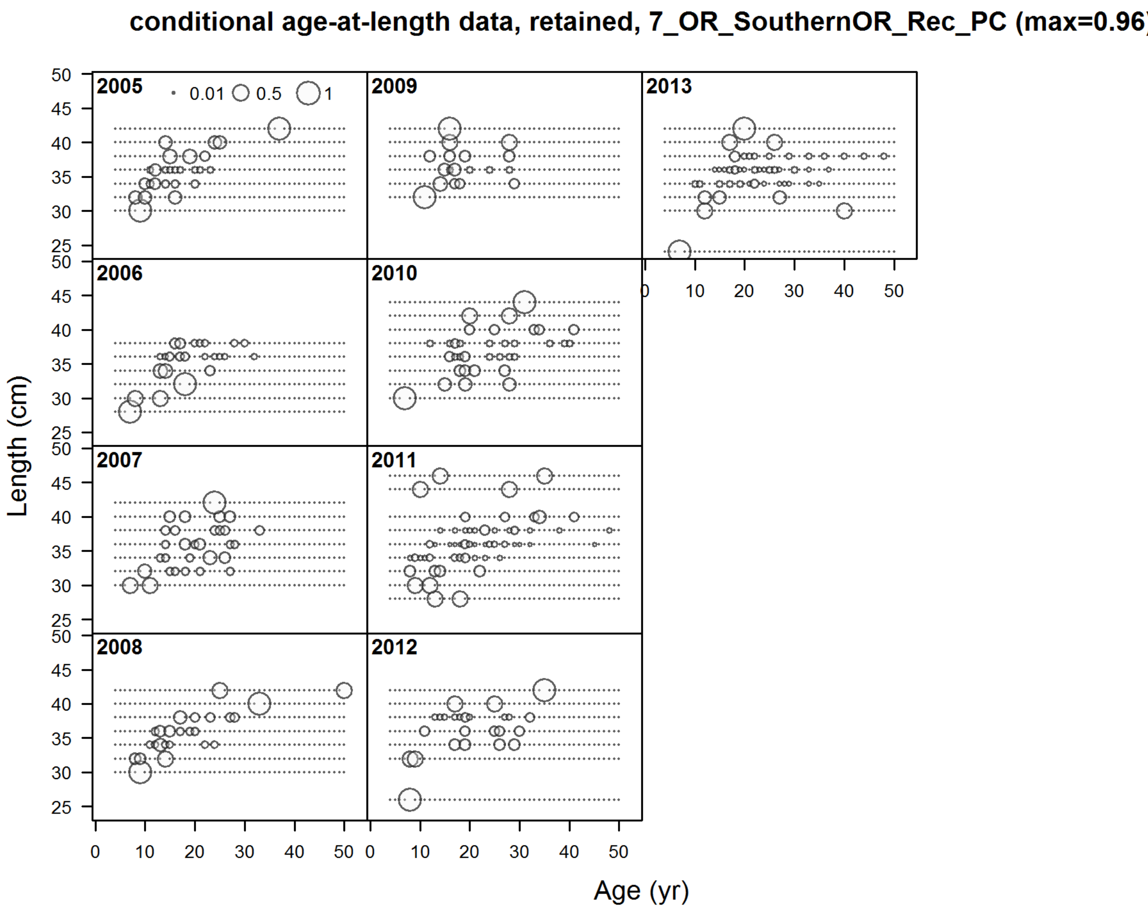


Figure 62: Conditional age-at-length compositions for the commercial dead-fish fishery in southern OR in the central model.

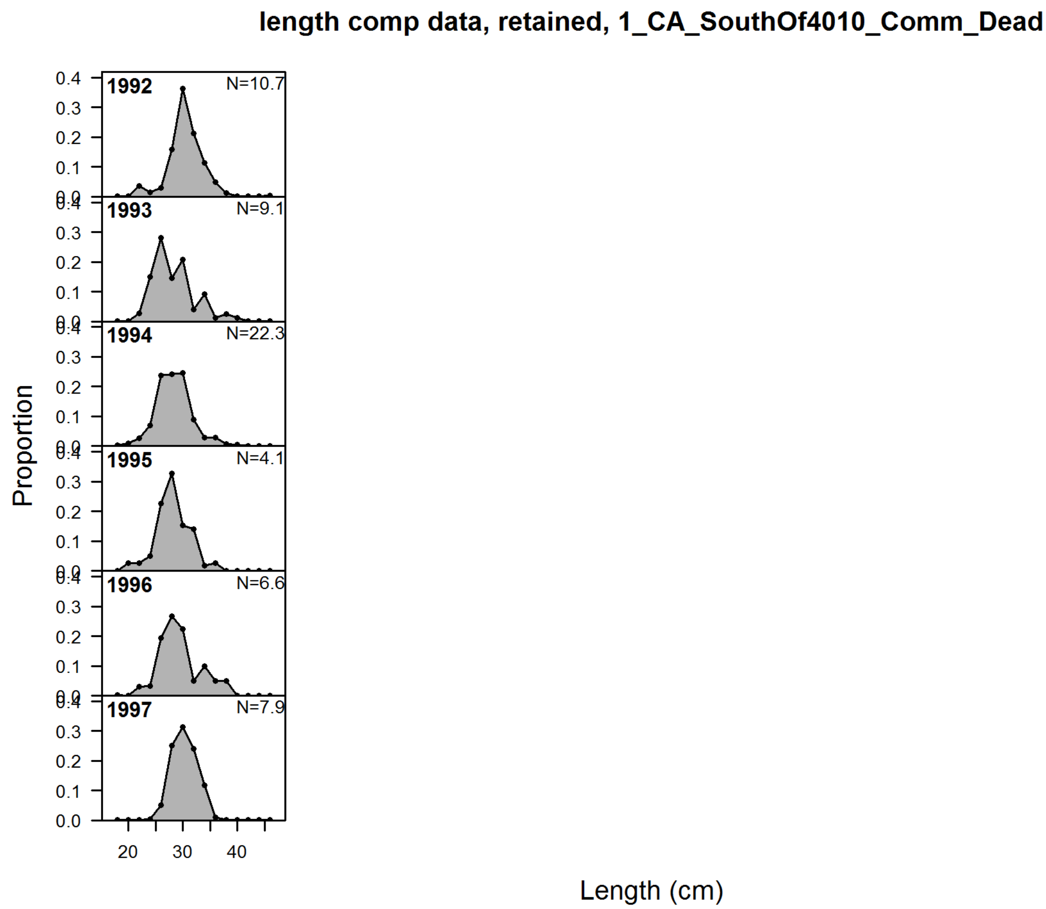


Figure 63: Length compositions by year for the California commercial dead-fish fishery south of 40°10′.

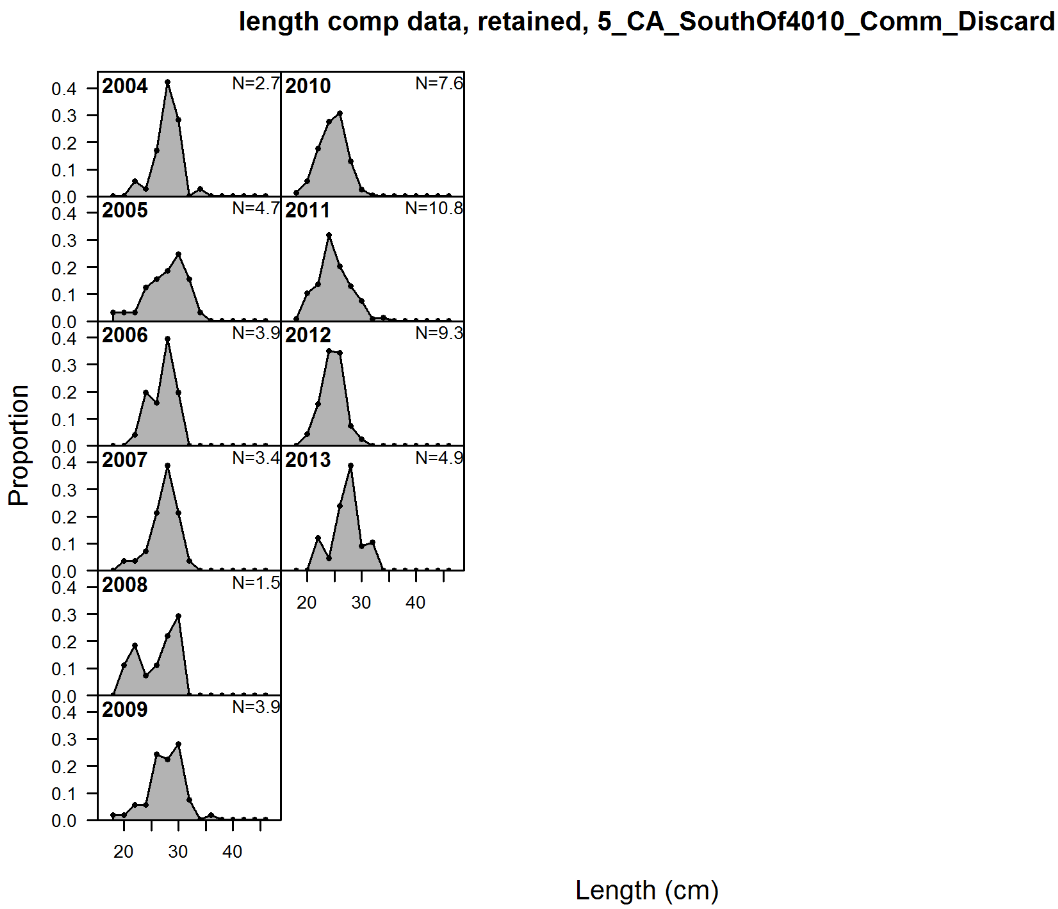


Figure 64: Length compositions by year for discarded fish in the California commercial fishery south of 40°10′.

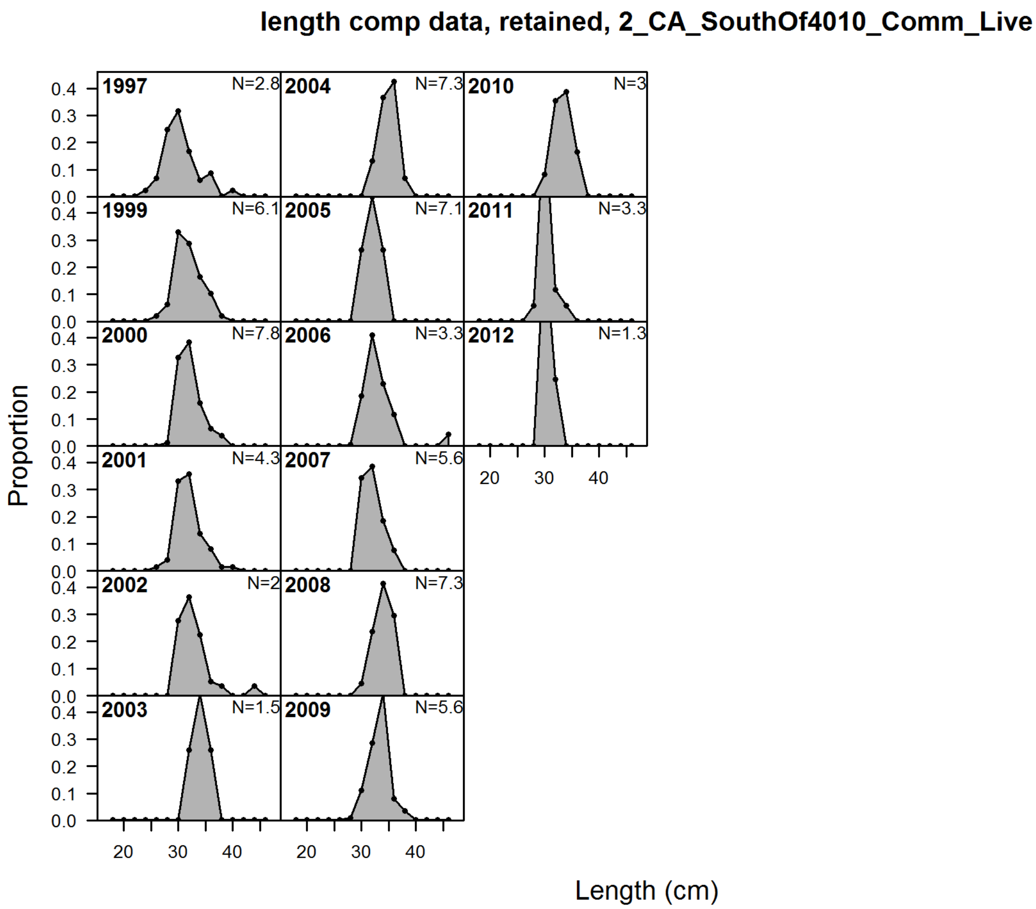


Figure 65: Length compositions by year for retained fish in the California commercial live-fish fishery south of 40°10′.

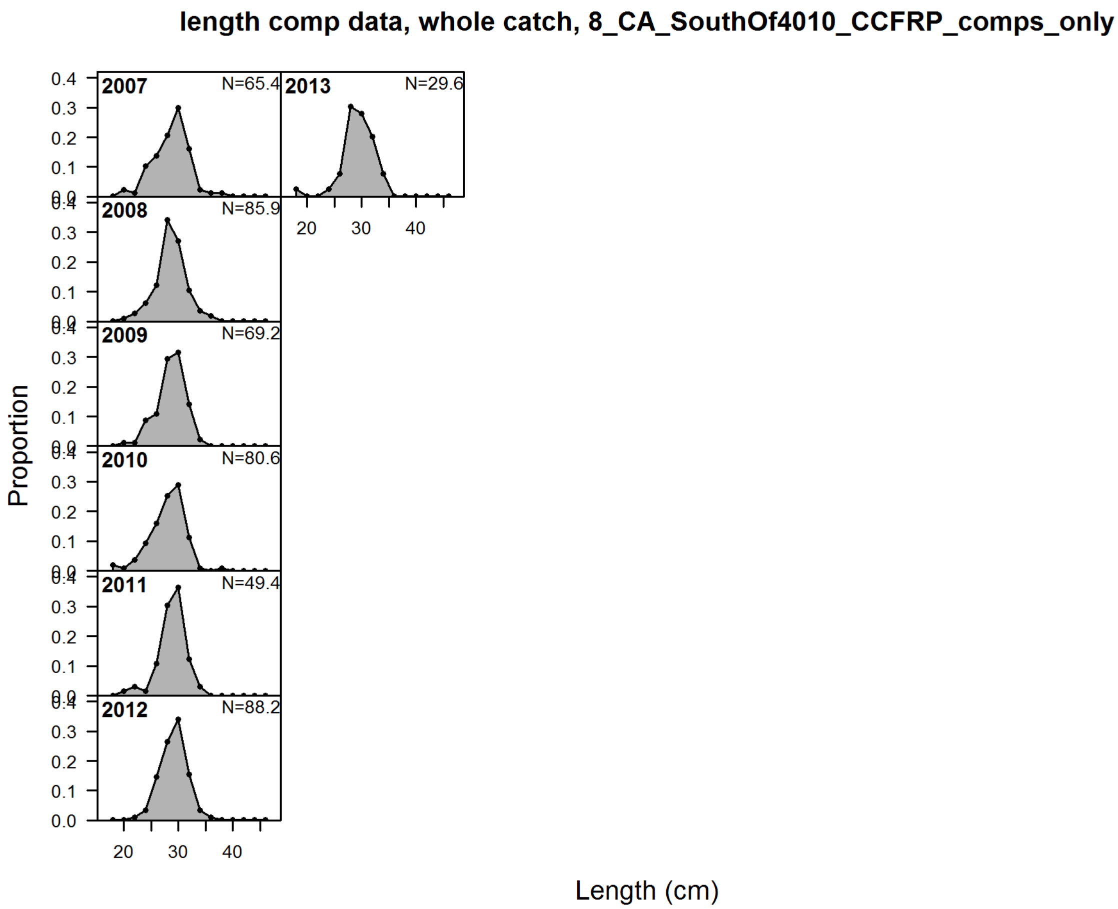


Figure 66: CCFRP research program length compositions for the southern model.

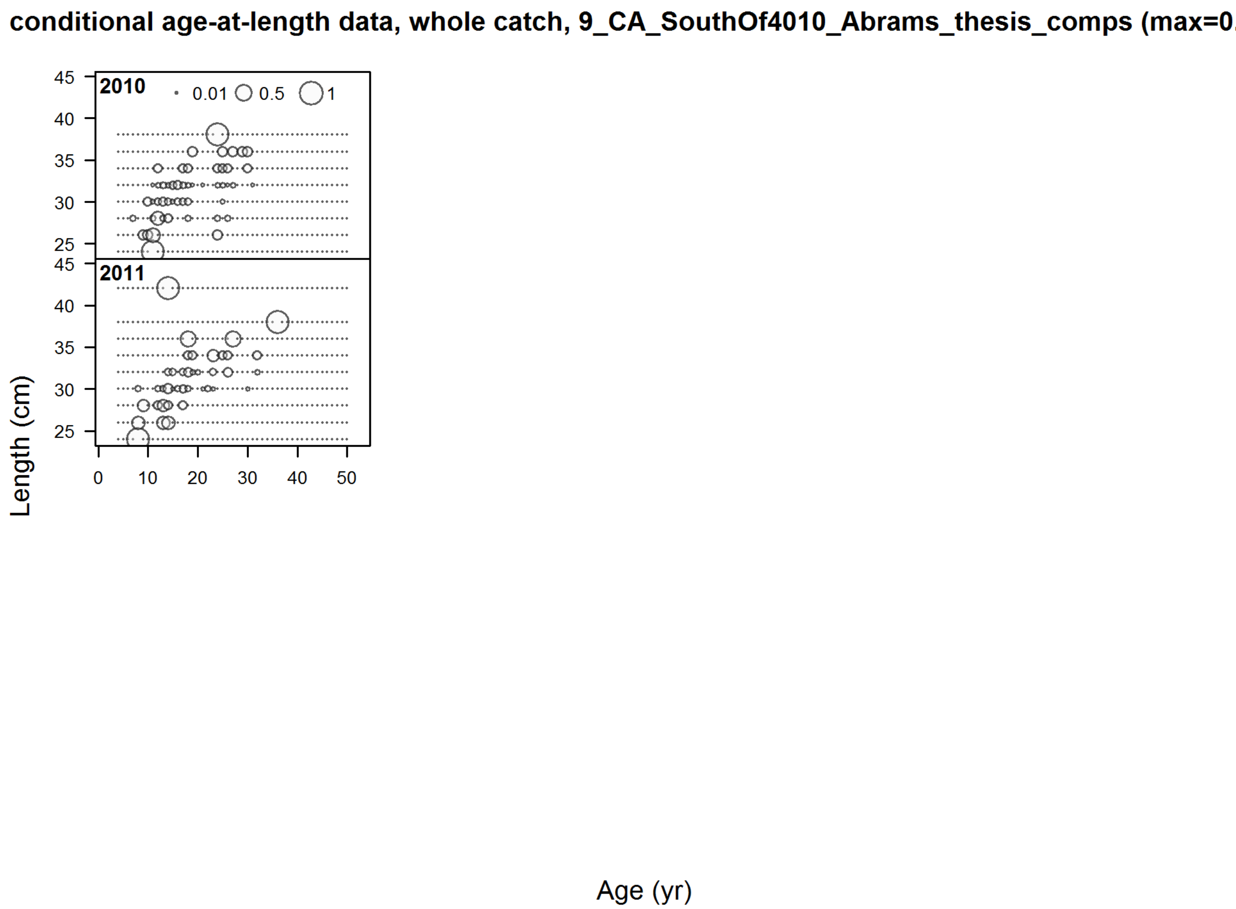


Figure 67: Conditional age-at-length compositions by year from the Abrams thesis study, used in the southern model.

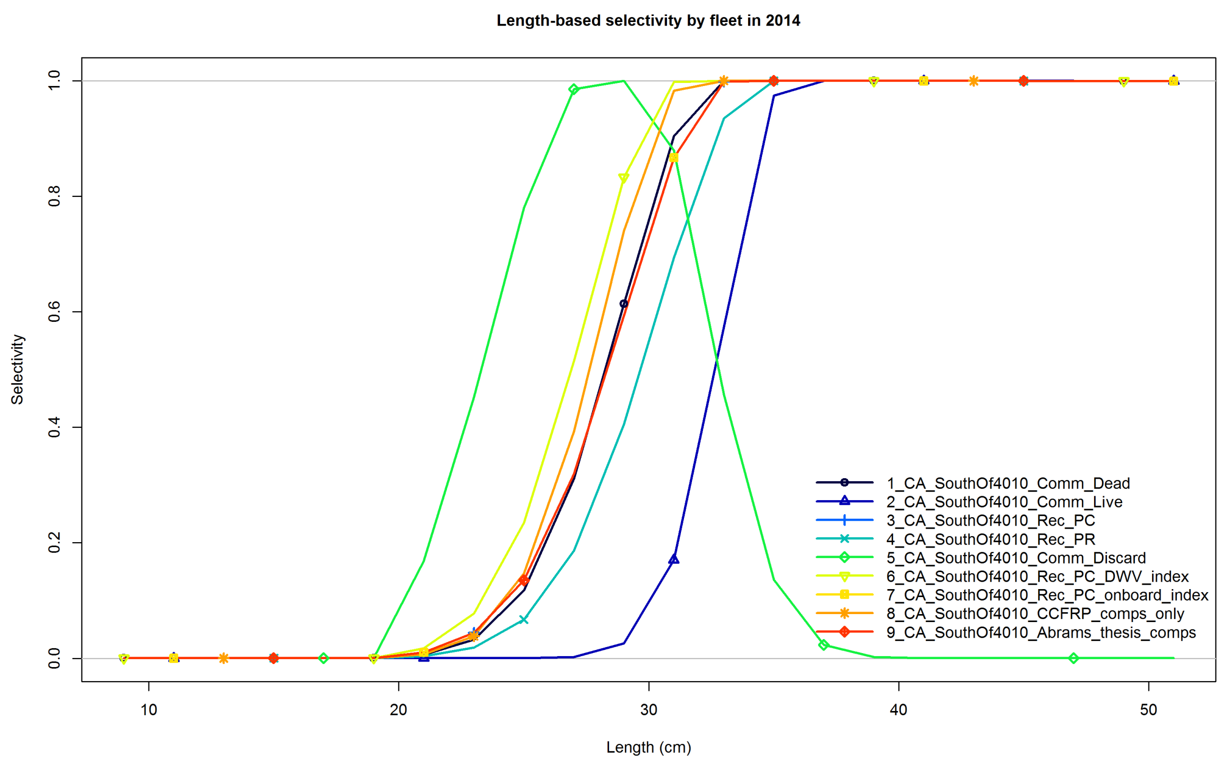


Figure 68: Length-based selectivity by fleet for the southern model.

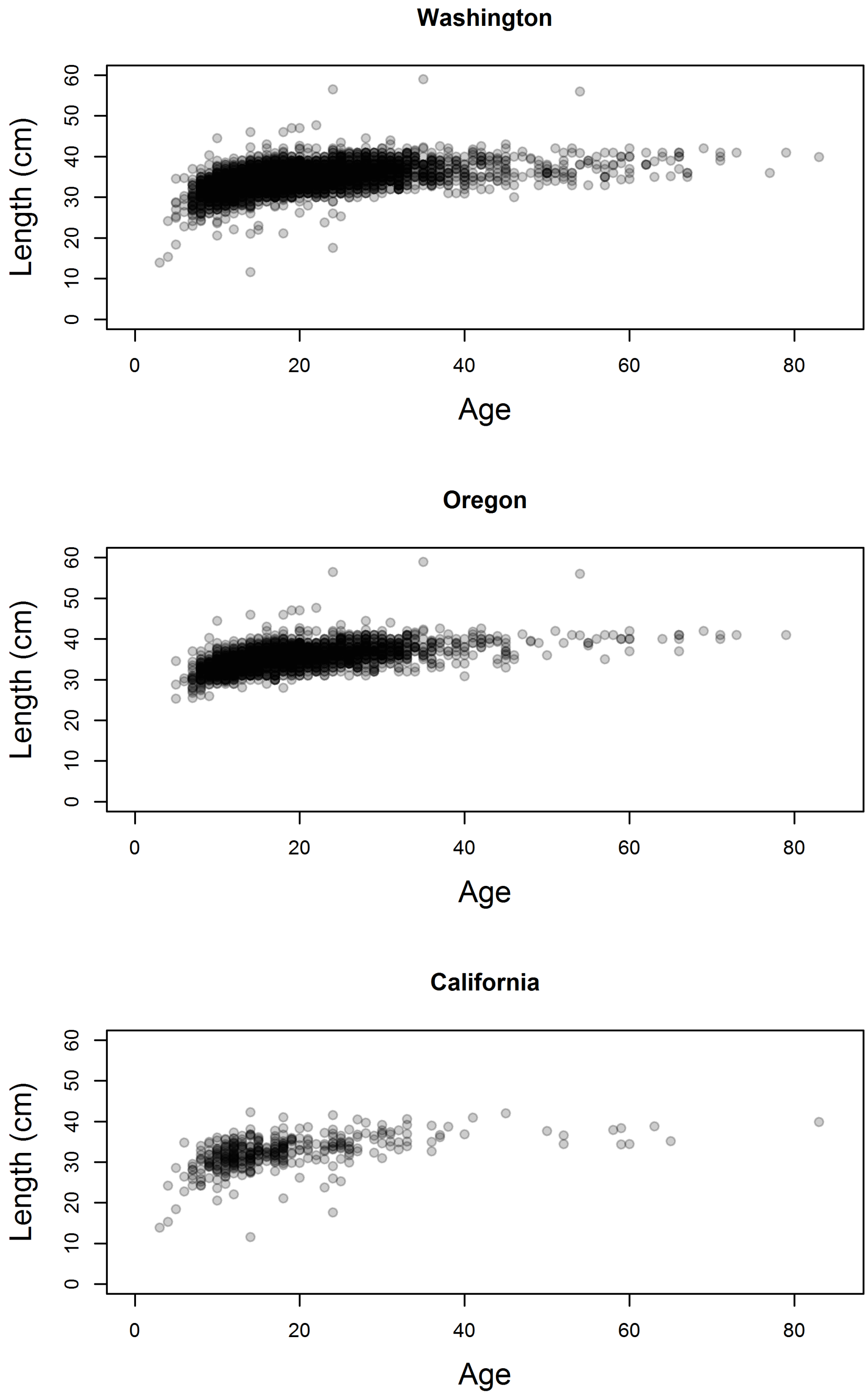


Figure 69: Raw length at age data by state.

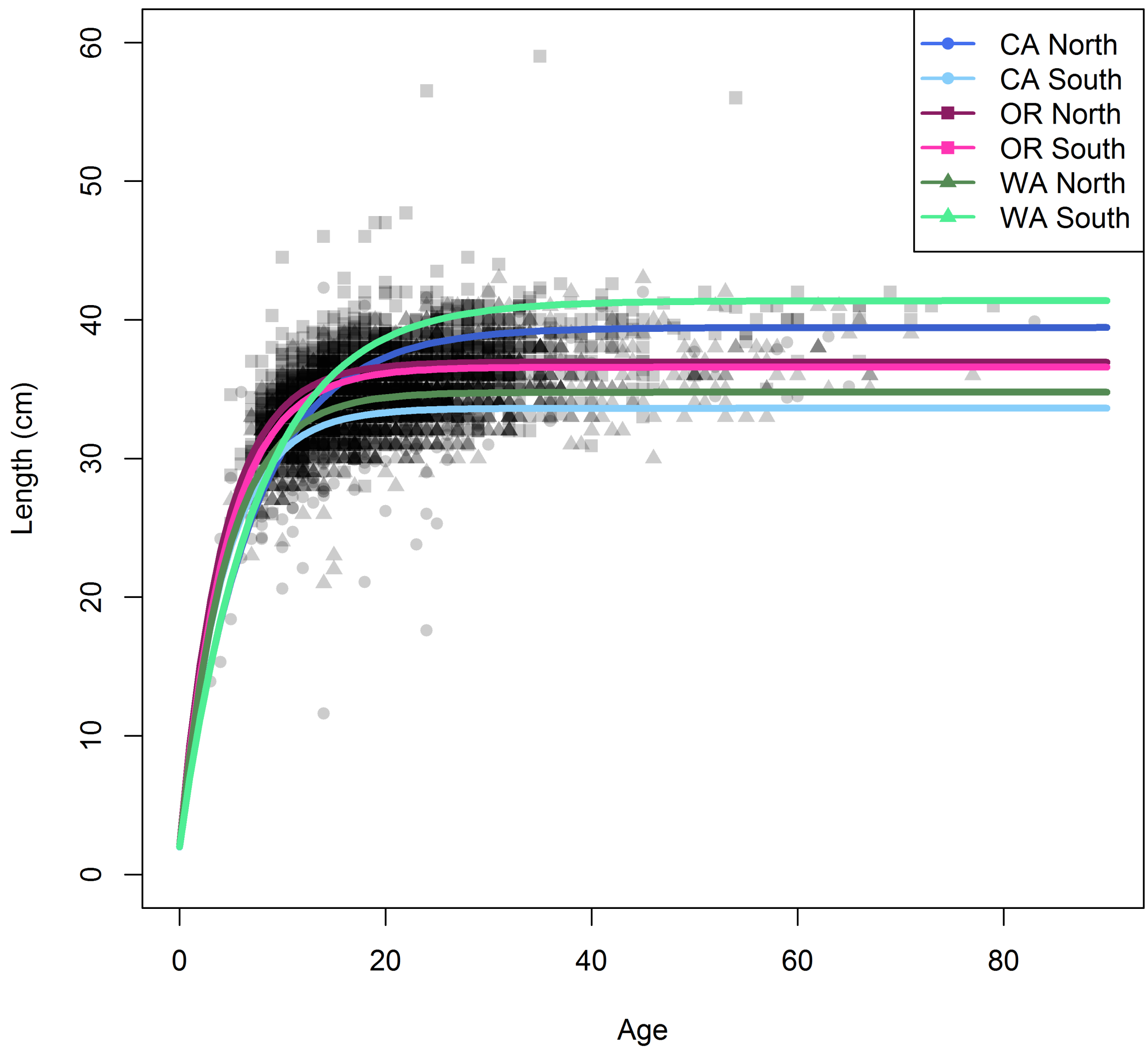


Figure 70: Fits by region to the von Bertalanffy growth curve with age-0 fixed at 2 cm. California is split at 40°106′, Oregon at Florence, OR, and Washington between MCAs 2 and 3.

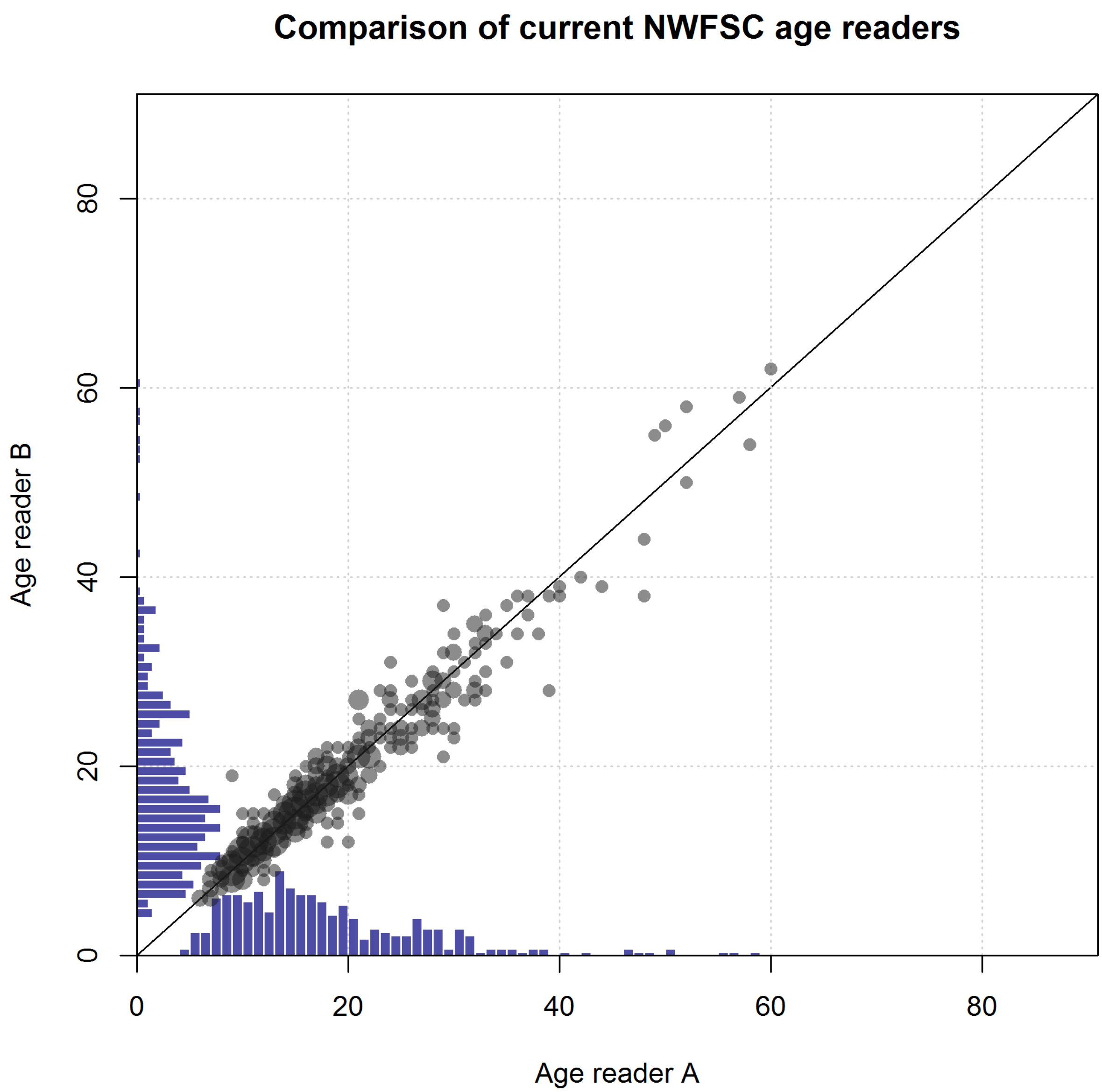


Figure 71: Aging precision between two current age readers at the NWFSC.

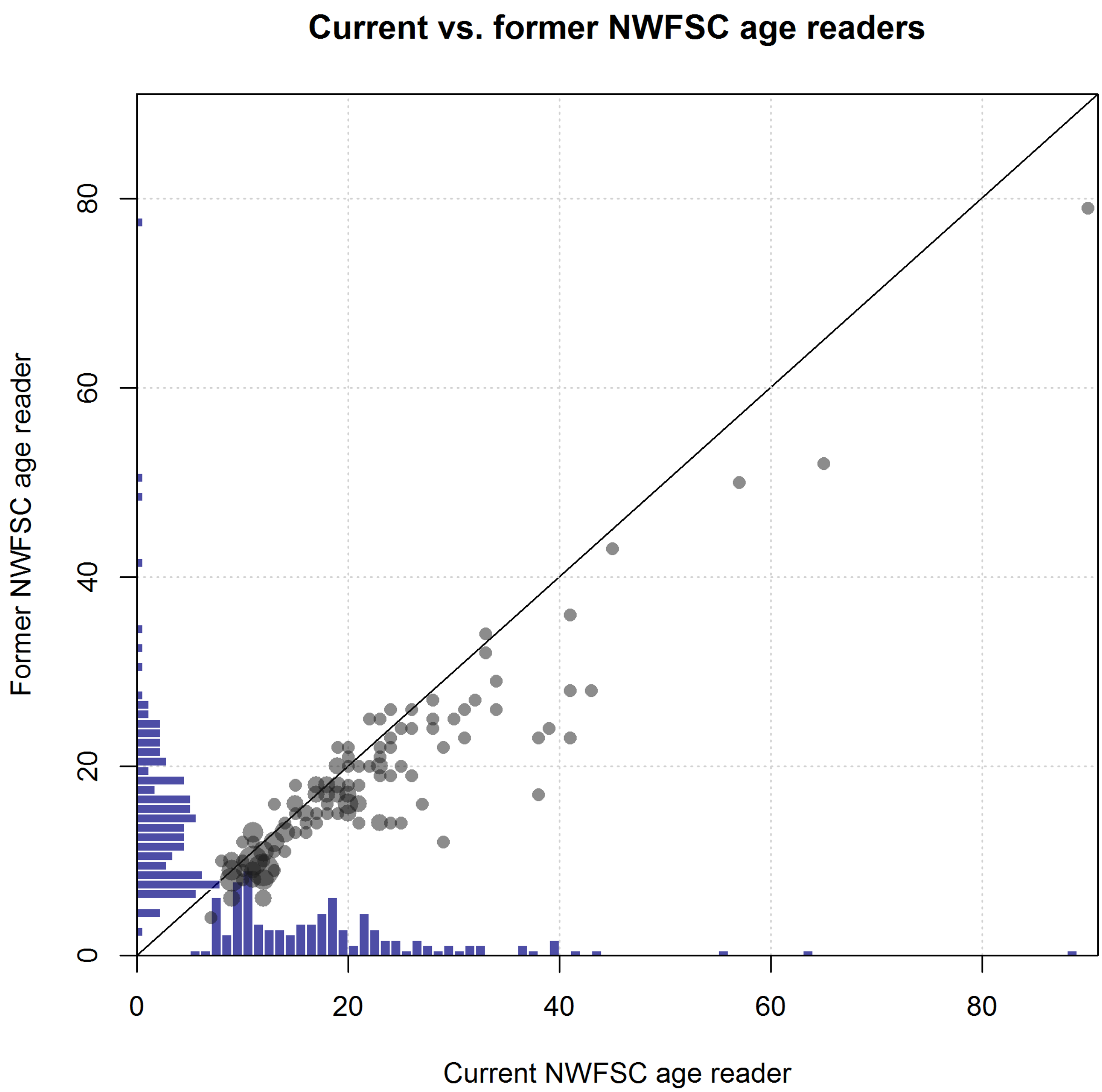


Figure 72: Aging precision between a current and former NWFSC age reader.

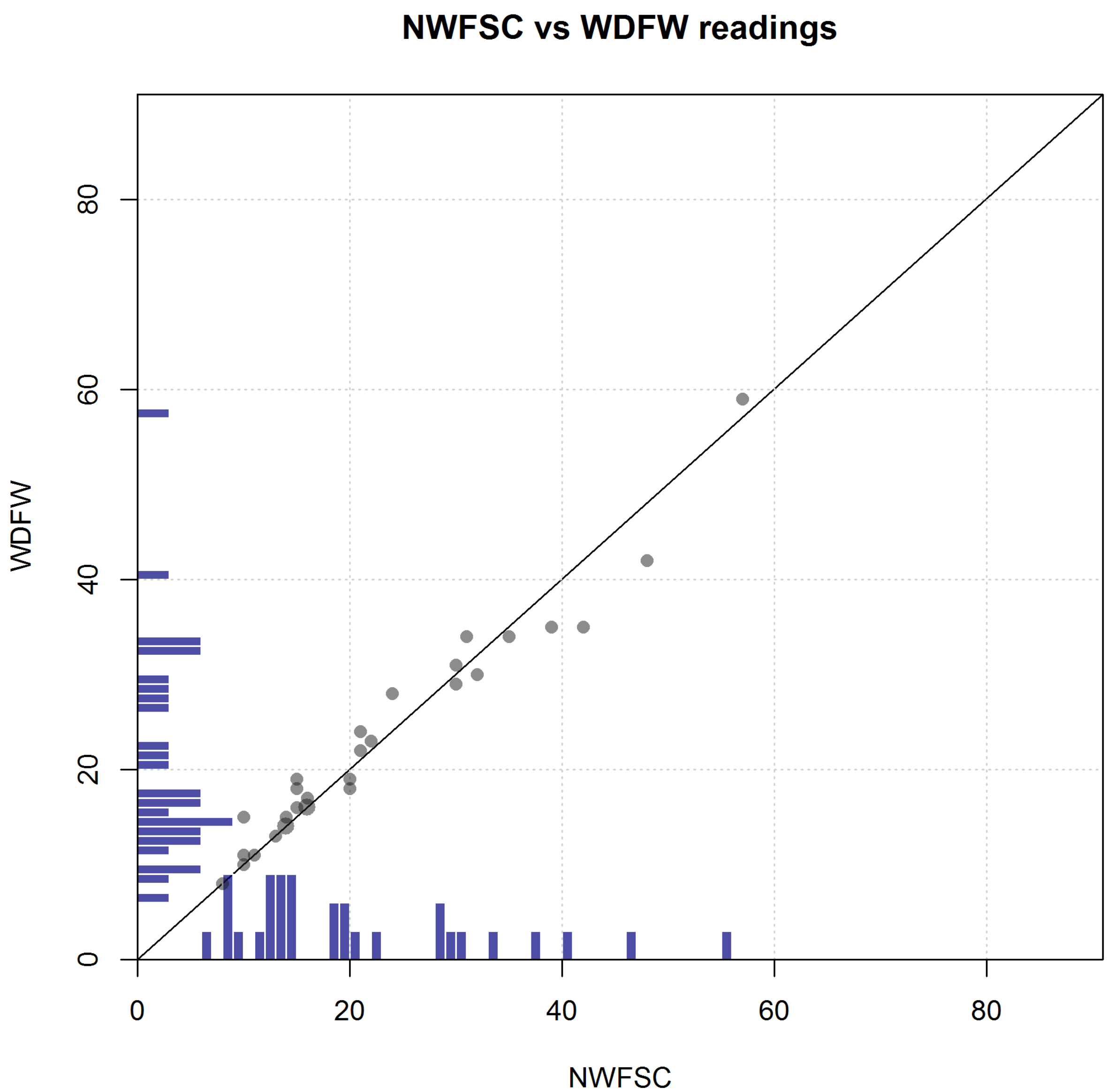


Figure 73: Aging precision between NWFSC and WDFW age readers.

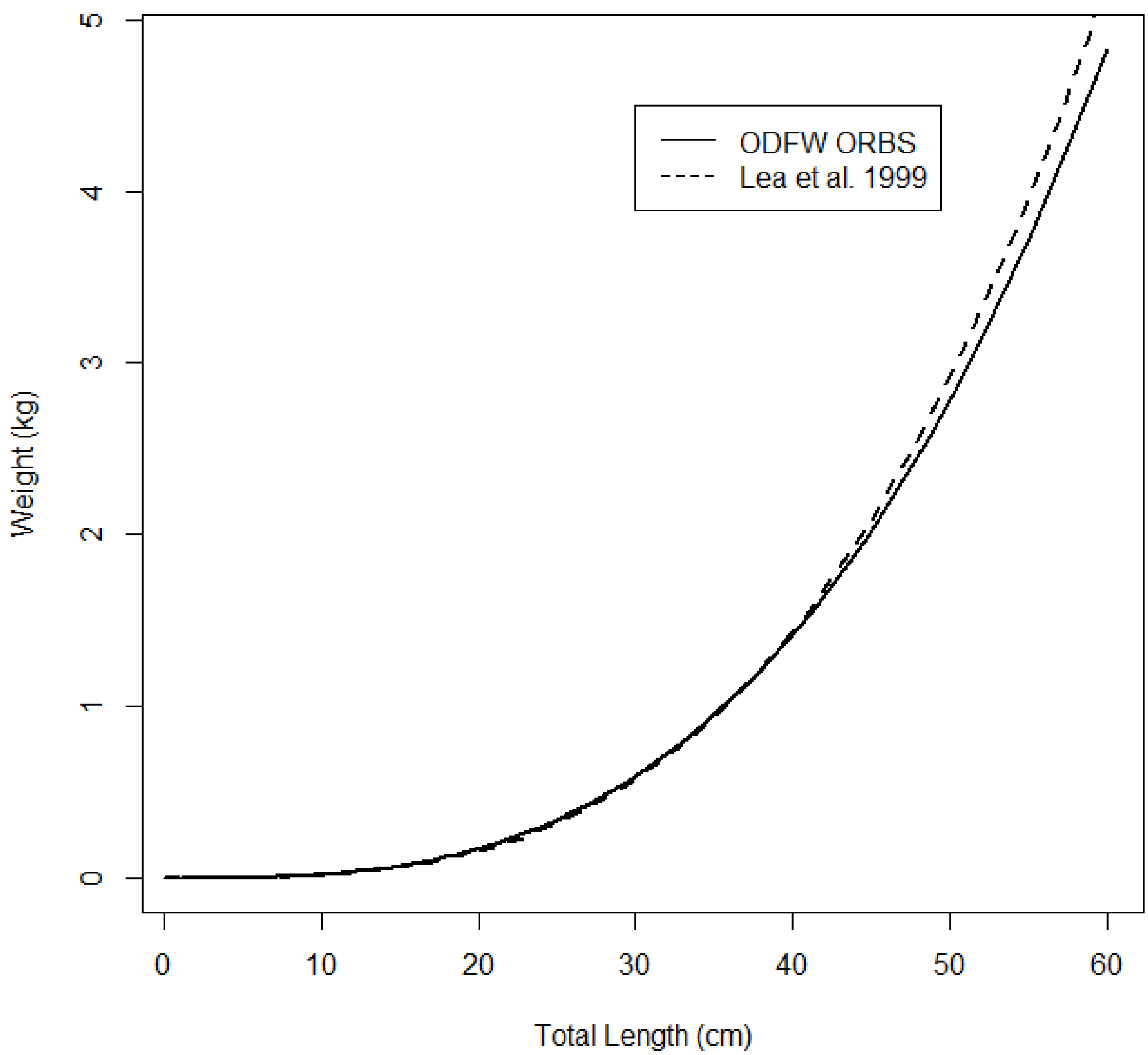


Figure 74: Comparison of the China rockfish weight-length curves from Lea et al. (1999) for California and those derived from the Oregone ORBS (dockside sampling program) data provided for this assessment.

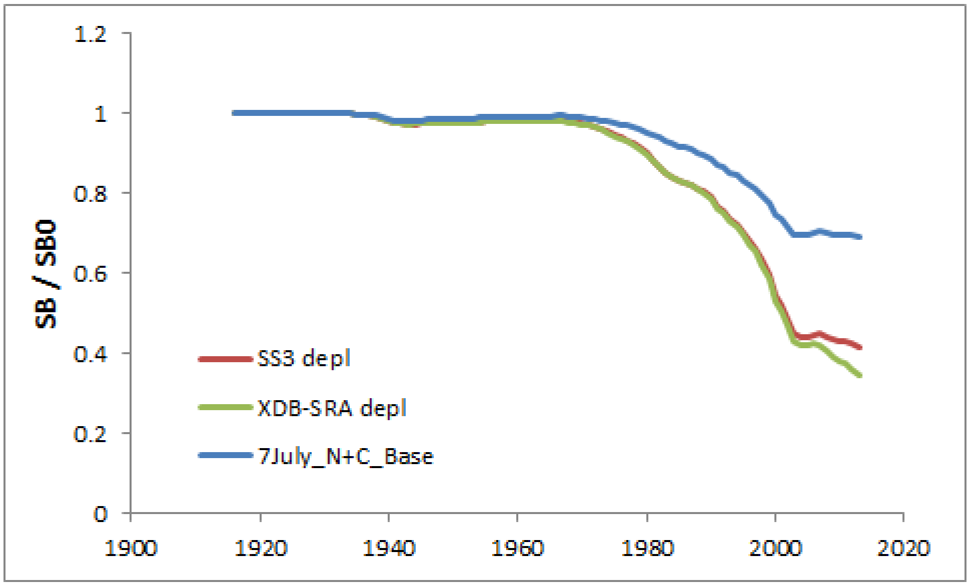


Figure 75: Comparison of depletion among the 2013 data moderate assessment, a SS3 bridge model, and the 2015 base case for the combined nothern and central models.

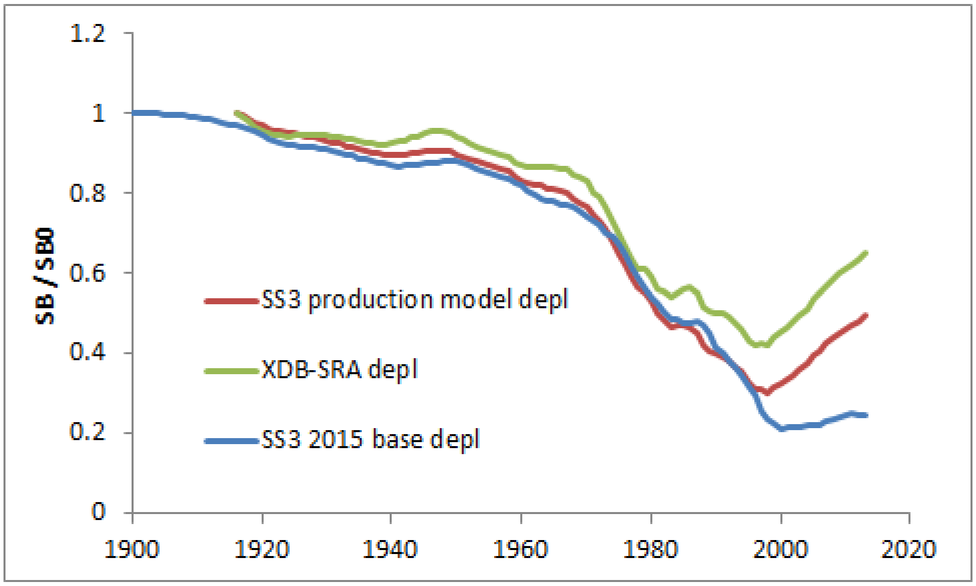


Figure 76: Comparison of depletion among the 2013 data moderate assessment, a SS3 bridge model, and the 2015 base case for the southern model.

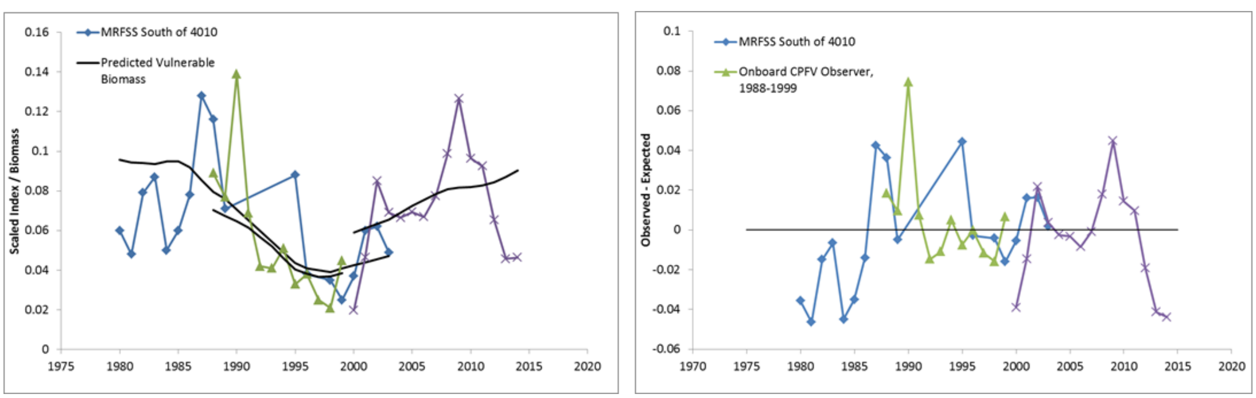


Figure 77: Normalized indices (left) and residuals for indices (right) for the southern model.

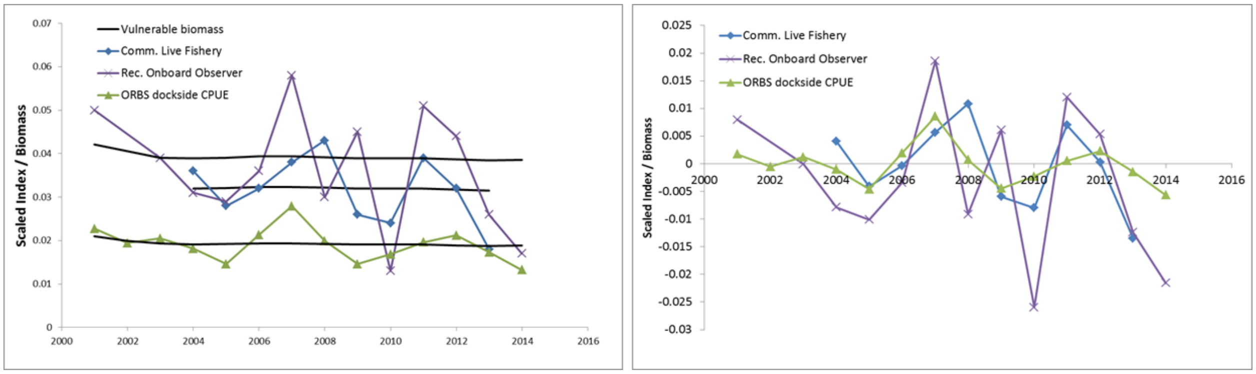


Figure 78: Normalized indices (left) and residuals for indices (right) for the central model.

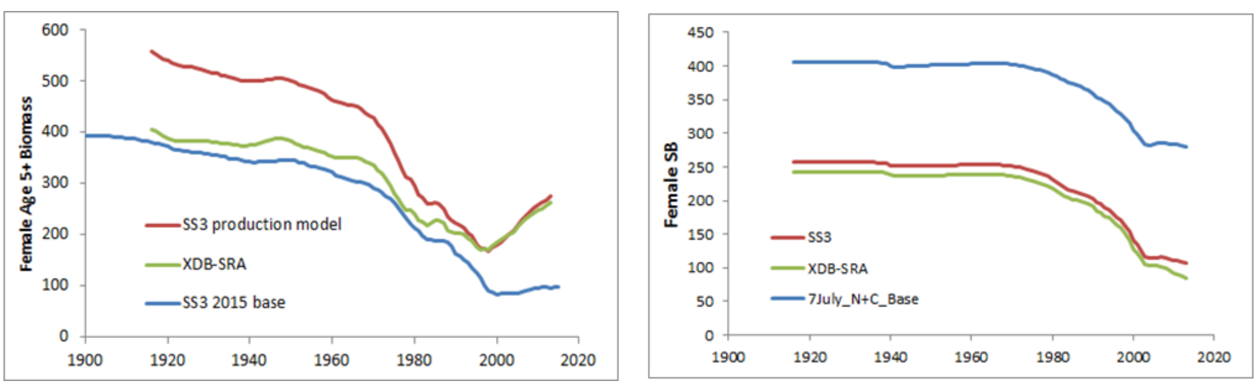


Figure 79: Comparison of depletion among the 2013 data moderate assessment, a SS3 bridge model, and the 2015 base case for the southern (left panel) and northern and central (right panel) models.

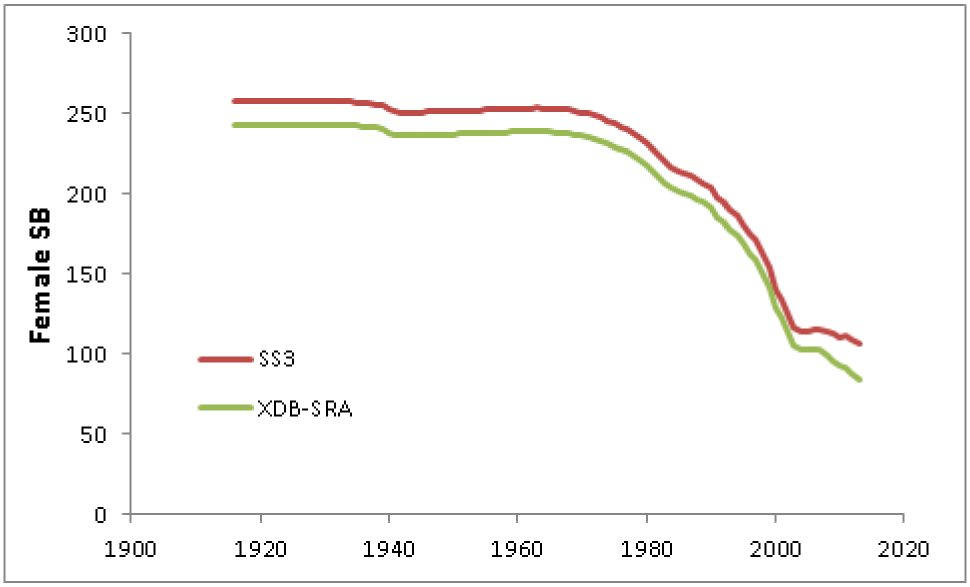


Figure 80: Time series of spawning biomass from the 2013 XDB-SRA assessment of China rockfish north of 40°10′ N. latitude, and an age-structured production model in Stock Synthesis v3 (SS3) fit to the same data.

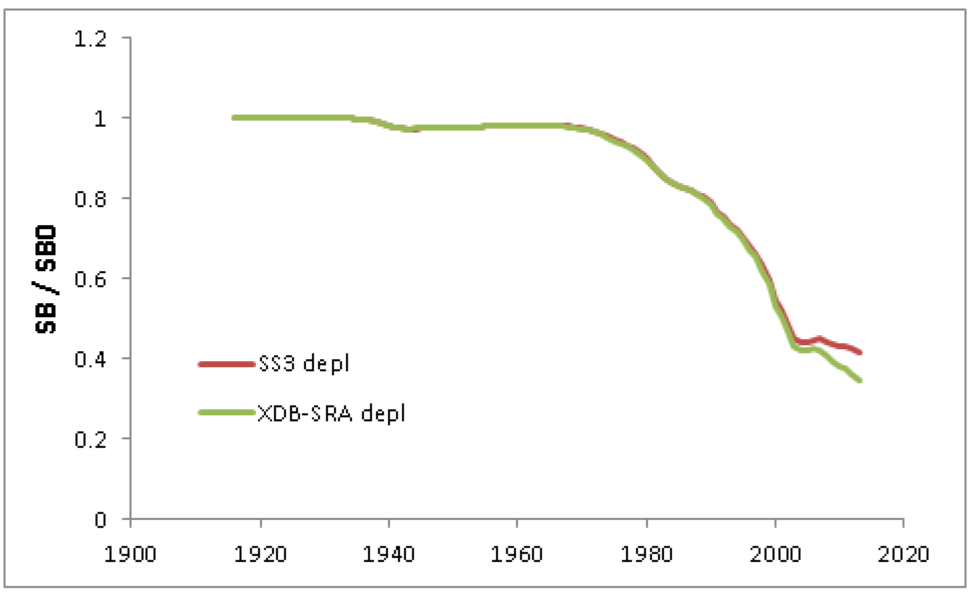


Figure 81: Time series of spawning biomass relative to unfished spawning biomass ("depletion", or SB/SB0) from the 2013 XDB-SRA assessment of China rockfish north of 40°10′ N. latitude, and an age-structured production model in Stock Synthesis v3 (SS3) fit to the same data.

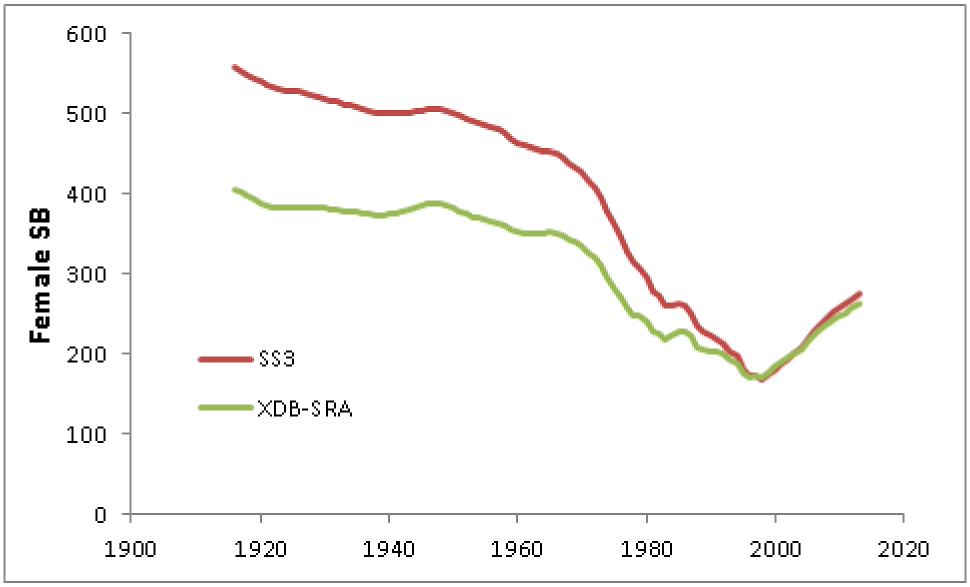


Figure 82: Time series of spawning biomass from the 2013 XDB-SRA assessment of China rockfish south of 40°10′ N. latitude, and an age-structured production model in Stock Synthesis v3 (SS3) fit to the same data.

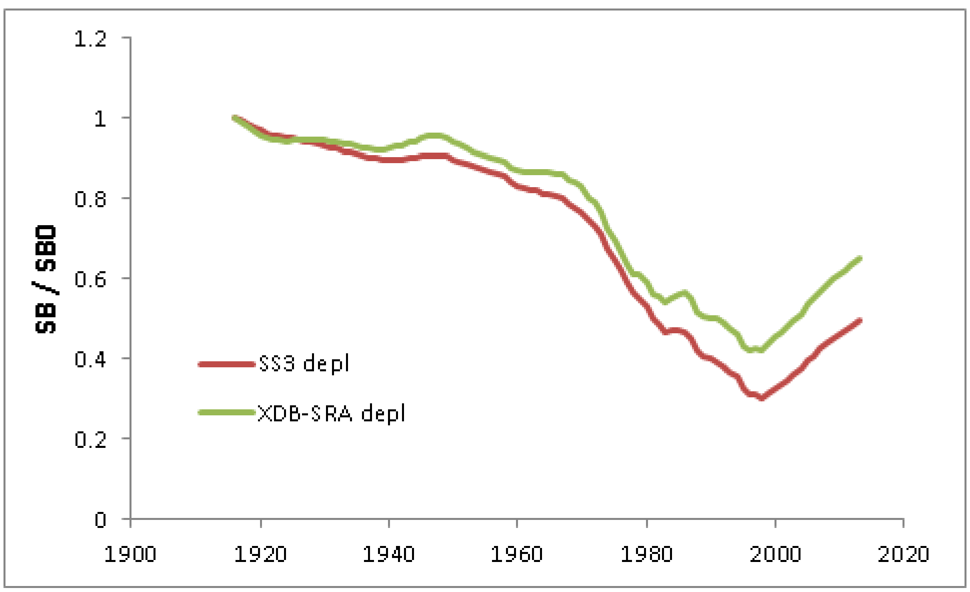


Figure 83: Time series of spawning biomass relative to unfished spawning biomass (“depletion”, or SB/SB0) from the 2013 XDB-SRA assessment of China rockfish south of 40°10′ N. latitude, and an age-structured production model in Stock Synthesis v3 (SS3) fit to the same data.

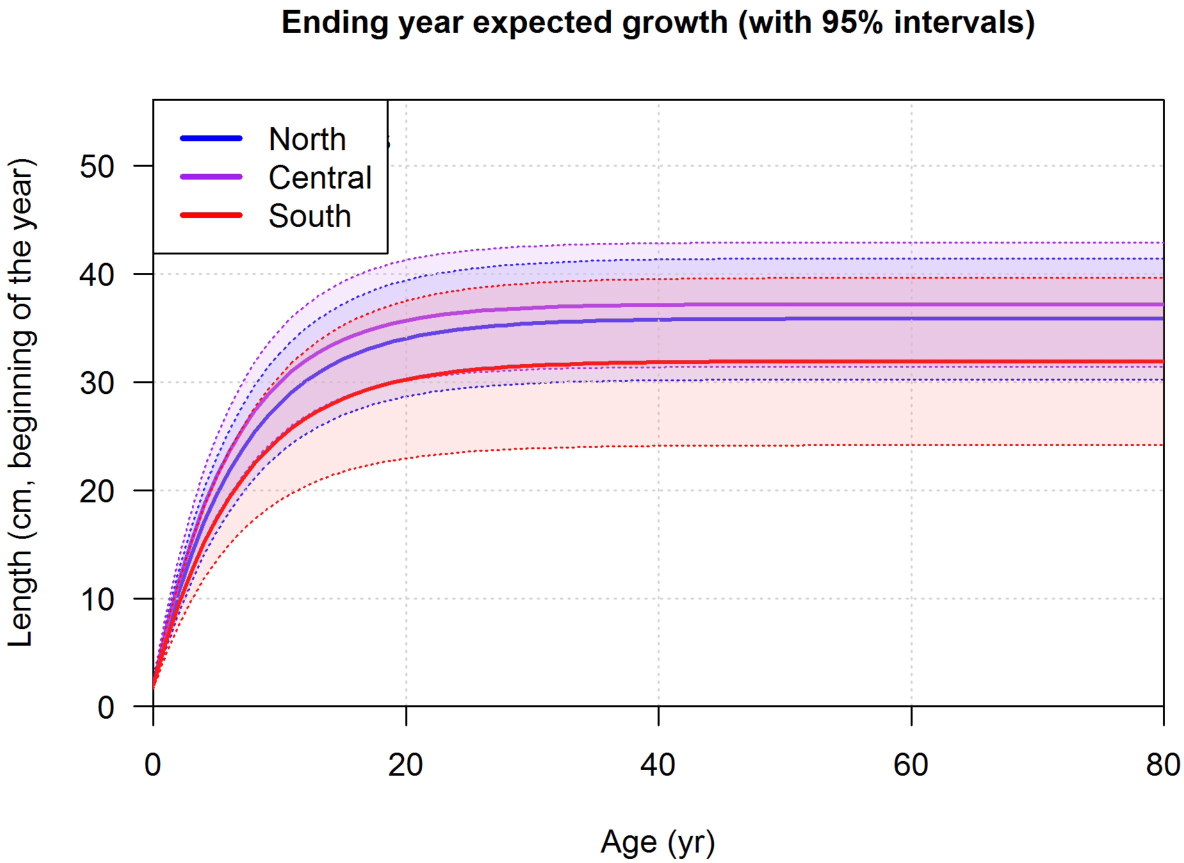


Figure 84: Fits to growth among models with no sex-specific growth.

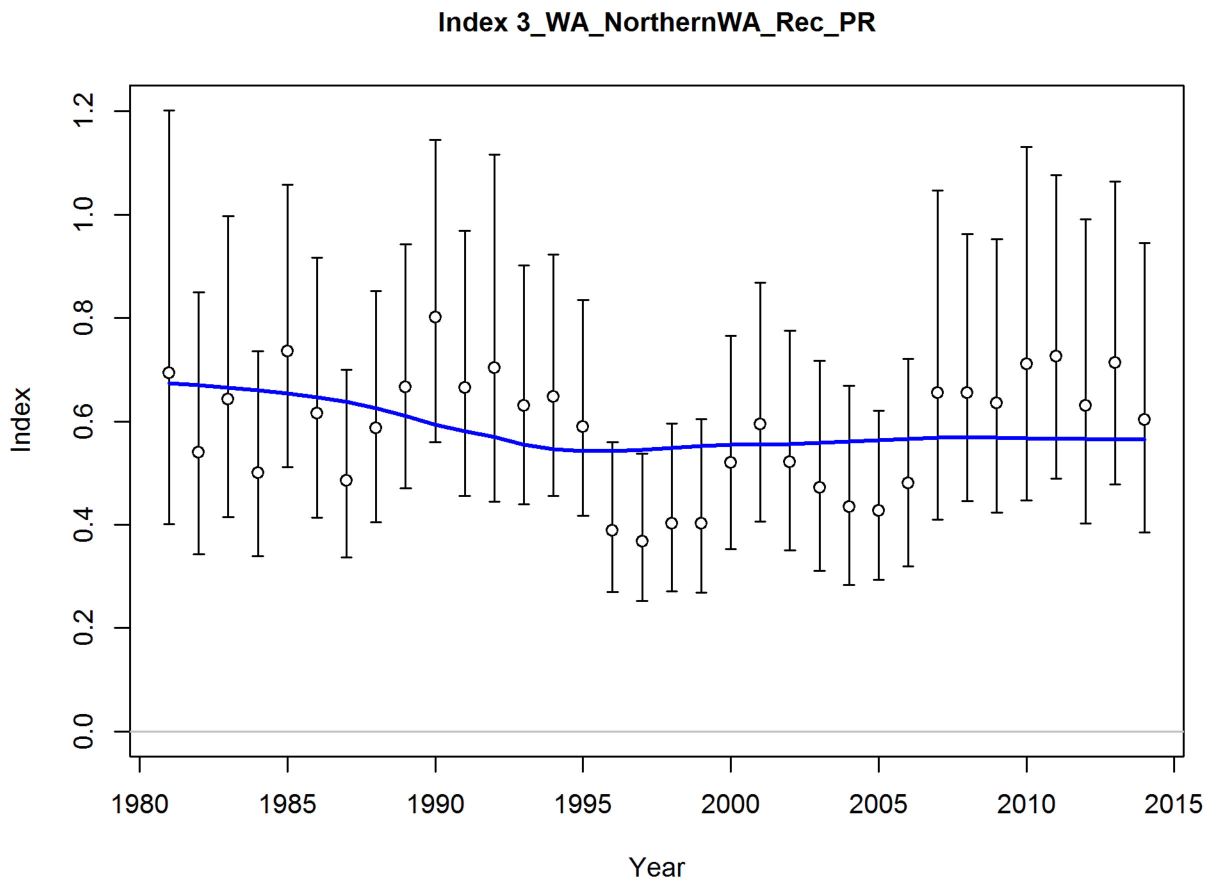


Figure 85: Fits to private boat recreational dockside index for Washington, northern model.

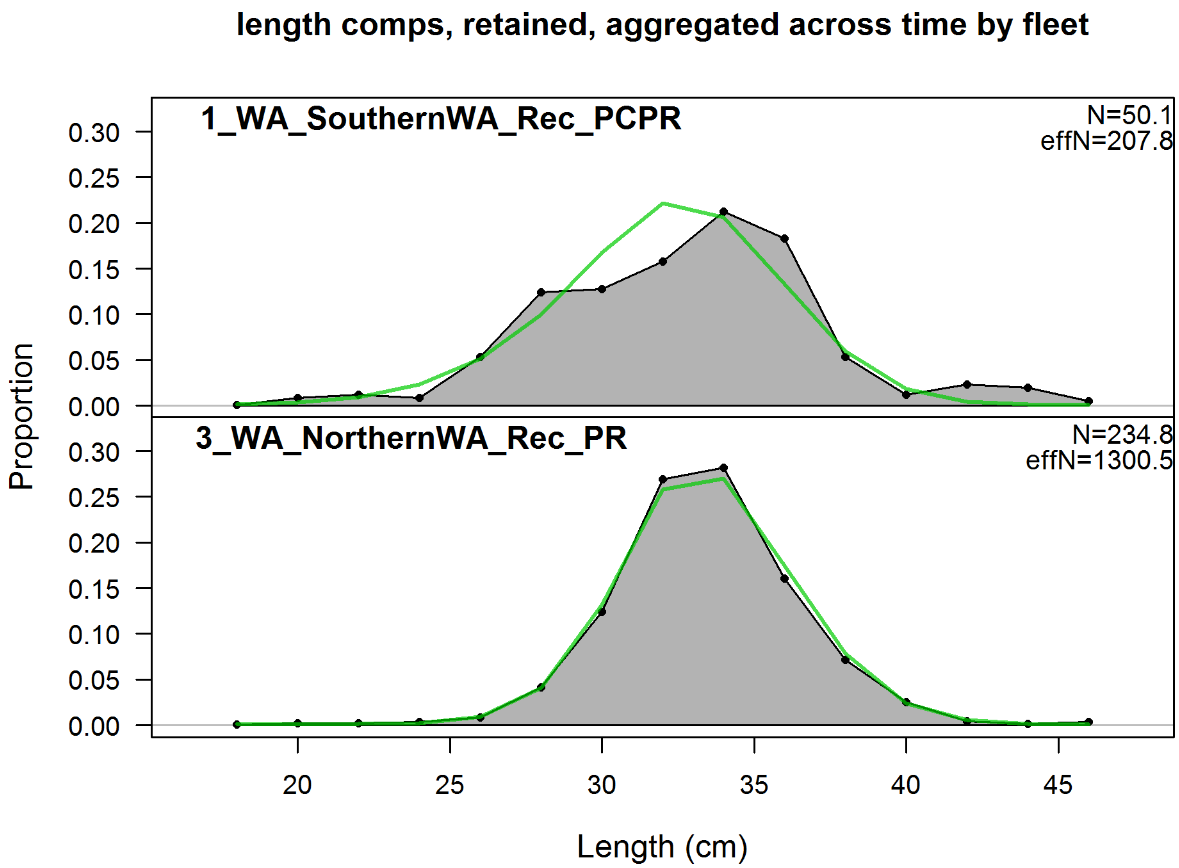


Figure 86: Fits to the time aggregated recreational length distributions for the northern model.

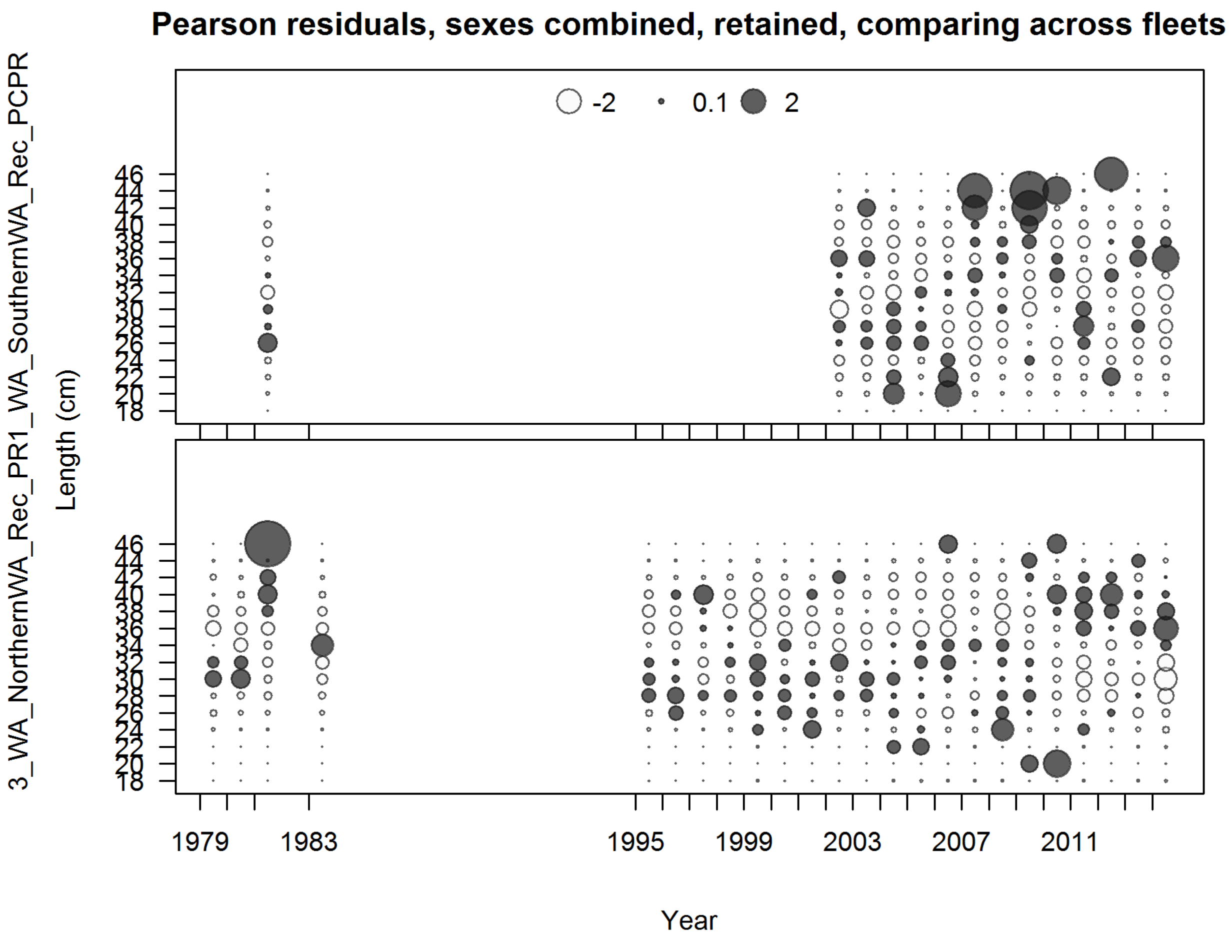


Figure 87: Residuals in fit to length compositions for northern model. Filled circles indicate observed values greater than expected values.

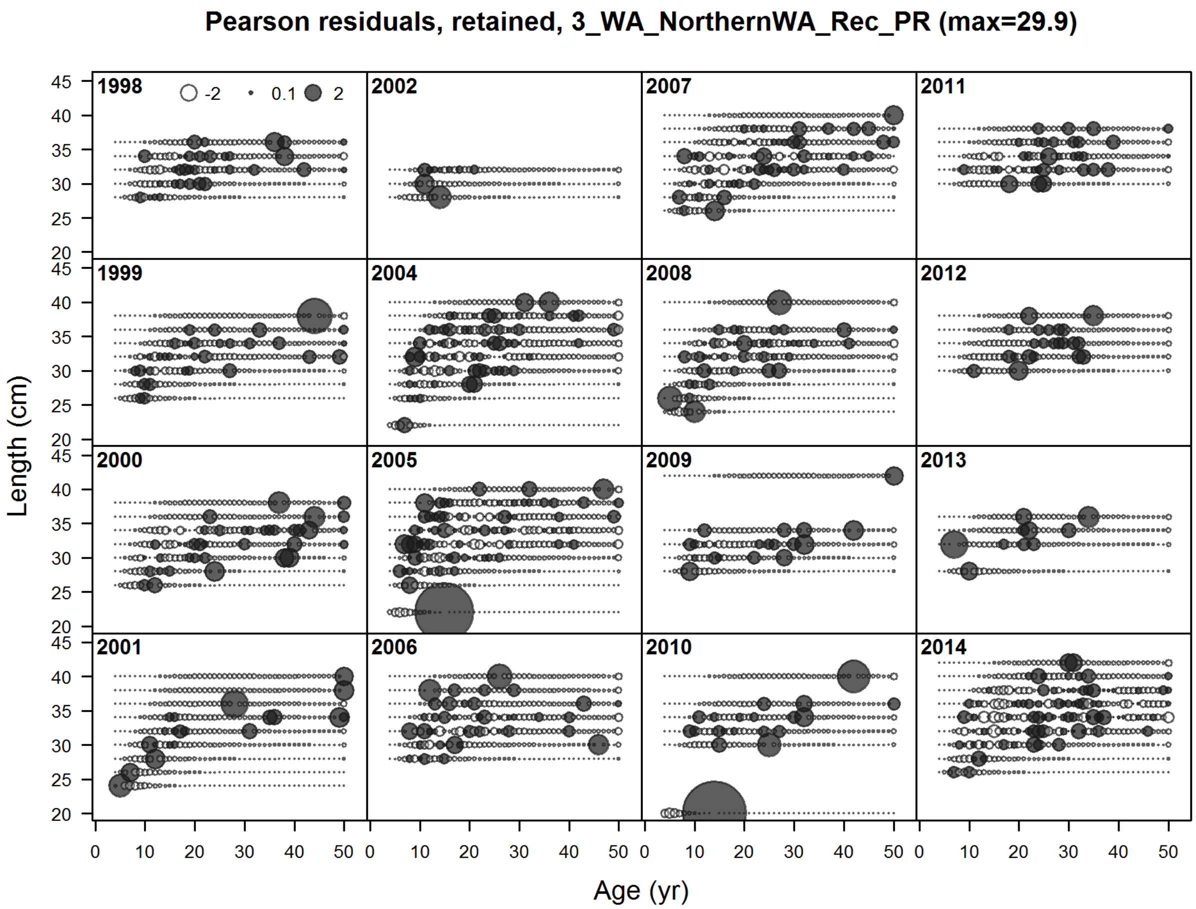


Figure 88: Residuals in fit to conditional age-at-length compositions for recreational private/rental catch in northern WA in the northern model. Filled circles indicate observed values greater than expected values.

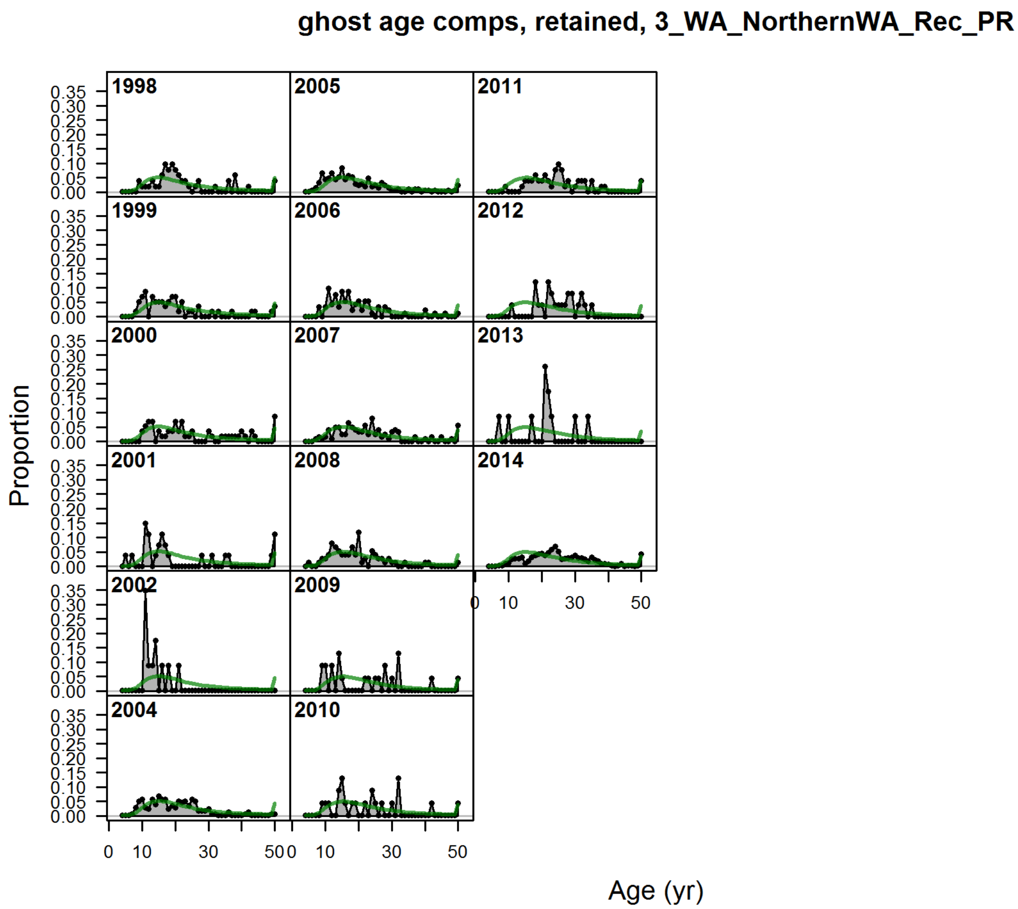


Figure 89: Implied fit to the marginal age-frequencies for recreational private/rental catch in northern WA in the northern model. Fits are provided for evaluation only, but not included in the model likelihood as these samples are included in the likelihood as conditional-age-at-length data.

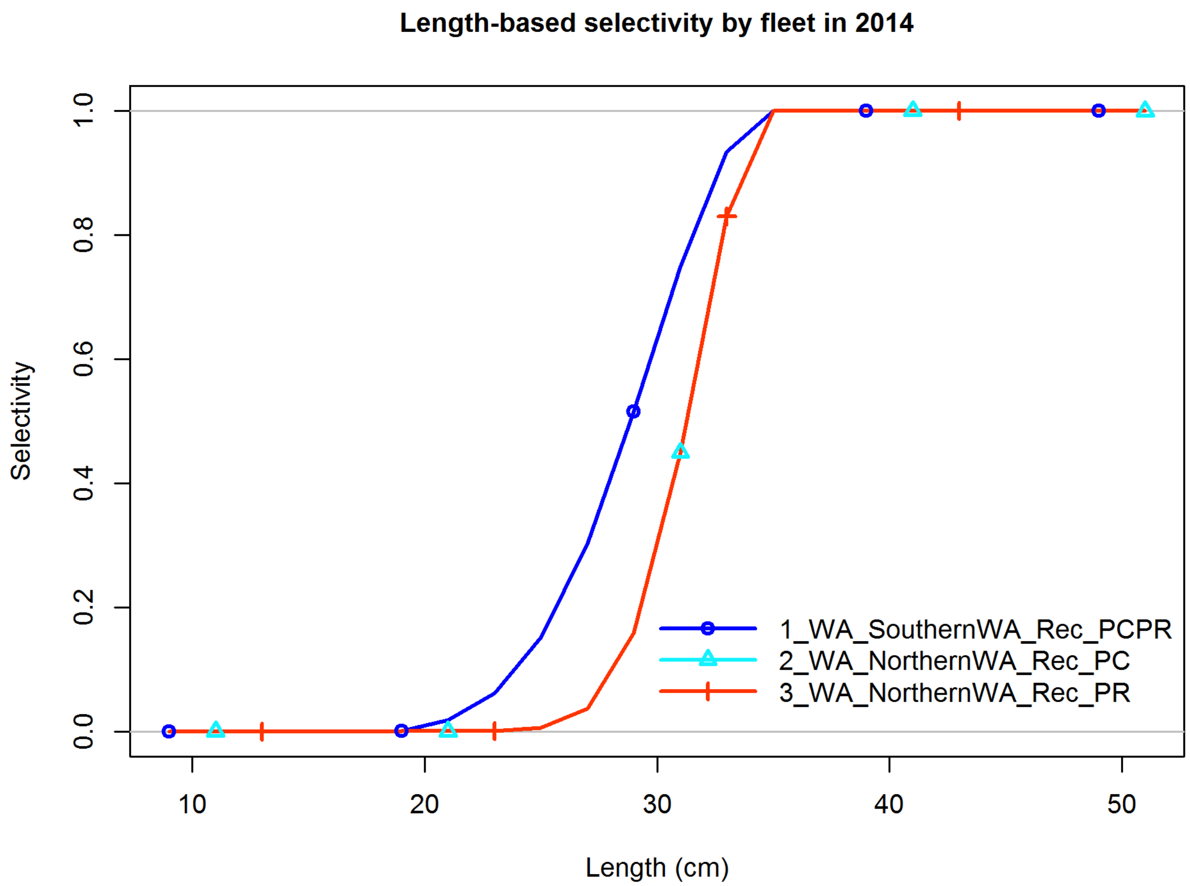


Figure 90: Estimated selectivity curves for the Washington recreational fleets.

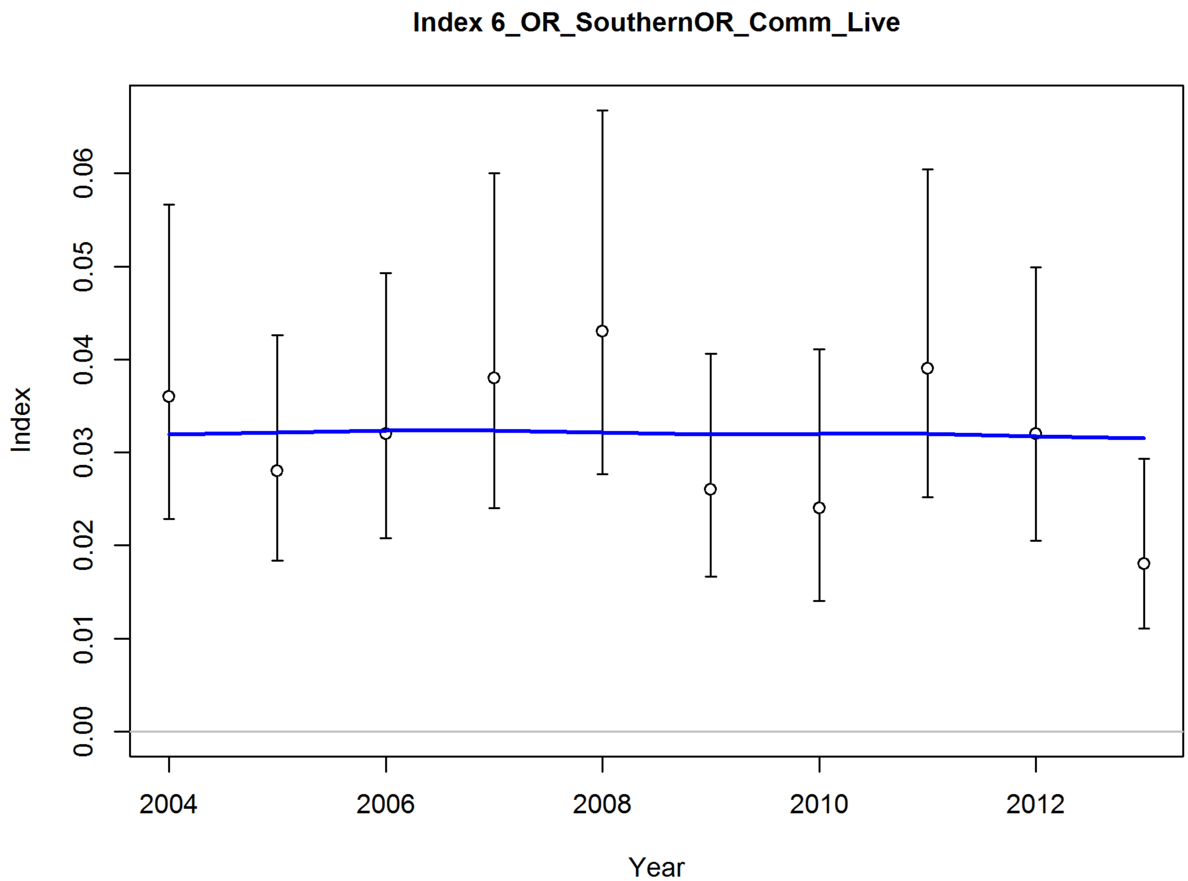


Figure 91: Fits to the southern Oregon commercial live-fish fishery for the central model.

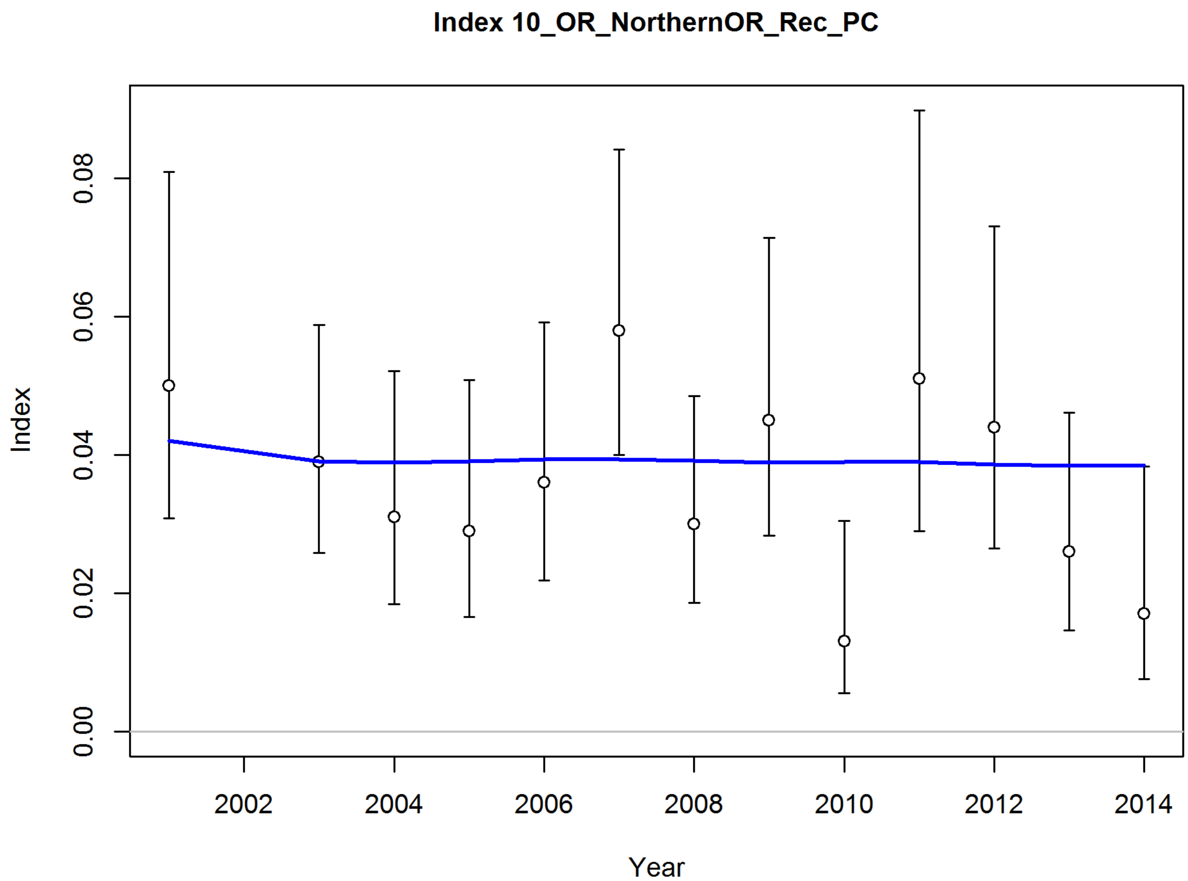


Figure 92: Fits to the northern Oregon recreational CPFV fleet onboard observer index for the central model.

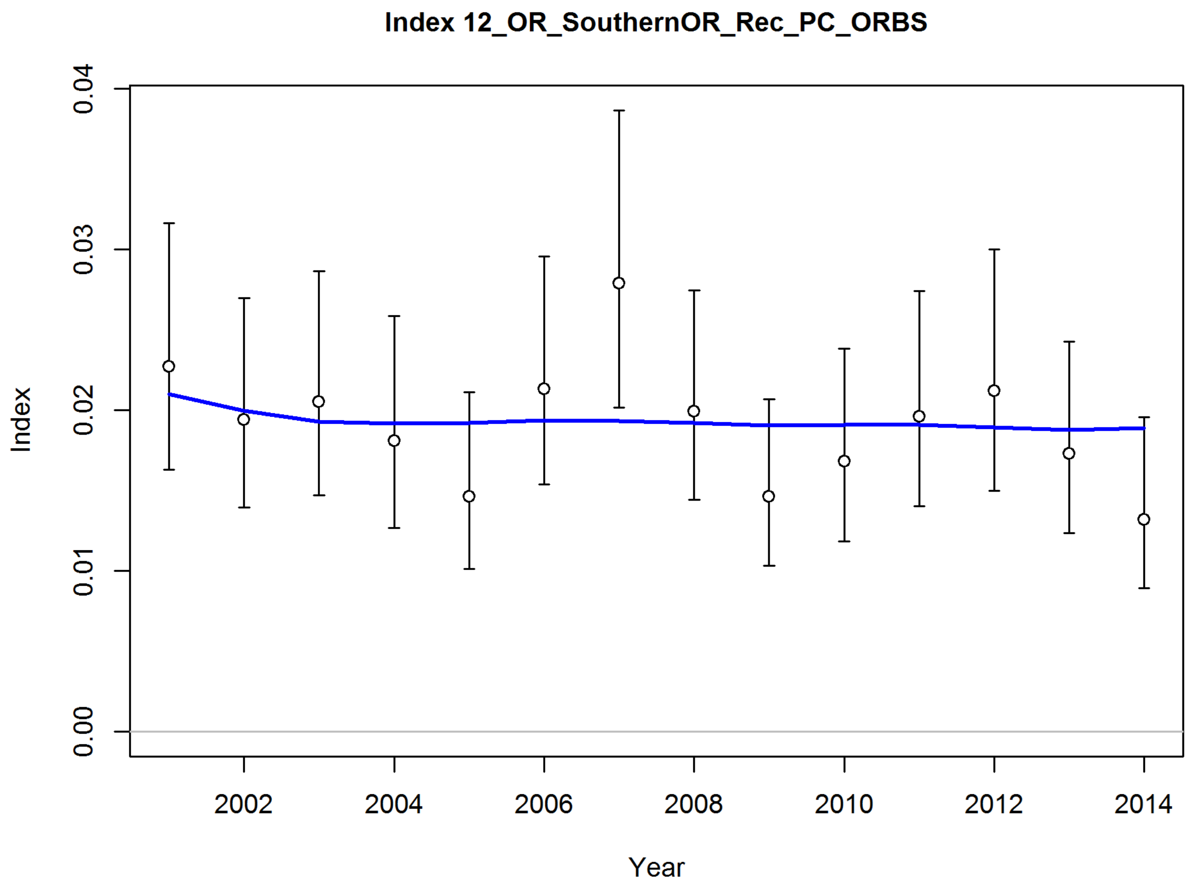


Figure 93: Fits to the northern Oregon recreational CPFV fleet ORBS dockside index for the central model.

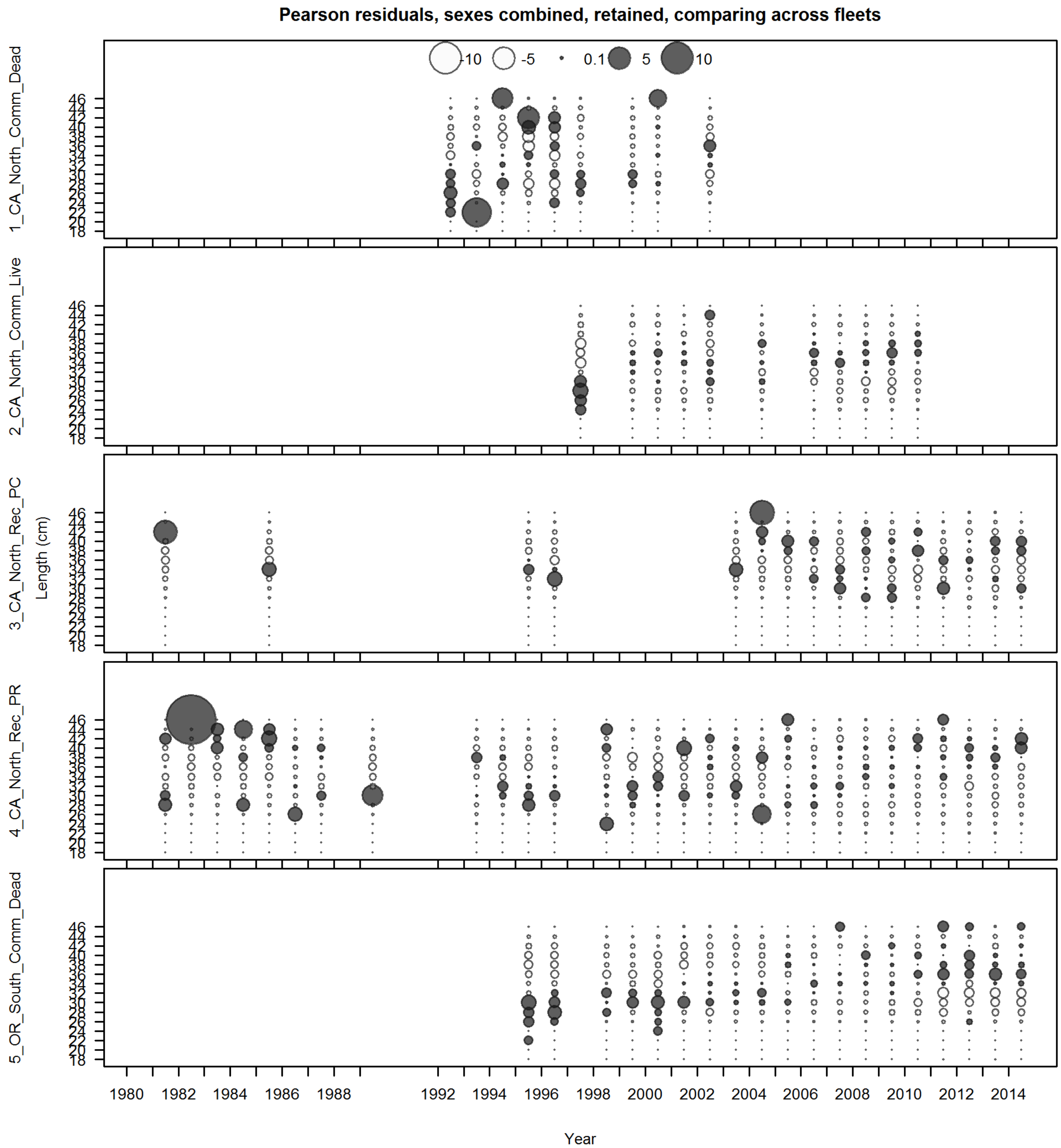


Figure 94: Residuals in fit to length compositions for northern model. Filled circles indicate observed values greater than expected values, figure 1 of 2.

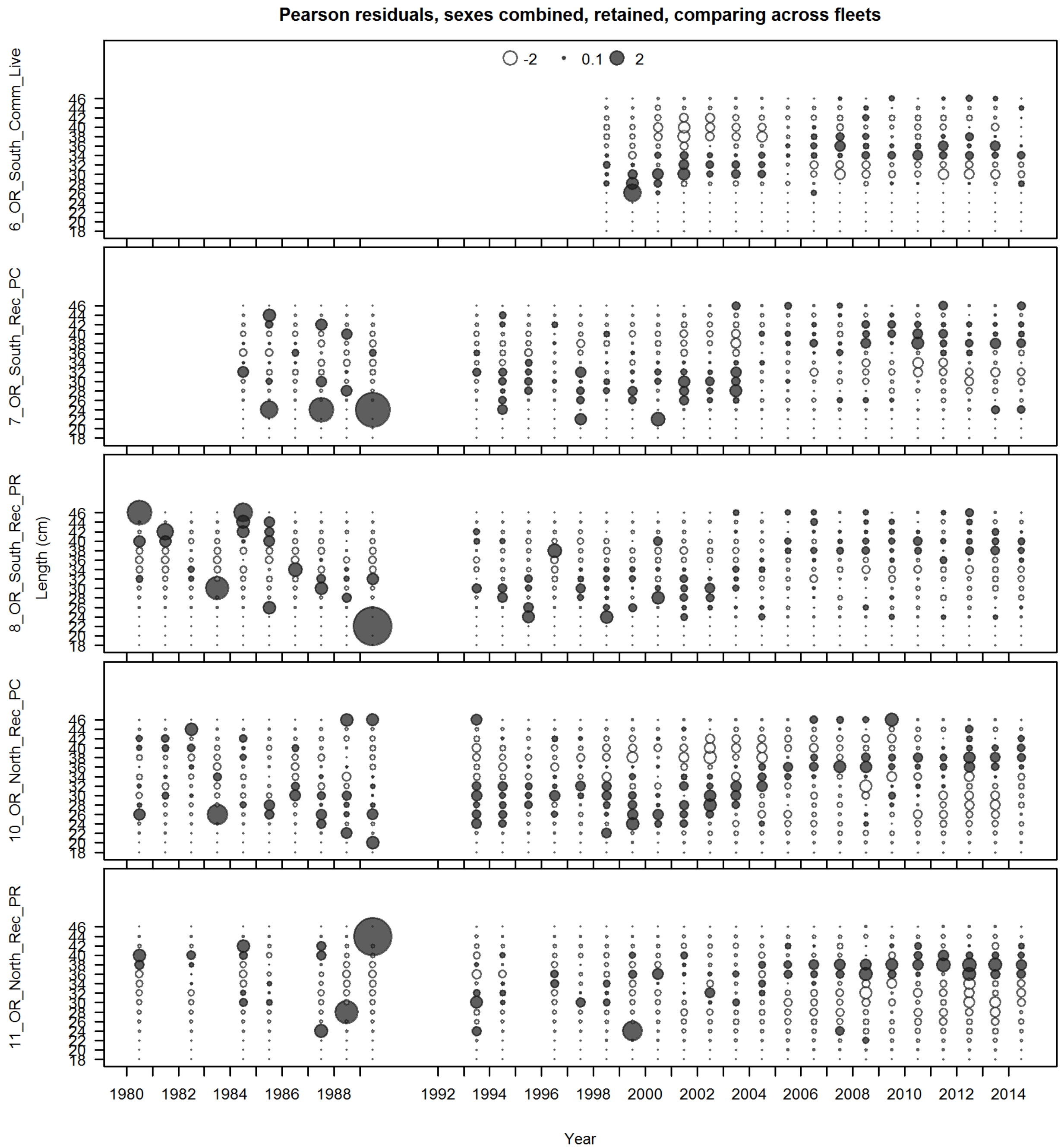


Figure 95: Residuals in fit to length compositions for northern model. Filled circles indicate observed values greater than expected values continued, figure 2 of 2.

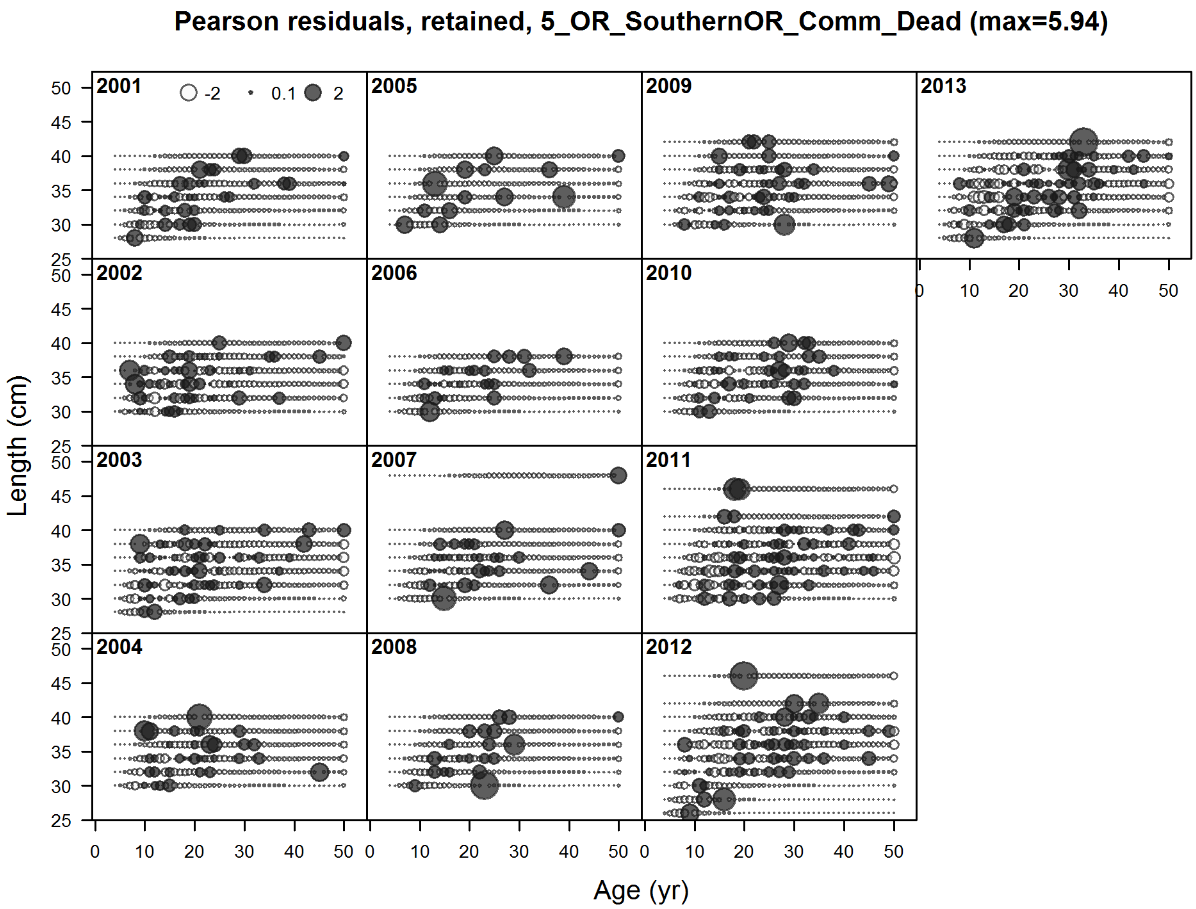


Figure 96: Residuals in fit to conditional age-at-length compositions for the commercial dead-fish fishery in southern OR in the central model. Filled circles indicate observed values greater than expected values.

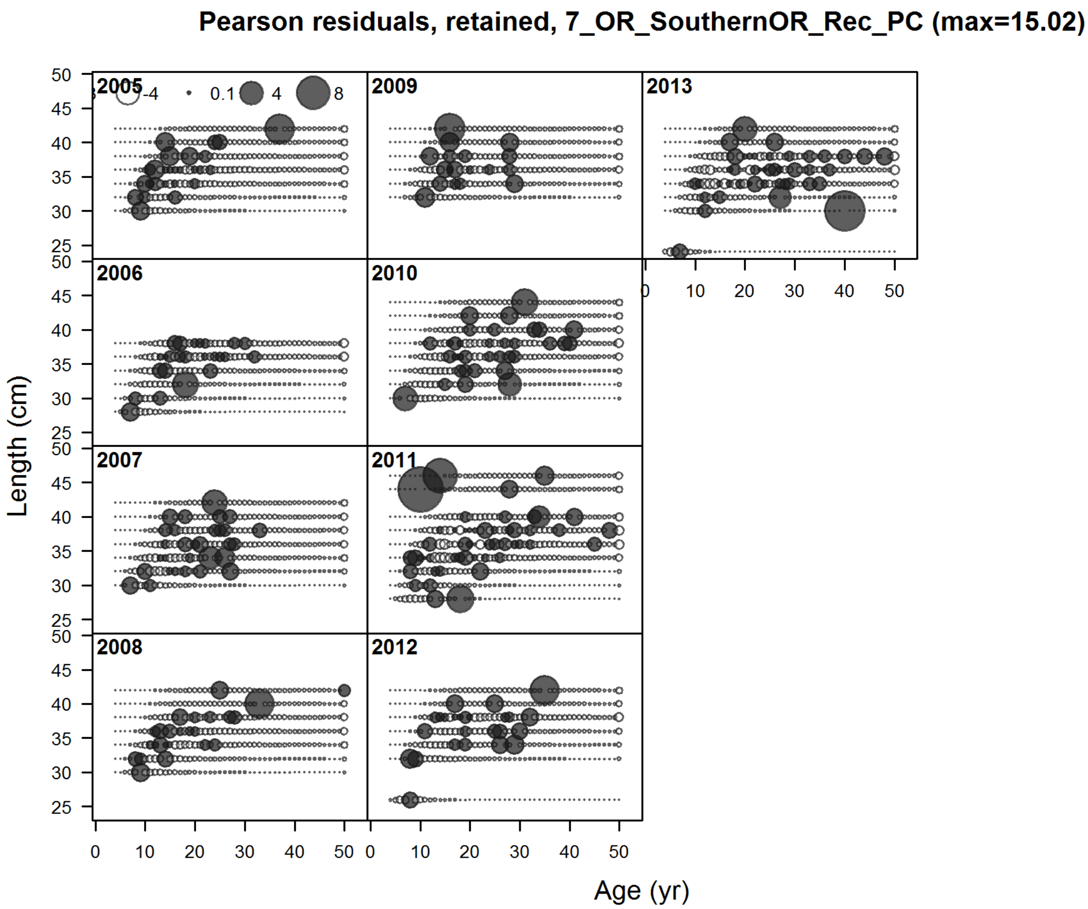


Figure 97: Residuals in fit to conditional age-at-length compositions for the recreational party/charter fishery in southern OR in the central model. Filled circles indicate observed values greater than expected values.

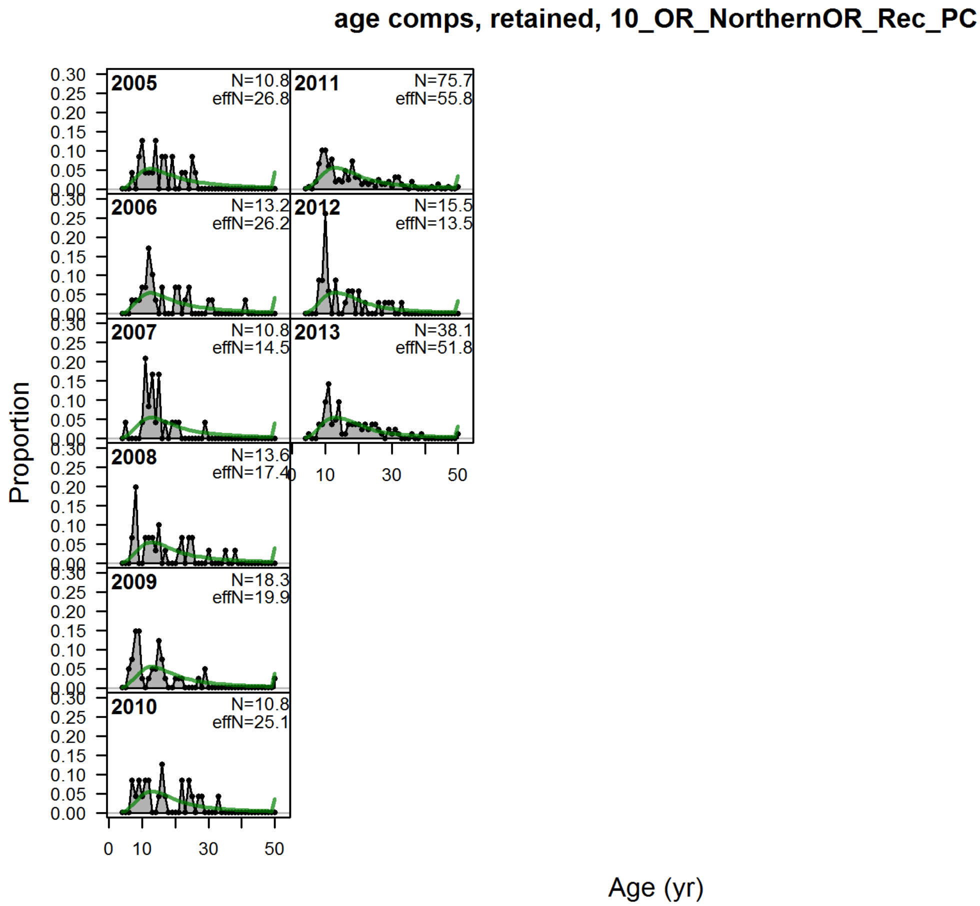


Figure 98: Fits to the marginal age composition for the northern OR recreational party/charter in the central model

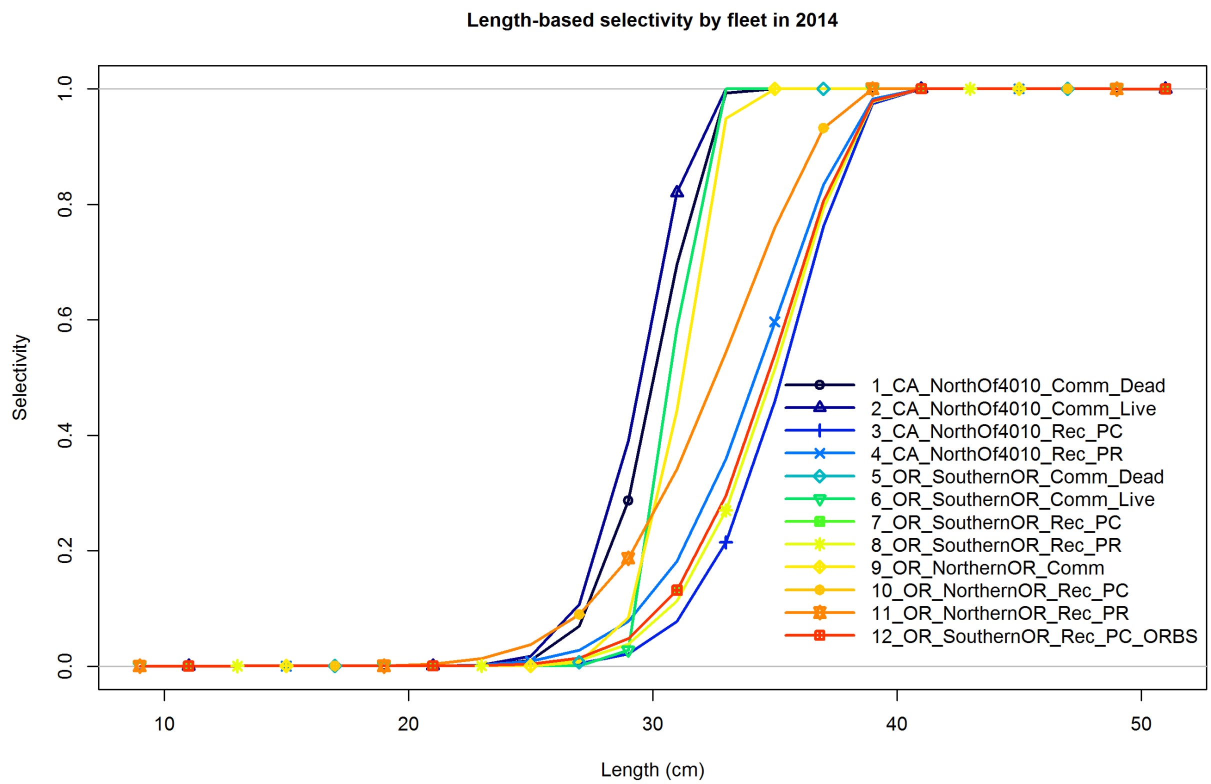


Figure 99: Length-based selectivity by fleet for the central model.

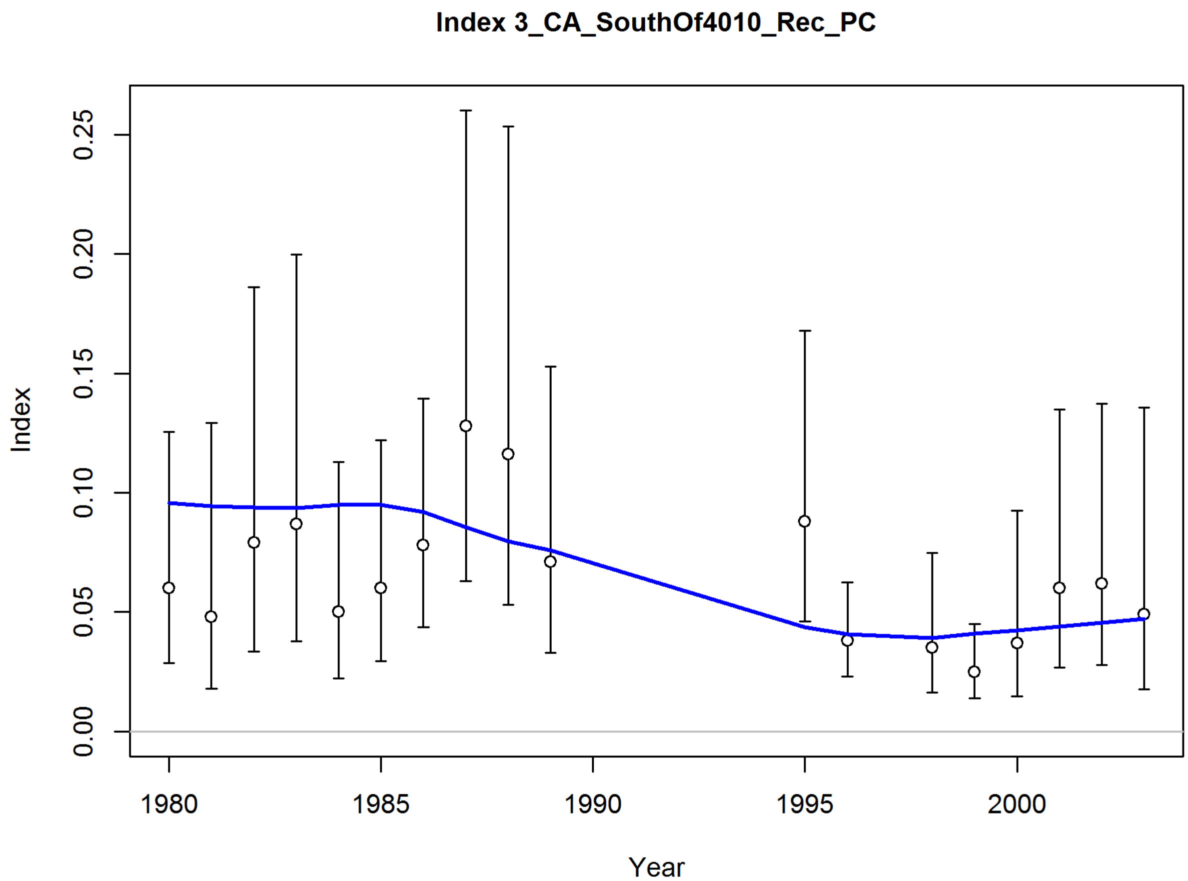


Figure 100: Fits to the CA recreational CPFV fleet dockside index for the southern model.

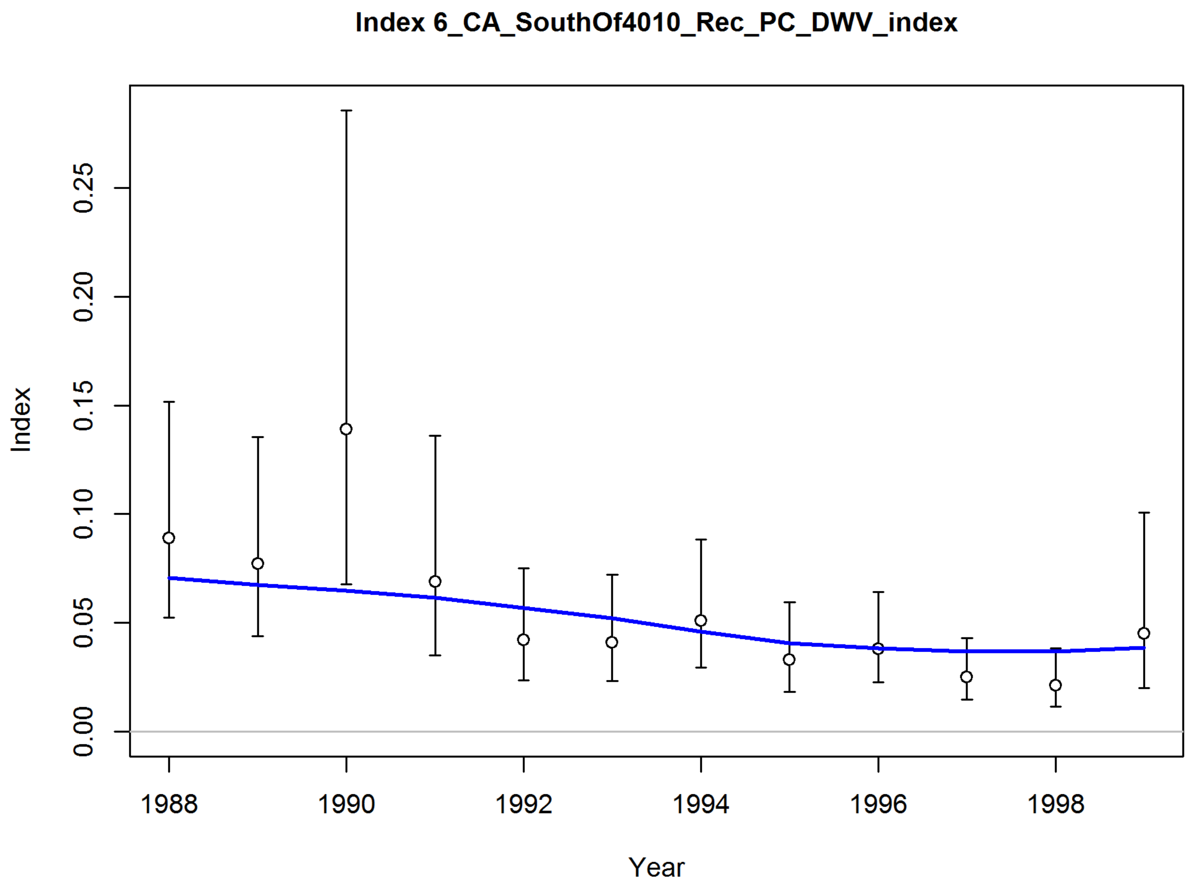


Figure 101: Fits to the CA recreational CPFV fleet 1988-1999 onboard observer index for the southern model.

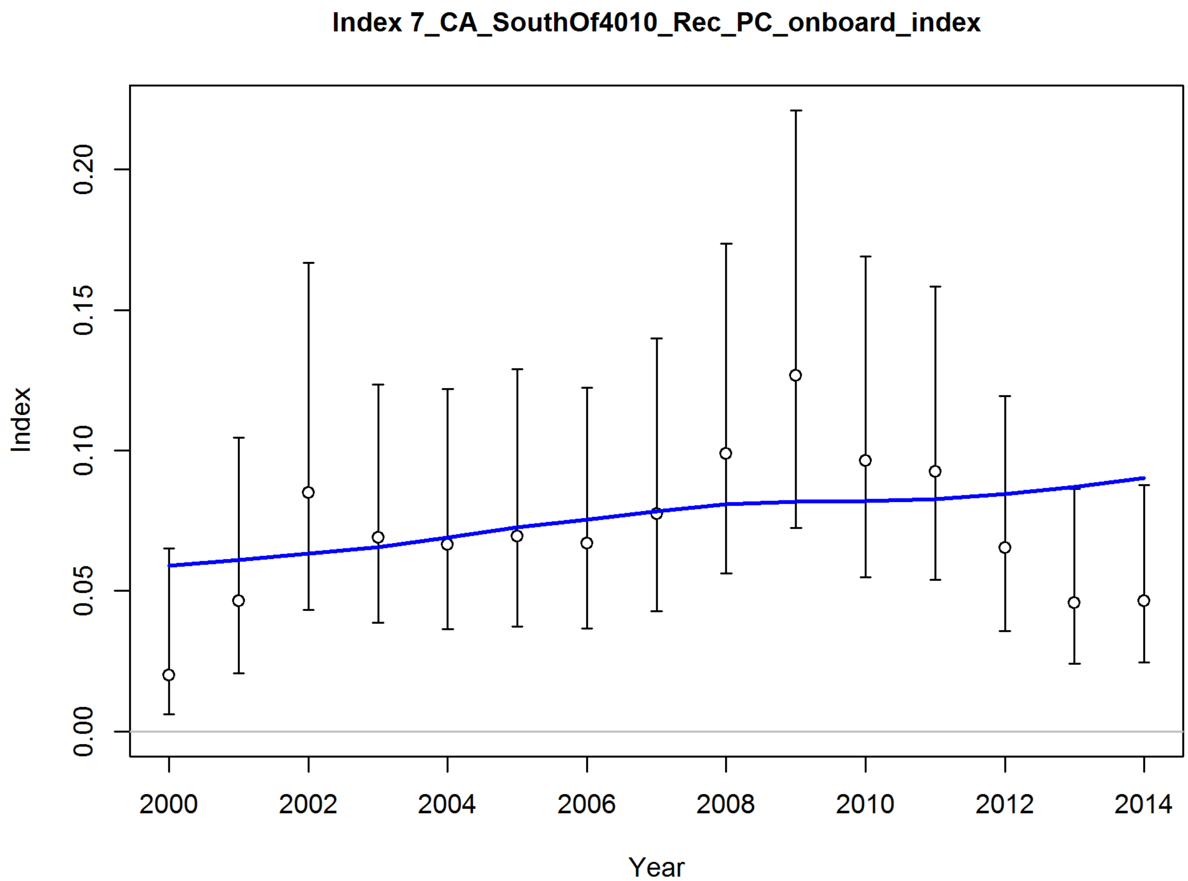


Figure 102: Fits to the CA recreational CPFV fleet 2000-2014 onboard observer index for the southern model.

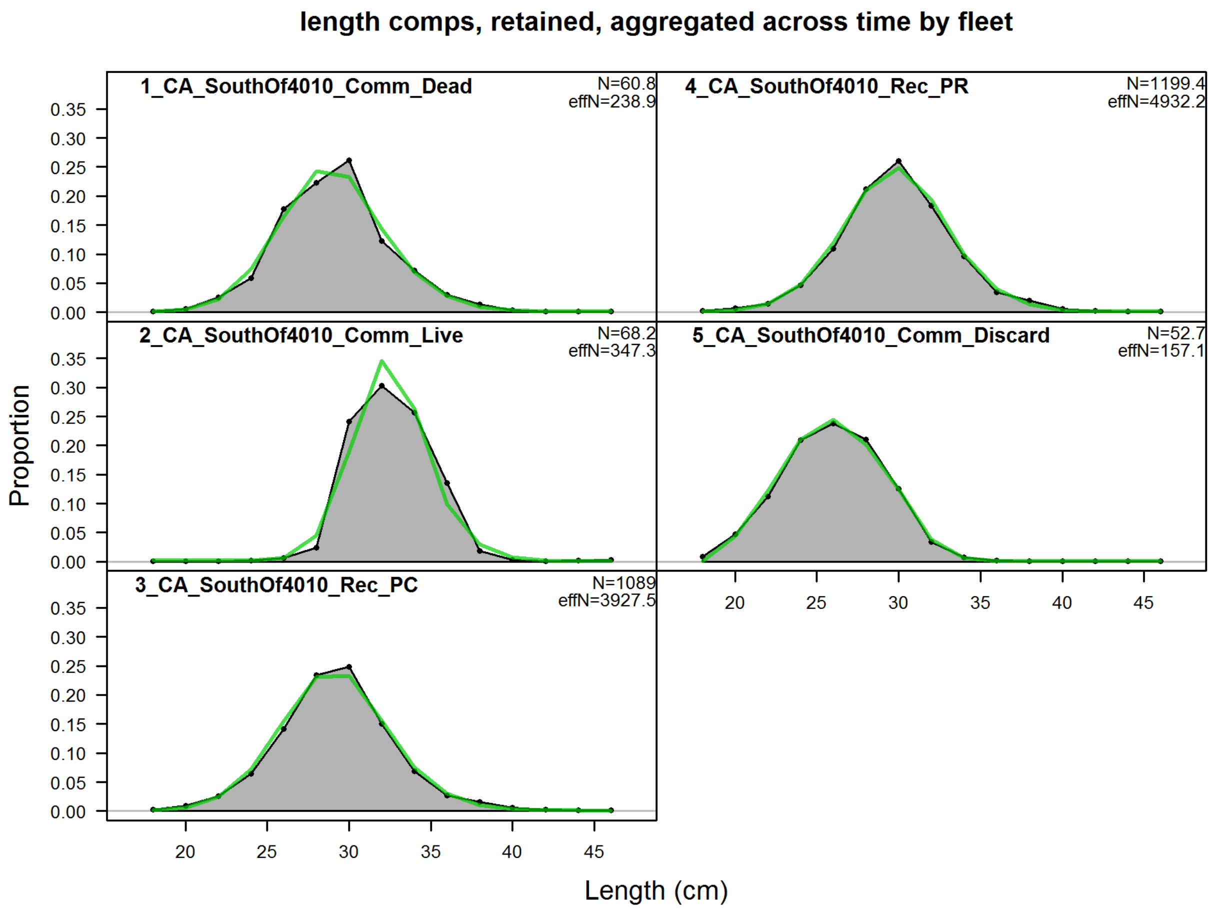
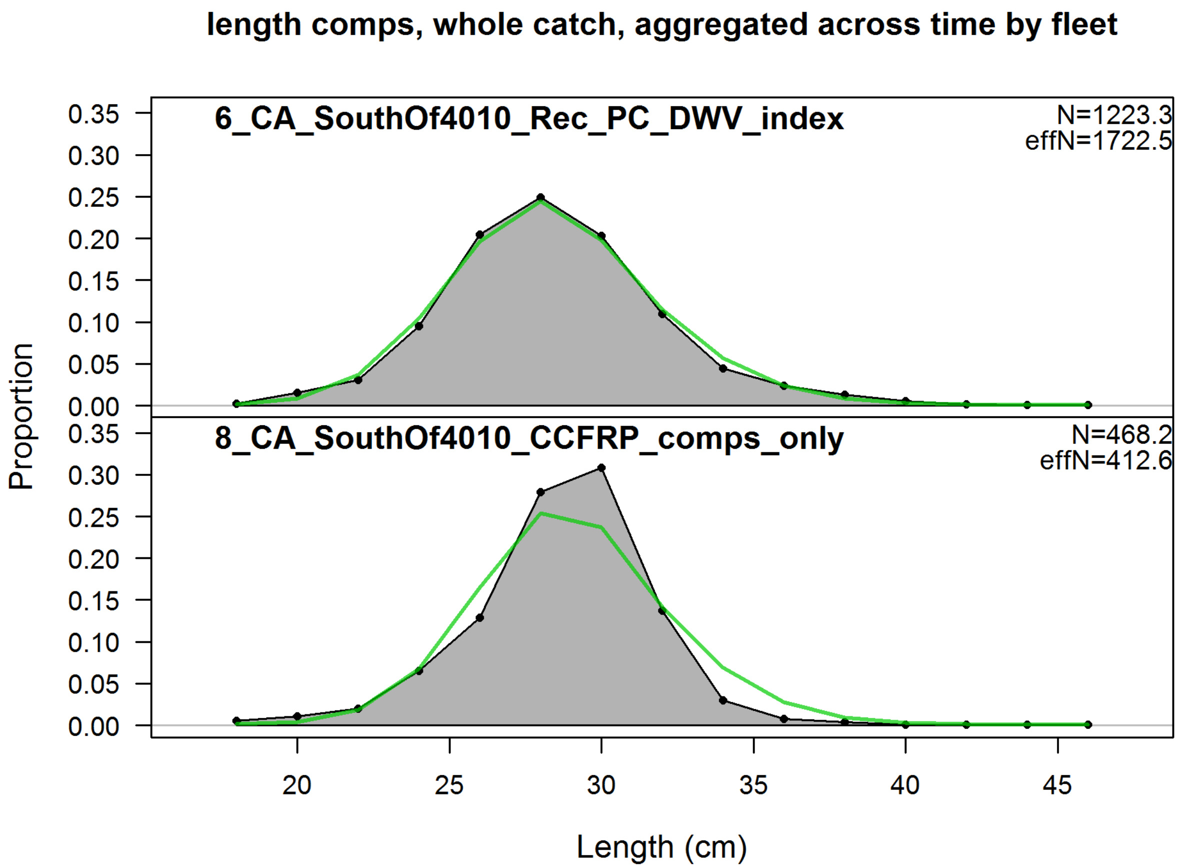


Figure 103: Fits to the length compositions from fleets in the southern model.


length comps, whole catch, aggregated across time by fleet
6_CA_SouthOf4010_Rec_PC_DWV_index
N=1223.3
effN=1722.5
8_CA_SouthOf4010_CCFRP_comps_only
N=468.2
effN=412.6
Proportion
Length (cm)

–>

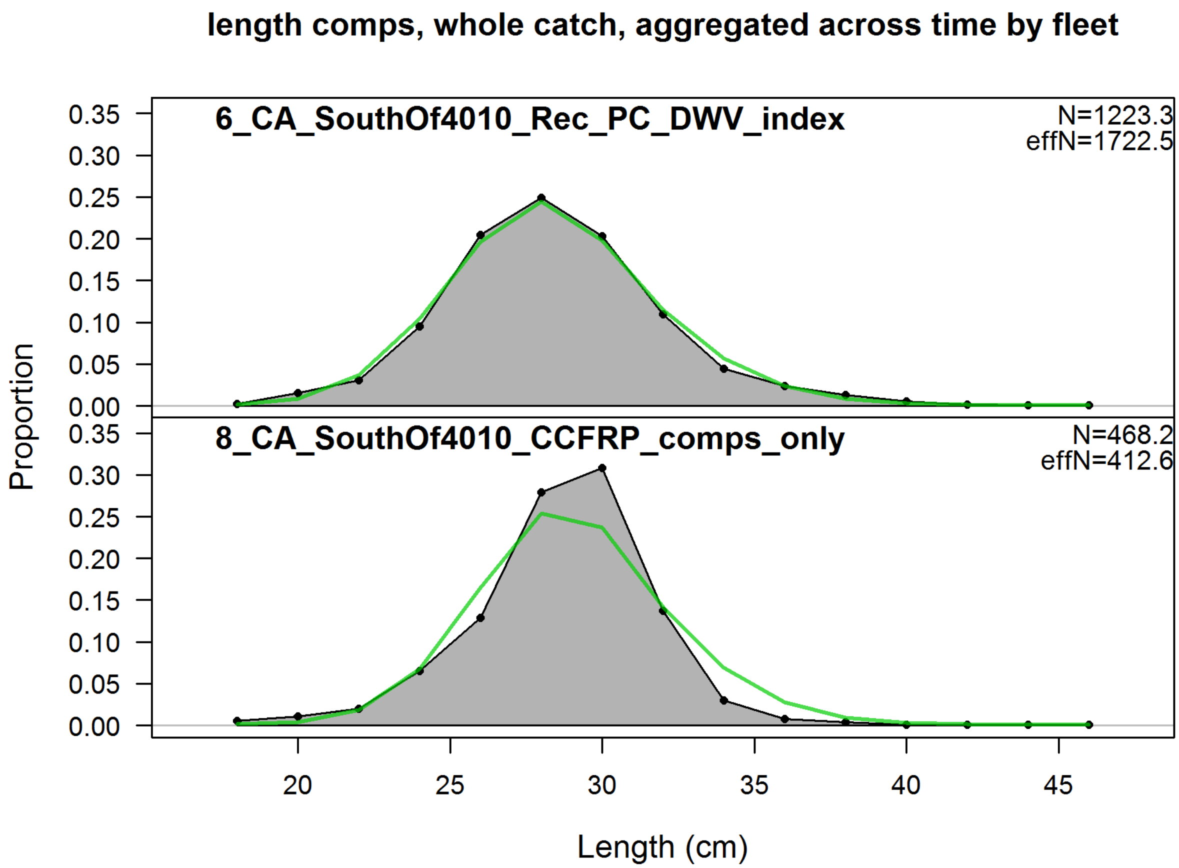


Figure 104: Fits to the length compositions of the central California 1988-1999 onboard observer and CCFRP surveys in the southern model.

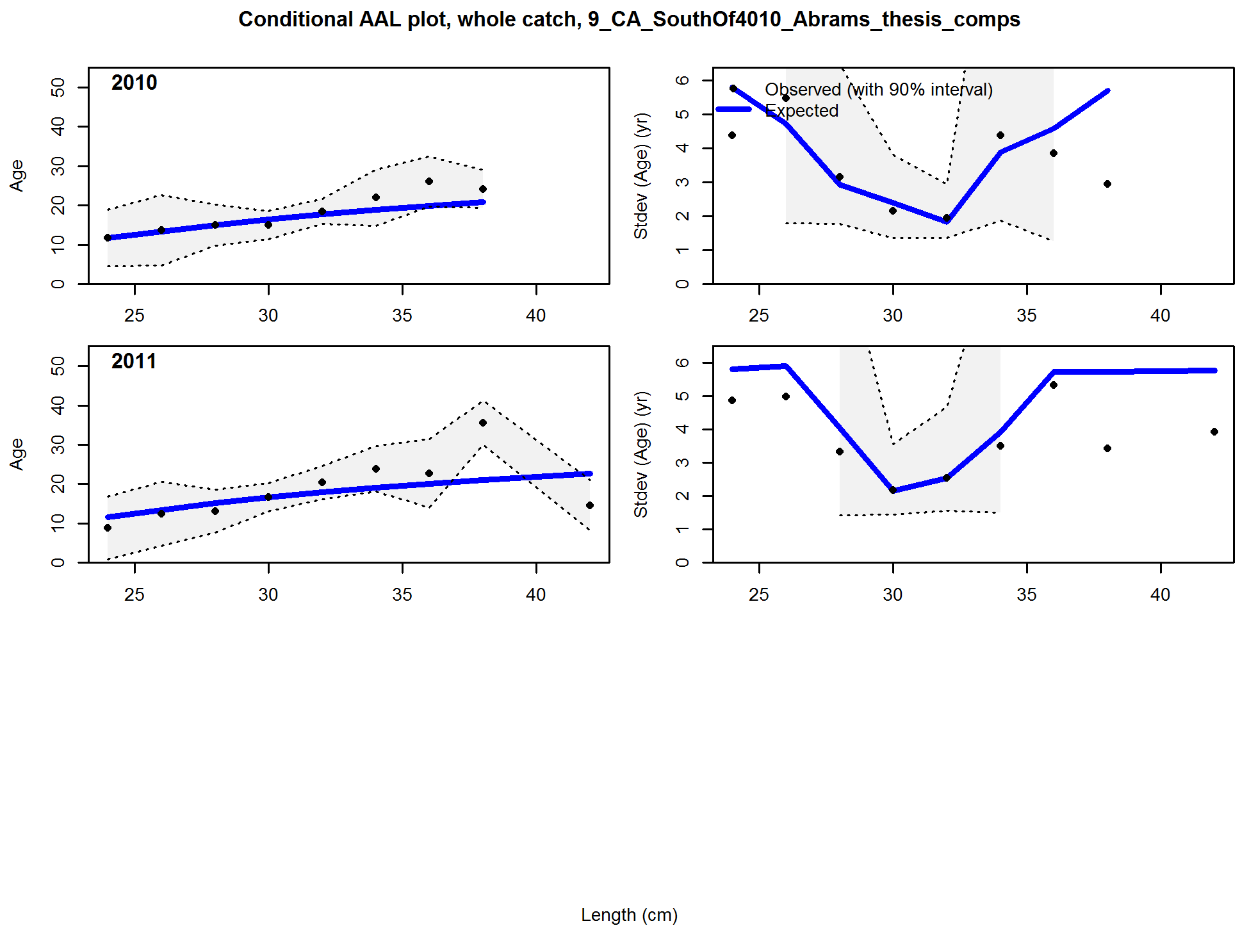


Figure 105: Fits to the conditional age-at-length data from Jeff Abrams' thesis, southern model.

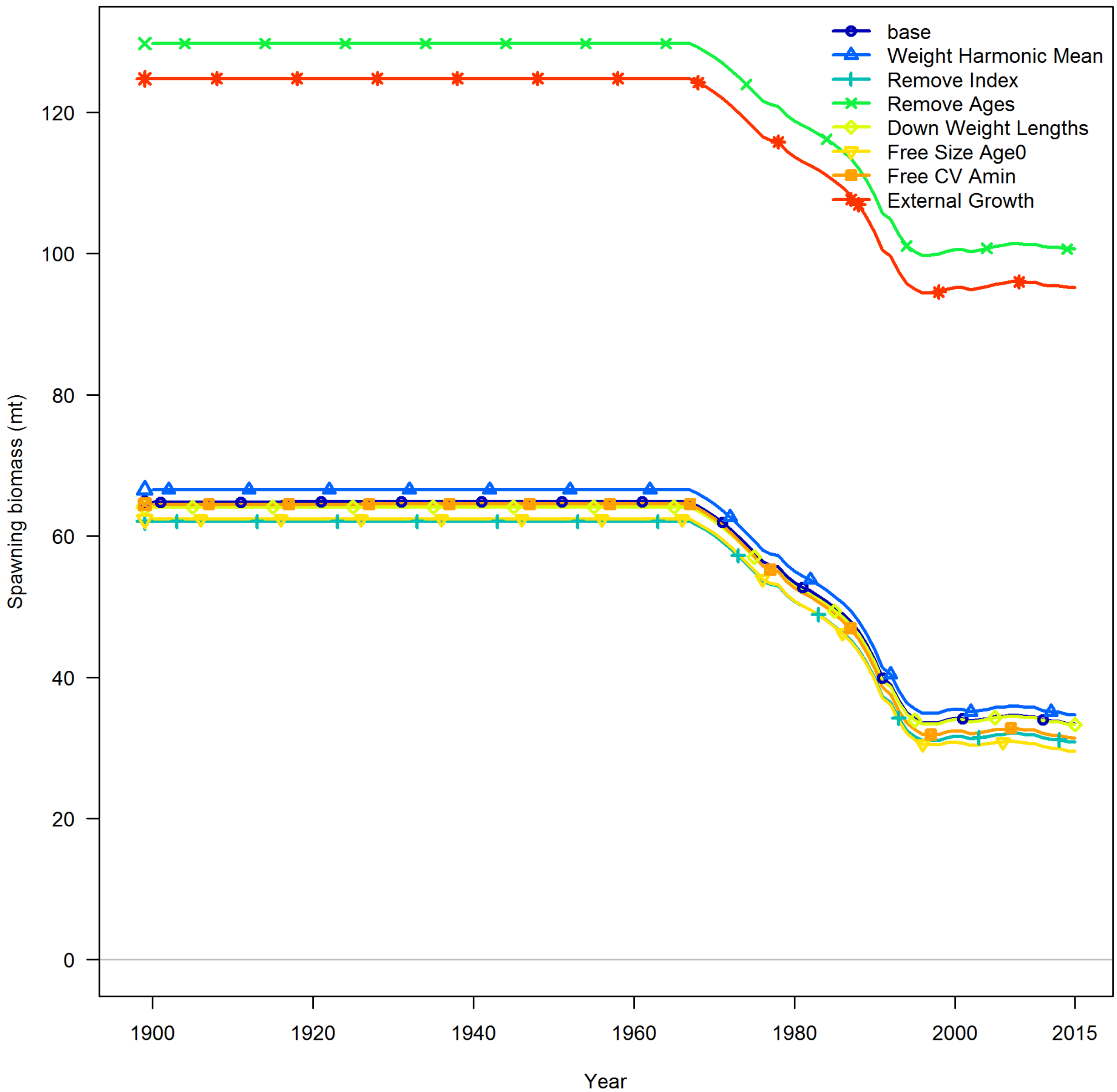


Figure 106: Sensitivity of the spawning biomass to dropping a single data type from the northern model.

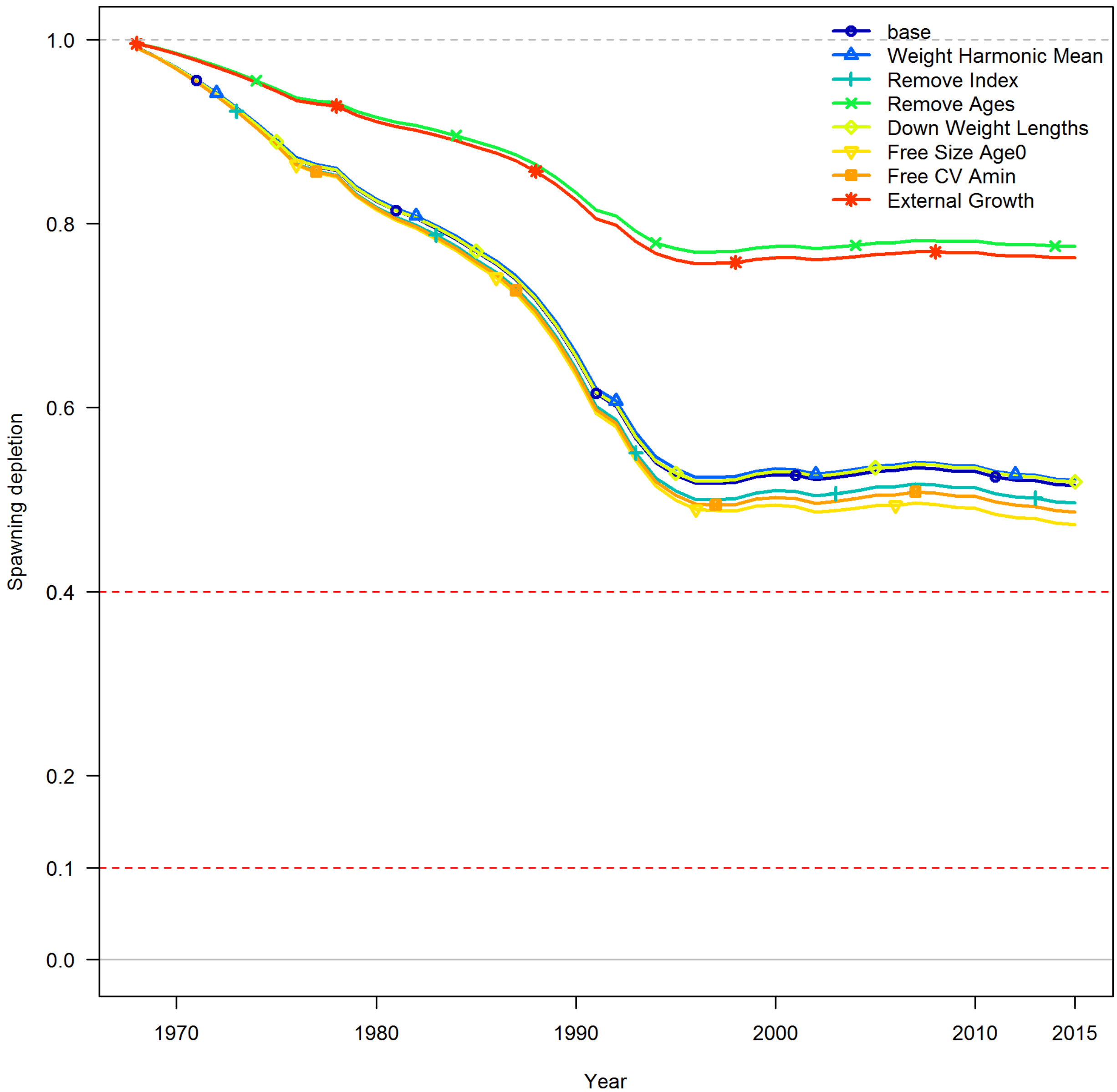


Figure 107: Sensitivity of the relative spawning biomass to dropping a single data type from the northern model.

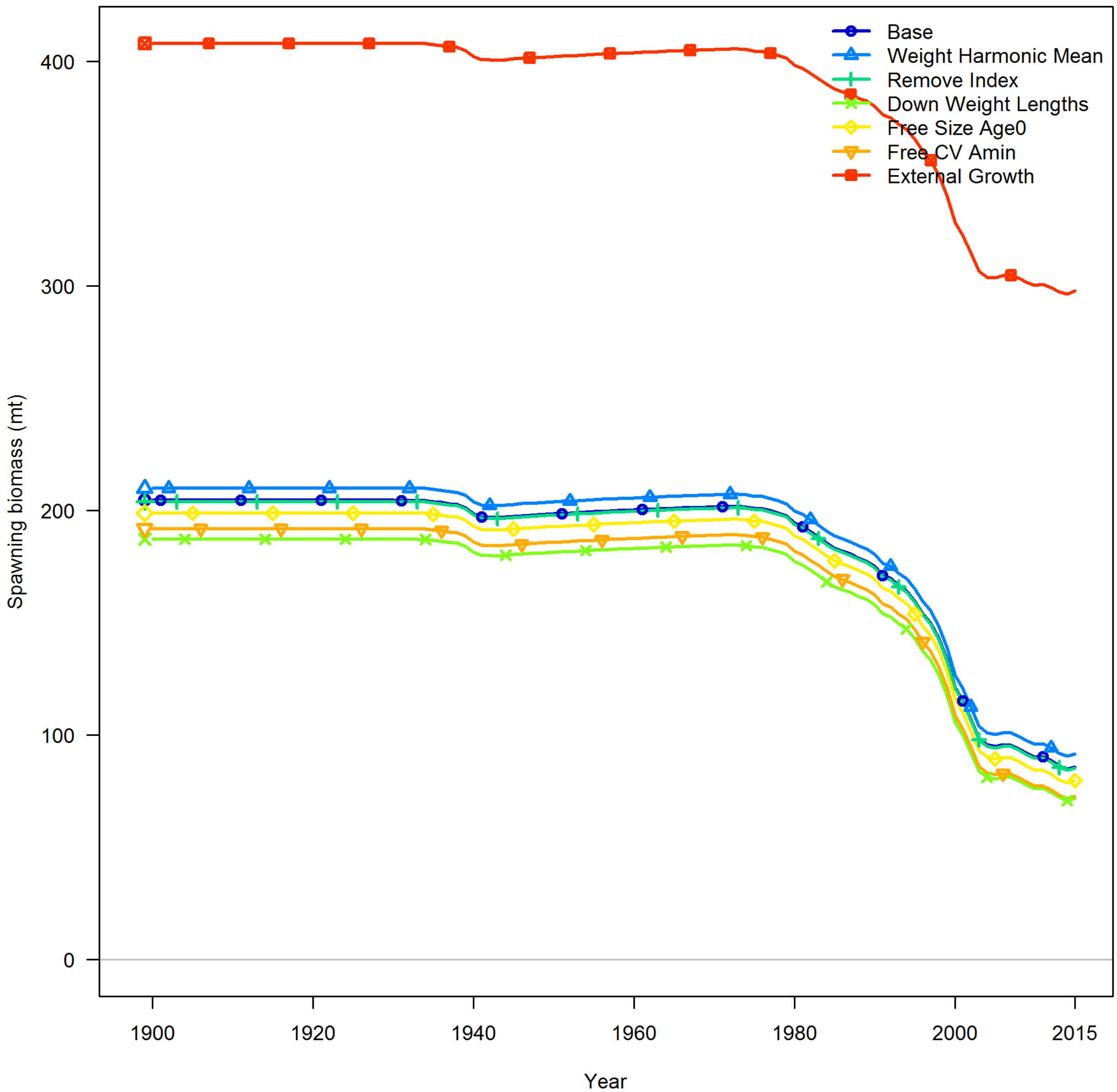


Figure 108: Sensitivity of the spawning biomass to dropping a single data type from the central model.

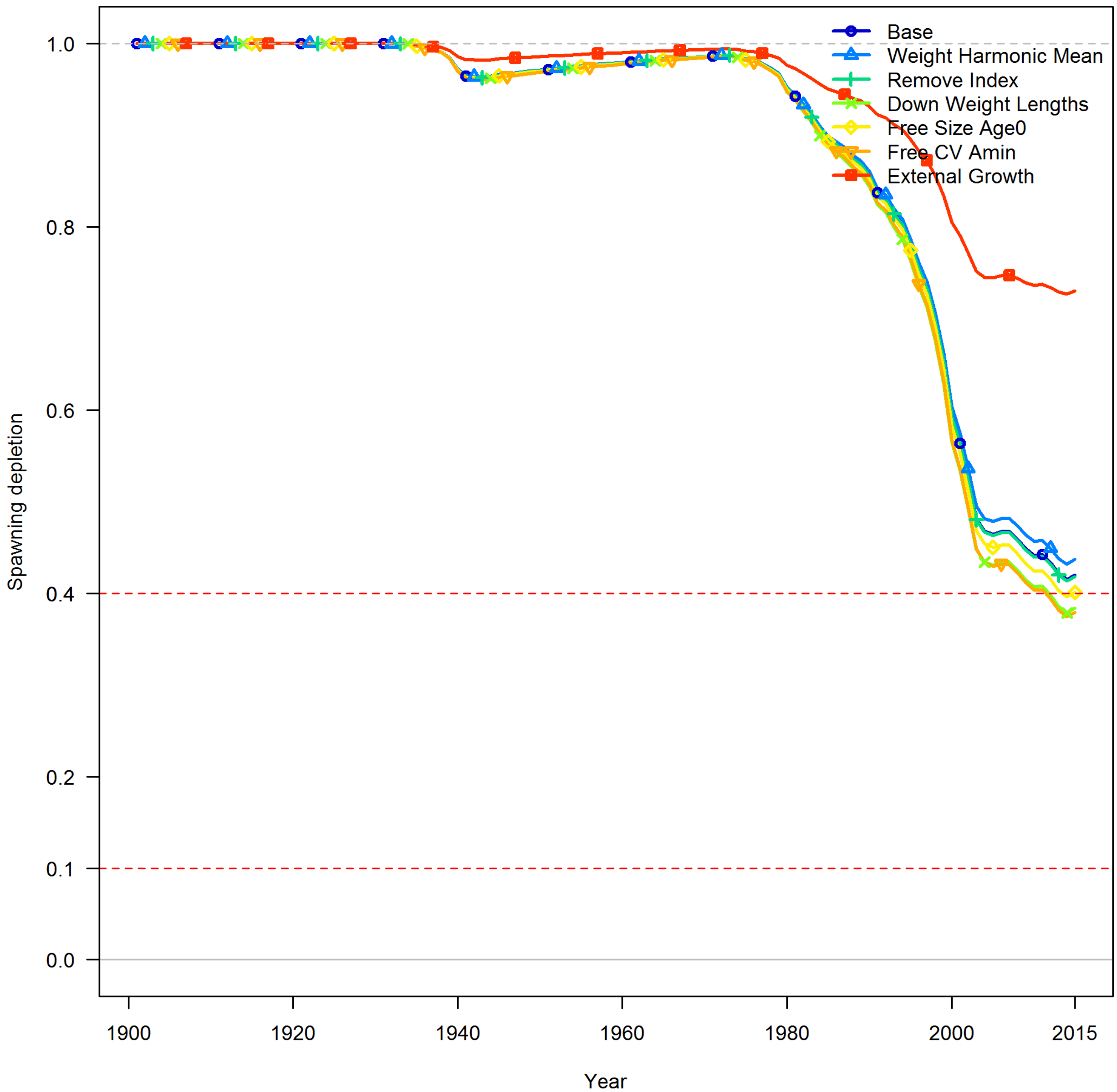


Figure 109: Sensitivity of the relative spawning biomass to dropping a single data type from the central model.

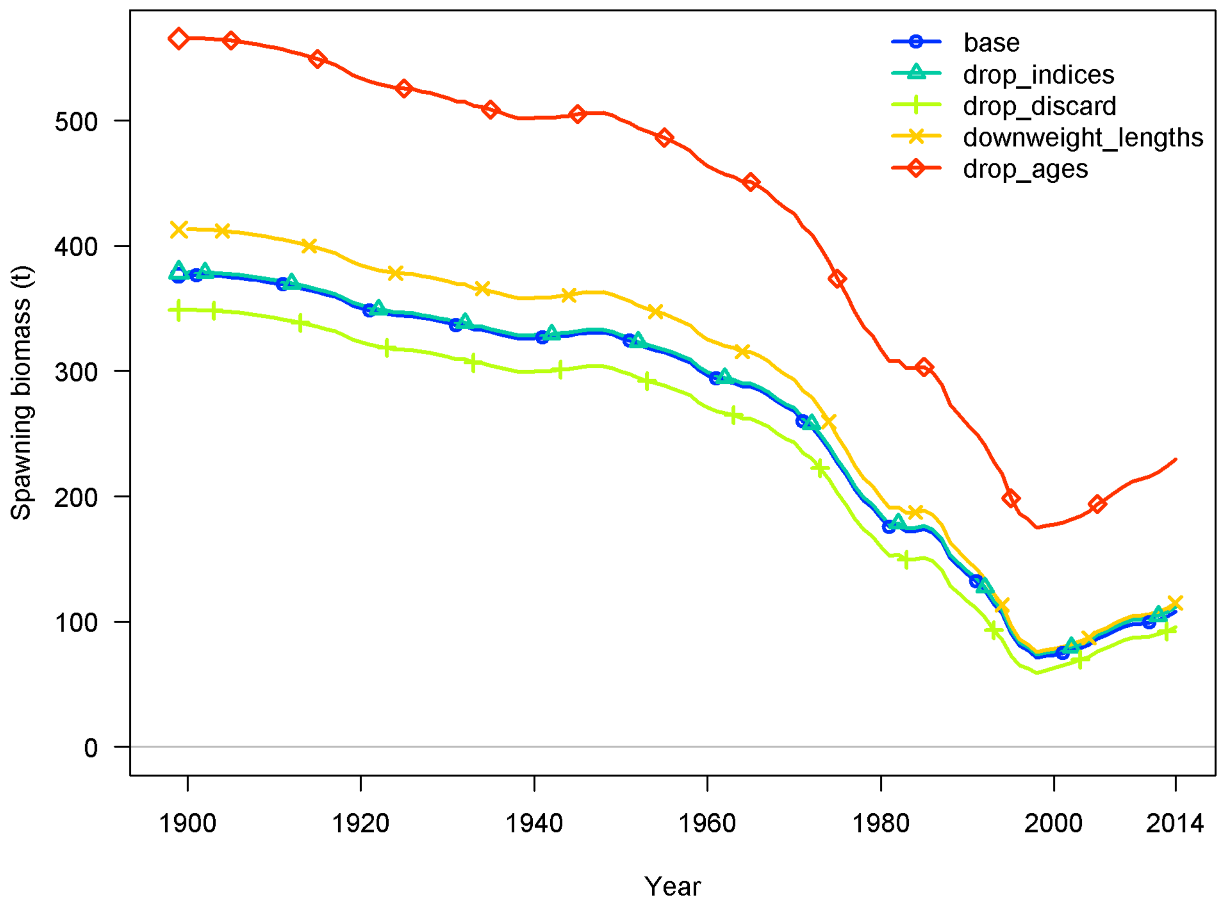


Figure 110: Sensitivity of the spawning biomass to dropping a single data type from the southern model.

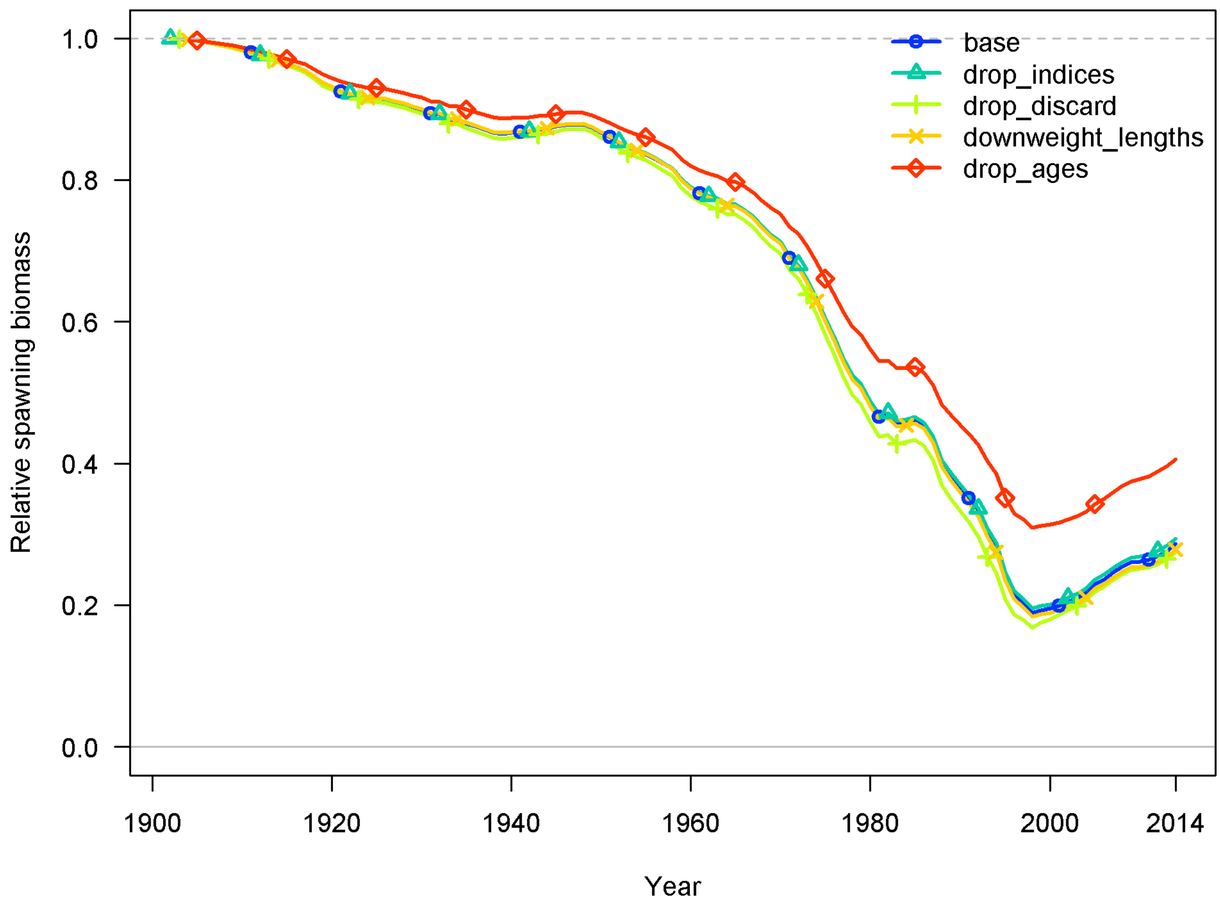


Figure 111: Sensitivity of the relative spawning biomass to dropping a single data type from the southern model.

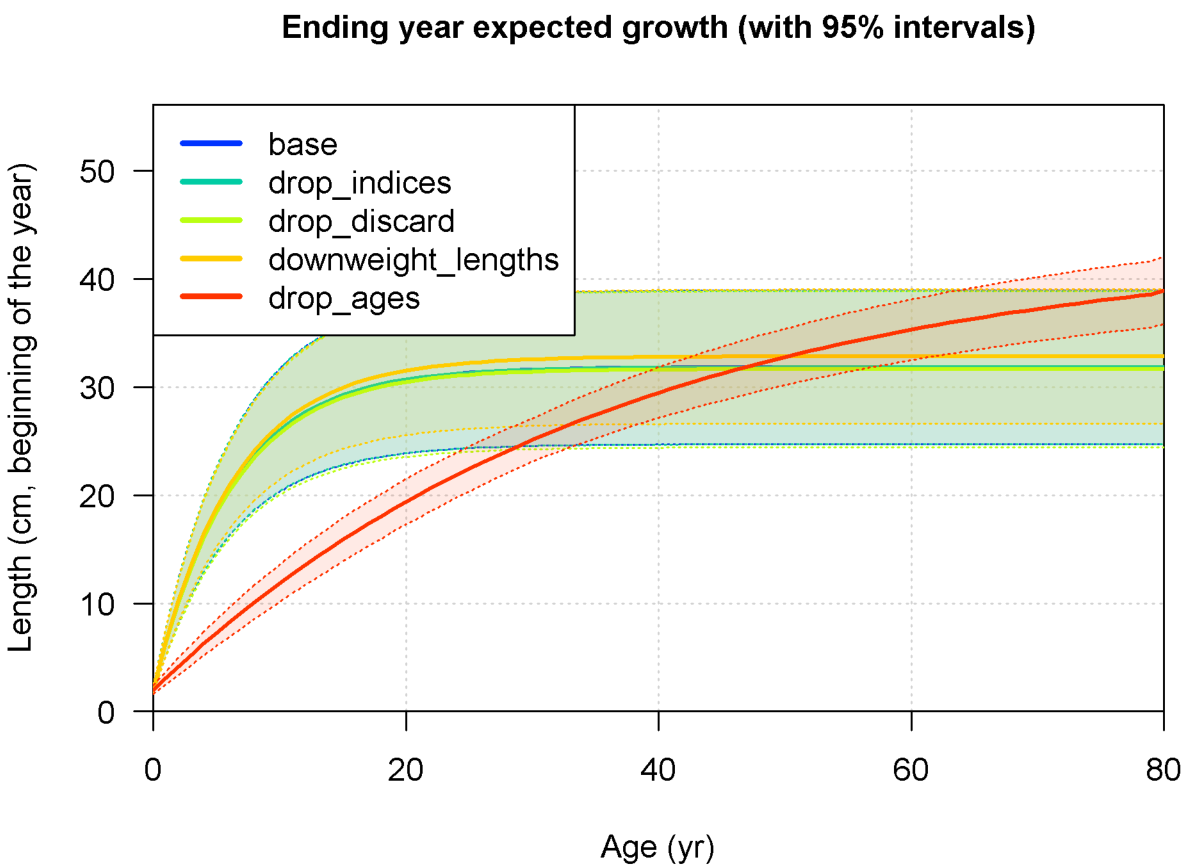


Figure 112: Sensitivity of removal of marginal age composition data and conditional age-at-length data from the southern model.

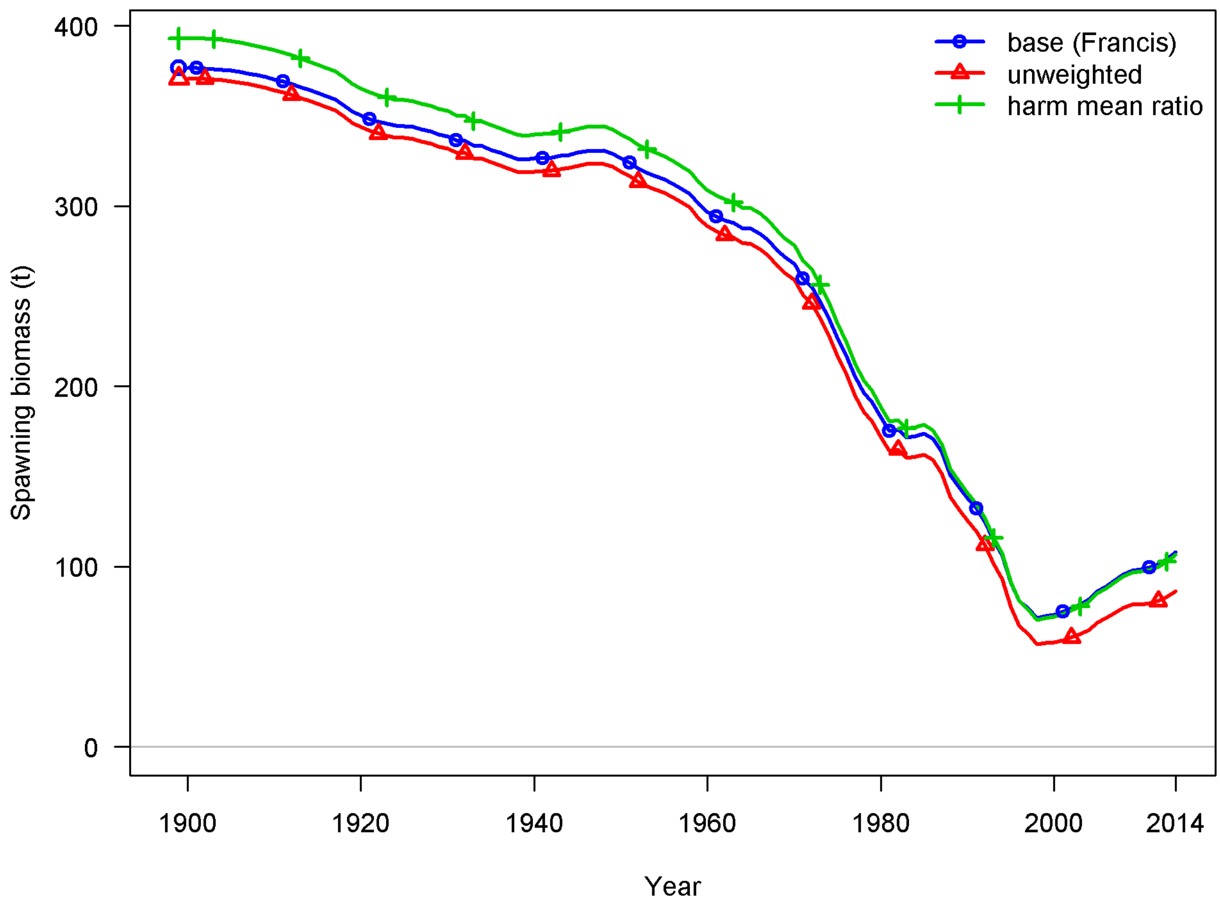


Figure 113: Sensitivity of the spawning biomass to the method of data weighting in the southern model.

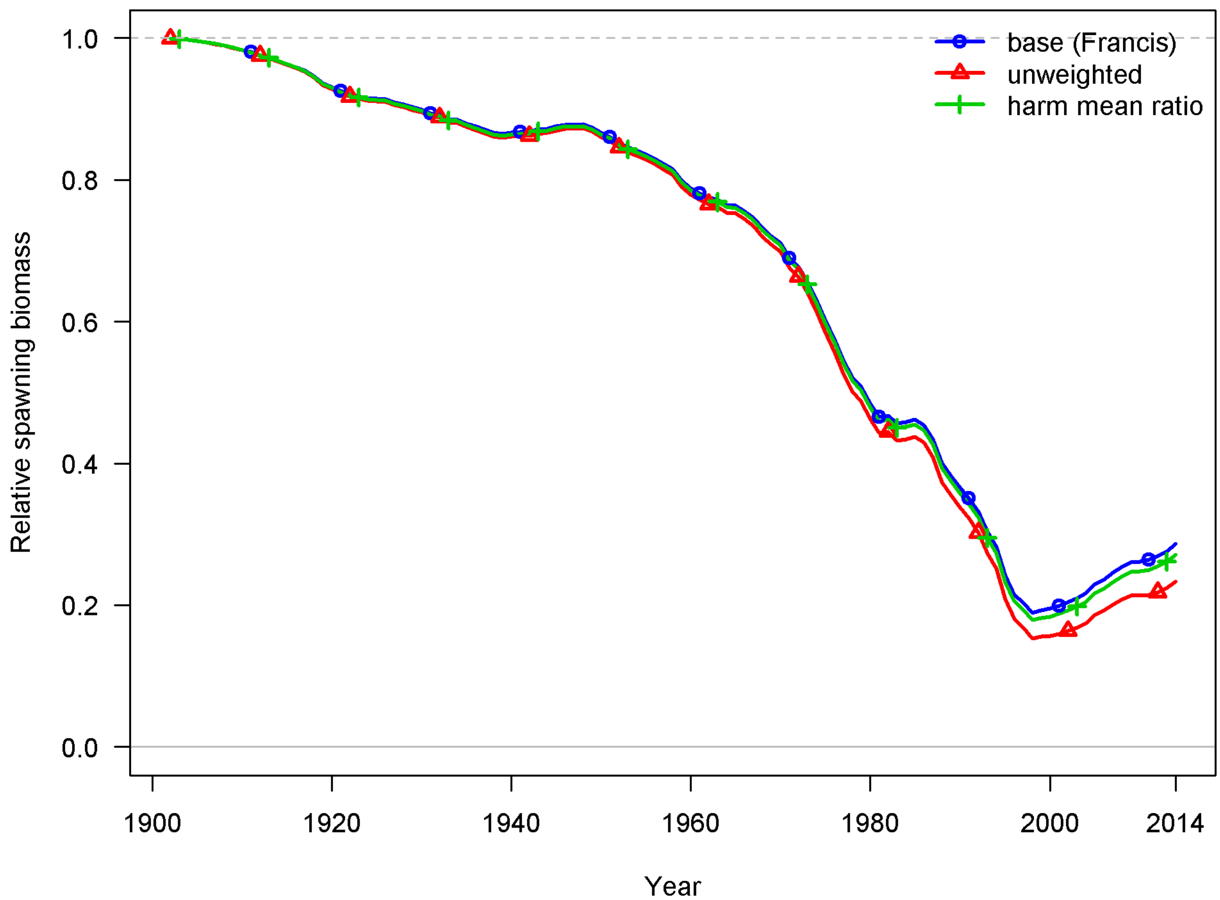


Figure 114: Sensitivity of the relative spawning biomass to the method of data weighting in the southern model.

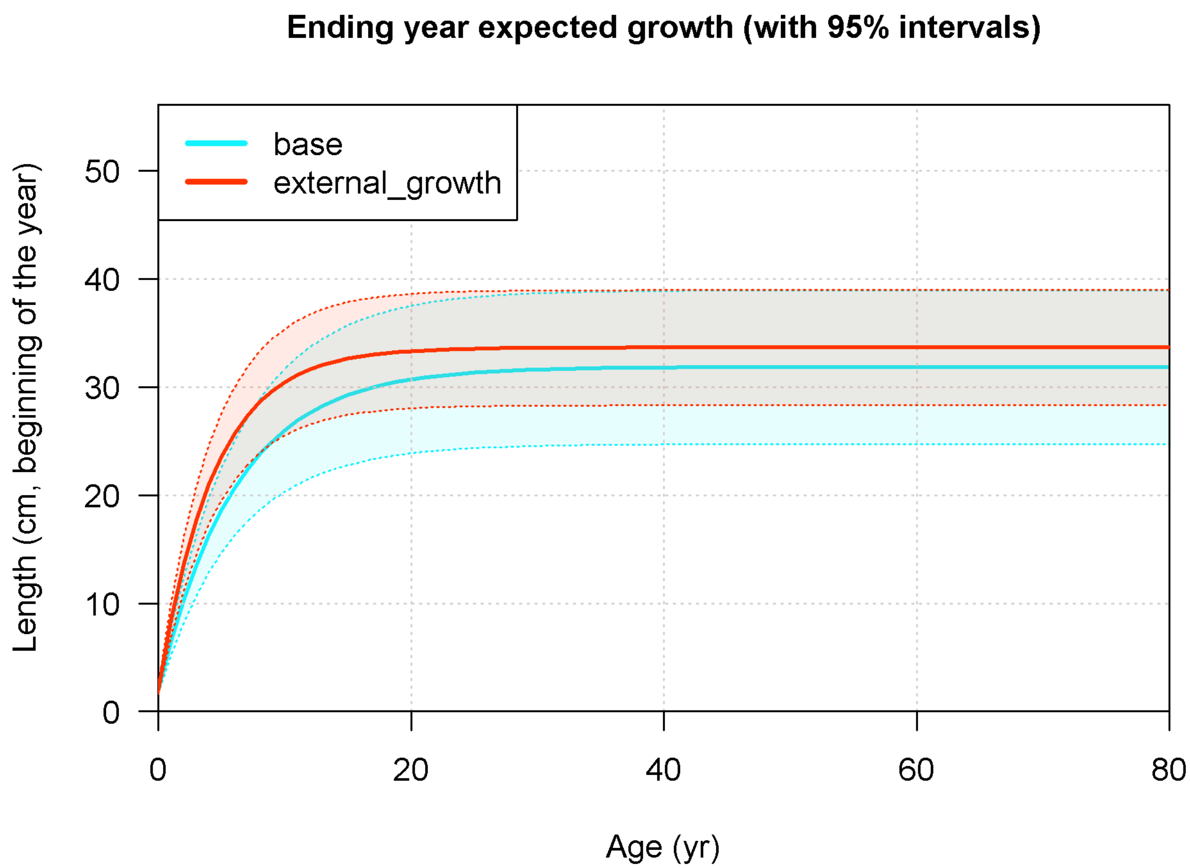


Figure 115: Sensitivity of the model to fixing growth parameters to external estimates in the southern model.

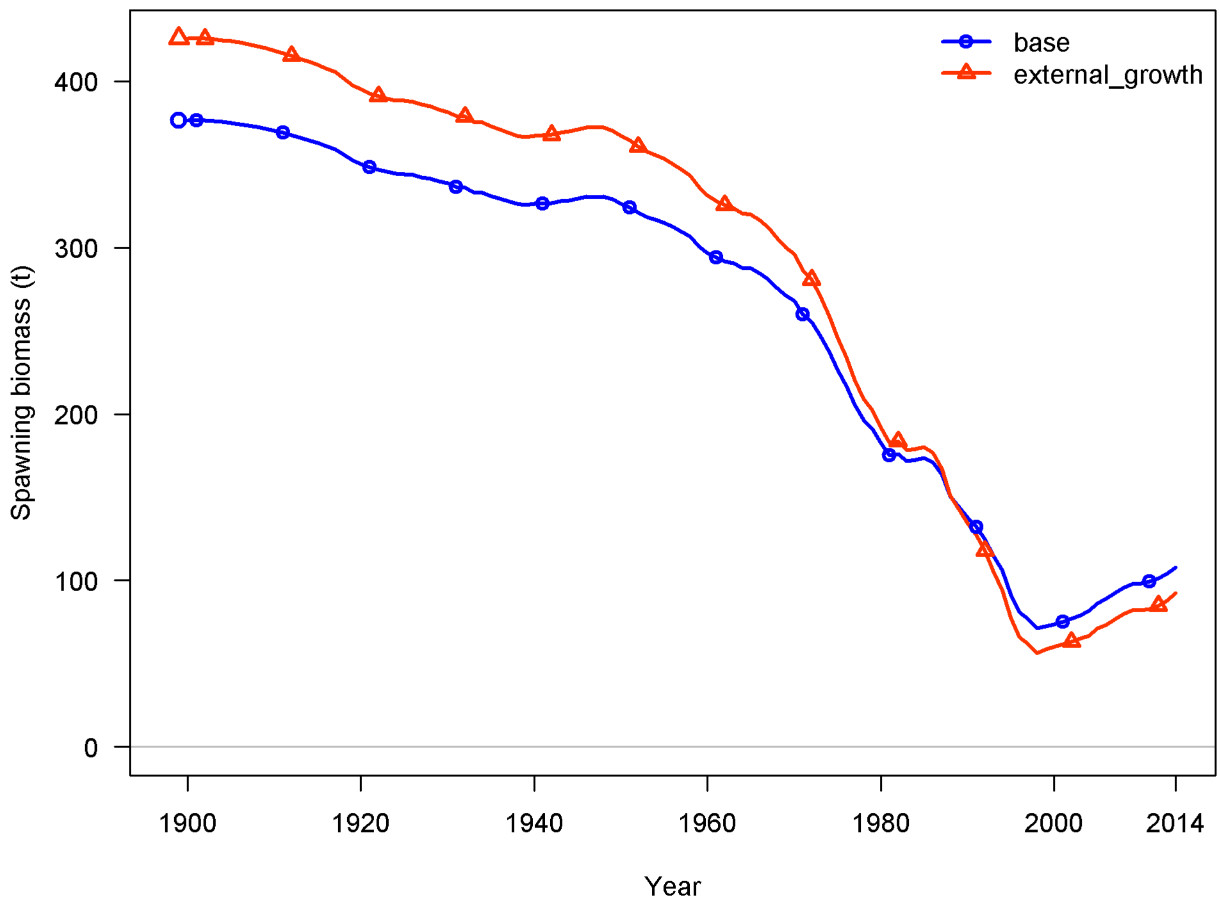


Figure 116: Sensitivity of the spawning biomass to fixing growth parameters to external estimates in the southern model.

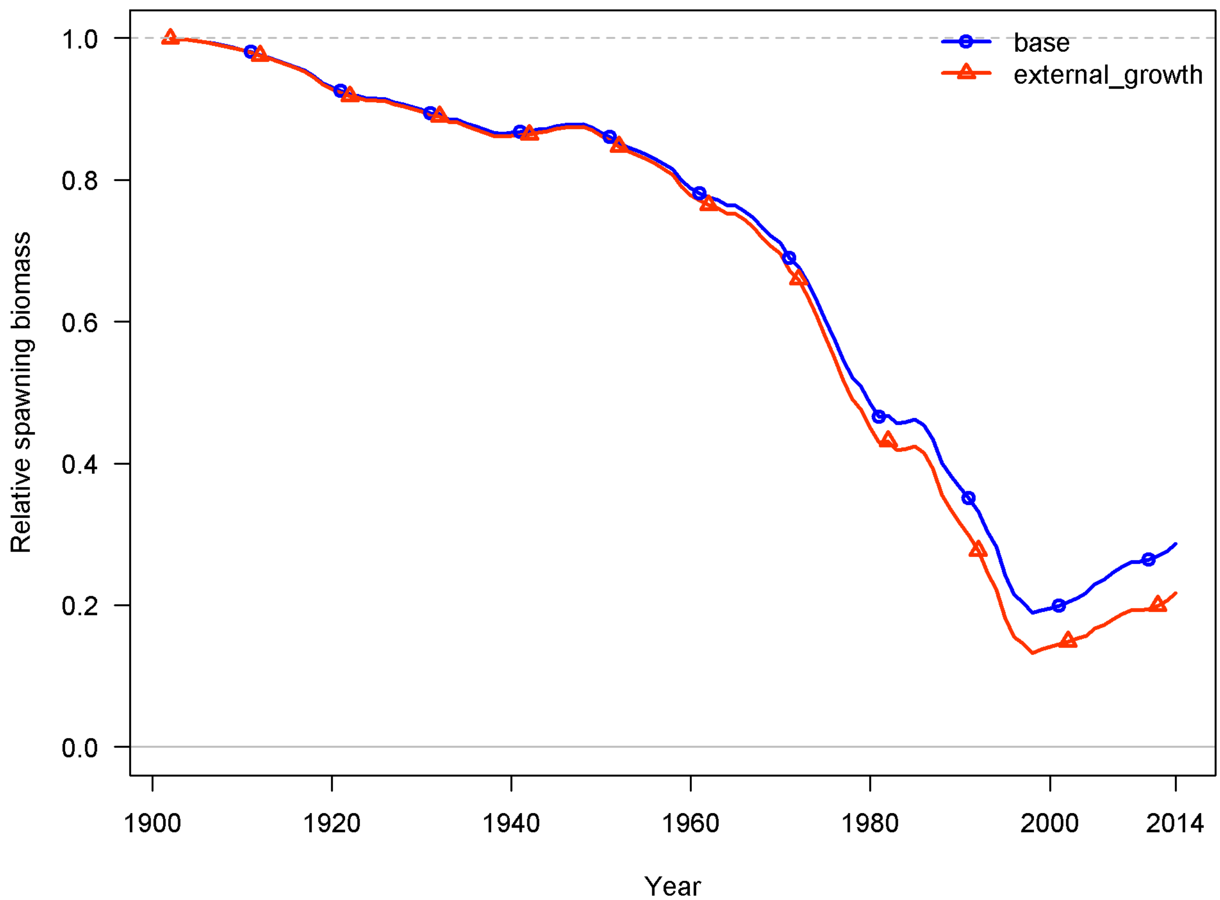


Figure 117: Sensitivity of the relative spawning biomass to fixing growth parameters to external estimates in the southern model.

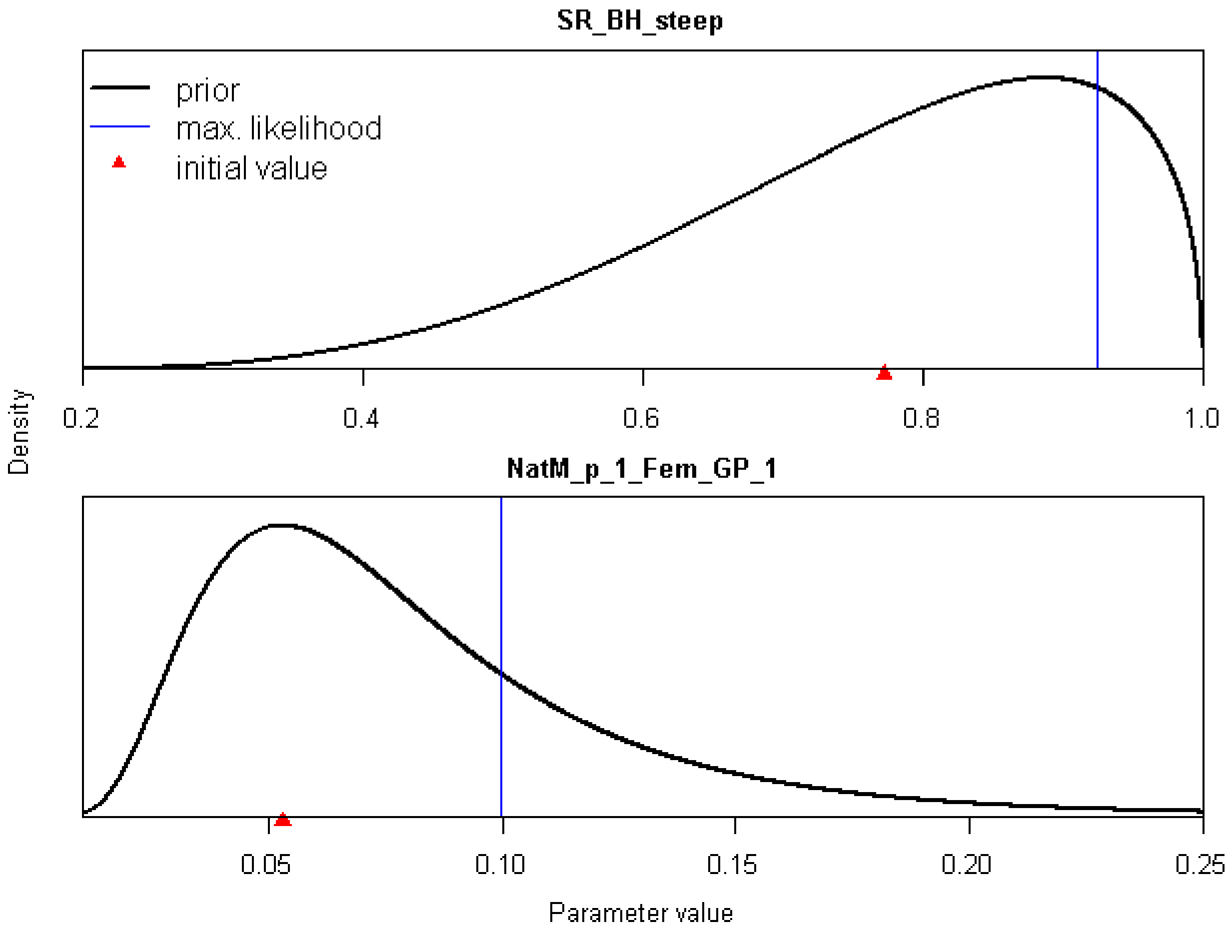


Figure 118: Prior distributions for stock-recruit steepness (upper panel) and natural mortality (lower panel). Fixed values used in all three base models are indicated by the red triangles. Blue vertical lines show estimates of these parameters from a southern model sensitivity analysis in which these values were estimated.

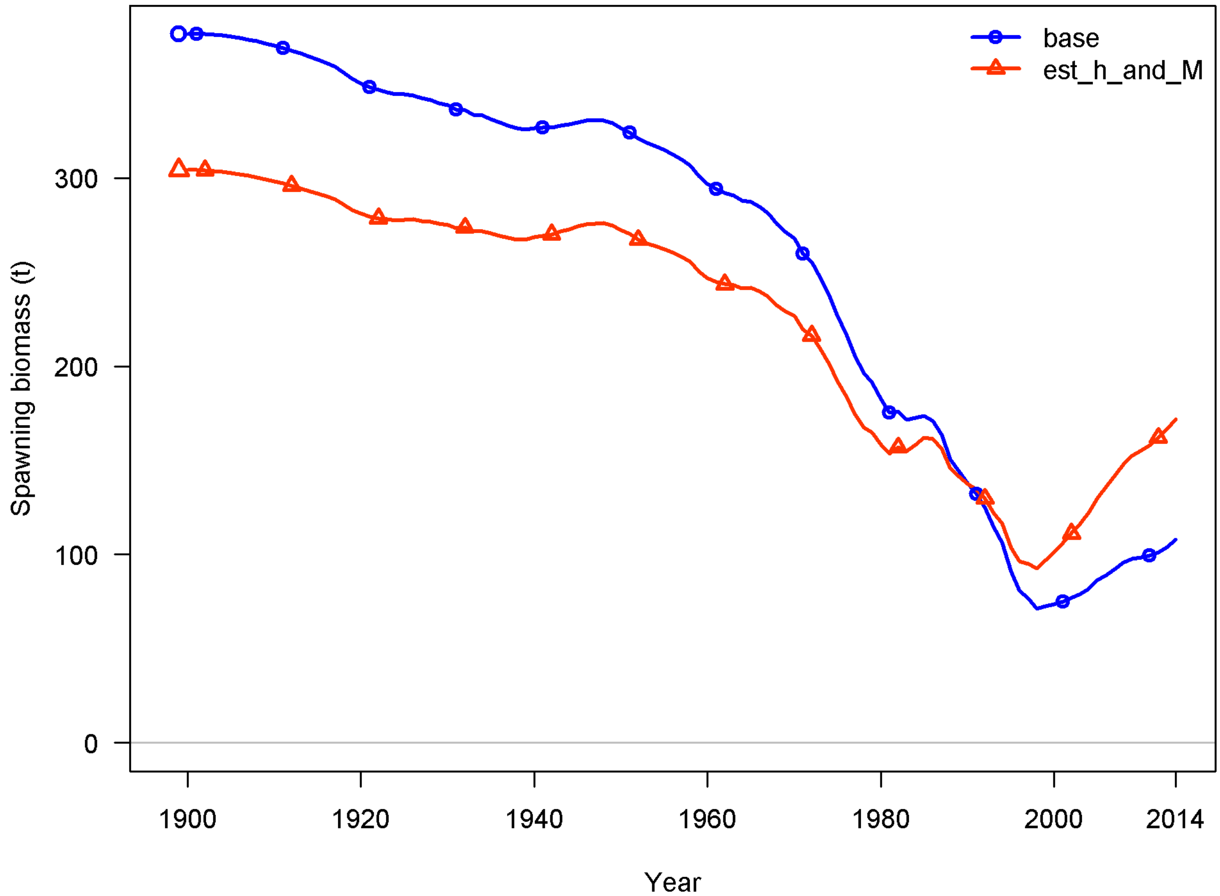


Figure 119: Sensitivity of spawning biomass to fixed versus estiamted values of steepness and natural mortality to estimated values in the southern model.

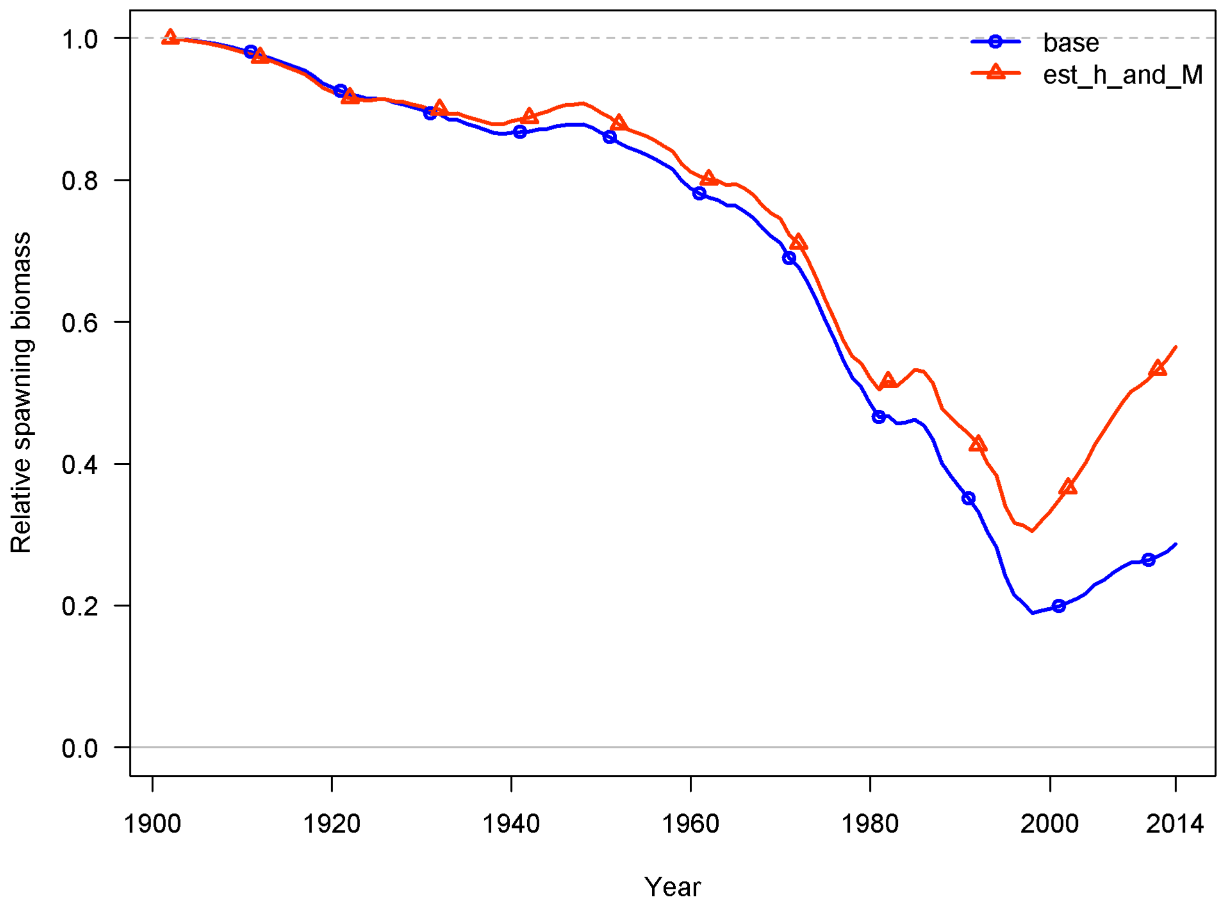


Figure 120: Sensitivity of relative spawning biomass to fixed versus estiamted values of steepness and natural mortality to estimated values in the southern model.

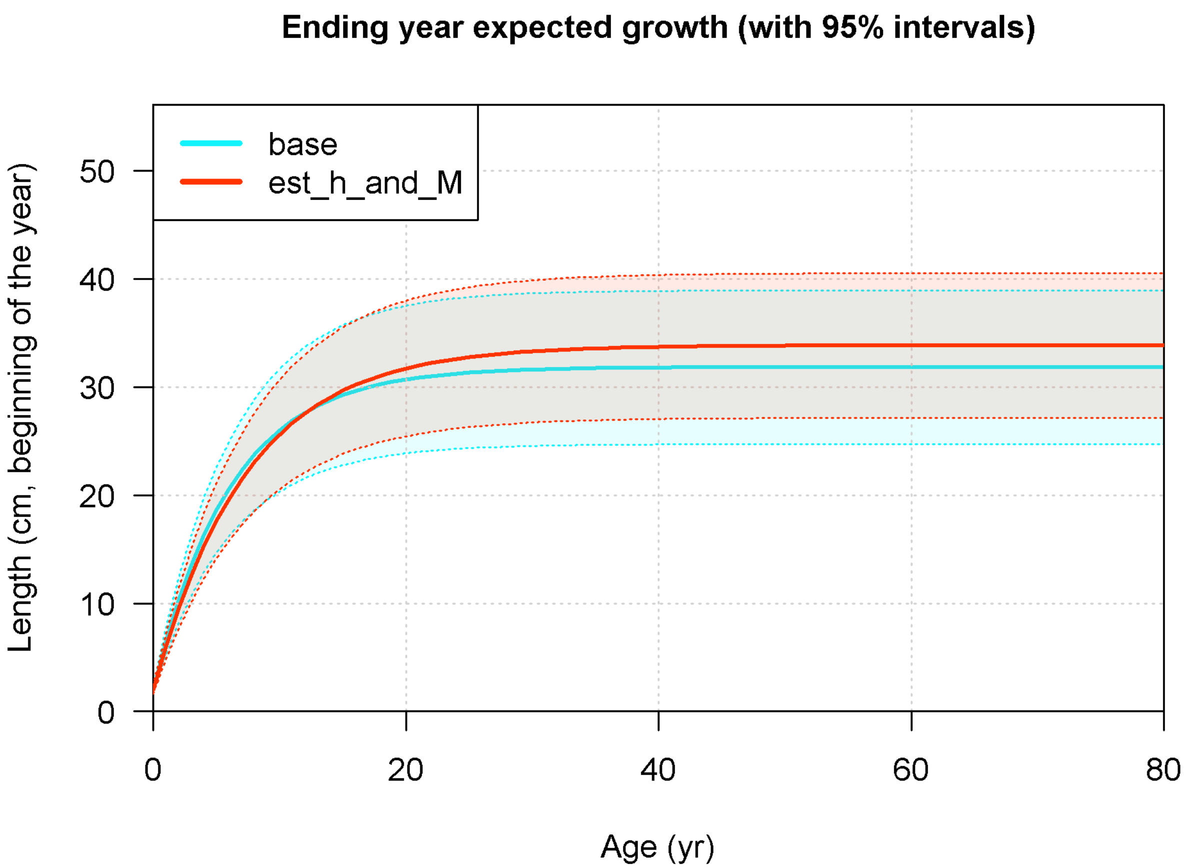


Figure 121: Sensitivity of growth to fixed versus estimated values of steepness and natural mortality to estimated values in the southern model.

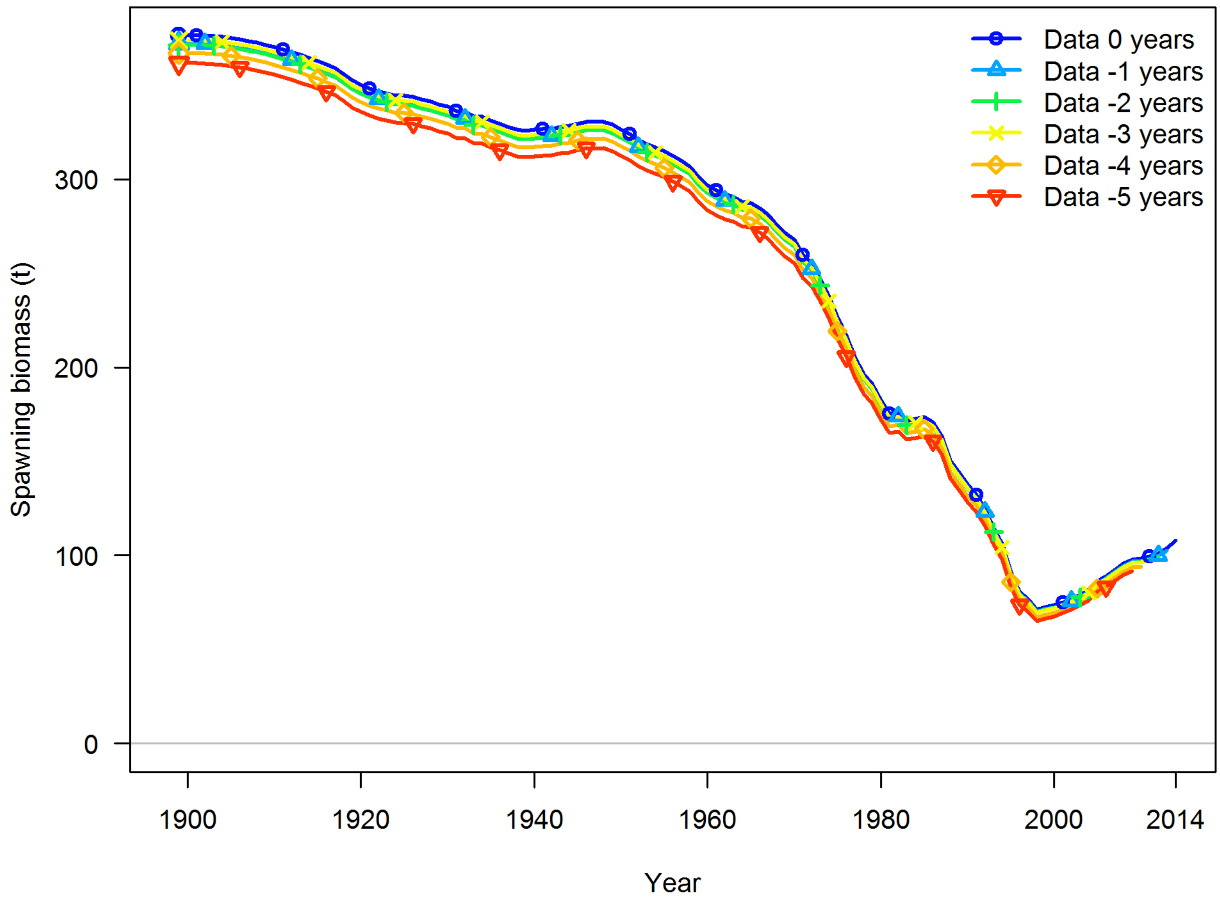


Figure 122: Retrospective analyses for the southern model.

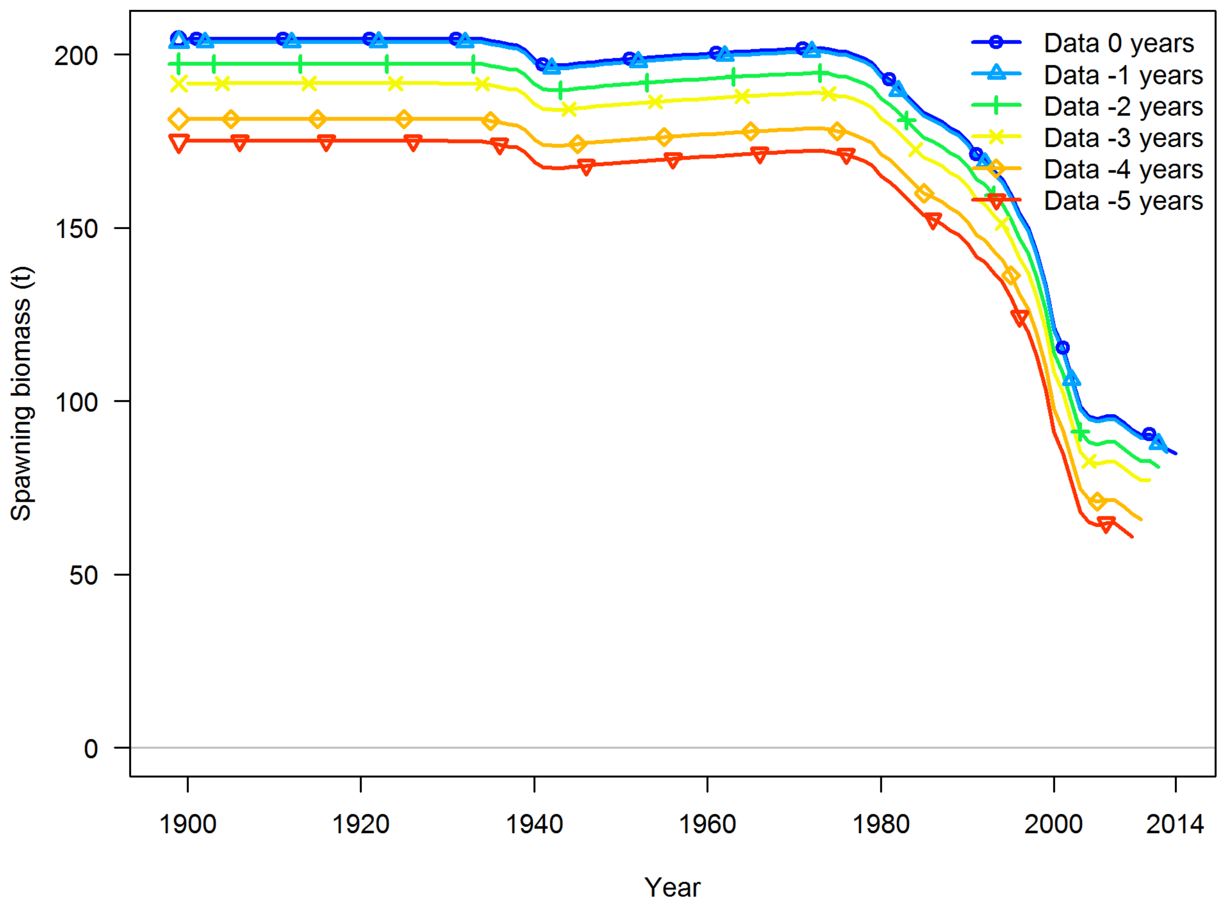


Figure 123: Retrospective analyses for the central model.

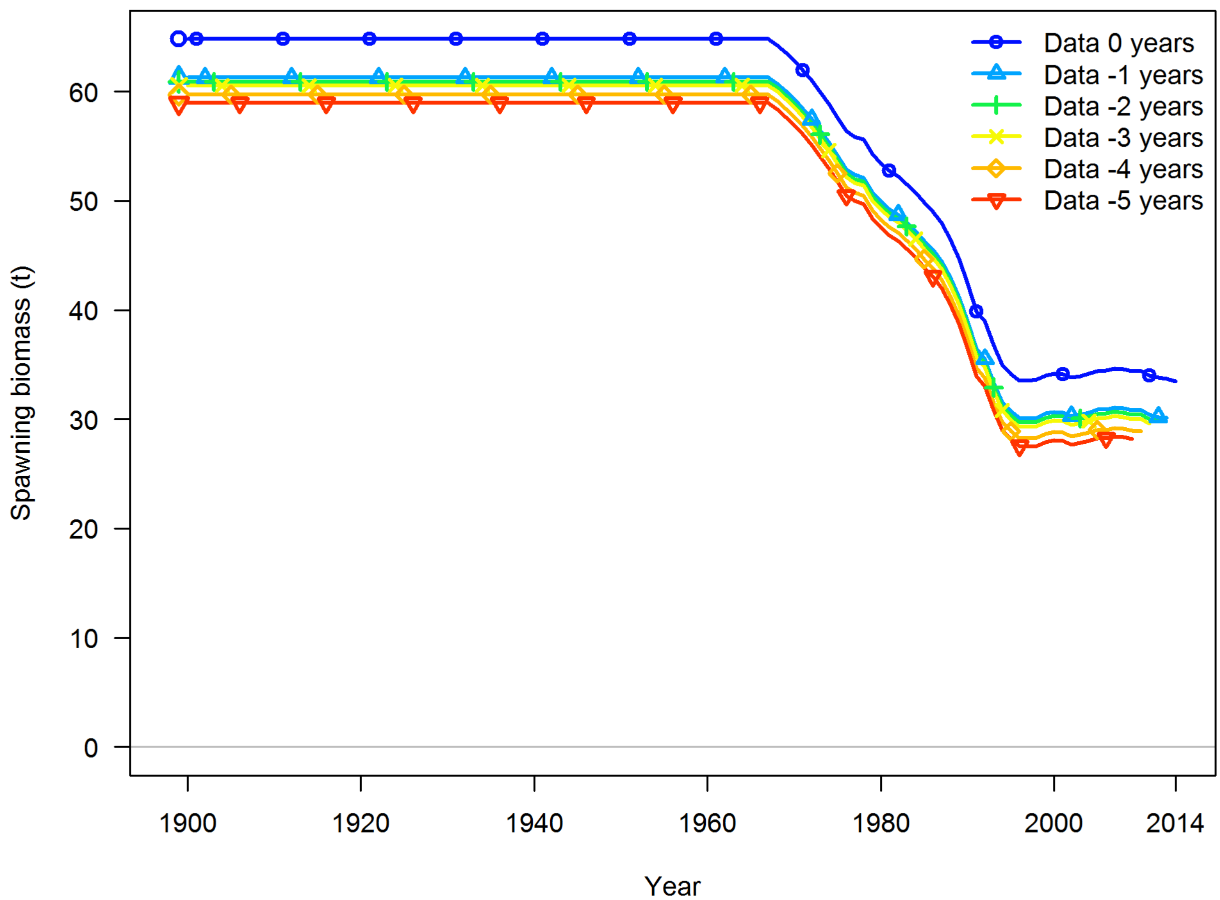


Figure 124: Retrospective analyses for the northern model.

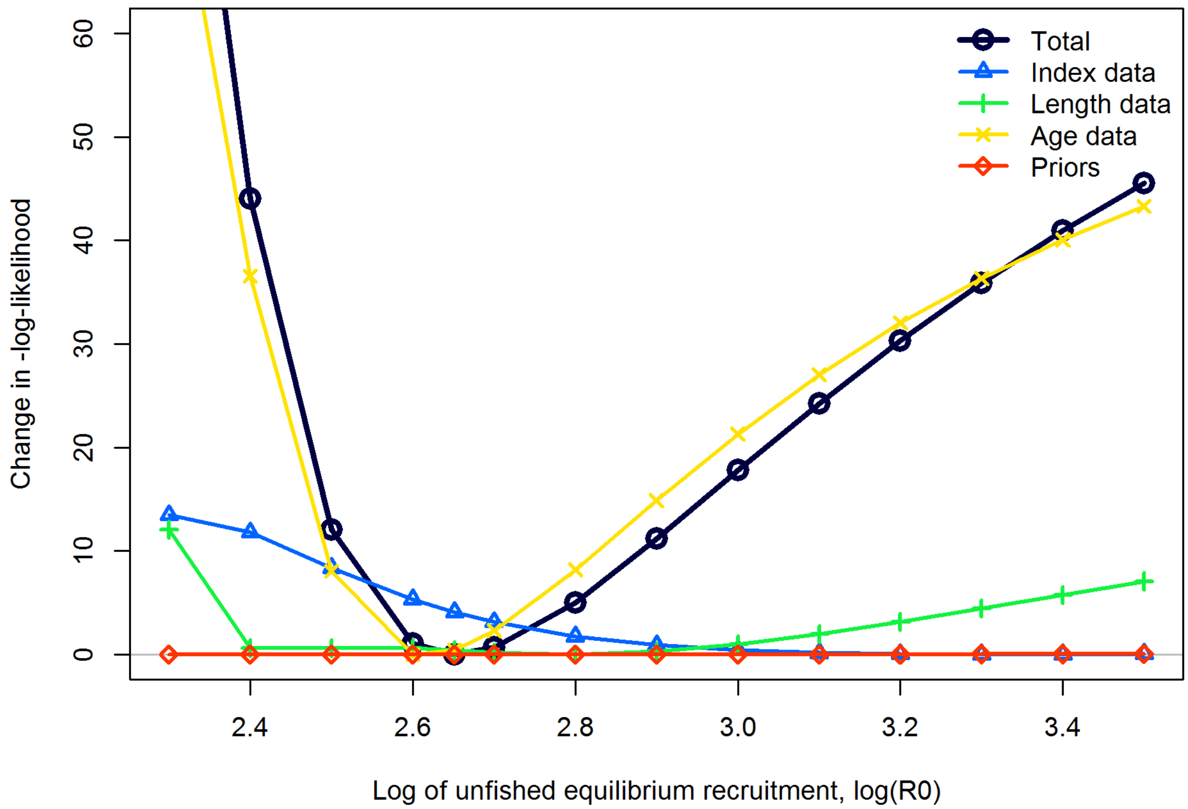


Figure 125: Likelihood profile over the log of equilibrium recruitment, $log(R_0)$ showing changes in negative log-likelihoods by data type for the pre-STAR northern model.

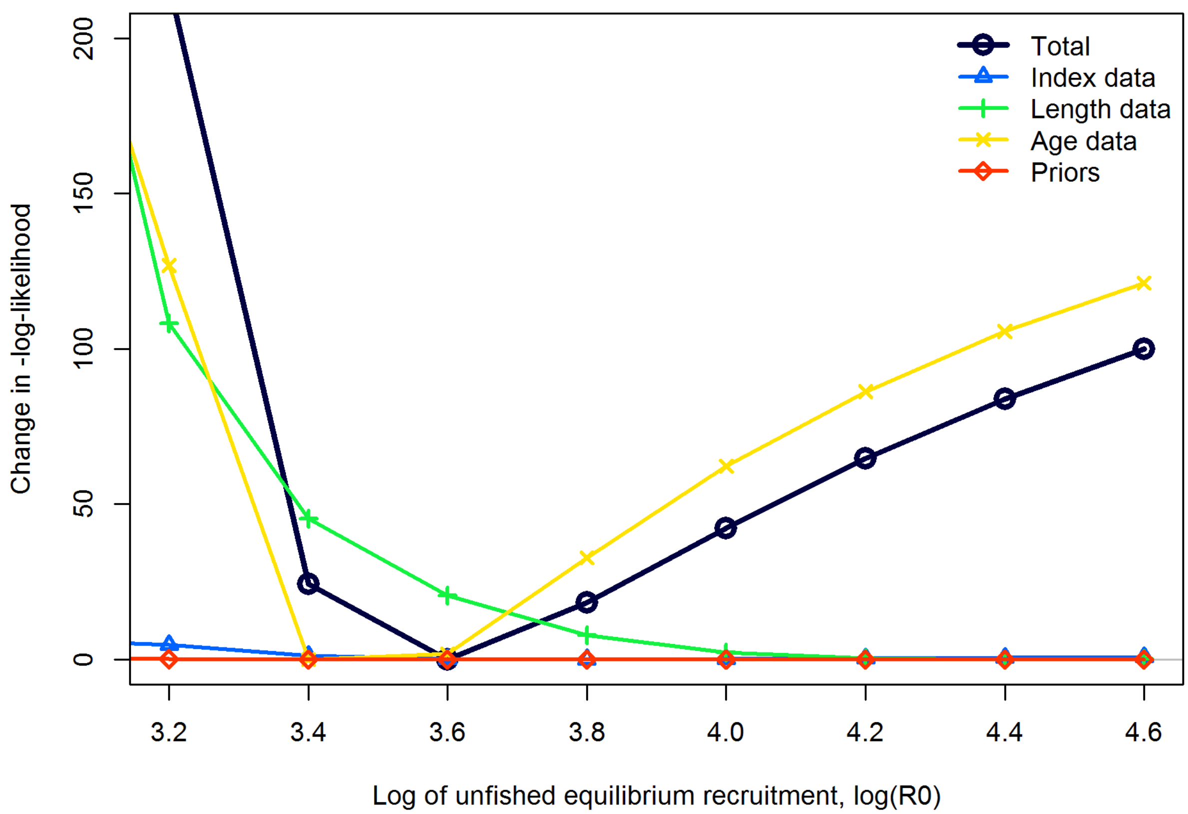


Figure 126: Likelihood profile over the log of equilibrium recruitment, $log(R_0)$ showing changes in negative log-likelihoods by data type for the pre-STAR central model.

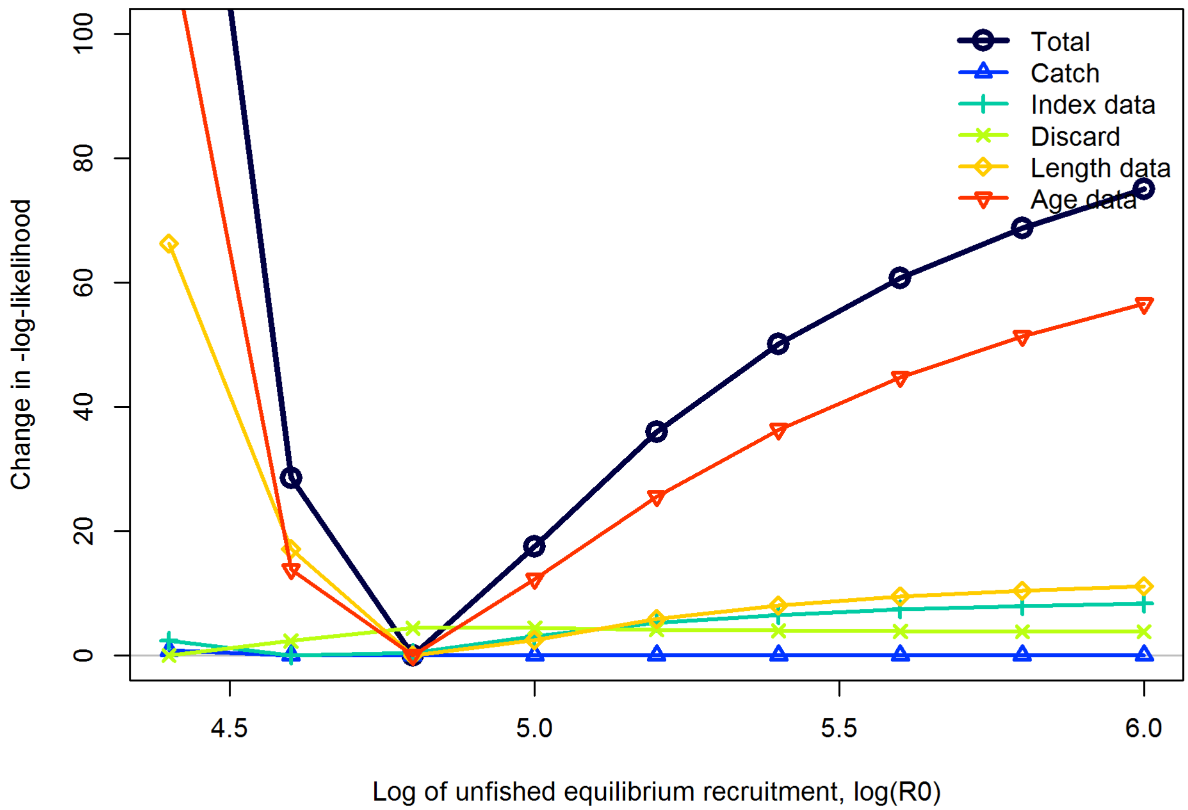


Figure 127: Likelihood profile over the log of equilibrium recruitment, $log(R_0)$ showing changes in negative log-likelihoods by data type for the pre-STAR southern model.

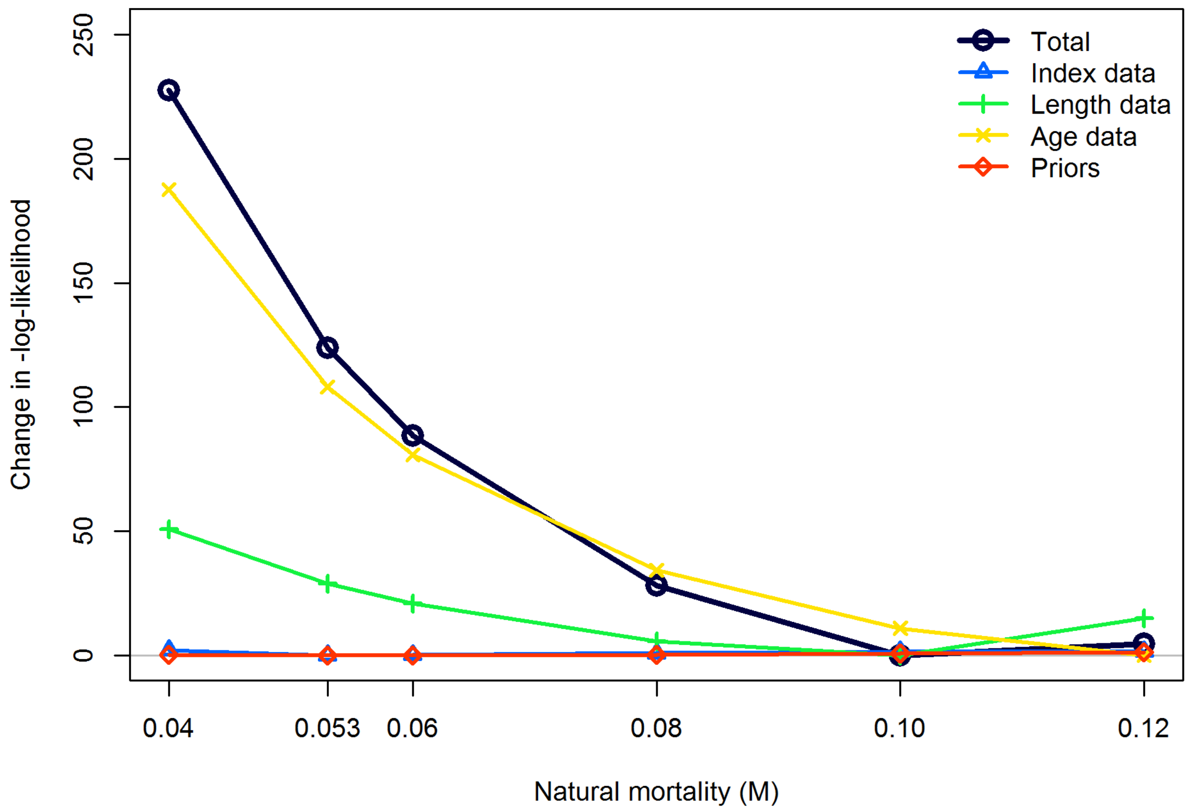


Figure 128: Likelihood profile over natrual mortality, M, showing changes in negative log-likelihoods by data type for the pre-STAR central model.

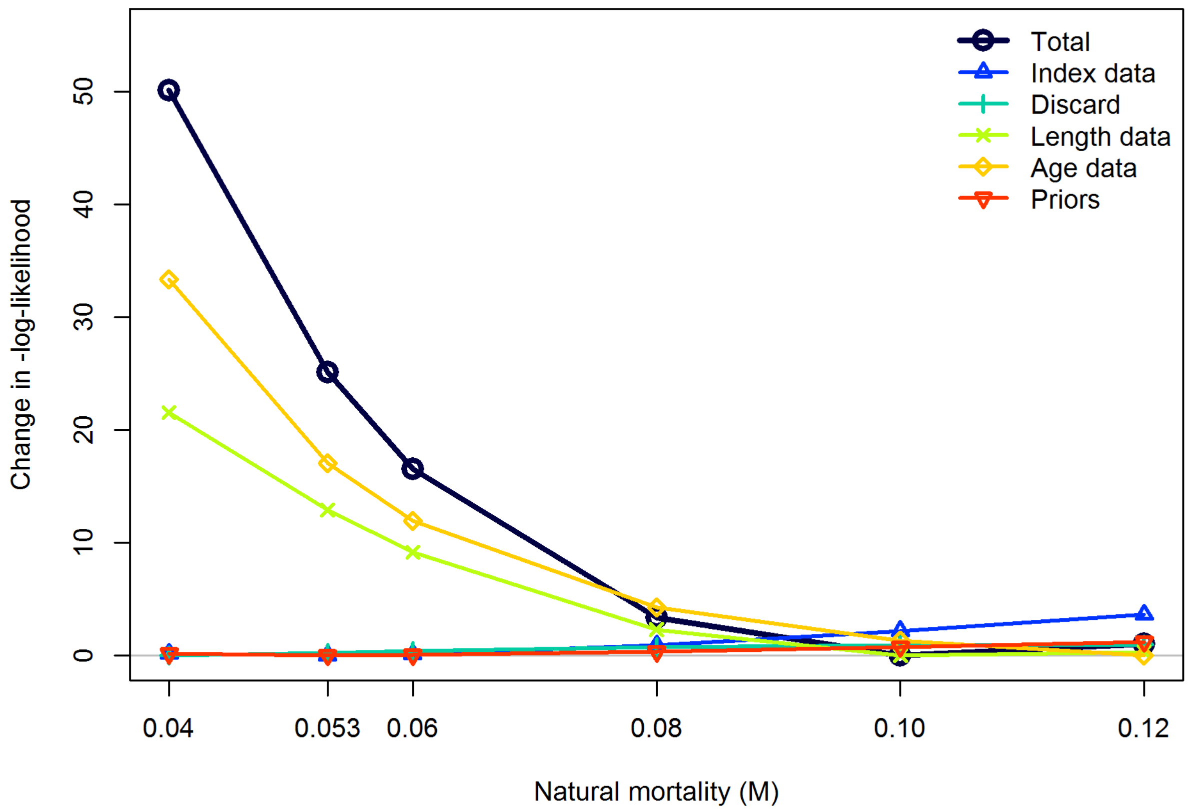


Figure 129: Likelihood profile over natrual mortality, M, showing changes in negative log-likelihoods by data type for the pre-STAR southern model.

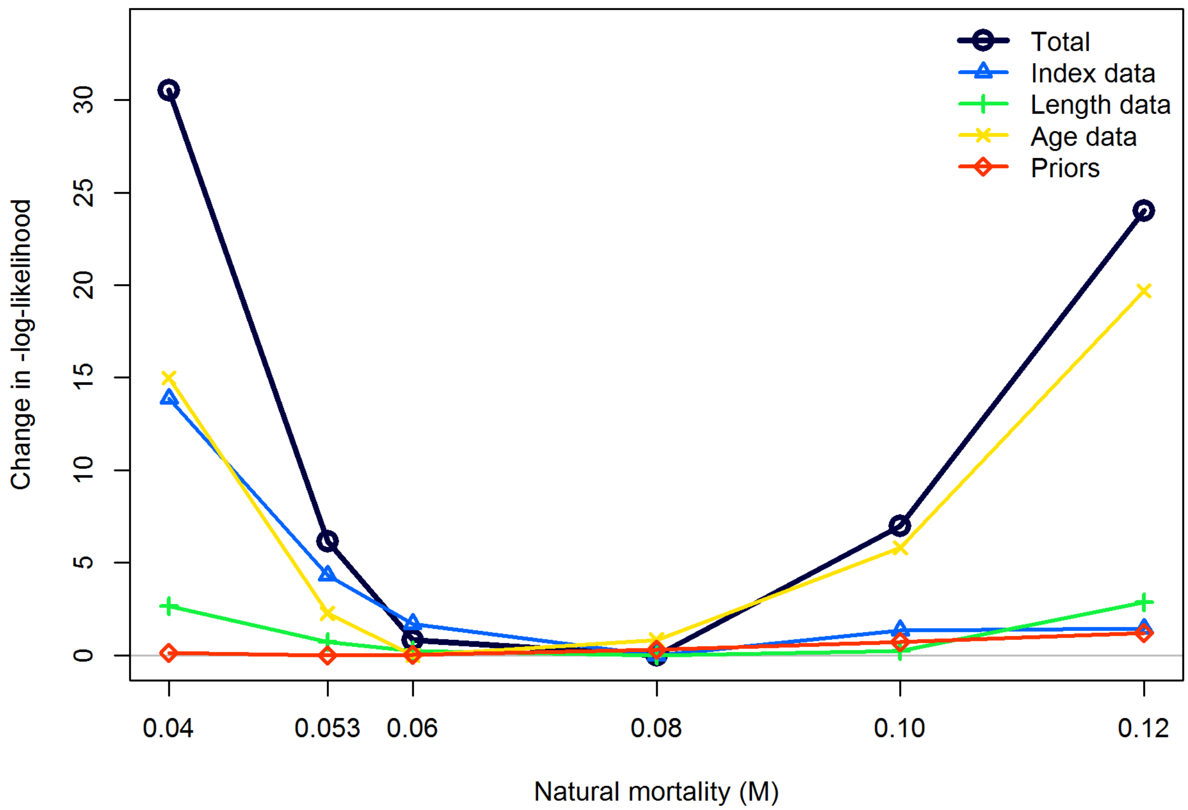


Figure 130: Likelihood profile over natrual mortality, M, showing changes in negative log-likelihoods by data type for the pre-STAR northern model.

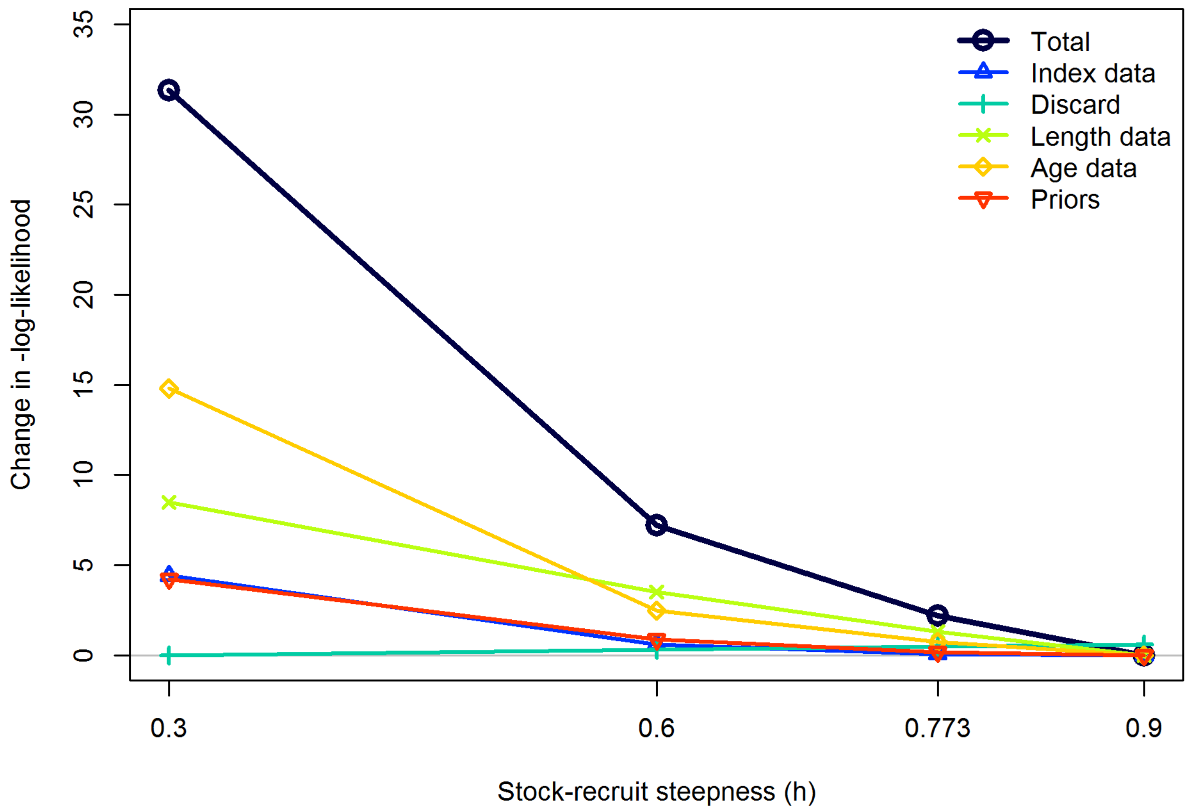


Figure 131: Likelihood profile over the steepness of the stock-recruit relationship, h, showing changes in negative log-likelihoods by data type for the pre-STAR southern model.

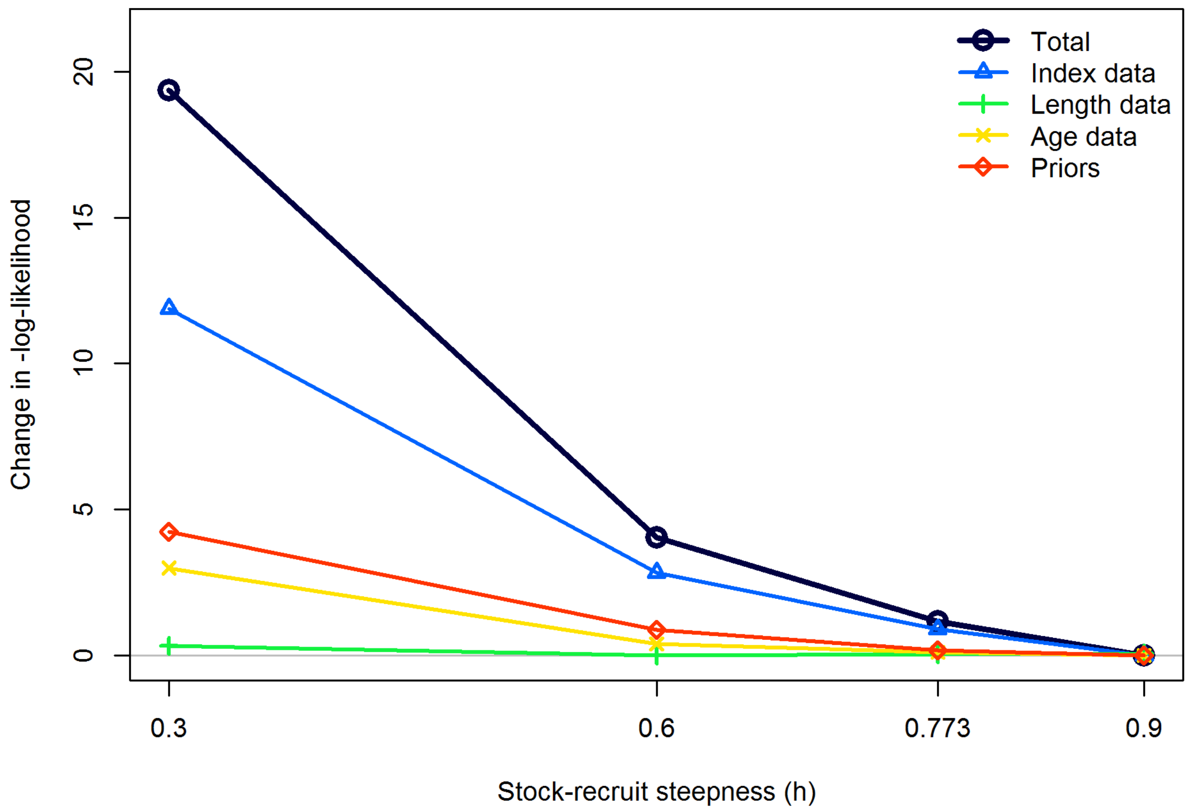


Figure 132: Likelihood profile over the steepness of the stock-recruit relationship, h, showing changes in negative log-likelihoods by data type for the pre-STAR northern model.

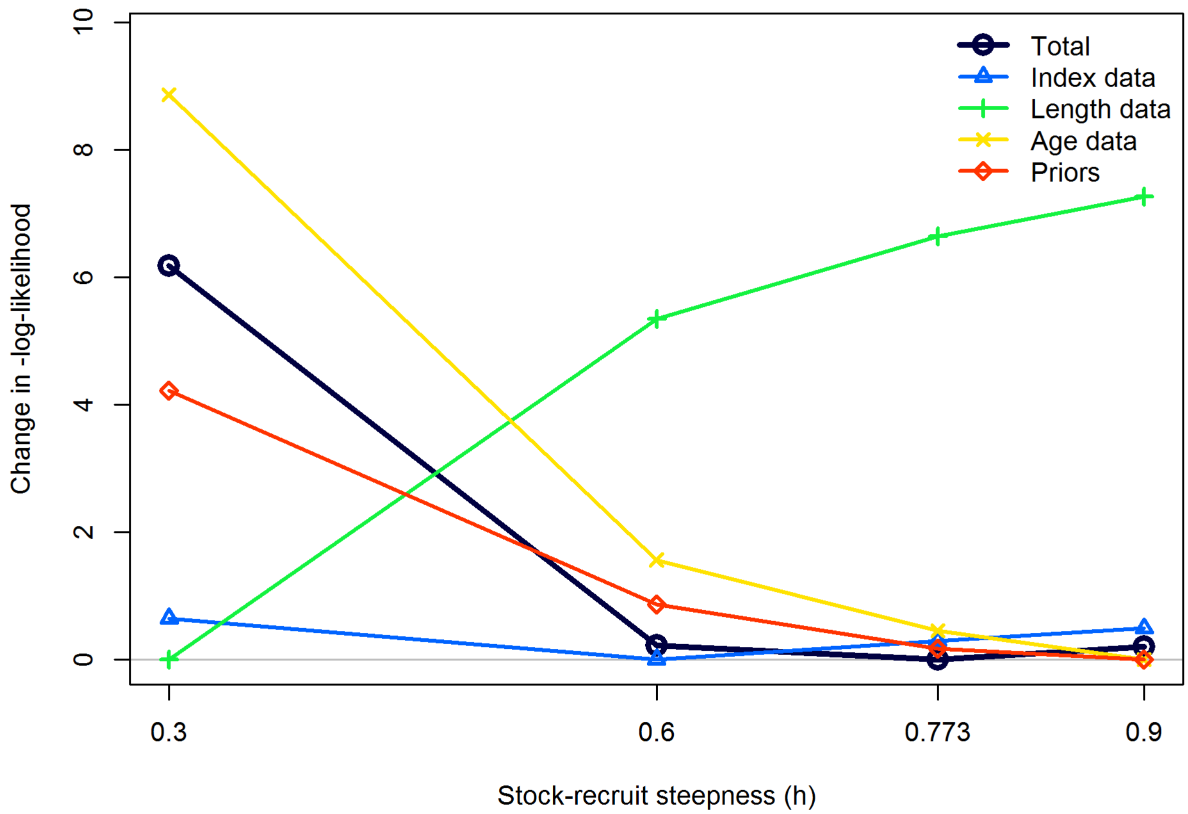


Figure 133: Likelihood profile over the steepness of the stock-recruit relationship, h, showing changes in negative log-likelihoods by data type for the pre-STAR central model.

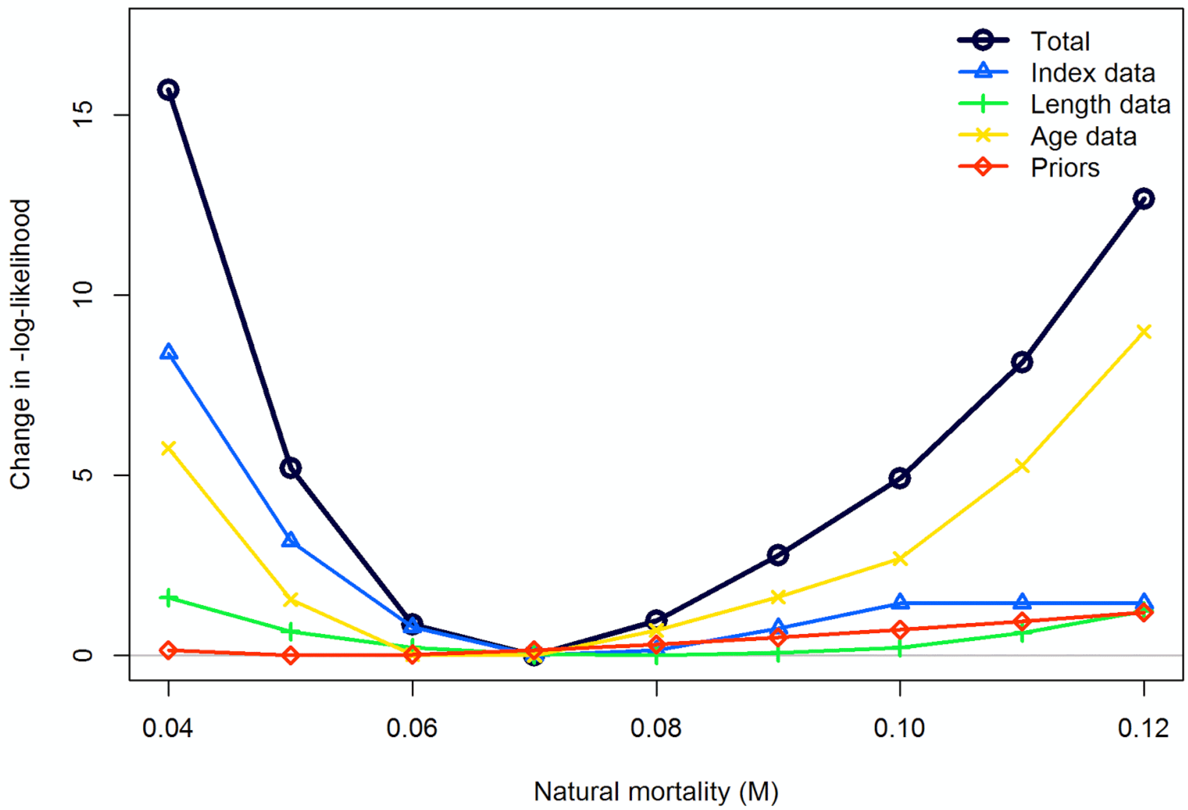


Figure 134: Likelihood profile over the natural mortality, M, for the final base model, showing changes in negative log-likelihoods by data type for the northern model.

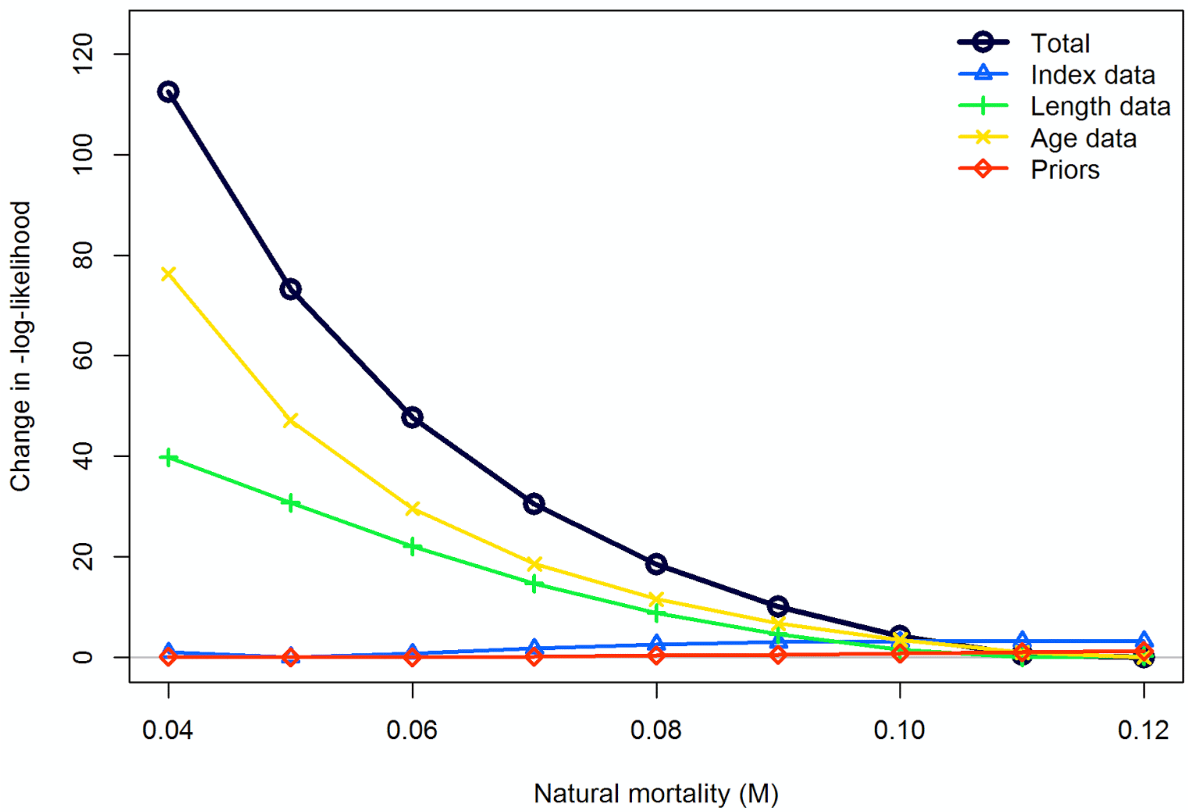


Figure 135: Likelihood profile over the natural mortality, M, for the final base model, showing changes in negative log-likelihoods by data type for the central model.

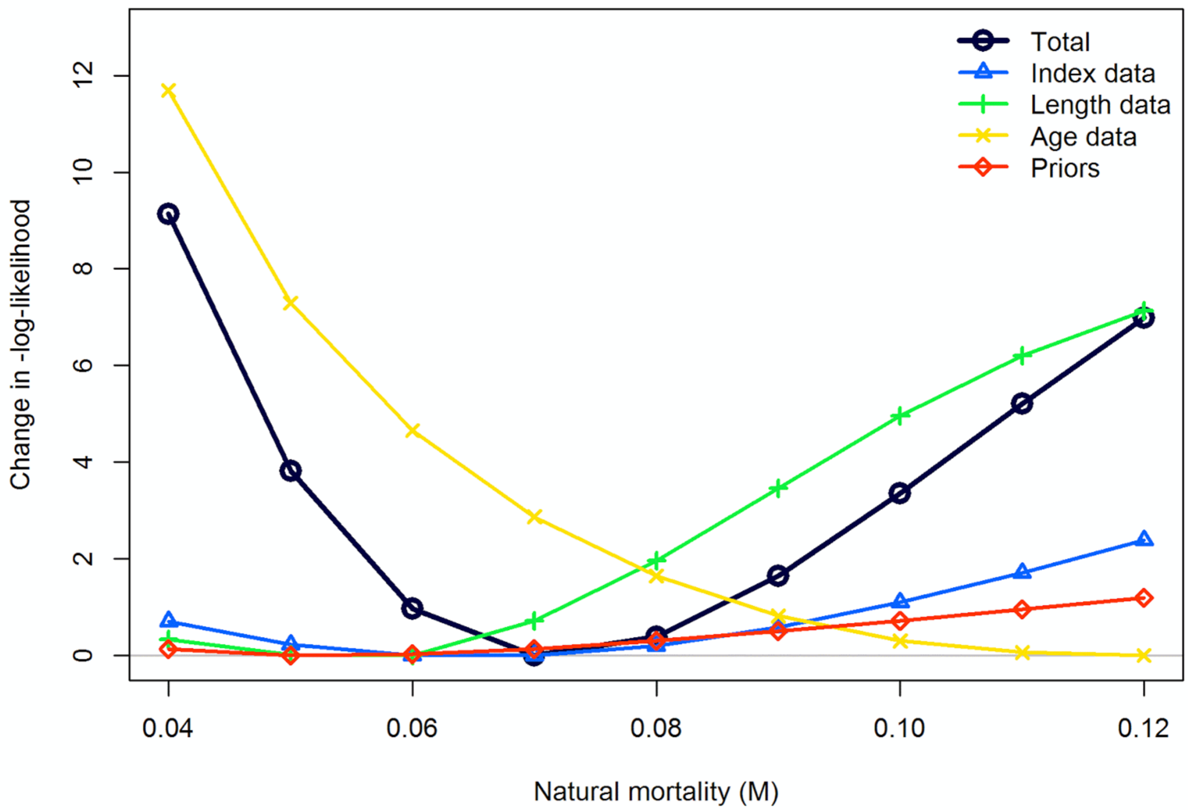


Figure 136: Likelihood profile over the natural mortality, M, for the final base model, showing changes in negative log-likelihoods by data type for the southern model.

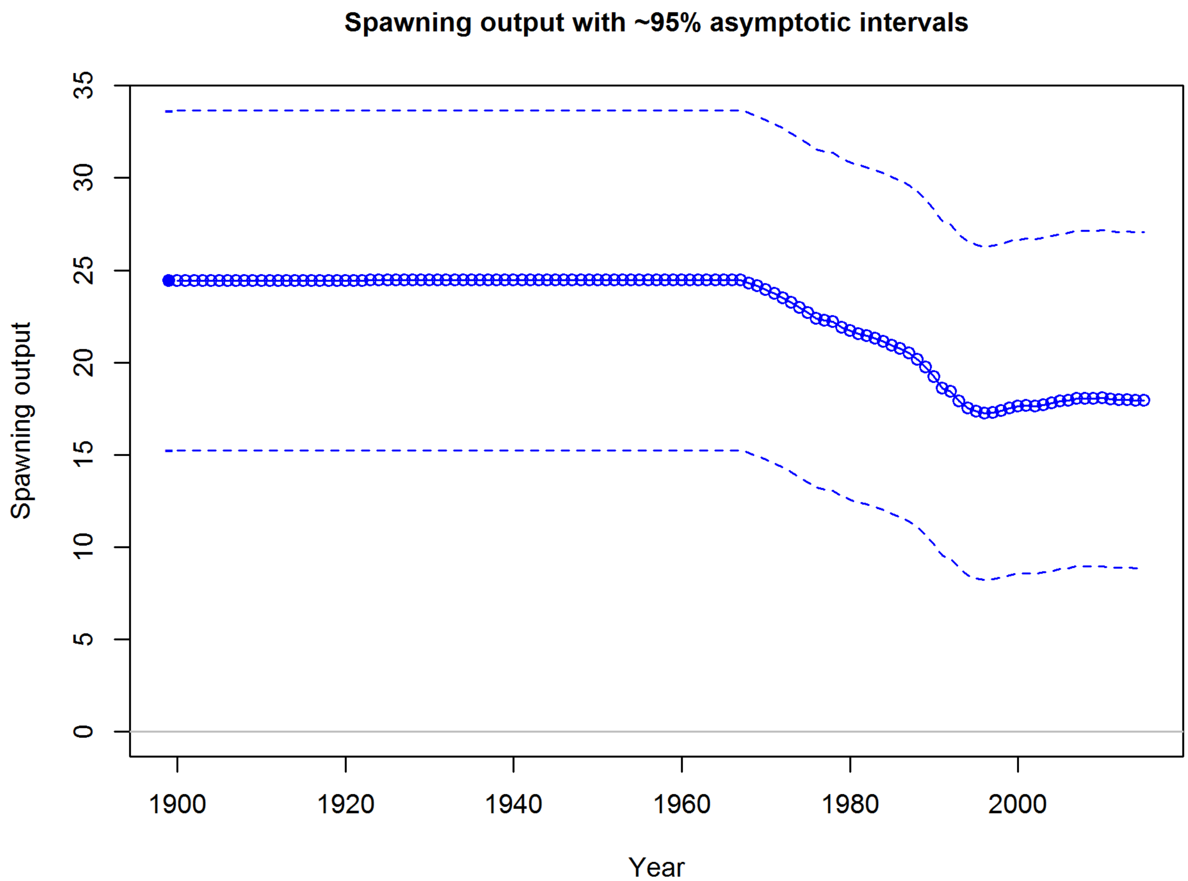


Figure 137: Time series of the spawning stock biomass for the northern model, with 95% asymptotic intervals.

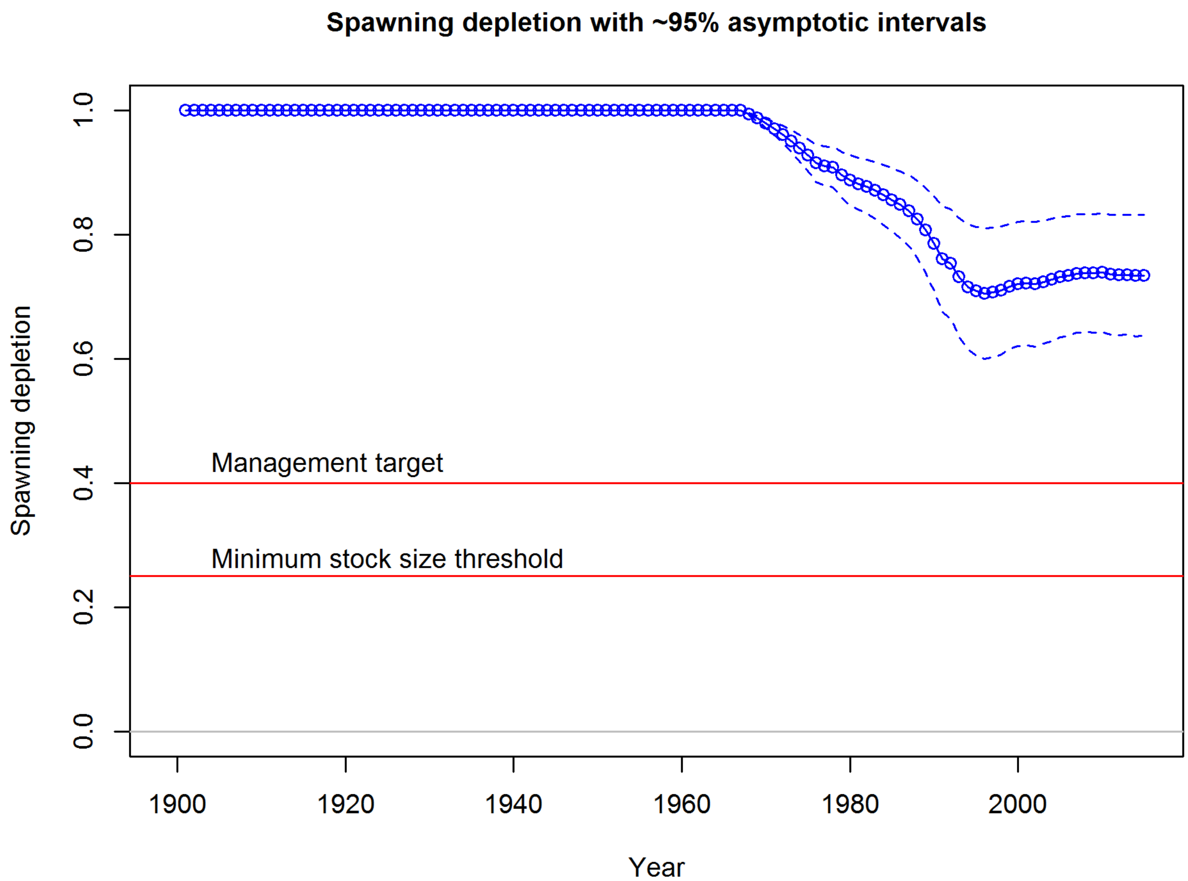


Figure 138: Spawning depletion relative to the management target and minimum stock size threshold for the northern model.

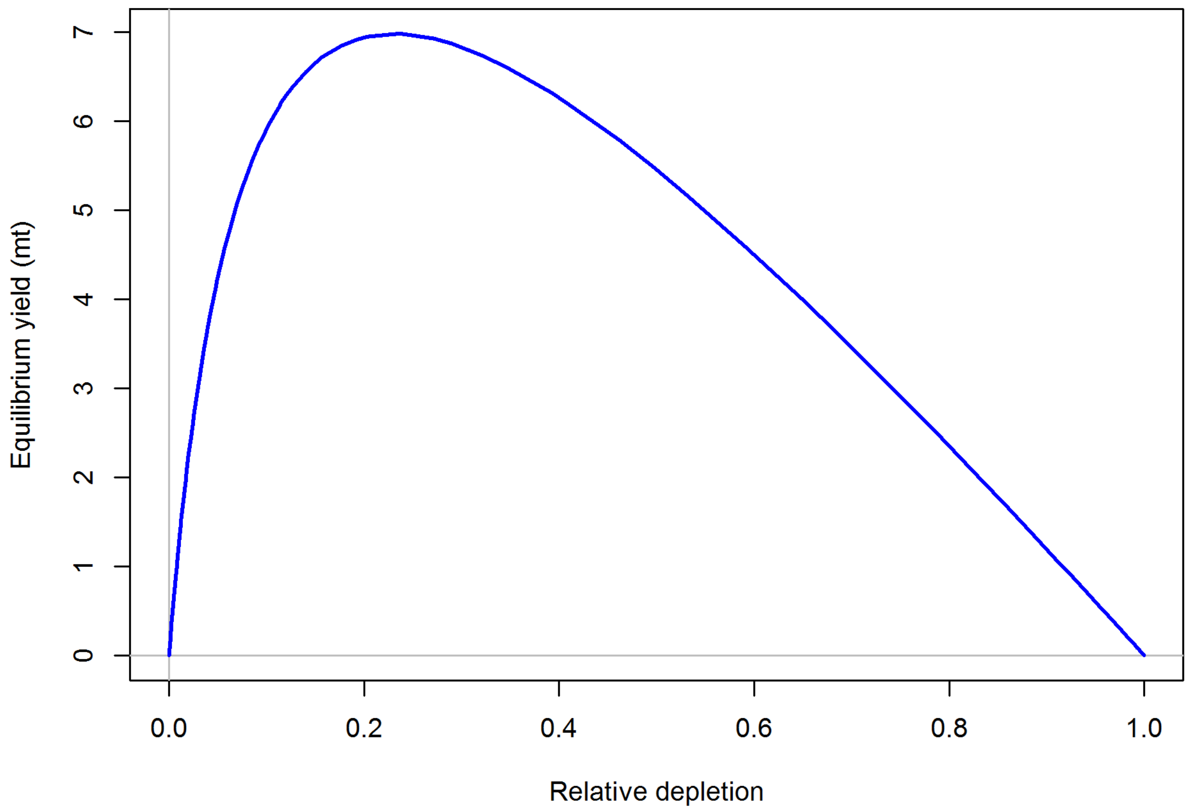


Figure 139: Equilibrium yield curve for the northern model.

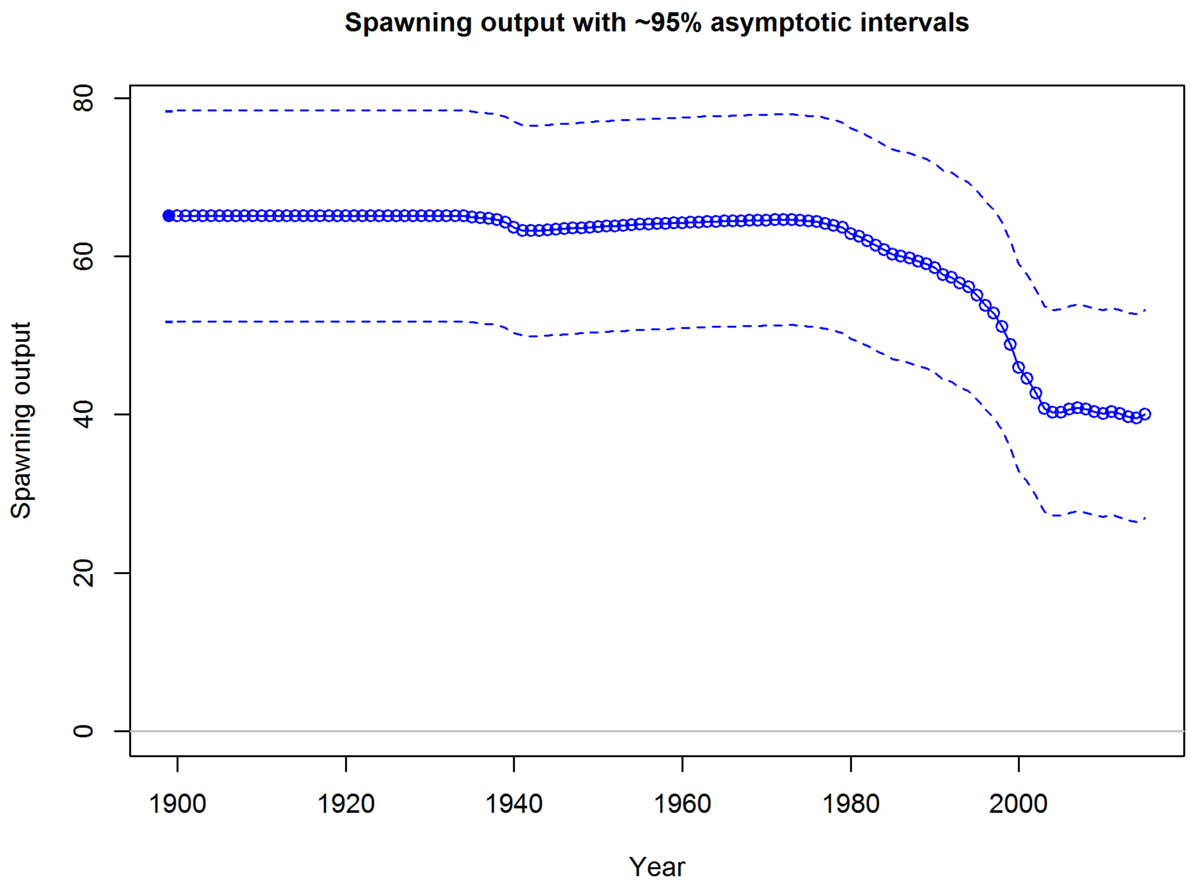


Figure 140: Time series of the spawning stock biomass for the central model, with 95% asymptotic intervals.

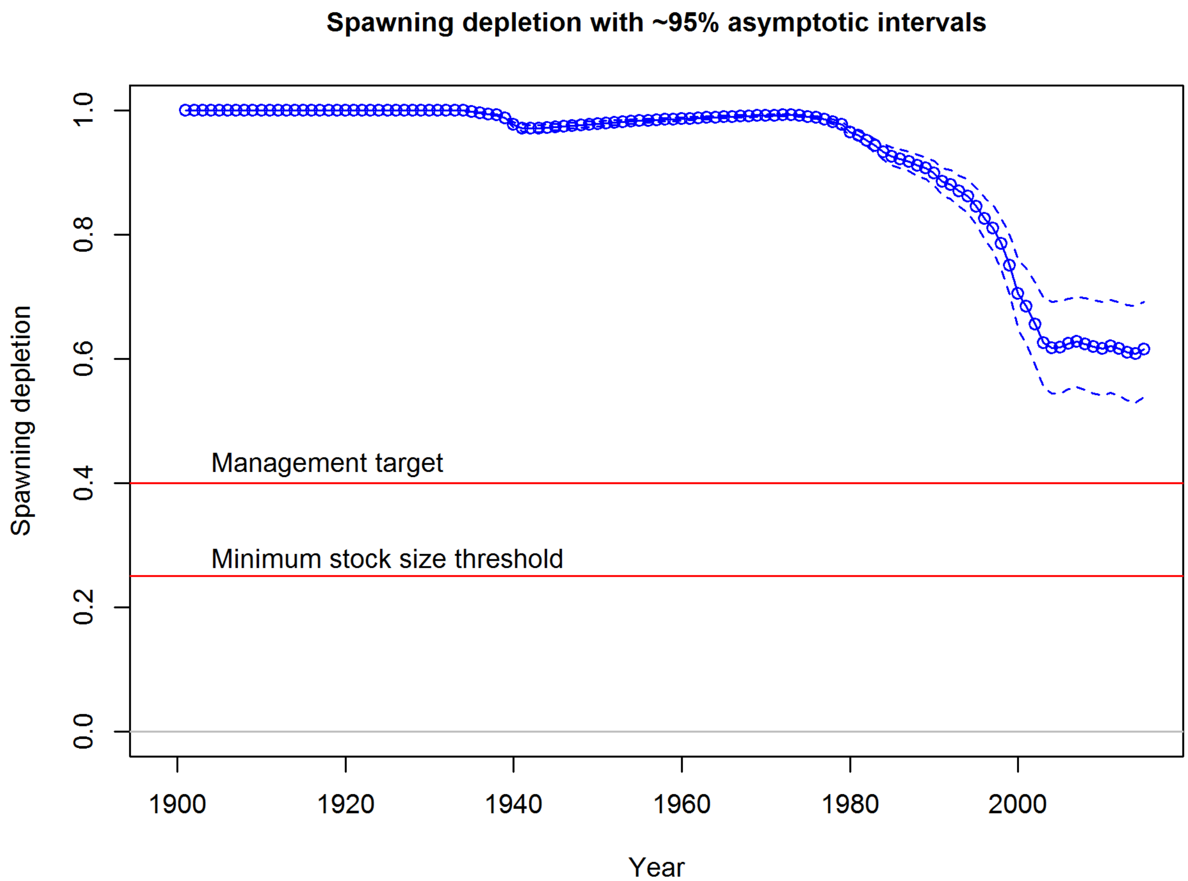


Figure 141: Spawning depletion relative to the management target and minimum stock size threshold for the central model.

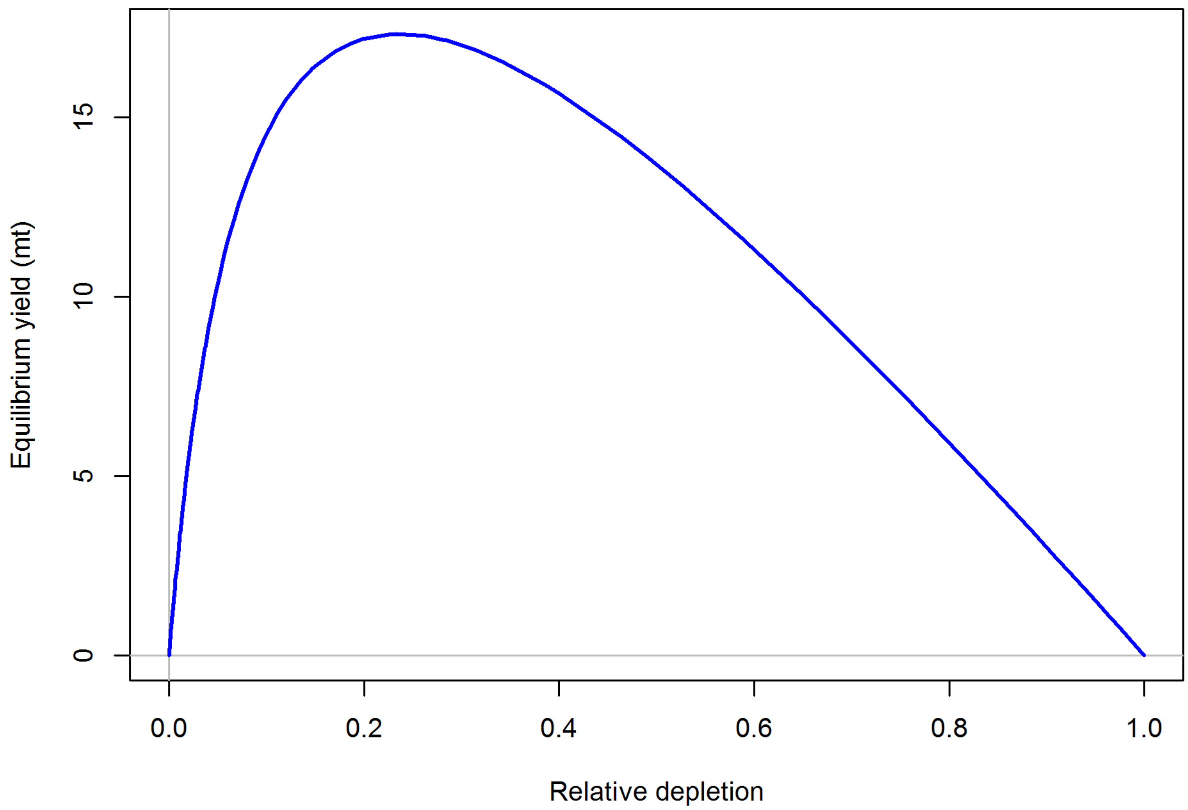


Figure 142: Equilibrium yield curve for the central model.

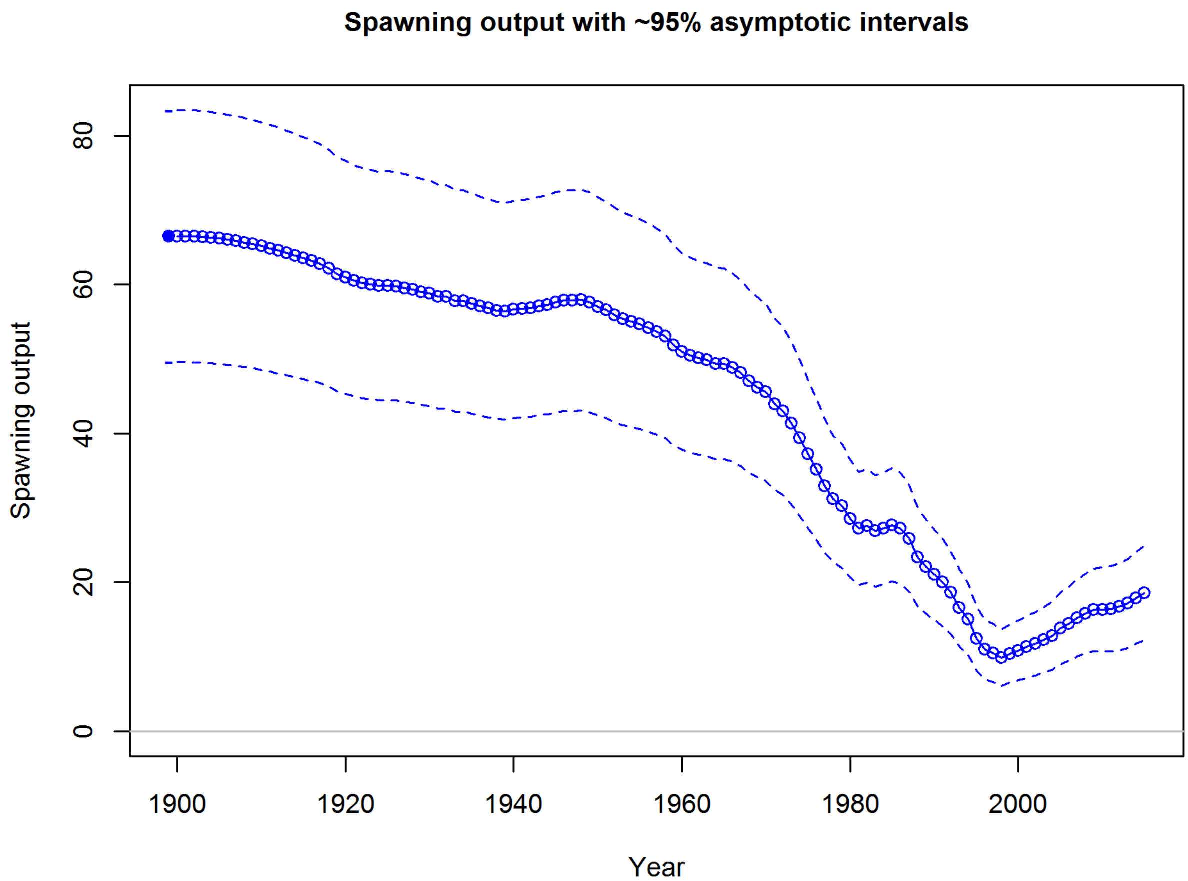


Figure 143: Time series of the spawning stock biomass for the southern model, with 95% asymptotic intervals.

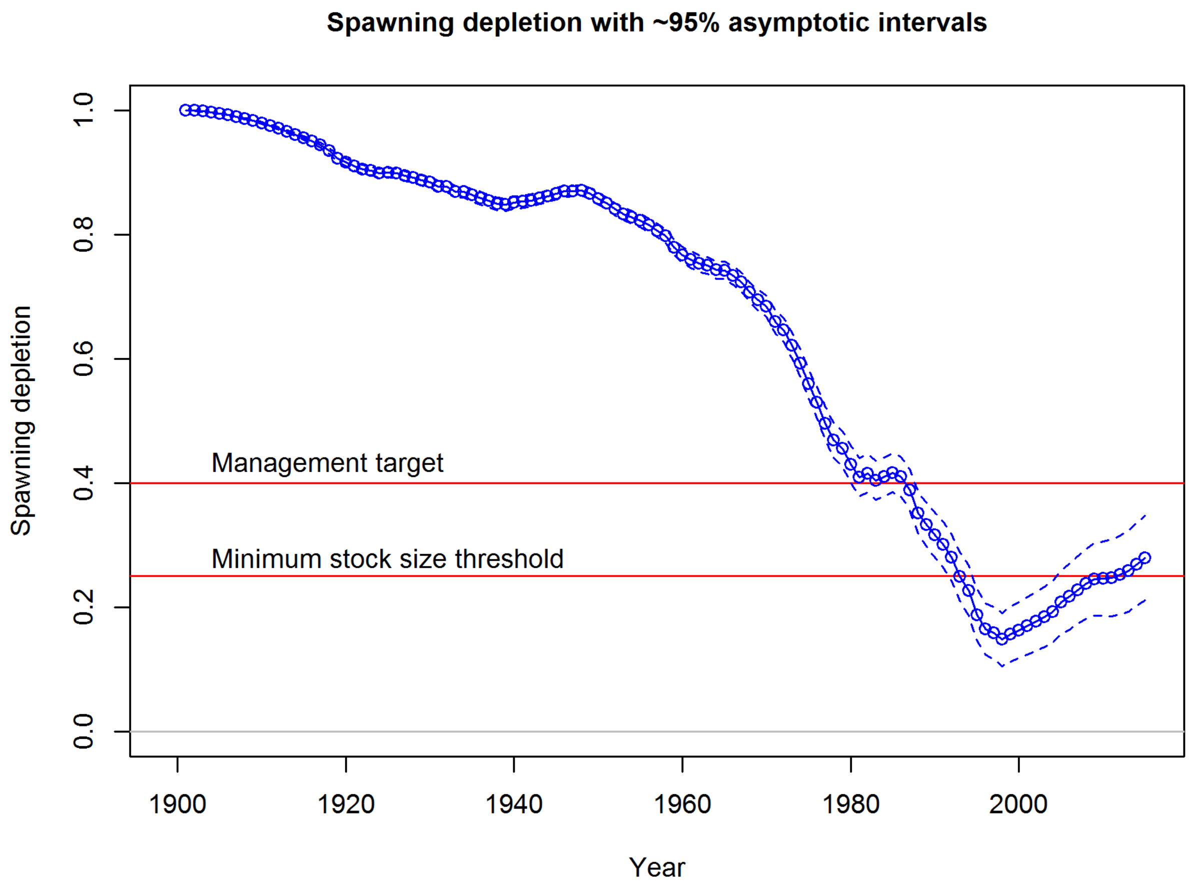


Figure 144: Spawning depletion relative to the management target and minimum stock size threshold for the southern model.

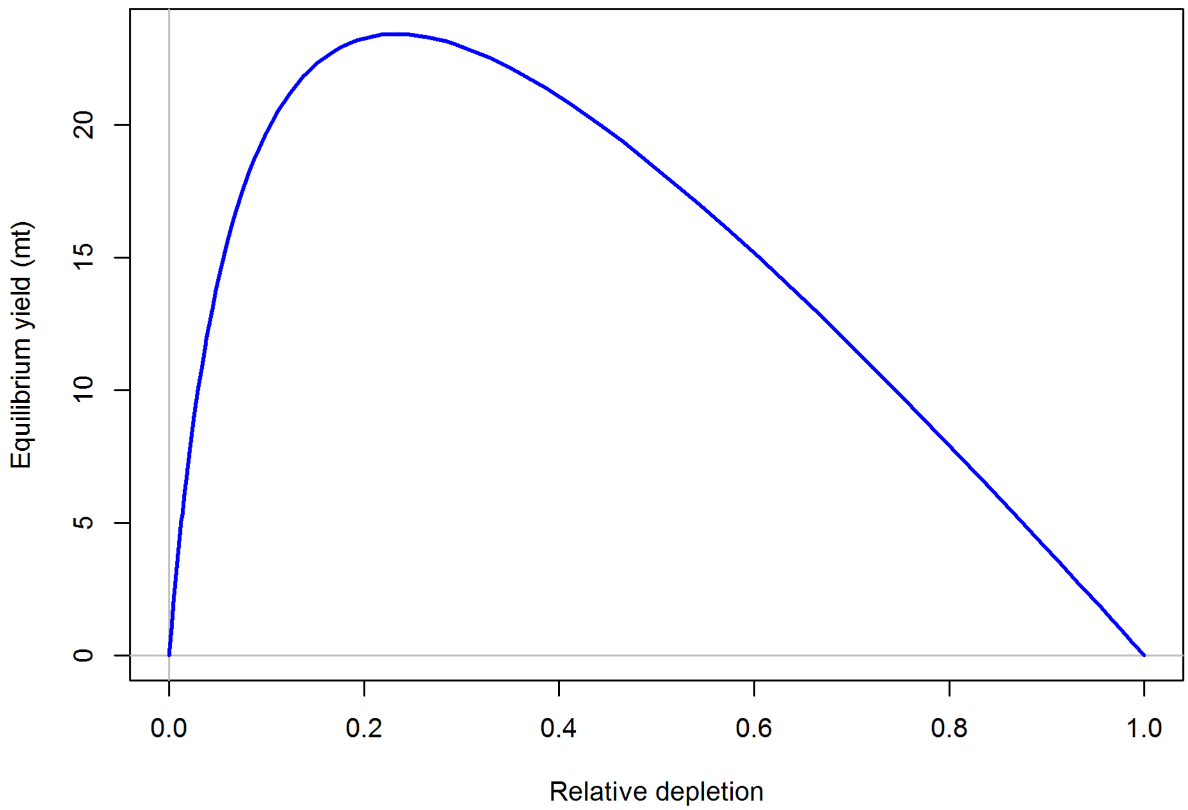


Figure 145: Equilibrium yield curve for the southern model.

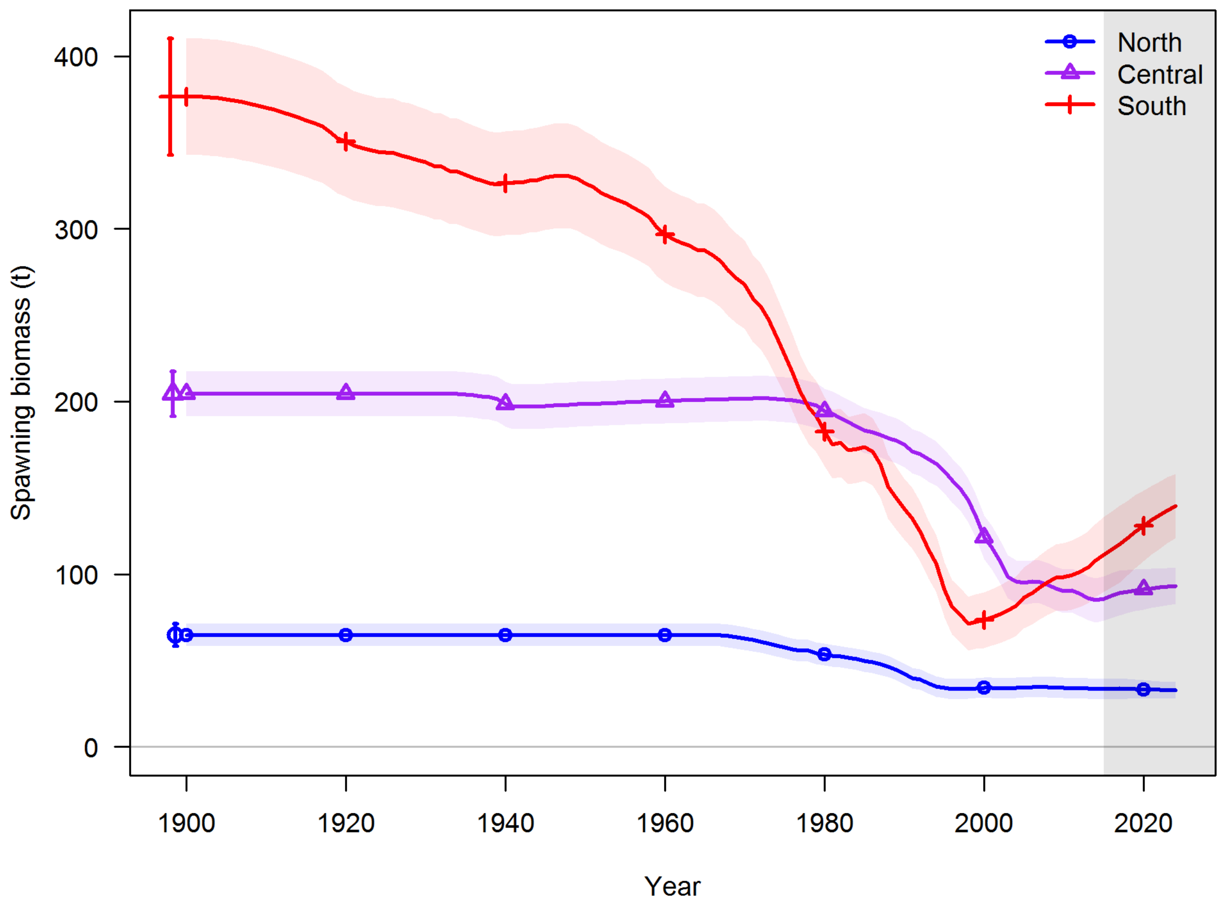


Figure 146: Time series of spawning biomass with a forecast to 2024 (shaded area) for the three base-case models.

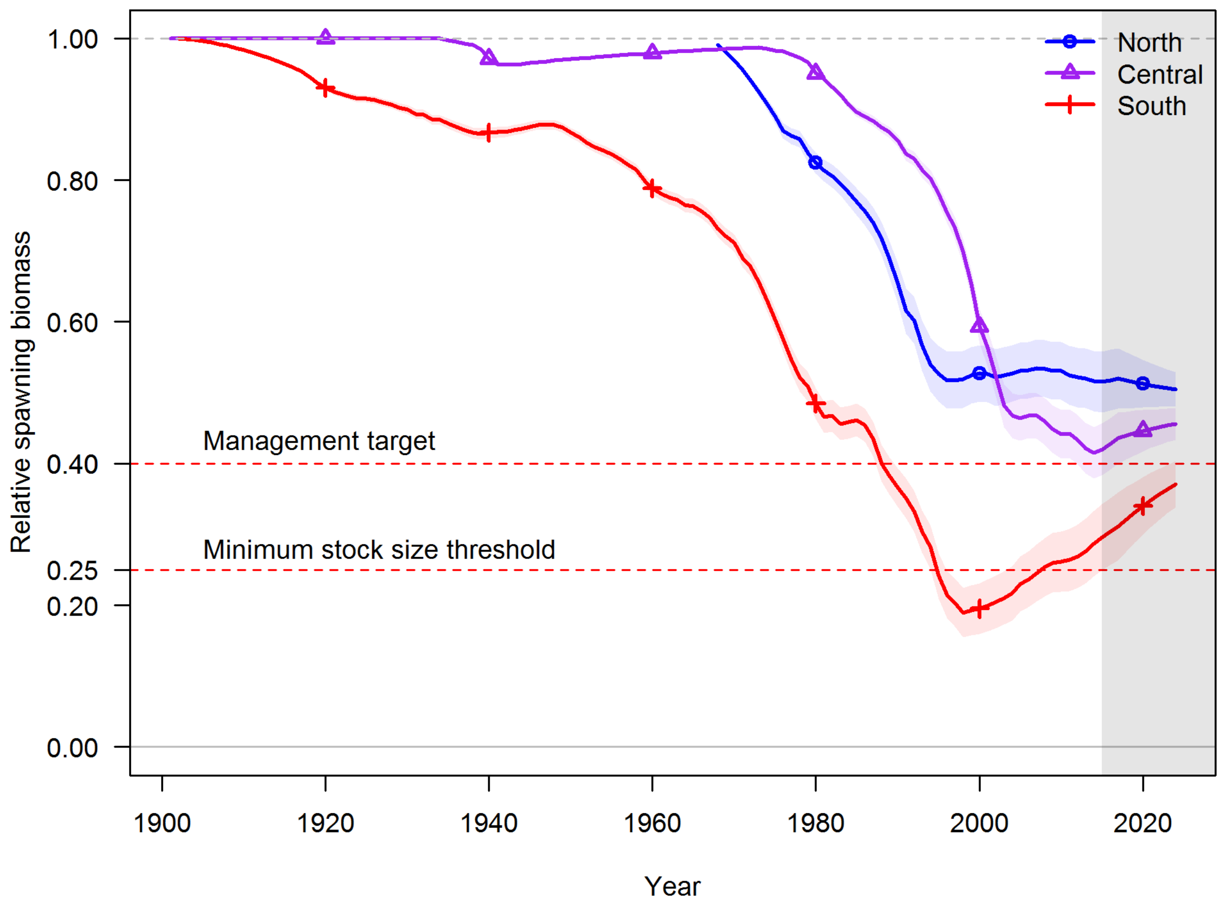


Figure 147: Time series of relative spawning biomass with a forecast to 2024 (shaded area) for the three base-case models.

Appendix A. SS data file

```
#V3.24u
#C data file for China rockfish North of 4010
#C adding multiple new data sources to approximate XDB-SRA model
#C 1) extended time series of catch to match southern model (for combining,
#  later)
#C 2) Combined Northern OR commercial (live+dead)
#C 3) Combined Southern WA rec (PC+PR)
#_observed data:
1900 #_styr -- extended to match southern model start year
2014 #_endyr
1 #_nseas
12 #_months/season
1  #_spawn_seas
3  #_Nfleet
0  #_Nsurveys
1  #_N_areas
## fleet names (second cut on June 7, 2015)
1_WA_SouthernWA_Rec_PCPR%2_WA_NorthernWA_Rec_PC%3_WA_NorthernWA_Rec_PR
## 12_WA_SouthernWA_Rec_PCPR
## 13_WA_NorthernWA_Rec_PC
## 14_WA_NorthernWA_Rec_PR
# following values are 1 per catch or survey fleet
0.5 0.5 0.5 #_surveytiming_in_season -- mid-year, not exactly like XDB-SRA
  1   1   1 #_area_assignments_for_each_fishery_and_survey
# following values are 1 per catch fleet
  1   1   1 #_units of catch:  1=bio; 2=num
0.1 0.1 0.1 #_se of log(catch) only used for init_eq_catch and for Fmethod
# 2 and 3; use -1 for discard only fleets
2 #_Ngenders
80 #_Nages
  0   0   0 #_init_equil_catch_for_each_fishery
115 #_N_lines_of_catch_to_read
#_catch_biomass(mtons):_columns_are_fisheries,year,season
# this file has catch in SS format based on formulas in the adjacent Google
#  Doc "Catch Pivot" worksheet
#fleet12 fleet13 fleet14 Year Season #
 0       0       0       1900    1       #
 0       0       0       1901    1       #
 0       0       0       1902    1       #
 0       0       0       1903    1       #
```

2800	0	0	0	1904	1	#
2801	0	0	0	1905	1	#
2802	0	0	0	1906	1	#
2803	0	0	0	1907	1	#
2804	0	0	0	1908	1	#
2805	0	0	0	1909	1	#
2806	0	0	0	1910	1	#
2807	0	0	0	1911	1	#
2808	0	0	0	1912	1	#
2809	0	0	0	1913	1	#
2810	0	0	0	1914	1	#
2811	0	0	0	1915	1	#
2812	0	0	0	1916	1	#
2813	0	0	0	1917	1	#
2814	0	0	0	1918	1	#
2815	0	0	0	1919	1	#
2816	0	0	0	1920	1	#
2817	0	0	0	1921	1	#
2818	0	0	0	1922	1	#
2819	0	0	0	1923	1	#
2820	0	0	0	1924	1	#
2821	0	0	0	1925	1	#
2822	0	0	0	1926	1	#
2823	0	0	0	1927	1	#
2824	0	0	0	1928	1	#
2825	0	0	0	1929	1	#
2826	0	0	0	1930	1	#
2827	0	0	0	1931	1	#
2828	0	0	0	1932	1	#
2829	0	0	0	1933	1	#
2830	0	0	0	1934	1	#
2831	0	0	0	1935	1	#
2832	0	0	0	1936	1	#
2833	0	0	0	1937	1	#
2834	0	0	0	1938	1	#
2835	0	0	0	1939	1	#
2836	0	0	0	1940	1	#
2837	0	0	0	1941	1	#
2838	0	0	0	1942	1	#
2839	0	0	0	1943	1	#
2840	0	0	0	1944	1	#
2841	0	0	0	1945	1	#

0	0	0	1946	1	#
0	0	0	1947	1	#
0	0	0	1948	1	#
0	0	0	1949	1	#
0	0	0	1950	1	#
0	0	0	1951	1	#
0	0	0	1952	1	#
0	0	0	1953	1	#
0	0	0	1954	1	#
0	0	0	1955	1	#
0	0	0	1956	1	#
0	0	0	1957	1	#
0	0	0	1958	1	#
0	0	0	1959	1	#
0	0	0	1960	1	#
0	0	0	1961	1	#
0	0	0	1962	1	#
0	0	0	1963	1	#
0	0	0	1964	1	#
0	0	0	1965	1	#
0	0	0	1966	1	#
0	0.27	1.04	1967	1	#
0.02	0.32	1.25	1968	1	#
0.04	0.37	1.45	1969	1	#
0.06	0.43	1.66	1970	1	#
0.08	0.48	1.87	1971	1	#
0.10	0.53	2.08	1972	1	#
0.11	0.59	2.29	1973	1	#
0.13	0.64	2.49	1974	1	#
0.15	0.69	2.7	1975	1	#
0.02	0.38	1.48	1976	1	#
0.01	0.29	1.12	1977	1	#
0.06	0.78	3.02	1978	1	#
0.01	0.62	2.4	1979	1	#
0.02	0.53	2.04	1980	1	#
0.06	0.47	1.83	1981	1	#
0.05	0.56	2.18	1982	1	#
0.00	0.62	2.42	1983	1	#
0.11	0.67	2.62	1984	1	#
0.06	0.68	2.64	1985	1	#
0.16	0.78	3.02	1986	1	#
0.20	1.03	3.73	1987	1	#

```
 0.24   1.28    4.45    1988    1       #
 0.27   1.54    5.16    1989    1       #
 0.31   1.79    5.88    1990    1       #
 0.23   0.51    3.58    1991    1       #
 0.35   1.46    5.81    1992    1       #
 0.32   1.13    5.08    1993    1       #
 0.32   1.18    3.24    1994    1       #
 0.10   0.6     3.43    1995    1       #
 0.12   0.45    2.29    1996    1       #
 0.19   0.4     2.13    1997    1       #
 0.26   0.08    1.65    1998    1       #
 0.06   0.09    2.35    1999    1       #
 0.10   0.41    2.51    2000    1       #
 0.25   0.25    3.13    2001    1       #
 0.09   0.23    2.17    2002    1       #
 0.09   0.12    2.18    2003    1       #
 0.12   0.14    1.97    2004    1       #
 0.03   0.19    2.46    2005    1       #
 0.03   0.08    2.2     2006    1       #
 0.07   0.15    2.73    2007    1       #
 0.17   0.31    2.68    2008    1       #
 0.07   0.17    2.55    2009    1       #
 0.19   0.13    3.36    2010    1       #
 0.07   0.17    3.02    2011    1       #
 0.08   0.25    2.63    2012    1       #
 0.07   0.27    3.06    2013    1       #
 0.04   0.3     2.68    2014    1       #
#
34 #_N_cpue_and_surveyabundance_observations
#_Units:  0=numbers; 1=biomass; 2=F
#_Errtype:  -1=normal; 0=lognormal; >0=T
#_Fleet Units Errtype
1      0     0 # 12_WA_SouthernWA_Rec_PCPR
2      0     0 # 13_WA_NorthernWA_Rec_PC
3      0     0 # 14_WA_NorthernWA_Rec_PR


### Washington Rec CPUE (lognormal) - only use one of the following
### Index with Stevens-MacCall filtering and all positives retained
### Assigned to fleet: "14_WA_NorthernWA_Rec_PC"
#_year seas index obs err (CV)
1981 1  3 0.694 0.154 # WA Rec CPUE
```

```
1982 1  3 0.54 0.105 # WA Rec CPUE
1983 1  3 0.643 0.098 # WA Rec CPUE
1984 1  3 0.5 0.071 # WA Rec CPUE
1985 1  3 0.736 0.059 # WA Rec CPUE
1986 1  3 0.616 0.077 # WA Rec CPUE
1987 1  3 0.486 0.06 # WA Rec CPUE
1988 1  3 0.587 0.064 # WA Rec CPUE
1989 1  3 0.666 0.051 # WA Rec CPUE
1990 1  3 0.801 0.056 # WA Rec CPUE
1991 1  3 0.665 0.066 # WA Rec CPUE
1992 1  3 0.704 0.109 # WA Rec CPUE
1993 1  3 0.63 0.057 # WA Rec CPUE
1994 1  3 0.648 0.054 # WA Rec CPUE
1995 1  3 0.59 0.051 # WA Rec CPUE
1996 1  3 0.389 0.06 # WA Rec CPUE
1997 1  3 0.368 0.067 # WA Rec CPUE
1998 1  3 0.402 0.075 # WA Rec CPUE
1999 1  3 0.403 0.081 # WA Rec CPUE
2000 1  3 0.52 0.071 # WA Rec CPUE
2001 1  3 0.594 0.068 # WA Rec CPUE
2002 1  3 0.521 0.077 # WA Rec CPUE
2003 1  3 0.472 0.087 # WA Rec CPUE
2004 1  3 0.435 0.093 # WA Rec CPUE
2005 1  3 0.427 0.065 # WA Rec CPUE
2006 1  3 0.48 0.081 # WA Rec CPUE
2007 1  3 0.655 0.113 # WA Rec CPUE
2008 1  3 0.655 0.07 # WA Rec CPUE
2009 1  3 0.635 0.081 # WA Rec CPUE
2010 1  3 0.711 0.111 # WA Rec CPUE
2011 1  3 0.726 0.075 # WA Rec CPUE
2012 1  3 0.631 0.104 # WA Rec CPUE
2013 1  3 0.713 0.078 # WA Rec CPUE
2014 1  3 0.603 0.103 # WA Rec CPUE

0 #_N_fleets_with_discard
#_discard_units (1=same_as_catchunits(bio/num); 2=fraction; 3=numbers)
#_discard_errtype:  >0 for DF of T-dist(read CV below); 0 for normal with C
# V; -1 for normal with se; -2 for lognormal
#Fleet Disc_units err_type
0 #N discard obs
#_year seas index obs err
#
```

```
0 #_N_meanbodywt_obs
30 #_DF_for_meanbodywt_T-distribution_like

2  # length bin method: 1=use databins; 2=generate from binwidth,min,max be
# low; 3=read vector
2  # binwidth for population size comp
8  # minimum size in the population (lower edge of first bin and size at ag
# e 0.00)
50 # maximum size in the population (lower edge of last bin)

-0.0001 #_comp_tail_compression
1e-003 #_add_to_comp
0 #_combine males into females at or below this bin number
15 #_N_LengthBins
18 20 22 24 26 28 30 32 34 36 38 40 42 44 46

38 #_N_Length_obs

### WA Rec, South, All modes combined (represent 4% of WA removals, 1969-20
# 14)
### initially assigning to fleet: "12_WA_SouthernWA_Rec_PCPR"
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1981    1       1       0       2       8       0       0       0       0
        2       1       2       0       2       1       0       0       0
  0       0       0       0       0       0       2       1       2       0
        2       1       0       0       0       0       0
2002    1       1       0       2       31      0       0       0       0
        2       5       0       8       7       8       1       0       0
  0       0       0       0       0       0       2       5       0       8
        7       8       1       0       0       0       0
2003    1       1       0       2       32      0       0       0       0
        3       5       4       4       6       8       1       0       1
  0       0       0       0       0       0       3       5       4       4
        6       8       1       0       1       0       0
2004    1       1       0       2       25      0       1       1       0
        3       5       7       2       4       2       0       0       0
  0       0       0       1       1       0       3       5       7       2
        4       2       0       0       0       0       0
2005    1       1       0       2       5       0       0       0       0
        1       1       1       2       0       0       0       0       0
```

```
   0       0       0       0       0       0       1       1       1       2
       0       0       0       0       0       0       0
2006    1       1       0       2      11       0       1       1       1
      0       0       1       3       3       1       0       0       0
   0       0       0       1       1       1       0       0       1       3
       3       1       0       0       0       0       0
2007    1       1       0       2      35       0       0       0       0
      0       2       2       9      11       3       3       1       2
   2       0       0       0       0       0       0       2       2       9
      11       3       3       1       2       2       0
2008    1       1       0       2       8       0       0       0       0
      0       0       2       1       2       2       1       0       0
   0       0       0       0       0       0       0       0       2       1
       2       2       1       0       0       0       0
2009    1       1       0       2      23       0       0       0       1
      1       2       1       3       3       2       3       2       3
   2       0       0       0       0       1       1       2       1       3
       3       2       3       2       3       2       0
2010    1       1       0       2      20       0       0       0       0
      0       2       3       3       7       4       0       0       0
   1       0       0       0       0       0       0       2       3       3
       7       4       0       0       0       1       0
2011    1       1       0       2      19       0       0       0       0
      2       6       6       2       1       2       0       0       0
   0       0       0       0       0       0       2       6       6       2
       1       2       0       0       0       0       0
2012    1       1       0       2      14       0       0       1       0
      0       1       2       2       5       1       1       0       0
   0       1       0       0       1       0       0       1       2       2
       5       1       1       0       0       0       1
2013    1       1       0       2      16       0       0       0       0
      0       3       1       2       3       5       2       0       0
   0       0       0       0       0       0       0       3       1       2
       3       5       2       0       0       0       0
2014    1       1       0       2      18       0       0       0       0
      0       0       2       1       3      10       2       0       0
   0       0       0       0       0       0       0       0       2       1
       3      10       2       0       0       0       0

### WA Rec, North, All modes combined (represent 96% of WA removals, 1969-2
# 014)
### initially assigning to fleet: "14_WA_NorthernWA_Rec_PR"
```

```
### ("WA_Rec_PC" has more catch than "WA_Rec_PC" but likely both will share
#  selectivity)
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1979    1       3       0       2       40      0       0       0       0
     0       1       11      14      11      1       1       1       0
  0       0       0       0       0       0       0       1       11      1
4      11      1       1       1       0       0       0
1980    1       3       0       2       2       0       0       0       0
     0       0       1       1       0       0       0       0       0
  0       0       0       0       0       0       0       0       1       1
       0       0       0       0       0       0       0
1981    1       3       0       2       16      0       0       0       0
     0       0       1       2       3       0       3       3       1
  0       3       0       0       0       0       0       0       1       2
       3       0       3       3       1       0       3
1983    1       3       0       2       2       0       0       0       0
     0       0       0       0       2       0       0       0       0
  0       0       0       0       0       0       0       0       0       0
       2       0       0       0       0       0       0
1995    1       3       0       2       36      0       0       0       0
     0       4       8       12      9       3       0       0       0
  0       0       0       0       0       0       0       4       8       1
2      9       3       0       0       0       0       0
1996    1       3       0       2       16      0       0       0       0
     1       3       3       5       3       0       0       1       0
  0       0       0       0       0       0       1       3       3       5
       3       0       0       1       0       0       0
1997    1       3       0       2       9       0       0       0       0
     0       1       0       1       2       2       1       2       0
  0       0       0       0       0       0       0       1       0       1
       2       2       1       2       0       0       0
1998    1       3       0       2       58      0       0       0       0
     0       5       6       19      17      11      0       0       0
  0       0       0       0       0       0       0       5       6       1
9      17      11      0       0       0       0       0
1999    1       3       0       2       180     0       0       0       1
     2       10      36      65      46      17      3       0       0
  0       0       0       0       0       1       2       10      36      6
5      46      17      3       0       0       0       0
2000    1       3       0       2       55      0       0       0       0
```

2 5 10 13 20 3 2 0 0
0 0 0 0 0 0 2 5 10 1
3 20 3 2 0 0 0 0
2001 1 3 0 2 38 0 0 0 1
1 2 10 11 9 1 1 2 0
0 0 0 0 0 1 1 2 10 1
1 9 1 1 2 0 0 0
2002 1 3 0 2 38 0 0 0 0
0 3 4 19 5 4 2 0 1
0 0 0 0 0 0 0 3 4 1
9 5 4 2 0 1 0 0
2003 1 3 0 2 28 0 0 0 0
0 3 8 8 5 2 2 0 0
0 0 0 0 0 0 0 3 8 8
5 2 2 0 0 0 0
2004 1 3 0 2 198 0 0 1 0
3 9 35 53 56 25 14 2 0
0 0 0 0 1 0 3 9 35 5
3 56 25 14 2 0 0 0
2005 1 3 0 2 358 0 0 2 1
1 16 49 109 106 42 27 5 0
0 0 0 0 2 1 1 16 49 1
09 106 42 27 5 0 0 0
2006 1 3 0 2 266 0 0 0 0
0 10 39 87 84 29 12 3 0
0 2 0 0 0 0 0 10 39 8
7 84 29 12 3 0 0 2
2007 1 3 0 2 185 0 0 0 0
2 5 24 48 60 31 12 3 0
0 0 0 0 0 0 2 5 24 4
8 60 31 12 3 0 0 0
2008 1 3 0 2 135 0 0 0 3
3 8 19 40 45 14 2 1 0
0 0 0 0 0 3 3 8 19 4
0 45 14 2 1 0 0 0
2009 1 3 0 2 95 0 1 0 0
1 7 14 28 22 14 4 2 1
1 0 0 1 0 0 1 7 14 2
8 22 14 4 2 1 1 0
2010 1 3 0 2 58 0 2 0 0
0 1 6 12 15 9 6 6 0
0 1 0 2 0 0 0 1 6 1

```
2       15       9        6        6        0        0        1
2011    1        3        0        2        163      0        0        0        1
     1        2        10       30       42       41       25       9        2
 0        0        0        0        0        1        1        2        10       3
0       42       41       25       9        2        0        0
2012    1        3        0        2        63       0        0        0        0
     1        0        3        15       13       12       10       8        1
 0        0        0        0        0        0        1        0        3        1
5       13       12       10       8        1        0        0
2013    1        3        0        2        156      0        0        0        0
     0        7        14       40       39       40       10       5        0
 1        0        0        0        0        0        0        7        14       4
0       39       40       10       5        0        1        0
2014    1        3        0        2        423      0        0        0        0
     2        6        15       81       128      126      51       12       2
 0        0        0        0        0        0        2        6        15       8
1       128      126      51       12       2        0        0
47 #_N_age_bins
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
2 #_N_ageerror_definitions
# Default ageing error matrix (1st row is expected age, 2nd is standard dev
# iation of age readings)
# Age 0 Age 1   Age 2   Age 3   Age 4   Age 5   Age 6   Age 7   Age 8   Age
#  9   Age 10  Age 11  Age 12  Age 13  Age 14  Age 15  Age 16  Age 17  Age
# 18  Age 19  Age 20  Age 21  Age 22  Age 23  Age 24  Age 25  Age 26  Age 2
# 7  Age 28  Age 29  Age 30  Age 31  Age 32  Age 33  Age 34  Age 35  Age 36
#   Age 37  Age 38  Age 39  Age 40  Age 41  Age 42  Age 43  Age 44  Age 45
#  Age 46  Age 47  Age 48  Age 49  Age 50  Age 51  Age 52  Age 53  Age 54
# Age 55  Age 56  Age 57  Age 58  Age 59  Age 60  Age 61  Age 62  Age 63  A
# ge 64  Age 65  Age 66  Age 67  Age 68  Age 69  Age 70  Age 71  Age 72  Ag
# e 73  Age 74  Age 75  Age 76  Age 77  Age 78  Age 79  Age 80  ### Age 81
#      Age 82  Age 83  Age 84  Age 85  Age 86  Age 87  Age 88  Age 89  Age
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5
     10.5    11.5    12.5    13.5    14.5    15.5    16.5    17.5    18.5
  19.5    20.5    21.5    22.5    23.5    24.5    25.5    26.5    27.5    2
8.5    29.5    30.5    31.5    32.5    33.5    34.5    35.5    36.5    37.5
    38.5    39.5    40.5    41.5    42.5    43.5    44.5    45.5    46.5
 47.5    48.5    49.5    50.5    51.5    52.5    53.5    54.5    55.5    56
.5    57.5    58.5    59.5    60.5    61.5    62.5    63.5    64.5    65.5
```

```
  66.5    67.5    68.5    69.5    70.5    71.5    72.5    73.5    74.5
75.5    76.5    77.5    78.5    79.5    80.5    ### 81.5        82.5    83.
# 5    84.5    85.5    86.5    87.5    88.5    89.5    90.5    #Expected_ag
0.0968  0.0968  0.1936  0.2904  0.3872  0.4840  0.5807  0.6775  0.7743  0.8
711  0.9679  1.0647  1.1615  1.2583  1.3551  1.4519  1.5487  1.6455  1.7422
  1.8390  1.9358  2.0326  2.1294  2.2262  2.3230  2.4198  2.5166  2.6134  2
.7102  2.8070  2.9037  3.0005  3.0973  3.1941  3.2909  3.3877  3.4845  3.58
13  3.6781  3.7749  3.8717  3.9684  4.0652  4.1620  4.2588  4.3556  4.4524
 4.5492  4.6460  4.7428  4.8396  4.9364  5.0332  5.1299  5.2267  5.3235  5.
4203  5.5171  5.6139  5.7107  5.8075  5.9043  6.0011  6.0979  6.1946  6.291
4  6.3882  6.4850  6.5818  6.6786  6.7754  6.8722  6.9690  7.0658  7.1626
7.2594  7.3561  7.4529  7.5497  7.6465  7.7433  ### 7.8401      7.9369  8.0
# 337  8.1305  8.2273  8.3241  8.4209  8.5176  8.6144  8.7112  #SD








                                                  ###
# Ageing error for ages associated with early years from former NWFSC age r
# eader (1st row is expected age, 2nd is standard deviation of age readings
# )
#
#
#
#
#
#                                                                   ###
# Age 0 Age 1   Age 2   Age 3   Age 4   Age 5   Age 6   Age 7   Age 8   Age
#  9   Age 10  Age 11  Age 12  Age 13  Age 14  Age 15  Age 16  Age 17  Age
# 18  Age 19  Age 20  Age 21  Age 22  Age 23  Age 24  Age 25  Age 26  Age 2
# 7  Age 28  Age 29  Age 30  Age 31  Age 32  Age 33  Age 34  Age 35  Age 36
#   Age 37  Age 38  Age 39  Age 40  Age 41  Age 42  Age 43  Age 44  Age 45
#  Age 46  Age 47  Age 48  Age 49  Age 50  Age 51  Age 52  Age 53  Age 54
# Age 55  Age 56  Age 57  Age 58  Age 59  Age 60  Age 61  Age 62  Age 63  A
# ge 64  Age 65  Age 66  Age 67  Age 68  Age 69  Age 70  Age 71  Age 72  Ag
# e 73  Age 74  Age 75  Age 76  Age 77  Age 78  Age 79  Age 80  ### Age 81
#      Age 82  Age 83  Age 84  Age 85  Age 86  Age 87  Age 88  Age 89  Age
0.43    1.29    2.16    3.02    3.88    4.75    5.61    6.47    7.33    8.2
```

```
0    9.06    9.92    10.79   11.65   12.51   13.37   14.24   15.10   15.96
  16.83   17.69   18.55   19.41   20.28   21.14   22.00   22.86   23.73   2
4.59   25.45   26.32   27.18   28.04   28.90   29.77   30.63   31.49   32.3
6   33.22   34.08   34.94   35.81   36.67   37.53   38.40   39.26   40.12
 40.98   41.85   42.71   43.57   44.44   45.30   46.16   47.02   47.89   48
.75   49.61   50.47   51.34   52.20   53.06   53.93   54.79   55.65   56.51
   57.38   58.24   59.10   59.97   60.83   61.69   62.55   63.42   64.28
65.14   66.01   66.87   67.73   68.59   69.46   ### 70.32      71.18   72.
# 05   72.91   73.77   74.63   75.50   76.36   77.22   78.09   #Expected_ag
0.0968  0.0968  0.1936  0.2904  0.3872  0.4840  0.5807  0.6775  0.7743  0.8
711  0.9679  1.0647  1.1615  1.2583  1.3551  1.4519  1.5487  1.6455  1.7422
  1.8390  1.9358  2.0326  2.1294  2.2262  2.3230  2.4198  2.5166  2.6134  2
.7102  2.8070  2.9037  3.0005  3.0973  3.1941  3.2909  3.3877  3.4845  3.58
13  3.6781  3.7749  3.8717  3.9684  4.0652  4.1620  4.2588  4.3556  4.4524
 4.5492  4.6460  4.7428  4.8396  4.9364  5.0332  5.1299  5.2267  5.3235  5.
4203  5.5171  5.6139  5.7107  5.8075  5.9043  6.0011  6.0979  6.1946  6.291
4  6.3882  6.4850  6.5818  6.6786  6.7754  6.8722  6.9690  7.0658  7.1626
7.2594  7.3561  7.4529  7.5497  7.6465  7.7433  ### 7.8401      7.9369  8.0
# 337  8.1305  8.2273  8.3241  8.4209  8.5176  8.6144  8.7112  #SD

123 #_N_Agecomp_obs
3 #_Lbin_method: 1=poplenbins; 2=datalenbins; 3=lengths
0 #_combine males into females at or below this bin number

### WA Rec, South, All modes combined
### initially assigning to fleet: "12_WA_SouthernWA_Rec_PCPR"
#Yr     Seas    Flt/Svy Gender  Part    AgeError        LbinLo  LbinHi  Nsa
# mp   4yrs    5yrs    6yrs    7yrs    8yrs    9yrs    10yrs   11yrs   12yr
# s   13yrs   14yrs   15yrs   16yrs   17yrs   18yrs   19yrs   20yrs   21yrs
#    22yrs   23yrs   24yrs   25yrs   26yrs   27yrs   28yrs   29yrs   30yrs
#   31yrs   32yrs   33yrs   34yrs   35yrs   36yrs   37yrs   38yrs   39yrs
#  40yrs   41yrs   42yrs   43yrs   44yrs   45yrs   46yrs   47yrs   48yrs
# 49yrs   50+yrs  repeat
2014    1       -1      0       0       1       -1      -1      15      0
     0       0       0       1       0       0       0       0       0
  0       0       0       1       1       1       0       0       0       1
       1       0       0       1       1       1       2       0       0
    0       0       1       0       1       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       1       1       1       0       0       0
1       1       0       0       1       1       1       2       0       0
```

```
     0       0       1       0       1       0       0       0       0

### WA Rec, North, All modes combined
### initially assigning to fleet: "14_WA_NorthernWA_Rec_PR"
### NOTE: setting fleet number negative to exclude from likelihood
###       to avoid double counting with conditional age-at-length values
###       entered below
#Yr     Seas    Flt/Svy Gender  Part    AgeErr  LbinLo  LbinHi  Nsamp   4yr
# s    5yrs    6yrs    7yrs    8yrs    9yrs    10yrs   11yrs   12yrs   13yr
# s   14yrs   15yrs   16yrs   17yrs   18yrs   19yrs   20yrs   21yrs   22yrs
#    23yrs   24yrs   25yrs   26yrs   27yrs   28yrs   29yrs   30yrs   31yrs
#   32yrs   33yrs   34yrs   35yrs   36yrs   37yrs   38yrs   39yrs   40yrs
#  41yrs   42yrs   43yrs   44yrs   45yrs   46yrs   47yrs   48yrs   49yrs
# 50+yrs  repeat
1998    1       -3      0       2       1       -1      -1      50      0
     0       0       0       0       2       1       1       1       2
  1       1       3       5       4       5       4       3       2       2
       1       0       1       2       0       0       0       0       1
    0       0       0       2       0       3       0       0       0
 1       0       0       0       0       0       0       0       2       0
      0       0       0       0       2       1       1       1       2
   1       1       3       5       4       5       4       3       2
2       1       0       1       2       0       0       0       0       1
     0       0       0       2       0       3       0       0       0
1999    1       -3      0       2       1       -1      -1      55      0
     0       0       0       1       3       4       5       0       4
  3       3       3       2       3       4       4       1       3       0
       1       1       0       2       0       0       0       1       0
    1       0       0       0       1       0       0       0       0
 0       1       1       0       0       0       0       1       2       0
      0       0       0       1       3       4       5       0       4
   3       3       3       2       3       4       4       1       3
0       1       1       0       2       0       0       0       1       0
     1       0       0       0       1       0       0       0       0
2000    1       -3      0       2       1       -1      -1      55      0
     0       0       0       0       0       2       3       4       4
  0       2       1       1       2       2       4       2       4       1
       1       2       0       0       0       0       2       1       0
    0       1       1       1       1       1       1       2       1
 0       2       1       0       0       0       0       0       5       0
      0       0       0       0       0       2       3       4       4
   0       2       1       1       2       2       4       2       4
```

```
1 1 2 0 0 0 0 2 1 0
 0 1 1 1 1 1 1 2 1
2001 1 -3 0 2 1 -1 -1 26 0
 1 0 1 0 0 0 4 3 0
 1 2 3 2 1 0 0 0 0 0
 0 0 0 0 1 0 0 1 0
 0 0 1 1 0 0 0 0 0
 0 0 0 0 0 0 0 1 3 0
 1 0 1 0 0 0 4 3 0
 1 2 3 2 1 0 0 0 0
0 0 0 0 0 1 0 0 1 0
 0 0 1 1 0 0 0 0 0
2002 1 -3 0 2 1 -1 -1 11 0
 0 0 0 0 0 0 4 1 1
 2 0 1 0 1 0 0 1 0 0
 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 4 1 1
 2 0 1 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
#2003 1 -3 0 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
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# 0 0 0 0 0 0 0 0 0
2004 1 -3 0 2 1 -1 -1 171 0
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 7 12 10 10 4 6 5 9 8 9
 6 10 9 3 3 3 4 1 1
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 7 12 10 10 4 6 5 9 8
9 6 10 9 3 3 3 4 1 1
 0 0 0 2 0 0 0 0 1
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11 18 9 12 11 6 5 6 4
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3 8 5 8 2 4 5 2 5 5
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3 8 5 8 2 4 5 2 5
5 1 0 3 0 3 2 0 0 0
0 1 0 0 0 0 0 2 0
2007 1 -3 0 2 1 -1 -1 119 0
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6 3 3 8 6 5 4 4 7 3
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6 3 3 8 6 5 4 4 7
3 10 3 5 2 3 1 4 5 4
0 0 0 0 2 0 0 1 0
2008 1 -3 0 2 1 -1 -1 73 0
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4 3 3 3 5 3 9 1 2 0
4 3 2 2 1 2 1 1 0
0 1 0 0 0 0 0 1 1
0 0 0 0 0 0 0 0 1 0
1 0 0 1 2 2 3 6 5
4 3 3 3 5 3 9 1 2
0 4 3 2 2 1 2 1 1 0
0 1 0 0 0 0 0 1 1
2009 1 -3 0 2 1 -1 -1 22 0
0 0 0 0 2 2 0 2 0

3 1 0 0 0 0 0 0 1 1
0 1 1 0 2 0 1 0 3
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0 0 0 0 2 2 0 2 0
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1 0 1 1 0 2 0 1 0 3
0 0 0 0 0 0 0 0 0
2010 1 −3 0 2 1 −1 −1 22 0
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2 1 0 1 0 0 1 0 3
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2 3 1 0 1 1 0 0 1
0 2 1 0 1 0 0 1 0 3
0 0 0 0 0 0 0 0 0
2011 1 −3 0 2 1 −1 −1 50 0
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1 2 2 2 3 2 2 3 2 1
4 5 4 1 2 0 1 2 2
2 0 2 0 0 1 1 0 0
0 0 0 0 0 0 0 0 2 0
0 0 0 0 1 0 0 0 0
1 2 2 2 3 2 2 3 2
1 4 5 4 1 2 0 1 2 2
2 0 2 0 0 1 1 0 0
2012 1 −3 0 2 1 −1 −1 24 0
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1 1 1 1 2 2 0 1 2
1 0 1 0 0 0 0 0 0
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0 0 0 0 3 1 1 0 3
2 1 1 1 1 2 2 0 1 2
1 0 1 0 0 0 0 0 0
2013 1 −3 0 2 1 −1 −1 11 0
0 0 1 0 0 1 0 0 0
0 0 0 1 0 0 0 3 2 1
0 0 0 0 0 0 1 0 0

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      0       0       1       0       0       1       0       0       0
   0       0       0       1       0       0       0       3       2
1       0       0       0       0       0       0       1       0       0
     0       1       0       0       0       0       0       0       0
2014    1       -3      0       2       1       -1      -1      398     0
     0       0       1       1       3       4       10      11      11
  13      3       7       13      15      17      18      15      19      2
4       28      21      10      11      12      13      15      12      12
    10      7       13      9       7       3       3       2       1
 0       1       3       0       1       1       0       1       17      0
      0       0       1       1       3       4       10      11      11
   13      3       7       13      15      17      18      15      19
24      28      21      10      11      12      13      15      12      12
     10      7       13      9       7       3       3       2       1


##### conditional age-at-length observations

### WA Rec, North, All modes combined (represent 96% of landings)
### initially assigning to fleet: "14_WA_NorthernWA_Rec_PR"
#Yr     Seas    Flt/Svy Gender  Part    AgeErr  LbinLo  LbinHi  Nsamp   4yr
# s    5yrs    6yrs    7yrs    8yrs    9yrs    10yrs   11yrs   12yrs   13yr
# s   14yrs   15yrs   16yrs   17yrs   18yrs   19yrs   20yrs   21yrs   22yrs
#    23yrs   24yrs   25yrs   26yrs   27yrs   28yrs   29yrs   30yrs   31yrs
#   32yrs   33yrs   34yrs   35yrs   36yrs   37yrs   38yrs   39yrs   40yrs
#  41yrs   42yrs   43yrs   44yrs   45yrs   46yrs   47yrs   48yrs   49yrs
# 50yrs   repeat
1998    1       3       0       2       1       28      28      5       0
     0       0       0       0       2       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       2       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
1998    1       3       0       2       1       30      30      6       0
     0       0       0       0       0       0       0       0       1
  0       0       1       1       0       1       0       1       1       0
```

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0 0 0 0 0 0 0 0 0
1998 1 3 0 2 1 32 32 19 0
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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
1 1 2 3 3 2 2 0 0
0 1 0 0 1 0 0 0 0 1
0 0 0 0 0 0 0 0 0
1998 1 3 0 2 1 34 34 13 0
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```
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0 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0 0
2007 1 3 0 2 1 26 26 2 0
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1 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0 0
2007 1 3 0 2 1 28 28 3 0
0 0 1 0 0 0 1 0 0
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0 0 0 0 0 0 0 0 0 0
0 0 1 0 0 0 1 0 0
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2007 1 3 0 2 1 30 30 10 0
0 0 0 0 1 1 1 0 2
1 0 0 1 1 1 0 0 1 0
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0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 1 0 2
1 0 0 1 1 1 0 0 1
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2007 1 3 0 2 1 32 32 33 0
0 0 0 0 0 0 1 0 4
2 2 0 2 2 1 0 2 1 3
2 2 3 1 1 0 2 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 1 0 4
2 2 0 2 2 1 0 2 1
3 2 2 3 1 1 0 2 0 1
0 0 0 0 0 0 0 1 0
2007 1 3 0 2 1 34 34 46 0

0 0 0 1 0 1 2 1 0
2 1 2 4 3 2 2 2 3 0
7 1 1 0 1 1 0 1 3
0 0 0 0 1 0 0 0 0
1 0 0 1 0 0 0 0 2 0
0 0 0 1 0 1 2 1 0
2 1 2 4 3 2 2 2 3
0 7 1 1 0 1 1 0 1 3
0 0 0 0 1 0 0 0 0
2007 1 3 0 2 1 36 36 15 0
0 0 0 0 0 0 0 0 0
0 0 0 1 0 1 1 0 1 0
0 0 1 1 1 0 2 2 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 3 0
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0 0 0 1 1 1 0 2 2 0
0 0 0 0 0 0 0 0 0
2007 1 3 0 2 1 38 38 9 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 1 0
1 0 0 0 0 0 0 2 0
0 0 0 0 1 0 0 0 0
1 0 0 1 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 1
0 1 0 0 0 0 0 0 2 0
0 0 0 0 1 0 0 0 0
2007 1 3 0 2 1 40 40 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 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 0 0 0 0 0 0
2008 1 3 0 2 1 24 24 1 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 0 0 0 0 0 0 0
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2008 1 3 0 2 1 26 26 2 0
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2008 1 3 0 2 1 28 28 3 0
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0 0 0 0 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
2008 1 3 0 2 1 30 30 7 0
0 0 0 0 0 0 0 3 1
0 0 0 0 1 0 0 0 0 0
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 3 1
0 0 0 0 1 0 0 0 0
0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2008 1 3 0 2 1 32 32 24 0
0 0 0 1 0 0 3 2 2
1 2 3 1 1 1 3 0 0 0
2 0 1 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 3 2 2
1 2 3 1 1 1 3 0 0
0 2 0 1 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0
2008 1 3 0 2 1 34 34 28 0
0 0 0 0 0 0 0 1 1
3 0 0 2 2 1 6 1 2 0
2 2 0 0 0 1 1 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 1 1
3 0 0 2 2 1 6 1 2
0 2 2 0 0 0 1 1 1 0
0 1 0 0 0 0 0 0 1
2008 1 3 0 2 1 36 36 7 0
0 0 0 0 0 0 0 0 0
0 1 0 0 1 1 0 0 0 0
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0 0 0 0 0 0 0 0 0
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2009 1 3 0 2 1 30 30 6 0
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2 1 0 0 0 0 0 0 1 0
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2 1 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
2009 1 3 0 2 1 32 32 10 0
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1 0 0 0 0 0 0 0 0 1
0 1 1 0 0 0 1 0 2
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0 0 0 0 0 0 0 0 0
2009 1 3 0 2 1 34 34 4 0
0 0 0 0 0 0 0 1 0
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2009 1 3 0 2 1 42 42 1 0
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0 0 0 0 0 0 0 0 0
2010 1 3 0 2 1 20 20 1 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
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2010 1 3 0 2 1 30 30 2 0
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0 0 0 0 0 0 0 0 0
2010 1 3 0 2 1 32 32 8 0
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0 2 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 0
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0 0 0 0 1 1 0 0 0
0 2 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 0
2010 1 3 0 2 1 34 34 7 0
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1 0 0 0 0 1 0 0 1 0
0 0 0 0 0 0 1 0 2
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0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 0
1 0 0 0 0 1 0 0 1
0 0 0 0 0 0 0 1 0 2
0 0 0 0 0 0 0 0 0
2010 1 3 0 2 1 36 36 3 0

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1 0 0 0 0 0 0 0 1
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0 1 0 0 0 0 0 0 0 1
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2010 1 3 0 2 1 40 40 1 0
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2011 1 3 0 2 1 30 30 4 0
0 0 0 0 0 0 0 0 0
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0 1 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2011 1 3 0 2 1 32 32 16 0
0 0 0 0 1 0 0 0 0
0 2 2 1 0 1 0 1 0 1
1 2 0 0 1 0 0 0 0
1 0 1 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 2 2 1 0 1 0 1 0
1 1 2 0 0 1 0 0 0 0
1 0 1 0 0 1 0 0 0
2011 1 3 0 2 1 34 34 19 0
0 0 0 0 0 0 0 0 0
1 0 0 1 1 1 1 2 2 0

0 1 4 0 1 0 0 1 1
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
1 0 0 1 1 1 1 2 2
0 0 1 4 0 1 0 0 1 1
1 0 0 0 0 0 0 0 0
2011 1 3 0 2 1 36 36 7 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 0 0
1 1 0 1 0 0 0 1 1
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0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
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2011 1 3 0 2 1 38 38 4 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 0 0
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2012 1 3 0 2 1 30 30 2 0
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2012 1 3 0 2 1 32 32 8 0
0 0 0 0 0 0 0 0 0
0 0 0 0 2 1 0 0 2 1
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0 0 0 0 0 0 0 0 0
0 0 0 0 2 1 0 0 2
1 0 0 0 0 0 0 0 0 1
1 0 0 0 0 0 0 0 0
2012 1 3 0 2 1 34 34 7 0
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2012 1 3 0 2 1 36 36 5 0
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0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0
0 1 0 1 0 1 1 0 0 0
0 0 0 0 0 0 0 0 0
2012 1 3 0 2 1 38 38 2 0
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0 0 1 0 0 0 0 0 0
2013 1 3 0 2 1 28 28 1 0
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0 0 0 0 0 0 0 0 0
2013 1 3 0 2 1 32 32 4 0
0 0 1 0 0 0 0 0 0
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0 0 0 0 0 0 0 0 0
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0 0 1 0 0 0 0 0 0
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2013 1 3 0 2 1 34 34 4 0
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0 0 0 0 0 0 0 1 2
0 0 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0
2013 1 3 0 2 1 36 36 2 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 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0 0
2014 1 3 0 2 1 26 26 2 0
0 0 1 0 0 1 0 0 0
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0 0 0 0 0 0 0 0 0 0
0 0 1 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0

0 0 0 0 0 0 0 0 0
2014 1 3 0 2 1 28 28 5 0
0 0 0 0 0 0 1 3 1
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 3 1
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2014 1 3 0 2 1 30 30 14 0
0 0 0 1 1 0 2 0 2
0 1 0 2 0 1 0 0 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 1 1 0 2 0 2
0 1 0 2 0 1 0 0 0
2 1 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0
2014 1 3 0 2 1 32 32 76 0
0 0 0 0 0 2 4 3 7
4 0 3 6 3 2 4 3 4 6
6 5 0 1 0 2 1 1 4
1 0 0 2 0 0 0 0 0
0 0 0 0 1 0 0 0 1 0
0 0 0 0 0 2 4 3 7
4 0 3 6 3 2 4 3 4
6 6 5 0 1 0 2 1 1 4
1 0 0 2 0 0 0 0 0
2014 1 3 0 2 1 34 34 118 0
0 0 0 0 2 0 3 3 0
5 1 3 3 8 5 5 3 4 9
9 5 6 4 3 4 5 4 1
0 2 6 3 5 1 1 1 1
0 0 1 0 0 1 0 0 1 0
0 0 0 0 2 0 3 3 0
5 1 3 3 8 5 5 3 4
9 9 5 6 4 3 4 5 4 1
0 2 6 3 5 1 1 1 1
2014 1 3 0 2 1 36 36 121 0

```
0 0 0 0 0 1 0 2 1
3 1 1 2 4 7 8 8 9 5
7 5 2 3 7 5 5 4 5
6 0 3 3 1 1 1 1 0
0 1 1 0 0 0 0 0 8 0
0 0 0 0 0 1 0 2 1
3 1 1 2 4 7 8 8 9
5 7 5 2 3 7 5 5 4 5
6 0 3 3 1 1 1 1 0
2014 1 3 0 2 1 38 38 49 0
0 0 0 0 0 0 0 0 0
1 0 0 0 0 2 1 1 1 2
2 5 2 3 1 2 2 2 1
3 3 4 1 1 1 1 0 0
0 0 1 0 0 0 0 1 5 0
0 0 0 0 0 0 0 0 0
1 0 0 0 0 2 1 1 1
2 2 5 2 3 1 2 2 2 1
3 3 4 1 1 1 1 0 0
2014 1 3 0 2 1 40 40 11 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0
3 1 0 0 0 0 1 0 1
0 2 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 1
0 3 1 0 0 0 0 1 0 1
0 2 0 0 0 0 0 0 0
2014 1 3 0 2 1 42 42 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 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 1 1 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)
# 1971 1 1 3 0 1 2 29.8931 40.6872 44.7411 50.027 52.5794 56.1489 57.1033 6
# 1.1728 61.7417 63.368 64.4088 65.6889 67.616 68.5972 69.9177 71.0443 72.3
# 609 32.8188 39.5964 43.988 50.1693 53.1729 54.9822 55.3463 60.3509 60.743
# 9 62.3432 64.3224 65.1032 64.1965 66.7452 67.5154 70.8749 71.2768 20 20 2
# 0 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
#  20 20 20 20 20 20 20

0 #_N_environ_variables
0 #_N_environ_obs
0 # N sizefreq methods to read

0 # no tag data

0 # no morphcomp data

999
```

Central Model

```
#V3.24u
#C data file for China rockfish North of 4010 to OR/WA border
#C changed from pre-star draft base by adding length comps from CA north of
#  40-10
#
#_observed data:
1900 #_styr -- extended to match southern model start year
2014 #_endyr
1 #_nseas
12 #_months/season
1  #_spawn_seas
11 #_Nfleet
1  #_Nsurveys
1  #_N_areas
## fleet names (second cut on June 7, 2015)
1_CA_NorthOf4010_Comm_Dead%2_CA_NorthOf4010_Comm_Live%3_CA_NorthOf4010_Rec_
PC%4_CA_NorthOf4010_Rec_PR%5_OR_SouthernOR_Comm_Dead%6_OR_SouthernOR_Comm_L
ive%7_OR_SouthernOR_Rec_PC%8_OR_SouthernOR_Rec_PR%9_OR_NorthernOR_Comm%10_O
R_NorthernOR_Rec_PC%11_OR_NorthernOR_Rec_PR%12_OR_SouthernOR_Rec_PC_ORBS
## 1_CA_NorthOf4010_Comm_Dead
## 2_CA_NorthOf4010_Comm_Live
## 3_CA_NorthOf4010_Rec_PC
```

```
## 4_CA_NorthOf4010_Rec_PR
## 5_OR_SouthernOR_Comm_Dead
## 6_OR_SouthernOR_Comm_Live
## 7_OR_SouthernOR_Rec_PC
## 8_OR_SouthernOR_Rec_PR
## 9_OR_NorthernOR_Comm
## 10_OR_NorthernOR_Rec_PC
## 11_OR_NorthernOR_Rec_PR
## 12_OR_SouthernOR_Rec_PC_ORBS
# following values are 1 per catch or survey fleet
0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 #_surveytiming_in_season --
#  mid-year, not exactly like XDB-SRA
  1   1   1   1   1   1   1   1   1   1   1   1   #_area_assignments_for_ea
# ch_fishery_and_survey
# following values are 1 per catch fleet
  1   1   1   1   1   1   1   1   1   1   1 #_units of catch:  1=bio; 2=num
0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 #_se of log(catch) only used fo
# r init_eq_catch and for Fmethod 2 and 3; use -1 for discard only fleets
2 #_Ngenders
80 #_Nages
  0   0   0   0   0   0   0   0   0   0   0  #_init_equil_catch_for_each_fi
# shery
115 #_N_lines_of_catch_to_read
#_catch_biomass(mtons):_columns_are_fisheries,year,season
# this file has catch in SS format based on formulas in the adjacent Google
#  Doc "Catch Pivot" worksheet
 #_fleet1 fleet2 fleet3 fleet4 fleet5 fleet6 fleet7 fleet8 fleet9 fleet10 f
# leet11 year seas
     0       0       0       0       0.01    0       0       0       0.01    0
  0    1900    1
     0       0       0       0       0       0       0       0       0       0
  0    1901    1
     0       0       0       0       0       0       0       0       0       0
  0    1902    1
     0       0       0       0       0       0       0       0       0       0
  0    1903    1
     0       0       0       0       0       0       0       0       0       0
  0    1904    1
     0       0       0       0       0       0       0       0       0       0
  0    1905    1
     0       0       0       0       0       0       0       0       0       0
  0    1906    1
```

```
    0    0    0    0    0    0    0    0    0    0
0   1907   1
    0    0    0    0    0    0    0    0    0    0
0   1908   1
    0    0    0    0    0    0    0    0    0    0
0   1909   1
    0    0    0    0    0    0    0    0    0    0
0   1910   1
    0    0    0    0    0    0    0    0    0    0
0   1911   1
    0    0    0    0    0    0    0    0    0    0
0   1912   1
    0    0    0    0    0    0    0    0    0    0
0   1913   1
    0    0    0    0    0    0    0    0    0    0
0   1914   1
    0    0    0    0    0    0    0    0    0    0
0   1915   1
    0    0    0    0    0    0    0    0    0    0
0   1916   1
    0    0    0    0    0    0    0    0    0    0
0   1917   1
    0    0    0    0    0    0    0    0    0    0
0   1918   1
    0    0    0    0    0    0    0    0    0    0
0   1919   1
    0    0    0    0    0    0    0    0    0    0
0   1920   1
    0    0    0    0    0    0    0    0    0    0
0   1921   1
    0    0    0    0    0    0    0    0    0    0
0   1922   1
    0    0    0    0    0    0    0    0    0    0
0   1923   1
    0    0    0    0    0    0    0    0    0    0
0   1924   1
    0    0    0    0    0    0    0    0    0    0
0   1925   1
    0    0    0    0    0    0    0    0    0    0
0   1926   1
    0    0    0    0    0    0    0    0    0    0
0   1927   1
```

```
    0     0     0     0     0     0     0     0     0     0
0   1928   1
    0.01  0     0     0.01  0.01  0     0     0     0.01  0
0   1929   1
    0.01  0     0     0.01  0.01  0     0     0     0.01  0
0   1930   1
    0     0     0     0.01  0     0     0     0     0     0
0   1931   1
    0.03  0     0     0.01  0     0     0     0     0     0
0   1932   1
    0.09  0     0     0.01  0     0     0     0     0     0
0   1933   1
    0.99  0     0     0.01  0     0     0     0     0     0
0   1934   1
    0.82  0     0.01  0.01  0     0     0     0     0     0
0   1935   1
    1.23  0     0.01  0.02  0.01  0     0     0     0.01  0
0   1936   1
    0.78  0     0.01  0.02  0.01  0     0     0     0.01  0
0   1937   1
    3.08  0     0.01  0.02  0     0     0     0     0     0
0   1938   1
    5.95  0     0.01  0.02  0     0     0     0     0     0
0   1939   1
    3.52  0     0.01  0.02  0.01  0     0     0     0.01  0
0   1940   1
    0.99  0     0.01  0.02  0.01  0     0     0     0.01  0
0   1941   1
    0.72  0     0     0.01  0.01  0     0     0     0.01  0
0   1942   1
    0.02  0     0     0.01  0.04  0     0     0     0.04  0
0   1943   1
    0     0     0     0.01  0.01  0     0     0     0.01  0
0   1944   1
    0     0     0     0.01  0.04  0     0     0     0.04  0
0   1945   1
    0.06  0     0.01  0.02  0.05  0     0     0     0.05  0
0   1946   1
    0.08  0     0.01  0.02  0.01  0     0     0     0.01  0
0   1947   1
    0.09  0     0.01  0.03  0.01  0     0     0     0.01  0
0   1948   1
```

0.01 0 0.01 0.04 0.07 0 0 0 0.07 0
0 1949 1
0.11 0 0.02 0.05 0.01 0 0 0 0.01 0
0 1950 1
0.14 0 0.02 0.06 0 0 0 0 0 0
0 1951 1
0 0 0.02 0.05 0 0 0 0 0 0
0 1952 1
0 0 0.02 0.05 0 0 0 0 0 0
0 1953 1
0 0 0.02 0.06 0 0 0 0 0 0
0 1954 1
0 0 0.02 0.07 0 0 0 0 0 0
0 1955 1
0 0 0.03 0.08 0 0 0 0 0 0
0 1956 1
0.09 0 0.03 0.10 0 0 0 0 0 0
0 1957 1
0 0 0.03 0.08 0 0 0 0 0 0
0 1958 1
0.01 0 0.02 0.06 0 0 0 0 0 0
0 1959 1
0 0 0.01 0.04 0 0 0 0 0 0
0 1960 1
0 0 0.01 0.04 0 0 0 0 0 0
0 1961 1
0 0 0.01 0.02 0 0 0 0 0 0
0 1962 1
0 0 0.01 0.02 0 0 0 0 0 0
0 1963 1
0 0 0.01 0.02 0.01 0 0 0 0.01 0
0 1964 1
0.02 0 0.01 0.04 0 0 0 0 0 0
0 1965 1
0.08 0 0 0.01 0 0 0 0 0 0
0 1966 1
0.01 0 0.02 0.05 0 0 0 0 0 0
0 1967 1
0 0 0.01 0.02 0 0 0 0 0 0
0 1968 1
0 0 0.02 0.05 0 0 0 0 0 0
0 1969 1

0	0	0.01	0.01	0	0	0	0	0	0	0	1970	1
0	0	0.01	0.02	0	0	0	0	0	0	0	1971	1
0.01	0	0.02	0.05	0	0	0	0	0	0	0	1972	1
0	0	0.01	0.03	0	0	0.16	0.19	0	0.44	0.07	1973	1
0.01	0	0.01	0.02	0.01	0	0.27	0.32	0.01	0.75	0.13	1974	1
0.01	0	0	0.01	0	0	0.13	0.16	0	0.37	0.06	1975	1
0.01	0	0	0.01	0	0	0.38	0.47	0	1.08	0.27	1976	1
0.02	0	0	0.01	0.09	0	0.41	0.49	0.09	1.15	0.29	1977	1
0.11	0	0.03	0.08	0.01	0	0.53	0.64	0.01	1.50	0.25	1978	1
0.02	0	0.03	0.10	0.13	0	2.94	1.53	0.13	1.52	0.98	1979	1
0.01	0	0.04	0.08	0.07	0	0.91	0.53	0.07	1.63	0.90	1980	1
0	0	0.04	0.10	0.07	0	1.56	0.89	0.07	2.18	0.97	1981	1
0.01	0	0.03	0.14	0.33	0	1.42	0.82	0.32	2.14	0.95	1982	1
0	0	0.08	0.16	0.36	0	1.36	0.81	0.35	2.69	1.20	1983	1
0	0	0.01	0.06	0.24	0	1.43	0.48	0.23	2.71	1.21	1984	1
0	0	0.02	0.14	0.22	0	1.04	0.59	0.21	1.38	0.62	1985	1
0	0	0.12	0.49	0.14	0	0.99	0.57	0.14	1.58	0.70	1986	1
0	0	0.28	0.53	0.90	0	1.29	0.69	0.84	1.03	0.46	1987	1
0.01	0	0.11	0.35	0.87	0	0.38	0.45	1.11	1.44	0.29	1988	1
0.23	0	0.06	0.14	1.08	0	1.04	1.57	0.81	2.21	0.31	1989	1
2.53	0	0.23	0.61	1.16	0	1.29	1.81	0.53	2.19	0.49	1990	1

0.72	0	0.20	0.64	0.68	0	0.52	0.68	0.64	1.44	0.31	1991	1
2.88	0	0.12	0.42	0.88	0	0.76	0.88	0.64	2.41	0.65	1992	1
0.85	0	0.15	0.66	0.84	0	0.90	1.12	0.01	3.03	0.99	1993	1
1.02	0	0.14	0.70	6.33	0	0.97	1.21	0	2.13	0.73	1994	1
4.74	0	0.12	0.60	6.52	0	0.68	0.94	0	1.09	0.51	1995	1
3.88	0.01	0.06	0.28	5.77	0	0.84	0.71	0	1.74	0.26	1996	1
2.02	1.78	0.06	0.06	5.45	5.45	1.08	1.00	0	2.04	0.47	1997	1
1.47	0.85	0.02	0.18	9.80	9.40	0.79	0.76	0	1.56	0.47	1998	1
0.62	1.61	0.10	0.40	8.62	15.32	1.78	1.26	0	2.11	0.45	1999	1
0.61	2.09	0.25	0.50	2.62	9.77	0.85	0.59	0	1.71	0.39	2000	1
0.43	1.09	0.31	0.44	3.93	15.89	0.32	0.36	0	1.41	0.57	2001	1
0.47	1.87	0.27	0.52	3.14	17.52	0.32	0.38	0	1.40	0.60	2002	1
0.09	0.50	0.33	0.91	1.93	8.38	0.26	0.32	0	1.12	0.51	2003	1
0.22	0.29	0.08	0.44	1.11	6.00	0.23	0.40	0	0.99	0.43	2004	1
0.14	0.60	0.16	0.37	0.65	3.48	0.26	0.51	0	0.77	0.51	2005	1
0.15	0.85	0.14	0.49	0.55	4.22	0.35	0.50	0	1.11	0.67	2006	1
0.41	1.64	0.64	0.87	1.18	5.01	0.38	0.48	0.01	1.40	0.82	2007	1
0.26	1.60	0.20	0.81	1.49	6.45	0.26	0.45	0.04	1.25	0.89	2008	1
0.05	0.62	0.66	0.89	1.15	6.88	0.12	0.49	0.06	0.95	0.76	2009	1
0.04	0.27	0.27	0.64	0.53	4.42	0.20	0.61	0.03	1.02	0.73	2010	1
0.09	0.36	0.16	1.06	1.41	6.77	0.31	0.60	0.02	1.56	0.96	2011	1

```
      0.08   0.39   0.37   1.02   1.32   7.61   0.37   0.41   0.06    1.68
   1.24 2012    1
      0.05   0.17   0.26   0.97   1.59   5.56   0.25   0.64   0.02    1.48
   1.26 2013    1
      0.02   0.09   0.08   0.66   0.74   3.72   0.18   0.48   0.03    0.51
   0.53 2014    1
#
58 #_N_cpue_and_surveyabundance_observations
#_Units:  0=numbers; 1=biomass; 2=F
#_Errtype:  -1=normal; 0=lognormal; >0=T
#_Fleet Units Errtype
1       0     0 # 1_CA_NorthOf4010_Comm_Dead
2       0     0 # 2_CA_NorthOf4010_Comm_Live
3       0     0 # 3_CA_NorthOf4010_Rec_PC
4       0     0 # 4_CA_NorthOf4010_Rec_PR
5       0     0 # 5_OR_SouthernOR_Comm_Dead
6       1     0 # 6_OR_SouthernOR_Comm_Live
7       1     0 # 7_OR_SouthernOR_Rec_PC
8       0     0 # 8_OR_SouthernOR_Rec_PR
9       0     0 # 9_OR_NorthernOR_Comm
10      0     0 # 10_OR_NorthernOR_Rec_PC
11      0     0 # 11_OR_NorthernOR_Rec_PR
12      0     0 # 12_OR_SouthernOR_Rec_PC_ORBS (mirror of fleet 7)

### Oregon commercial logbook index (southern OR; vessels from Port Orford,
#  Gold Beach, and Brookings)
### initially assigning to fleet: "6_OR_SouthernOR_Comm_Live"
#_year  seas    index   obs     err
2004    1        6       0.036   0.211   # OR Commercial Logbook
2005    1        6       0.028   0.194   # OR Commercial Logbook
2006    1        6       0.032   0.200   # OR Commercial Logbook
2007    1        6       0.038   0.213   # OR Commercial Logbook
2008    1        6       0.043   0.204   # OR Commercial Logbook
2009    1        6       0.026   0.207   # OR Commercial Logbook
2010    1        6       0.024   0.254   # OR Commercial Logbook
2011    1        6       0.039   0.203   # OR Commercial Logbook
2012    1        6       0.032   0.206   # OR Commercial Logbook
2013    1        6       0.018   0.228   # OR Commercial Logbook

### Northern CA + Oregon, MRFSS Dockside Charter Boat Trip-Based CPUE (nort
# h of 40-10)
### assigned to fleet: "7_OR_SouthernOR_Rec_PC"
```

```
### NOTE: fleet changed to be negative (removed from likelihood)
###       due to issues identified at STAR panel (see report)
#_year  seas    index   obs     err
1980    1       -7      0.190   0.260   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1981    1       -7      0.086   0.221   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1982    1       -7      0.119   0.241   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1983    1       -7      0.152   0.350   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1984    1       -7      0.056   0.296   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1985    1       -7      0.091   0.269   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1986    1       -7      0.121   0.429   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1987    1       -7      0.234   0.167   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1988    1       -7      0.193   0.175   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1989    1       -7      0.084   0.162   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1993    1       -7      0.178   0.135   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1994    1       -7      0.152   0.135   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1995    1       -7      0.115   0.136   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1996    1       -7      0.093   0.178   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1997    1       -7      0.116   0.172   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1998    1       -7      0.131   0.183   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
1999    1       -7      0.134   0.128   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
2000    1       -7      0.132   0.147   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
2001    1       -7      0.109   0.225   # NoCA-OR Rec MRFSS Charter Boat CP
# UE
2002    1       -7      0.109   0.196   # NoCA-OR Rec MRFSS Charter Boat CP
```

```
# UE
2003    1       -7      0.044   0.530   # NoCA-OR Rec MRFSS Charter Boat CP
# UE

### OR ORBS Charter Boat Dockside Trip-Based CPUE
### (AREA WEIGHTED SUM OF REGIONAL TRENDS)
### assigning to fleet: "12_OR_SouthernOR_Rec_PC_ORBS" which is a mirror
###                     of fleet "7_OR_SouthernOR_Rec_PC"
#_year  seas    index   obs     err
2001    1       12      0.0227  0.078   #OR Rec ORBS Trip-based Charter CPU
# E
2002    1       12      0.0194  0.0771  #OR Rec ORBS Trip-based Charter CPU
# E
2003    1       12      0.0205  0.0792  #OR Rec ORBS Trip-based Charter CPU
# E
2004    1       12      0.0181  0.0907  #OR Rec ORBS Trip-based Charter CPU
# E
2005    1       12      0.0146  0.0971  #OR Rec ORBS Trip-based Charter CPU
# E
2006    1       12      0.0213  0.0758  #OR Rec ORBS Trip-based Charter CPU
# E
2007    1       12      0.0279  0.0751  #OR Rec ORBS Trip-based Charter CPU
# E
2008    1       12      0.0199  0.0731  #OR Rec ORBS Trip-based Charter CPU
# E
2009    1       12      0.0146  0.0867  #OR Rec ORBS Trip-based Charter CPU
# E
2010    1       12      0.0168  0.0873  #OR Rec ORBS Trip-based Charter CPU
# E
2011    1       12      0.0196  0.0798  #OR Rec ORBS Trip-based Charter CPU
# E
2012    1       12      0.0212  0.0863  #OR Rec ORBS Trip-based Charter CPU
# E
2013    1       12      0.0173  0.0817  #OR Rec ORBS Trip-based Charter CPU
# E
2014    1       12      0.0132  0.1091  #OR Rec ORBS Trip-based Charter CPU
# E

### OR onboard index
### initially assigning to fleet: "10_OR_NorthernOR_Rec_PC"
#_year  seas    index   obs     err
2001    1       10      0.050   0.246   #OR onboard
```

```
2003    1       10      0.039   0.210   #OR onboard
2004    1       10      0.031   0.265   #OR onboard
2005    1       10      0.029   0.287   #OR onboard
2006    1       10      0.036   0.254   #OR onboard
2007    1       10      0.058   0.190   #OR onboard
2008    1       10      0.030   0.245   #OR onboard
2009    1       10      0.045   0.236   #OR onboard
2010    1       10      0.013   0.435   #OR onboard
2011    1       10      0.051   0.289   #OR onboard
2012    1       10      0.044   0.259   #OR onboard
2013    1       10      0.026   0.293   #OR onboard
2014    1       10      0.017   0.415   #OR onboard

0 #_N_fleets_with_discard
#_discard_units (1=same_as_catchunits(bio/num); 2=fraction; 3=numbers)
#_discard_errtype:  >0 for DF of T-dist(read CV below); 0 for normal with C
# V; -1 for normal with se; -2 for lognormal
#Fleet Disc_units err_type
0 #N discard obs
#_year seas index obs err
#
0 #_N_meanbodywt_obs
30 #_DF_for_meanbodywt_T-distribution_like

2  # length bin method: 1=use databins; 2=generate from binwidth,min,max be
# low; 3=read vector
2  # binwidth for population size comp
8  # minimum size in the population (lower edge of first bin and size at ag
# e 0.00)
50 # maximum size in the population (lower edge of last bin)

-0.0001 #_comp_tail_compression
1e-003 #_add_to_comp
0 #_combine males into females at or below this bin number
15 #_N_LengthBins
18 20 22 24 26 28 30 32 34 36 38 40 42 44 46

221 # pre-STAR base was 156 #_N_Length_obs

### CA commercial landings, dead fish, north of 40-10
### initially assigning to fleet: 1_CA_NorthOf4010_Comm_Dead
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
```

```
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1992    1       1       0       2       4       0       0       8       11
     48      59      131     94      16      54      3       0       0
 0       0       0       0       8       11      48      59      131     9
4       16      54      3       0       0       0       0
1993    1       1       0       2       6       0       0       83      0
     0       0       0       104     135     208     69      0       0
 0       0       0       0       83      0       0       0       0       1
04      135     208     69      0       0       0       0
1994    1       1       0       2       9       0       0       0       0
     0       139     120     240     218     139     0       0       0
 0       60      0       0       0       0       0       139     120     2
40      218     139     0       0       0       0       60
1995    1       1       0       2       41      0       0       0       0
     0       0       399     935     1200    393     134     533     533
 0       0       0       0       0       0       0       0       399     9
35      1200    393     134     533     533     0       0
1996    1       1       0       2       42      0       0       0       42
     0       0       714     811     598     1068    314     440     200
 0       0       0       0       0       42      0       0       714     8
11      598     1068    314     440     200     0       0
1997    1       1       0       2       25      0       0       0       0
     62      248     454     480     462     474     212     106     0
 0       0       0       0       0       0       62      248     454     4
80      462     474     212     106     0       0       0
1999    1       1       0       2       8       0       0       0       0
     7       91      224     147     161     126     63      28      0
 0       0       0       0       0       0       7       91      224     1
47      161     126     63      28      0       0       0
2000    1       1       0       2       5       0       0       0       0
     0       40      37      116     143     87      43      37      0
 0       32      0       0       0       0       0       40      37      1
16      143     87      43      37      0       0       32
2002    1       1       0       2       6       0       0       0       0
     0       0       0       153     153     255     0       0       0
 0       0       0       0       0       0       0       0       0       1
53      153     255     0       0       0       0       0

### CA commercial landings, live fish, north of 40-10
### initially assigning to fleet: 2_CA_NorthOf4010_Comm_Live
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
```

```
# m     26cm     28cm     30cm     32cm     34cm     36cm     38cm     40cm     42cm
#        44cm     46cm+    repeat
1997     1        2        0        2        27       0        0        0        60
          180      664      852      448      164      232      0        60       0
  0        0        0        0        0        60       180      664      852      4
48       164      232      0        60       0        0        0
1999     1        2        0        2        22       0        0        0        0
          24       79       273      548      595      479      123      98       0
  0        0        0        0        0        0        24       79       273      5
48       595      479      123      98       0        0        0
2000     1        2        0        2        20       0        0        0        0
          0        57       342      270      480      540      171      102      0
  0        0        0        0        0        0        0        57       342      2
70       480      540      171      102      0        0        0
2001     1        2        0        2        12       0        0        0        0
          0        16       160      208      336      256      144      16       16
  0        0        0        0        0        0        0        16       160      2
08       336      256      144      16       16       0        0
2002     1        2        0        2        22       0        0        0        0
          0        90       535      570      640      210      50       45       0
  50       0        0        0        0        0        0        90       535      5
70       640      210      50       45       0        50       0
2004     1        2        0        2        3        0        0        0        0
          0        0        87       0        87       29       87       0        0
  0        0        0        0        0        0        0        0        87       0
          87       29       87       0        0        0        0
2006     1        2        0        2        11       0        0        0        0
          20       74       66       70       316      360      130      54       0
  0        0        0        0        0        0        20       74       66       7
0        316      360      130      54       0        0        0
2007     1        2        0        2        16       0        0        0        0
          0        37       157      275      582      328      155      45       0
  0        0        0        0        0        0        0        37       157      2
75       582      328      155      45       0        0        0
2008     1        2        0        2        15       0        0        0        0
          0        56       56       350      420      357      210      49       0
  0        0        0        0        0        0        0        56       56       3
50       420      357      210      49       0        0        0
2009     1        2        0        2        13       0        0        0        0
          0        0        50       177      358      464      224      29       0
  0        0        0        0        0        0        0        0        50       1
77       358      464      224      29       0        0        0
```

```
2010    1       2       0       2       2       0       0       0       0
     0       0       0       21      42      77      56      21      0
  0       0       0       0       0       0       0       0       0       2
1      42      77      56      21      0       0       0

### CA rec landings, PC mode, north of 40-10
### initially assigning to fleet: 3_CA_NorthOf4010_Rec_PC
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1981    1       3       0       2       1       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       1       0       0
1985    1       3       0       2       1       0       0       0       0
     0       0       0       0       1       0       0       0       0
  0       0       0       0       0       0       0       0       0       0
       1       0       0       0       0       0       0
1995    1       3       0       2       3       0       0       0       0
     0       0       0       0       2       1       0       0       0
  0       0       0       0       0       0       0       0       0       0
       2       1       0       0       0       0       0
1996    1       3       0       2       7       0       0       0       0
     0       0       0       4       2       0       1       0       0
  0       0       0       0       0       0       0       0       0       4
       2       0       1       0       0       0       0
2003    1       3       0       2       1       0       0       0       0
     0       0       0       0       1       0       0       0       0
  0       0       0       0       0       0       0       0       0       0
       1       0       0       0       0       0       0
2004    1       3       0       2       4       0       0       0       0
     0       0       0       0       0       0       1       1       1
  0       1       0       0       0       0       0       0       0       0
       0       0       1       1       1       0       1
2005    1       3       0       2       2       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       1       1       0       0       0
2006    1       3       0       2       3       0       0       0       0
     0       0       0       1       0       1       0       1       0
  0       0       0       0       0       0       0       0       0       1
       0       1       0       1       0       0       0
```

```
2007    1       3       0       2       11      0       0       0       0
     0       0       2       2       5       1       1       0       0
 0       0       0       0       0       0       0       0       2       2
       5       1       1       0       0       0       0
2008    1       3       0       2       25      0       0       0       0
     0       1       1       3       4       5       8       1       2
 0       0       0       0       0       0       0       1       1       3
       4       5       8       1       2       0       0
2009    1       3       0       2       21      0       0       0       0
     0       1       2       1       2       8       4       3       0
 0       0       0       0       0       0       0       1       2       1
       2       8       4       3       0       0       0
2010    1       3       0       2       11      0       0       0       0
     0       0       0       0       0       3       6       1       1
 0       0       0       0       0       0       0       0       0       0
       0       3       6       1       1       0       0
2011    1       3       0       2       3       0       0       0       0
     0       0       1       0       0       2       0       0       0
 0       0       0       0       0       0       0       0       1       0
       0       2       0       0       0       0       0
2012    1       3       0       2       32      0       0       0       0
     0       0       1       2       8       12      6       3       0
 0       0       0       0       0       0       0       0       1       2
       8       12      6       3       0       0       0
2013    1       3       0       2       33      0       0       0       0
     0       0       0       5       4       8       10      6       0
 0       0       0       0       0       0       0       0       0       5
       4       8       10      6       0       0       0
2014    1       3       0       2       6       0       0       0       0
     0       0       1       0       0       0       3       2       0
 0       0       0       0       0       0       0       0       1       0
       0       0       3       2       0       0       0

### CA rec landings, PR mode, north of 40-10
### initially assigning to fleet: 4_CA_NorthOf4010_Rec_PR
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1981    1       4       0       2       4       0       0       0       0
     0       1       1       0       0       1       0       0       1
 0       0       0       0       0       0       0       1       1       0
       0       1       0       0       1       0       0
```

1982 1 4 0 2 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 1
1983 1 4 0 2 8 0 0 0 0
0 0 0 1 0 0 1 4 1
1 0 0 0 0 0 0 0 0 1
0 0 1 4 1 1 0
1984 1 4 0 2 4 0 0 0 0
0 1 0 0 0 0 2 0 0
1 0 0 0 0 0 0 1 0 0
0 0 2 0 0 1 0
1985 1 4 0 2 11 0 0 0 0
0 0 0 1 0 1 1 3 4
1 0 0 0 0 0 0 0 0 1
0 1 1 3 4 1 0
1986 1 4 0 2 6 0 0 0 0
1 0 0 1 1 1 1 1 0
0 0 0 0 0 0 1 0 0 1
1 1 1 1 0 0 0
1987 1 4 0 2 4 0 0 0 0
0 0 1 0 0 1 1 1 0
0 0 0 0 0 0 0 0 1 0
0 1 1 1 0 0 0
1989 1 4 0 2 1 0 0 0 0
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
1993 1 4 0 2 16 0 0 0 0
0 0 1 2 2 3 8 0 0
0 0 0 0 0 0 0 0 1 2
2 3 8 0 0 0 0
1994 1 4 0 2 6 0 0 0 0
0 0 1 3 0 0 2 0 0
0 0 0 0 0 0 0 0 1 3
0 0 2 0 0 0 0
1995 1 4 0 2 4 0 0 0 0
0 1 1 1 1 0 0 0 0
0 0 0 0 0 0 0 1 1 1
1 0 0 0 0 0 0
1996 1 4 0 2 12 0 0 0 0
0 0 3 2 3 2 2 0 0

```
0 0 0 0 0 0 0 0 3 2
3 2 2 0 0 0 0
1998 1 4 0 2 11 0 0 0 1
0 0 1 2 1 2 0 3 0
1 0 0 0 0 1 0 0 1 2
1 2 0 3 0 1 0
1999 1 4 0 2 48 0 0 0 0
0 2 7 14 11 8 1 4 1
0 0 0 0 0 0 0 2 7 1
4 11 8 1 4 1 0 0
2000 1 4 0 2 31 0 0 0 0
0 1 2 9 14 3 0 2 0
0 0 0 0 0 0 0 1 2 9
14 3 0 2 0 0 0
2001 1 4 0 2 3 0 0 0 0
0 0 1 0 0 0 0 2 0
0 0 0 0 0 0 0 0 1 0
0 0 0 2 0 0 0
2002 1 4 0 2 7 0 0 0 0
0 0 1 0 0 3 2 0 1
0 0 0 0 0 0 0 0 1 0
0 3 2 0 1 0 0
2003 1 4 0 2 5 0 0 0 0
0 0 1 3 0 0 0 1 0
0 0 0 0 0 0 0 0 1 3
0 0 0 1 0 0 0
2004 1 4 0 2 3 0 0 0 0
1 0 0 0 0 0 2 0 0
0 0 0 0 0 0 1 0 0 0
0 0 2 0 0 0 0
2005 1 4 0 2 36 0 0 0 0
0 2 1 6 8 6 8 2 2
0 1 0 0 0 0 0 2 1 6
8 6 8 2 2 0 1
2006 1 4 0 2 54 0 0 0 0
0 3 4 11 10 15 8 2 1
0 0 0 0 0 0 0 3 4 1
1 10 15 8 2 1 0 0
2007 1 4 0 2 99 0 0 0 0
0 1 8 20 21 21 19 9 0
0 0 0 0 0 0 0 1 8 2
0 21 21 19 9 0 0 0
```

```
2008    1       4       0       2       94      0       0       0       0
        0       1       6       10      27      28      13      8       1
  0       0       0       0       0       0       0       1       6       1
0       27      28      13      8       1       0       0
2009    1       4       0       2       73      0       0       0       0
        0       0       4       13      15      21      13      7       0
  0       0       0       0       0       0       0       0       4       1
3       15      21      13      7       0       0       0
2010    1       4       0       2       35      0       0       0       0
        0       0       1       4       6       10      6       5       3
  0       0       0       0       0       0       0       0       1       4
        6       10      6       5       3       0       0
2011    1       4       0       2       50      0       0       0       0
        0       1       2       4       16      12      11      1       2
  0       1       0       0       0       0       0       1       2       4
        16      12      11      1       2       0       1
2012    1       4       0       2       66      0       0       0       0
        0       1       3       3       13      19      16      9       2
  0       0       0       0       0       0       0       1       3       3
        13      19      16      9       2       0       0
2013    1       4       0       2       62      0       0       0       0
        0       0       1       7       10      19      18      6       1
  0       0       0       0       0       0       0       0       1       7
        10      19      18      6       1       0       0
2014    1       4       0       2       29      0       0       0       0
        0       0       1       2       5       4       5       8       4
  0       0       0       0       0       0       0       0       1       2
        5       4       5       8       4       0       0

###     OR      Comm,   sexes   combined,       DEAD    FISHERY
###     initially       assigning       to      fleet:  5_OR_SouthernOR_Com
# m_Dead
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m     26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1995    1       5       0       2       102     0       0       1       0
        2.1     7       36.9    23.1    27.8    18.3    6.3     1.7     0
  0       0       0       0       1       0       2.1     7       36.9    2
3.1     27.8    18.3    6.3     1.7     0       0       0
1996    1       5       0       2       118     0       0       0       0
        1.1     10.4    23.9    35.6    25.9    15.2    8.1     2       0
  0       0       0       0       0       0       1.1     10.4    23.9    3
```

```
5.6    25.9   15.2   8.1    2      0      0      0
1998   1      5      0      2      38     0      0      0      0
       0      3.7    6.5    28     15     3.2    5.3    1.1    0
 0      0      0      0      0      0      0      3.7    6.5    2
8      15     3.2    5.3    1.1    0      0      0
1999   1      5      0      2      37     0      0      0      0
       0      0      11.3   14.5   6.2    2      3.1    1      0
 0      0      0      0      0      0      0      0      11.3   1
4.5    6.2    2      3.1    1      0      0      0
2000   1      5      0      2      137    0      0      0      1.2
       1.2    5.3    37.8   45.8   26.2   20.1   14     2.2    2
 0      0      0      0      0      1.2    1.2    5.3    37.8   4
5.8    26.2   20.1   14     2.2    2      0      0
2001   1      5      0      2      196    0      0      0      0
       0      2.3    50.2   55.4   64.2   50.2   16.2   6.6    0
 1      0      0      0      0      0      0      2.3    50.2   5
5.4    64.2   50.2   16.2   6.6    0      1      0
2002   1      5      0      2      253    0      0      0      0
       0      0      37.3   65.3   72.3   56.8   24.2   9.1    1
 0      0      0      0      0      0      0      0      37.3   6
5.3    72.3   56.8   24.2   9.1    1      0      0
2003   1      5      0      2      200    0      0      0      0
       0      2.4    30.1   70.7   66.8   49.1   21.9   9.8    0
 0      0      0      0      0      0      0      2.4    30.1   7
0.7    66.8   49.1   21.9   9.8    0      0      0
2004   1      5      0      2      115    0      0      0      0
       0      1      16.8   43.3   32     17.9   9.5    3.1    0
 0      0      0      0      0      0      0      1      16.8   4
3.3    32     17.9   9.5    3.1    0      0      0
2005   1      5      0      2      23     0      0      0      0
       0      0      4.9    4.5    6.2    2.3    5.1    2.1    0
 0      0      0      0      0      0      0      0      4.9    4
.5     6.2    2.3    5.1    2.1    0      0      0
2006   1      5      0      2      30     0      0      0      0
       0      0      1.7    11.4   17.4   7.8    5.6    0      0
 0      0      0      0      0      0      0      0      1.7    1
1.4    17.4   7.8    5.6    0      0      0      0
2007   1      5      0      2      44     0      0      0      0
       0      0      3.7    14.7   18.6   13.6   7.3    2.9    0
 0      1      0      0      0      0      0      0      3.7    1
4.7    18.6   13.6   7.3    2.9    0      0      1
2008   1      5      0      2      28     0      0      0      0
```

```
     0       0       2       5.4     9       4       4.1     4.3     0
  0       0       0       0       0       0       0       0       2       5
.4     9       4       4.1     4.3     0       0       0
2009    1       5       0       2       82      0       0       0       0
     0       0       6.2     26      28.3    15.5    12.6    4       3
  0       0       0       0       0       0       0       0       6.2     2
6      28.3    15.5    12.6    4       3       0       0
2010    1       5       0       2       75      0       0       0       0
     0       0       2.1     18      19.8    24.9    9.4     7       0
  0       0       0       0       0       0       0       0       2.1     1
8      19.8    24.9    9.4     7       0       0       0
2011    1       5       0       2       309     0       0       0       0
     0       0       21.2    48.9    87.4    96.9    47.1    15      5.7
  0       2.8     0       0       0       0       0       0       21.2    4
8.9    87.4    96.9    47.1    15      5.7     0       2.8
2012    1       5       0       2       156     0       0       0       0
     1       2       8.1     22.2    31.4    45.5    30      17.2    2
  0       1.1     0       0       0       0       1       2       8.1     2
2.2    31.4    45.5    30      17.2    2       0       1.1
2013    1       5       0       2       265     0       0       0       0
     0       1       15.2    43.2    72.2    88.9    36.4    15.3    1
  0       0       0       0       0       0       0       1       15.2    4
3.2    72.2    88.9    36.4    15.3    1       0       0
2014    1       5       0       2       165     0       0       0       0
     0       0       8       25.4    49.2    50.7    24.2    8       3
  0       1       0       0       0       0       0       0       8       2
5.4    49.2    50.7    24.2    8       3       0       1

###     OR      Comm,   sexes   combined,       LIVE    FISHERY
###     initially       assigning       to      fleet:  6_OR_SouthernOR_Com
# m_Live
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1998    1       6       0       2       100     0       0       0       0
     0       3.6     31      74.4    61.1    37.4    14.5    2       0
  0       0       0       0       0       0       0       3.6     31      7
4.4    61.1    37.4    14.5    2       0       0       0
1999    1       6       0       2       93      0       0       0       0
     5.9     7       30.6    30      13.2    15.2    7.6     2       1
  0       0       0       0       0       0       5.9     7       30.6    3
0      13.2    15.2    7.6     2       1       0       0
```

```
2000    1       6       0       2       1095    0       0       0       0
        1.1     13.6    209.9   257     309.4   209.9   101.3   26.4    7.3
  0       0       0       0       0       0       1.1     13.6    209.9   2
57      309.4   209.9   101.3   26.4    7.3     0       0
2001    1       6       0       2       1858    0       0       0       0
        0       4       350.1   554     527.9   320.5   127.4   29.6    5
  3       0       0       0       0       0       0       4       350.1   5
54      527.9   320.5   127.4   29.6    5       3       0
2002    1       6       0       2       1339    0       0       0       0
        0       5.1     207.5   386.4   363.4   276     116.4   31.4    0
  2       0       0       0       0       0       0       5.1     207.5   3
86.4    363.4   276     116.4   31.4    0       2       0
2003    1       6       0       2       794     0       0       0       0
        0       1       144.5   239.7   205.8   145.4   64.1    17.3    4
  1.1     0       0       0       0       0       0       1       144.5   2
39.7    205.8   145.4   64.1    17.3    4       1.1     0
2004    1       6       0       2       586     0       0       0       0
        0       2       104.8   172.3   168.8   109.6   25.5    9.2     3.1
  1       0       0       0       0       0       0       2       104.8   1
72.3    168.8   109.6   25.5    9.2     3.1     1       0
2005    1       6       0       2       194     0       0       0       0
        0       0       26.9    46.2    53.2    44      19.3    8.3     1
  0       0       0       0       0       0       0       0       26.9    4
6.2     53.2    44      19.3    8.3     1       0       0
2006    1       6       0       2       408     0       0       0       0
        1       2       40.4    75.2    120.1   99.3    59.2    23.1    2
  0       0       0       0       0       0       1       2       40.4    7
5.2     120.1   99.3    59.2    23.1    2       0       0
2007    1       6       0       2       680     0       0       0       0
        0       4       46.1    141.2   184.3   193.6   106     17.1    3
  0       1       0       0       0       0       0       4       46.1    1
41.2    184.3   193.6   106     17.1    3       0       1
2008    1       6       0       2       348     0       0       0       0
        0       0       26.2    60.8    109.9   80.1    52.6    12      9.1
  2.1     0       0       0       0       0       0       0       26.2    6
0.8     109.9   80.1    52.6    12      9.1     2.1     0
2009    1       6       0       2       348     0       0       0       0
        0       3.4     36.4    95.1    130.1   87.6    42.6    13.8    0
  1.1     1.2     0       0       0       0       0       3.4     36.4    9
5.1     130.1   87.6    42.6    13.8    0       1.1     1.2
2010    1       6       0       2       454     0       0       0       0
        0       3.3     50.4    103.5   174.8   113.1   40.8    12.1    1
```

```
 0       0       0       0       0       0       0       3.3     50.4    1
03.5   174.8   113.1   40.8    12.1    1       0       0
2011    1       6       0       2       688     0       0       0       0
    0       4.1     44.5    161.8   221.4   200.6   90.1    19.1    3.1
 1.1     1       0       0       0       0       0       4.1     44.5    1
61.8   221.4   200.6   90.1    19.1    3.1     1.1     1
2012    1       6       0       2       447     0       0       0       0
    0       3.1     28.1    92.3    149.9   99.9    74.6    21.5    1
 0       2       0       0       0       0       0       3.1     28.1    9
2.3    149.9   99.9    74.6    21.5    1       0       2
2013    1       6       0       2       423     0       0       0       0
    0       1.1     28.5    96.8    128     126.3   50.3    6.2     4.1
 0       1       0       0       0       0       0       1.1     28.5    9
6.8    128     126.3   50.3    6.2     4.1     0       1
2014    1       6       0       2       355     0       0       0       0
    0       5.3     32.8    82.6    116.9   73.4    40.4    16.2    4.7
 2       0       0       0       0       0       0       5.3     32.8    8
2.6    116.9   73.4    40.4    16.2    4.7     2       0

###     Oregon  Rec,    South,  Party/Charter
###     initially       assigning       to      fleet:  7_OR_SouthernOR_Rec
# _PC
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#    44cm    46cm+   repeat
1984    1       7       0       2       4       0       0       0       0
    0       0       0       2       1       0       1       0       0
 0       0       0       0       0       0       0       0       0       2
      1       0       1       0       0       0       0
1985    1       7       0       2       8       0       0       0       1
    0       0       1       0       2       0       2       0       1
 1       0       0       0       0       1       0       0       1       0
      2       0       2       0       1       1       0
1986    1       7       0       2       4       0       0       0       0
    0       0       0       0       1       2       1       0       0
 0       0       0       0       0       0       0       0       0       0
      1       2       1       0       0       0       0
1987    1       7       0       2       4       0       0       0       1
    0       0       1       0       0       1       0       0       1
 0       0       0       0       0       1       0       0       1       0
      0       1       0       0       1       0       0
1988    1       7       0       2       7       0       0       0       0
```

0 1 0 1 0 1 1 3 0
0 0 0 0 0 0 0 1 0 1
0 1 1 3 0 0 0
1989 1 7 0 2 2 0 0 0 1
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
1993 1 7 0 2 9 0 0 0 0
0 0 0 3 1 4 1 0 0
0 0 0 0 0 0 0 0 0 3
1 4 1 0 0 0 0
1994 1 7 0 2 31 0 0 0 1
1 1 4 8 3 5 3 2 2
1 0 0 0 0 1 1 1 4 8
3 5 3 2 2 1 0
1995 1 7 0 2 12 0 0 0 0
0 1 2 3 5 0 1 0 0
0 0 0 0 0 0 0 1 2 3
5 0 1 0 0 0 0
1996 1 7 0 2 12 0 0 0 0
0 0 1 1 2 3 3 1 1
0 0 0 0 0 0 0 0 1 1
2 3 3 1 1 0 0
1997 1 7 0 2 29 0 0 1 0
1 2 2 11 6 5 0 1 0
0 0 0 0 1 0 1 2 2 1
1 6 5 0 1 0 0 0
1998 1 7 0 2 16 0 0 0 0
0 1 2 1 4 4 1 3 0
0 0 0 0 0 0 0 1 2 1
4 4 1 3 0 0 0
1999 1 7 0 2 31 0 0 0 0
1 3 2 5 4 10 6 0 0
0 0 0 0 0 0 1 3 2 5
4 10 6 0 0 0 0
2000 1 7 0 2 15 0 0 1 0
0 0 2 4 4 3 1 0 0
0 0 0 0 1 0 0 0 2 4
4 3 1 0 0 0 0
2001 1 7 0 2 96 0 0 0 0
3 6 16 17 23 17 12 2 0
0 0 0 0 0 0 3 6 16 1

```
7 23 17 12 2 0 0 0
2002 1 7 0 2 188 0 0 0 0
2 6 19 27 43 50 30 9 2
0 0 0 0 0 0 2 6 19 2
7 43 50 30 9 2 0 0
2003 1 7 0 2 257 0 0 0 0
3 17 24 56 64 55 26 8 2
0 2 0 0 0 0 3 17 24 5
6 64 55 26 8 2 0 2
2004 1 7 0 2 117 0 0 0 0
0 2 5 13 31 31 21 13 1
0 0 0 0 0 0 0 2 5 1
3 31 31 21 13 1 0 0
2005 1 7 0 2 137 0 0 0 0
0 2 9 16 27 34 31 15 2
0 1 0 0 0 0 0 2 9 1
6 27 34 31 15 2 0 1
2006 1 7 0 2 187 0 0 0 0
0 3 8 12 40 52 49 17 6
0 0 0 0 0 0 0 3 8 1
2 40 52 49 17 6 0 0
2007 1 7 0 2 317 0 0 0 0
3 5 12 37 71 99 65 18 4
2 1 0 0 0 0 3 5 12 3
7 71 99 65 18 4 2 1
2008 1 7 0 2 192 0 0 0 0
2 3 5 16 29 48 57 23 9
0 0 0 0 0 0 2 3 5 1
6 29 48 57 23 9 0 0
2009 1 7 0 2 106 0 0 0 0
1 0 4 8 21 28 22 15 6
1 0 0 0 0 0 1 0 4 8
21 28 22 15 6 1 0
2010 1 7 0 2 210 0 0 0 0
1 2 10 10 22 53 72 32 8
0 0 0 0 0 0 1 2 10 1
0 22 53 72 32 8 0 0
2011 1 7 0 2 230 0 0 0 0
0 2 8 17 34 73 56 31 7
0 2 0 0 0 0 0 2 8 1
7 34 73 56 31 7 0 2
2012 1 7 0 2 280 0 0 0 0
```

```
     1       1       3       23      63      86      69      24      9
  1       0       0       0       0       0       1       1       3       2
3      63      86      69      24      9       1       0
2013    1       7       0       2       206     0       0       0       2
     1       1       8       9       44      51      63      20      6
  1       0       0       0       0       2       1       1       8       9
       44      51      63      20      6       1       0
2014    1       7       0       2       75      0       0       0       1
     0       1       0       3       17      15      25      9       3
  0       1       0       0       0       1       0       1       0       3
       17      15      25      9       3       0       1

###     Oregon  Rec,    South   Private/Rental
###     initially       assigning       to      fleet:  8_OR_SouthernOR_Rec
# _PR
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1980    1       8       0       2       4       0       0       0       0
     0       0       0       1       0       0       0       2       0
  0       1       0       0       0       0       0       0       0       1
       0       0       0       2       0       0       1
1981    1       8       0       2       2       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       1       1       0       0
1982    1       8       0       2       5       0       0       0       0
     0       0       0       1       2       1       1       0       0
  0       0       0       0       0       0       0       0       0       1
       2       1       1       0       0       0       0
1983    1       8       0       2       1       0       0       0       0
     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
1984    1       8       0       2       7       0       0       0       0
     0       0       0       0       0       2       0       1       2
  1       1       0       0       0       0       0       0       0       0
       0       2       0       1       2       1       1
1985    1       8       0       2       11      0       0       0       0
     1       0       0       0       2       0       0       5       2
  1       0       0       0       0       0       1       0       0       0
       2       0       0       5       2       1       0
```

```
1986 1 8 0 2 1 0 0 0 0
0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0
1987 1 8 0 2 3 0 0 0 0
0 0 1 1 0 1 0 0 0
0 0 0 0 0 0 0 0 1 1
0 1 0 0 0 0 0
1988 1 8 0 2 10 0 0 0 0
0 1 0 2 3 1 2 1 0
0 0 0 0 0 0 0 1 0 2
3 1 2 1 0 0 0
1989 1 8 0 2 2 0 0 1 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
1993 1 8 0 2 10 0 0 0 0
0 0 2 1 1 1 2 2 1
0 0 0 0 0 0 0 0 2 1
1 1 2 2 1 0 0
1994 1 8 0 2 17 0 0 0 0
0 2 3 1 2 4 2 3 0
0 0 0 0 0 0 0 2 3 1
2 4 2 3 0 0 0
1995 1 8 0 2 17 0 0 0 1
1 0 2 5 2 4 2 0 0
0 0 0 0 0 1 1 0 2 5
2 4 2 0 0 0 0
1996 1 8 0 2 1 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 1 0 0 0 0
1997 1 8 0 2 42 0 0 0 0
0 2 7 8 11 8 6 0 0
0 0 0 0 0 0 0 2 7 8
11 8 6 0 0 0 0
1998 1 8 0 2 41 0 0 0 2
1 1 3 9 13 8 2 1 1
0 0 0 0 0 2 1 1 3 9
13 8 2 1 1 0 0
1999 1 8 0 2 21 0 0 0 0
1 0 1 5 7 3 2 2 0
```

```
0 0 0 0 0 0 1 0 1 5
7 3 2 2 0 0 0
2000 1 8 0 2 10 0 0 0 0
0 2 1 0 3 1 0 3 0
0 0 0 0 0 0 0 2 1 0
3 1 0 3 0 0 0
2001 1 8 0 2 81 0 0 0 1
1 4 8 18 21 16 6 5 1
0 0 0 0 0 1 1 4 8 1
8 21 16 6 5 1 0 0
2002 1 8 0 2 85 0 0 0 0
1 5 13 13 19 17 11 4 2
0 0 0 0 0 0 1 5 13 1
3 19 17 11 4 2 0 0
2003 1 8 0 2 159 0 0 0 0
1 2 13 24 47 35 22 9 5
0 1 0 0 0 0 1 2 13 2
4 47 35 22 9 5 0 1
2004 1 8 0 2 107 0 0 0 1
1 1 3 8 32 34 19 6 2
0 0 0 0 0 1 1 1 3 8
32 34 19 6 2 0 0
2005 1 8 0 2 200 0 0 0 0
0 3 7 19 41 47 51 25 5
1 1 0 0 0 0 0 3 7 1
9 41 47 51 25 5 1 1
2006 1 8 0 2 254 0 0 0 0
1 4 14 15 52 75 65 16 7
4 1 0 0 0 0 1 4 14 1
5 52 75 65 16 7 4 1
2007 1 8 0 2 212 0 0 0 0
0 1 10 24 37 55 56 22 6
1 0 0 0 0 0 0 1 10 2
4 37 55 56 22 6 1 0
2008 1 8 0 2 196 0 0 0 0
2 3 9 22 26 45 56 24 6
2 1 0 0 0 0 2 3 9 2
2 26 45 56 24 6 2 1
2009 1 8 0 2 169 0 0 0 1
0 4 7 10 25 53 38 22 7
2 0 0 0 0 1 0 4 7 1
0 25 53 38 22 7 2 0
```

```
2010    1       8       0       2       207     0       0       0       0
        0       2       6       24      30      52      54      32      6
  1       0       0       0       0       0       0       2       6       2
4       30      52      54      32      6       1       0
2011    1       8       0       2       272     0       0       0       1
        1       0       13      27      50      93      54      28      4
  0       1       0       0       0       1       1       0       13      2
7       50      93      54      28      4       0       1
2012    1       8       0       2       229     0       0       0       0
        0       1       7       24      32      62      64      26      8
  3       2       0       0       0       0       0       1       7       2
4       32      62      64      26      8       3       2
2013    1       8       0       2       261     0       0       0       1
        1       3       6       22      48      61      75      32      12
  0       0       0       0       0       1       1       3       6       2
2       48      61      75      32      12      0       0
2014    1       8       0       2       158     0       0       0       0
        1       0       4       11      25      50      42      21      4
  0       0       0       0       0       0       1       0       4       1
1       25      50      42      21      4       0       0

###     Oregon  Rec,    North,  Party/Charter
###     initially       assigning       to      fleet:  10_OR_NorthernOR_Re
# c_PC
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1980    1       10      0       2       16      0       0       0       0
        2       1       0       3       2       4       1       2       1
  0       0       0       0       0       0       2       1       0       3
          2       4       1       2       1       0       0
1981    1       10      0       2       11      0       0       0       0
        0       0       2       0       3       2       1       2       1
  0       0       0       0       0       0       0       0       2       0
          3       2       1       2       1       0       0
1982    1       10      0       2       9       0       0       0       0
        0       0       1       1       1       3       0       2       0
  1       0       0       0       0       0       0       0       1       1
          1       3       0       2       0       1       0
1983    1       10      0       2       2       0       0       0       0
        1       0       0       0       1       0       0       0       0
  0       0       0       0       0       0       1       0       0       0
```

1 0 0 0 0 0 0
1984 1 10 0 2 10 0 0 0 0
0 1 0 1 1 2 3 1 1
0 0 0 0 0 0 0 1 0 1
1 2 3 1 1 0 0
1985 1 10 0 2 9 0 0 0 0
1 2 0 1 2 2 1 0 0
0 0 0 0 0 0 1 2 0 1
2 2 1 0 0 0 0
1986 1 10 0 2 5 0 0 0 0
0 0 2 2 0 0 0 1 0
0 0 0 0 0 0 0 0 2 2
0 0 0 1 0 0 0
1987 1 10 0 2 22 0 0 0 1
2 1 4 1 6 5 1 1 0
0 0 0 0 0 1 2 1 4 1
6 5 1 1 0 0 0
1988 1 10 0 2 31 0 0 1 0
1 2 6 3 2 8 5 2 0
0 1 0 0 1 0 1 2 6 3
2 8 5 2 0 0 1
1989 1 10 0 2 37 0 1 0 0
3 2 3 7 9 6 4 1 0
0 1 0 1 0 0 3 2 3 7
9 6 4 1 0 0 1
1993 1 10 0 2 61 0 0 0 2
3 4 11 15 9 11 5 0 0
0 1 0 0 0 2 3 4 11 1
5 9 11 5 0 0 0 1
1994 1 10 0 2 37 0 0 0 1
2 3 5 11 6 4 3 1 1
0 0 0 0 0 1 2 3 5 1
1 6 4 3 1 1 0 0
1995 1 10 0 2 19 0 0 0 0
0 2 3 5 2 5 1 1 0
0 0 0 0 0 0 0 2 3 5
2 5 1 1 0 0 0
1996 1 10 0 2 19 0 0 0 0
1 0 5 4 5 1 2 0 1
0 0 0 0 0 0 1 0 5 4
5 1 2 0 1 0 0
1997 1 10 0 2 31 0 0 0 0

```
      0       1       4       10      5       8       1       1       1
  0       0       0       0       0       0       0       1       4       1
0     5       8       1       1       1       0       0
1998    1       10      0       2       36      0       0       1       0
      1       3       7       11      2       9       2       0       0
  0       0       0       0       1       0       1       3       7       1
1     2       9       2       0       0       0       0
1999    1       10      0       2       79      0       0       0       4
      5       7       11      9       22      19      1       1       0
  0       0       0       0       0       4       5       7       11      9
        22      19      1       1       0       0       0
2000    1       10      0       2       36      0       0       0       1
      3       2       4       3       8       9       5       0       1
  0       0       0       0       0       1       3       2       4       3
        8       9       5       0       1       0       0
2001    1       10      0       2       161     0       0       0       3
      6       13      14      35      42      29      11      5       2
  1       0       0       0       0       3       6       13      14      3
5     42      29      11      5       2       1       0
2002    1       10      0       2       345     0       0       0       2
      11      32      51      64      84      72      22      6       0
  1       0       0       0       0       2       11      32      51      6
4     84      72      22      6       0       1       0
2003    1       10      0       2       229     0       0       0       0
      4       16      33      54      38      53      26      5       0
  0       0       0       0       0       0       4       16      33      5
4     38      53      26      5       0       0       0
2004    1       10      0       2       151     0       0       0       2
      0       5       12      38      44      41      8       1       0
  0       0       0       0       0       2       0       5       12      3
8     44      41      8       1       0       0       0
2005    1       10      0       2       220     0       0       0       0
      1       10      19      30      58      63      30      8       1
  0       0       0       0       0       0       1       10      19      3
0     58      63      30      8       1       0       0
2006    1       10      0       2       221     0       0       0       0
      3       8       15      35      54      61      38      5       1
  0       1       0       0       0       0       3       8       15      3
5     54      61      38      5       1       0       1
2007    1       10      0       2       301     0       0       0       1
      5       11      27      49      63      95      34      12      2
  1       1       0       0       0       1       5       11      27      4
```

```
9       63      95      34      12      2       1       1
2008    1       10      0       2       396     0       0       0       4
        9       18      29      37      93      117     68      17      2
  1       1       0       0       0       4       9       18      29      3
7       93      117     68      17      2       1       1
2009    1       10      0       2       286     0       0       0       2
        4       15      35      50      47      71      47      12      0
  0       3       0       0       0       2       4       15      35      5
0       47      71      47      12      0       0       3
2010    1       10      0       2       228     0       0       0       0
        0       10      23      43      42      55      43      11      1
  0       0       0       0       0       0       0       10      23      4
3       42      55      43      11      1       0       0
2011    1       10      0       2       273     0       0       0       0
        1       8       16      49      65      69      45      16      4
  0       0       0       0       0       0       1       8       16      4
9       65      69      45      16      4       0       0
2012    1       10      0       2       213     0       0       0       0
        1       2       11      31      33      65      48      15      5
  2       0       0       0       0       0       1       2       11      3
1       33      65      48      15      5       2       0
2013    1       10      0       2       202     0       0       0       0
        0       1       10      30      48      54      41      15      3
  0       0       0       0       0       0       0       1       10      3
0       48      54      41      15      3       0       0
2014    1       10      0       2       58      0       0       0       0
        1       1       4       7       9       15      13      6       2
  0       0       0       0       0       0       1       1       4       7
        9       15      13      6       2       0       0

## #Yr      Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm
# 24cm    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    4
# 2cm    44cm    46cm+   repeat  m20     m22     m24     m26     m28     m3
# 0     m32     m34     m36     m38     m40     m42     m44     m46
## 2004    -1      10      0       1       23      0       0       0
# 2       3       5       2       5       3       0       3       0       0
#         0       0       0       0       0       2       3       5       2
#       5       3       0       3       0       0       0       0
## 2014    -1      -10     0       1       23      0       0       0
# 2       3       5       2       5       3       0       3       0       0
#         0       0       0       0       0       2       3       5       2
#       5       3       0       3       0       0       0       0
```

```
###     Oregon  Rec,    North,  Private/Rental
###     initially       assigning       to      fleet:  11_OR_NorthernOR_Re
# c_PR
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
1980    1       11      0       2       2       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       1       1       0       0       0
1982    1       11      0       2       8       0       0       0       0
     0       0       0       0       2       2       2       2       0
 0       0       0       0       0       0       0       0       0       0
        2       2       2       2       0       0       0
1984    1       11      0       2       4       0       0       0       0
     0       0       1       1       0       0       0       1       1
 0       0       0       0       0       0       0       0       1       1
        0       0       0       1       1       0       0
1985    1       11      0       2       6       0       0       0       0
     0       0       1       1       2       1       1       0       0
 0       0       0       0       0       0       0       0       1       1
        2       1       1       0       0       0       0
1987    1       11      0       2       7       0       0       0       1
     0       0       0       0       1       1       1       2       1
 0       0       0       0       0       1       0       0       0       0
        1       1       1       2       1       0       0
1988    1       11      0       2       1       0       0       0       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
1989    1       11      0       2       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       1       0
1993    1       11      0       2       25      0       0       0       1
     0       0       7       6       5       1       5       0       0
 0       0       0       0       0       1       0       0       7       6
        5       1       5       0       0       0       0
1994    1       11      0       2       7       0       0       0       0
     0       0       1       2       2       0       1       1       0
 0       0       0       0       0       0       0       0       1       2
```

2 0 1 1 0 0 0
1996 1 11 0 2 2 0 0 0 0
0 0 0 0 1 1 0 0 0
0 0 0 0 0 0 0 0 0 0
1 1 0 0 0 0 0
1997 1 11 0 2 6 0 0 0 0
0 0 2 1 1 1 1 0 0
0 0 0 0 0 0 0 0 2 1
1 1 1 0 0 0 0
1998 1 11 0 2 10 0 0 0 0
0 0 2 2 4 1 1 0 0
0 0 0 0 0 0 0 0 2 2
4 1 1 0 0 0 0
1999 1 11 0 2 6 0 0 0 2
0 0 0 0 0 3 0 1 0
0 0 0 0 0 2 0 0 0 0
0 3 0 1 0 0 0
2000 1 11 0 2 4 0 0 0 0
0 0 0 0 1 3 0 0 0
0 0 0 0 0 0 0 0 0 0
1 3 0 0 0 0 0
2001 1 11 0 2 35 0 0 0 0
0 0 2 6 8 9 6 4 0
0 0 0 0 0 0 0 0 2 6
8 9 6 4 0 0 0
2002 1 11 0 2 26 0 0 0 0
0 0 3 9 3 7 3 1 0
0 0 0 0 0 0 0 0 3 9
3 7 3 1 0 0 0
2003 1 11 0 2 40 0 0 0 0
0 1 6 6 8 12 5 2 0
0 0 0 0 0 0 0 1 6 6
8 12 5 2 0 0 0
2004 1 11 0 2 20 0 0 0 0
0 0 1 5 7 2 5 0 0
0 0 0 0 0 0 0 0 1 5
7 2 5 0 0 0 0
2005 1 11 0 2 62 0 0 0 0
0 1 2 8 14 19 13 3 2
0 0 0 0 0 0 0 1 2 8
14 19 13 3 2 0 0
2006 1 11 0 2 51 0 0 0 0

```
      0       0       2       5       13      15      13      2       1
   0       0       0       0       0       0       0       0       2       5
        13      15      13      2       1       0       0
2007    1       11      0       2       69      0       0       0       2
      0       0       4       7       14      21      18      3       0
   0       0       0       0       0       2       0       0       4       7
        14      21      18      3       0       0       0
2008    1       11      0       2       123     0       0       1       0
      1       4       6       5       20      48      29      7       2
   0       0       0       0       1       0       1       4       6       5
        20      48      29      7       2       0       0
2009    1       11      0       2       92      0       0       0       0
      1       4       5       15      11      27      25      2       2
   0       0       0       0       0       0       1       4       5       1
5       11      27      25      2       2       0       0
2010    1       11      0       2       97      0       0       0       0
      0       1       8       9       20      24      23      9       3
   0       0       0       0       0       0       0       1       8       9
        20      24      23      9       3       0       0
2011    1       11      0       2       111     0       0       0       0
      0       1       8       13      20      23      32      13      1
   0       0       0       0       0       0       0       1       8       1
3       20      23      32      13      1       0       0
2012    1       11      0       2       124     0       0       0       0
      1       2       2       11      13      48      35      10      2
   0       0       0       0       0       0       1       2       2       1
1       13      48      35      10      2       0       0
2013    1       11      0       2       123     0       0       0       0
      0       0       2       17      24      37      33      10      0
   0       0       0       0       0       0       0       0       2       1
7       24      37      33      10      0       0       0
2014    1       11      0       2       29      0       0       0       0
      0       1       0       1       3       11      9       3       1
   0       0       0       0       0       0       0       1       0       1
        3       11      9       3       1       0       0

47 #_N_age_bins
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
2 #_N_ageerror_definitions
# Default ageing error matrix (1st row is expected age, 2nd is standard dev
# iation of age readings)
```

```
# Age 0 Age 1   Age 2   Age 3   Age 4   Age 5   Age 6   Age 7   Age 8   Age
#  9   Age 10  Age 11  Age 12  Age 13  Age 14  Age 15  Age 16  Age 17  Age
# 18  Age 19  Age 20  Age 21  Age 22  Age 23  Age 24  Age 25  Age 26  Age 2
# 7  Age 28  Age 29  Age 30  Age 31  Age 32  Age 33  Age 34  Age 35  Age 36
#   Age 37  Age 38  Age 39  Age 40  Age 41  Age 42  Age 43  Age 44  Age 45
#  Age 46  Age 47  Age 48  Age 49  Age 50  Age 51  Age 52  Age 53  Age 54
# Age 55  Age 56  Age 57  Age 58  Age 59  Age 60  Age 61  Age 62  Age 63  A
# ge 64  Age 65  Age 66  Age 67  Age 68  Age 69  Age 70  Age 71  Age 72  Ag
# e 73  Age 74  Age 75  Age 76  Age 77  Age 78  Age 79  Age 80  ### Age 81
#       Age 82  Age 83  Age 84  Age 85  Age 86  Age 87  Age 88  Age 89  Age
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5
     10.5    11.5    12.5    13.5    14.5    15.5    16.5    17.5    18.5
  19.5    20.5    21.5    22.5    23.5    24.5    25.5    26.5    27.5    2
8.5    29.5    30.5    31.5    32.5    33.5    34.5    35.5    36.5    37.5
    38.5    39.5    40.5    41.5    42.5    43.5    44.5    45.5    46.5
 47.5    48.5    49.5    50.5    51.5    52.5    53.5    54.5    55.5    56
.5    57.5    58.5    59.5    60.5    61.5    62.5    63.5    64.5    65.5
   66.5    67.5    68.5    69.5    70.5    71.5    72.5    73.5    74.5
75.5    76.5    77.5    78.5    79.5    80.5    ### 81.5        82.5    83.
# 5    84.5    85.5    86.5    87.5    88.5    89.5    90.5    #Expected_ag
0.0968  0.0968  0.1936  0.2904  0.3872  0.4840  0.5807  0.6775  0.7743  0.8
711  0.9679  1.0647  1.1615  1.2583  1.3551  1.4519  1.5487  1.6455  1.7422
  1.8390  1.9358  2.0326  2.1294  2.2262  2.3230  2.4198  2.5166  2.6134  2
.7102  2.8070  2.9037  3.0005  3.0973  3.1941  3.2909  3.3877  3.4845  3.58
13  3.6781  3.7749  3.8717  3.9684  4.0652  4.1620  4.2588  4.3556  4.4524
 4.5492  4.6460  4.7428  4.8396  4.9364  5.0332  5.1299  5.2267  5.3235  5.
4203  5.5171  5.6139  5.7107  5.8075  5.9043  6.0011  6.0979  6.1946  6.291
4  6.3882  6.4850  6.5818  6.6786  6.7754  6.8722  6.9690  7.0658  7.1626
7.2594  7.3561  7.4529  7.5497  7.6465  7.7433  ### 7.8401      7.9369  8.0
# 337  8.1305  8.2273  8.3241  8.4209  8.5176  8.6144  8.7112  #SD








                                                  ###
# Ageing error for ages associated with early years from former NWFSC age r
# eader (1st row is expected age, 2nd is standard deviation of age readings
# )
```

```
#
#
#
#
#
#                                                                  ###
# Age 0 Age 1   Age 2   Age 3   Age 4   Age 5   Age 6   Age 7   Age 8   Age
#  9   Age 10  Age 11  Age 12  Age 13  Age 14  Age 15  Age 16  Age 17  Age
# 18  Age 19  Age 20  Age 21  Age 22  Age 23  Age 24  Age 25  Age 26  Age 2
# 7  Age 28  Age 29  Age 30  Age 31  Age 32  Age 33  Age 34  Age 35  Age 36
#   Age 37  Age 38  Age 39  Age 40  Age 41  Age 42  Age 43  Age 44  Age 45
#  Age 46  Age 47  Age 48  Age 49  Age 50  Age 51  Age 52  Age 53  Age 54
# Age 55  Age 56  Age 57  Age 58  Age 59  Age 60  Age 61  Age 62  Age 63  A
# ge 64  Age 65  Age 66  Age 67  Age 68  Age 69  Age 70  Age 71  Age 72  Ag
# e 73  Age 74  Age 75  Age 76  Age 77  Age 78  Age 79  Age 80  ### Age 81
#      Age 82  Age 83  Age 84  Age 85  Age 86  Age 87  Age 88  Age 89  Age
0.43    1.29    2.16    3.02    3.88    4.75    5.61    6.47    7.33    8.2
0    9.06    9.92    10.79   11.65   12.51   13.37   14.24   15.10   15.96
  16.83   17.69   18.55   19.41   20.28   21.14   22.00   22.86   23.73   2
4.59   25.45   26.32   27.18   28.04   28.90   29.77   30.63   31.49   32.3
6   33.22   34.08   34.94   35.81   36.67   37.53   38.40   39.26   40.12
 40.98   41.85   42.71   43.57   44.44   45.30   46.16   47.02   47.89   48
.75   49.61   50.47   51.34   52.20   53.06   53.93   54.79   55.65   56.51
   57.38   58.24   59.10   59.97   60.83   61.69   62.55   63.42   64.28
65.14   66.01   66.87   67.73   68.59   69.46   ### 70.32      71.18   72.
# 05   72.91   73.77   74.63   75.50   76.36   77.22   78.09   #Expected_ag
0.0968  0.0968  0.1936  0.2904  0.3872  0.4840  0.5807  0.6775  0.7743  0.8
711  0.9679  1.0647  1.1615  1.2583  1.3551  1.4519  1.5487  1.6455  1.7422
  1.8390  1.9358  2.0326  2.1294  2.2262  2.3230  2.4198  2.5166  2.6134  2
.7102  2.8070  2.9037  3.0005  3.0973  3.1941  3.2909  3.3877  3.4845  3.58
13  3.6781  3.7749  3.8717  3.9684  4.0652  4.1620  4.2588  4.3556  4.4524
 4.5492  4.6460  4.7428  4.8396  4.9364  5.0332  5.1299  5.2267  5.3235  5.
4203  5.5171  5.6139  5.7107  5.8075  5.9043  6.0011  6.0979  6.1946  6.291
4  6.3882  6.4850  6.5818  6.6786  6.7754  6.8722  6.9690  7.0658  7.1626
7.2594  7.3561  7.4529  7.5497  7.6465  7.7433  ### 7.8401      7.9369  8.0
# 337  8.1305  8.2273  8.3241  8.4209  8.5176  8.6144  8.7112  #SD

#154 #_N_Agecomp_obs
186 #_N_Agecomp_obs
3 #_Lbin_method: 1=poplenbins; 2=datalenbins; 3=lengths
0 #_combine males into females at or below this bin number

```

```
### OR Comm, dead landings, expanded by catch (mainly southern OR, landed d
# ead); 17/1393 fish from "live" fishery dropped; is dead catch representat
# ive of live fishery?
### initially assigning to fleet: "5_OR_SouthernOR_Comm_Dead"
### negative fleet because these data are represented below as conditioned
# on length
#fishyr season  fleet   gender  part    ageErr  LbinLo  LbinHi  Nsamps  A4
#      A5      A6      A7      A8      A9      A10     A11     A12     A13
#     A14     A15     A16     A17     A18     A19     A20     A21     A22
#    A23     A24     A25     A26     A27     A28     A29     A30     A31
#   A32     A33     A34     A35     A36     A37     A38     A39     A40
#  A41     A42     A43     A44     A45     A46     A47     A48     A49
# A50     repeat
2001    1       -5      0       2       1       -1      -1      47      0
     0       0       0       1.29    3.04    4.66    1       1.07    2
  6.57    1.07    2.07    6.62    2.82    5.27    3.82    3.07    1.07    1
       1.07    0       1       1.29    0       1       1       0       1
    0       0       0       0       0       1.07    1.75    0       0
 0       0       0       0       0       0       0       0       3.12    0
      0       0       0       1.29    3.04    4.66    1       1.07    2
   6.57    1.07    2.07    6.62    2.82    5.27    3.82    3.07    1.07
1       1.07    0       1       1.29    0       1       1       0       1
     0       0       0       0       0       1.07    1.75    0       0
2002    1       -5      0       2       1       -1      -1      121     0
     0       0       2.01    4.23    11.34   9.14    6.12    1       9.32
  7.42    10.11   9.07    4       6.17    15.77   3.39    4.16    2.06    4
.24    2.21    2       0       1.06    0       3.54    0       1.3     0
    0       0       1       1.16    1.21    0       0       0       0
 0       0       0       1.01    0       0       0       0       3.03    0
      0       0       2.01    4.23    11.34   9.14    6.12    1       9.32
   7.42    10.11   9.07    4       6.17    15.77   3.39    4.16    2.06
4.24    2.21    2       0       1.06    0       3.54    0       1.3     0
     0       0       1       1.16    1.21    0       0       0       0
2003    1       -5      0       2       1       -1      -1      181     0
     0       0       0       0       10.58   19      20.27   15.74   13.46
  9.49    10.88   14.14   8.67    13.88   9.89    13.47   12.06   10.16   4
.27    4.82    7.15    1.37    1       1.35    3.89    0       1.35    1.22
    2       4.08    0       0       1.02    0       1       0       0
 2.05    1.05    0       0       0       0       0       0       3.76    0
      0       0       0       0       10.58   19      20.27   15.74   13.46
   9.49    10.88   14.14   8.67    13.88   9.89    13.47   12.06   10.16
4.27    4.82    7.15    1.37    1       1.35    3.89    0       1.35    1.2
```

```
2 2 4.08 0 0 1.02 0 1 0 0
2004 1 -5 0 2 1 -1 -1 55 0
0 0 0 0 1.01 4.09 7.18 7.12 3
0 6.52 2 2 1.02 1.02 4.02 4.08 1 4
.08 3.03 0 0 0 0 2.02 1 0 1
1 0 0 0 0 0 0 0 0
0 0 0 1.02 0 0 0 0 0 0
0 0 0 0 1.01 4.09 7.18 7.12 3
0 6.52 2 2 1.02 1.02 4.02 4.08 1
4.08 3.03 0 0 0 0 2.02 1 0 1
1 0 0 0 0 0 0 0 0
2005 1 -5 0 2 1 -1 -1 14 0
0 0 1 0 0 0 1 0 1
1 0 1.64 0 0 3 0 0 0 1
0 1 0 1.64 0 0 0 0 0
0 0 0 1.6 0 0 1 0 0
0 0 0 0 0 0 0 0 1.6 0
0 0 1 0 0 0 1 0 1
1 0 1.64 0 0 3 0 0 0
1 0 1 0 1.64 0 0 0 0 0
0 0 0 1.6 0 0 1 0 0
2006 1 -5 0 2 1 -1 -1 29 0
0 0 0 0 0 0 4.88 2.88 4.88
2.75 2 2.14 0 1.75 0 1 1 0 3
.5 1 4.92 0 0 1 0 0 1.74 1
0 0 0 0 0 0 1.42 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 4.88 2.88 4.88
2.75 2 2.14 0 1.75 0 1 1 0
3.5 1 4.92 0 0 1 0 0 1.74 1
0 0 0 0 0 0 1.42 0 0
2007 1 -5 0 2 1 -1 -1 40 0
0 0 0 0 0 0 0 5.55 4.07
5.27 5.78 1.52 1.75 2 4.03 1.52 3.52 4.55 1
.75 1.52 1 3.03 1.4 0 0 1.52 0 0
0 0 0 1 0 0 0 0 0
0 0 1.52 0 0 0 0 0 2.52 0
0 0 0 0 0 0 0 5.55 4.07
5.27 5.78 1.52 1.75 2 4.03 1.52 3.52 4.55
1.75 1.52 1 3.03 1.4 0 0 1.52 0 0
0 0 0 1 0 0 0 0 0
2008 1 -5 0 2 1 -1 -1 26 0
```

```
0 0 0 0 1 0 0 0 5.27
1 2 2 0 1 0 2 0 1.12 3
.02 1.02 2.05 1.05 0 1.02 2 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1.27 0
0 0 0 0 1 0 0 0 5.27
1 2 2 0 1 0 2 0 1.12
3.02 1.02 2.05 1.05 0 1.02 2 0 0 0
0 0 0 0 0 0 0 0 0
2009 1 -5 0 2 1 -1 -1 79 0
0 0 0 2.13 2.12 3.33 4.1 2 3.02
4.77 9.77 5.03 8.19 1 3.02 3 1 3.75 3
.77 7.1 4.02 1.75 3.05 3.18 1 1 1.11 1
0 1 0 0 0 0 0 0 0
0 0 0 1.75 0 0 0 0 2.75 0
0 0 0 2.13 2.12 3.33 4.1 2 3.02
4.77 9.77 5.03 8.19 1 3.02 3 1 3.75
3.77 7.1 4.02 1.75 3.05 3.18 1 1 1.11 1
0 1 0 0 0 0 0 0 0
2010 1 -5 0 2 1 -1 -1 65 0
0 0 0 0 0 1 5.12 1.75 3.05
5.8 5.26 4.23 5 3.02 1 3 1.2 0 0
2 2 3 5 2 3 2.05 1 3.05
2.32 0 1.54 0 0 1 0 0 0
0 0 0 0 0 0 0 0 1 0
0 0 0 0 0 1 5.12 1.75 3.05
5.8 5.26 4.23 5 3.02 1 3 1.2 0
0 2 2 3 5 2 3 2.05 1 3.0
5 2.32 0 1.54 0 0 1 0 0 0
2011 1 -5 0 2 1 -1 -1 307 0
0 0 1 1 5 3.21 7.49 27.48 7.08
10.89 8.04 17.17 21.74 29.1 24.18 18.03 6.75 9.17 8
.5 10.12 10.45 13.78 15.57 14.23 5.05 6.05 5.04 5.11
3.35 4.04 1 2 2 1 0 2.03 2
1.03 1 1 1 2 0 0 0 6.5 0
0 0 1 1 5 3.21 7.49 27.48 7.08
10.89 8.04 17.17 21.74 29.1 24.18 18.03 6.75 9.17
8.5 10.12 10.45 13.78 15.57 14.23 5.05 6.05 5.04 5.1
1 3.35 4.04 1 2 2 1 0 2.03 2
2012 1 -5 0 2 1 -1 -1 152 0
0 0 0 2 4.02 4 7.15 6.09 8.39
2.1 3.03 5.02 4.16 6.91 16.04 10.09 4.14 6.3 5
```

```
      2       4.24    8.26    3.06    9.19    4       9.28    2       5
   3       1       1       2       0       0       0       2       0
 2.16    0       0       2       0       0       0       1       1       0
      0       0       0       2       4.02    4       7.15    6.09    8.39
   2.1     3.03    5.02    4.16    6.91    16.04   10.09   4.14    6.3
5       2       4.24    8.26    3.06    9.19    4       9.28    2       5
   3       1       1       2       0       0       0       2       0
2013    1       -5      0       2       1       -1      -1      260     0
     0       0       0       4.02    2.11    12.32   5.22    4.03    4
  23.32   10.12   3.03    14.93   13.45   19.32   11.33   17.29   11.31   1
1.11    7.09    5.77    9.08    8.2     9.23    3.19    13.18   10.14   9.04
    3.02    3.01    5.3     2.75    1       0       2       0       0
 1       1.02    0       2.06    0       0       0       0       4.25    0
      0       0       0       4.02    2.11    12.32   5.22    4.03    4
   23.32   10.12   3.03    14.93   13.45   19.32   11.33   17.29   11.31
11.11   7.09    5.77    9.08    8.2     9.23    3.19    13.18   10.14   9.0
4    3.02    3.01    5.3     2.75    1       0       2       0       0

### OR Rec South, 2005-2013, all modes combined,no BARSS
### initially assigning to fleet: "7_OR_SouthernOR_Rec_PC"
### negative fleet because these data are represented below as conditioned
# on length
#fishyr season  fleet   gender  part    ageErr  LbinLo  LbinHi  Nsamps  A4
#      A5      A6      A7      A8      A9      A10     A11     A12     A13
#     A14     A15     A16     A17     A18     A19     A20     A21     A22
#    A23     A24     A25     A26     A27     A28     A29     A30     A31
#   A32     A33     A34     A35     A36     A37     A38     A39     A40
#  A41     A42     A43     A44     A45     A46     A47     A48     A49
# A50     repeat
2005    1       -7      0       2       1       -1      -1      32      0
     0       0       0       1       1       3       2       5       0
  3       3       3       1       0       2       2       1       1       1
       1       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       1       1       3       2       5       0
   3       3       3       1       0       2       2       1       1
1       1       1       0       0       0       0       0       0       0
     0       0       0       0       1       0       0       0       0
2006    1       -7      0       2       1       -1      -1      32      0
     0       0       1       1       0       0       0       0       4
  3       2       2       4       4       0       1       1       2       1
```

1 1 1 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 1 1 0 0 0 0 4
3 2 2 4 4 0 1 1 2
1 1 1 1 0 1 0 1 0 1
0 0 0 0 0 0 0 0 0
2007 1 -7 0 2 1 -1 -1 37 0
0 0 1 0 0 3 1 0 1
3 2 2 0 4 1 1 3 0 3
2 2 3 3 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 1 0 0 3 1 0 1
3 2 2 0 4 1 1 3 0
3 2 2 3 3 1 0 0 0 0
1 0 0 0 0 0 0 0 0
2008 1 -7 0 2 1 -1 -1 31 0
0 0 0 1 2 0 1 2 5
3 3 0 3 0 1 2 0 1 1
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 1 0
0 0 0 1 2 0 1 2 5
3 3 0 3 0 1 2 0 1
1 1 1 0 1 1 0 0 0 0
1 0 0 0 0 0 0 0 0
2009 1 -7 0 2 1 -1 -1 23 0
0 0 0 0 0 0 1 1 0
2 3 4 4 1 1 1 0 0 0
1 0 0 0 3 1 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 1 0
2 3 4 4 1 1 1 0 0
0 1 0 0 0 3 1 0 0 0
0 0 0 0 0 0 0 0 0
2010 1 -7 0 2 1 -1 -1 37 0
0 0 1 0 0 0 0 1 0
0 1 3 3 3 4 2 1 0 0
2 1 1 2 3 2 0 1 0
1 1 0 1 0 0 1 1 1

```
0 0 0 0 0 0 0 0 0 0
0 0 1 0 0 0 0 1 0
0 1 3 3 3 4 2 1 0
0 2 1 1 2 3 2 0 1 0
1 1 0 1 0 0 1 1 1
2011 1 -7 0 2 1 -1 -1 75 0
0 0 0 2 3 2 1 6 3
3 0 1 4 4 9 3 3 1 5
2 3 1 3 2 3 1 0 2
1 2 1 0 0 1 0 0 1
0 0 0 1 0 0 1 0 0 0
0 0 0 2 3 2 1 6 3
3 0 1 4 4 9 3 3 1
5 2 3 1 3 2 3 1 0 2
1 2 1 0 0 1 0 0 1
2012 1 -7 0 2 1 -1 -1 27 0
0 0 0 2 1 0 1 0 1
1 1 0 3 1 4 1 0 0 0
0 2 2 1 1 1 1 0 2
0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 2 1 0 1 0 1
1 1 0 3 1 4 1 0 0
0 0 2 2 1 1 1 1 0 2
0 0 1 0 0 0 0 0 0
2013 1 -7 0 2 1 -1 -1 65 0
0 0 1 0 0 2 2 2 0
1 4 1 5 6 3 3 2 6 1
2 3 3 3 1 2 2 0 0
3 0 1 1 1 0 0 2 0
0 0 1 0 0 0 1 0 0 0
0 0 1 0 0 2 2 2 0
1 4 1 5 6 3 3 2 6
1 2 3 3 3 1 2 2 0 0
3 0 1 1 1 0 0 2 0

### OR Rec North, 2002-2013, all modes combined, no BARSS
### initially assigning to fleet: "10_OR_NorthernOR_Rec_PC"
#fishyr season  fleet   gender  part    ageErr  LbinLo  LbinHi  Nsamps  A4
#      A5      A6      A7      A8      A9      A10     A11     A12     A13
#     A14     A15     A16     A17     A18     A19     A20     A21     A22
#    A23     A24     A25     A26     A27     A28     A29     A30     A31
```

```
#   A32     A33     A34     A35     A36     A37     A38     A39     A40
#  A41     A42     A43     A44     A45     A46     A47     A48     A49
# A50     repeat
2005    1       10      0       2       1       -1      -1      23      0
     0       0       1       0       2       3       1       1       1
  3       0       2       2       0       2       0       0       1       1
       0       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       1       0       2       3       1       1       1
   3       0       2       2       0       2       0       0       1
1       0       2       1       0       0       0       0       0       0
     0       0       0       0       0       0       0       0       0
2006    1       10      0       2       1       -1      -1      28      0
     0       0       1       1       1       2       2       5       3
  1       0       2       0       0       0       2       2       0       1
       2       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       1       1       1       2       2       5       3
   1       0       2       0       0       0       2       2       0
1       2       0       0       0       0       0       1       1       0
     0       0       0       0       0       0       0       0       1
2007    1       10      0       2       1       -1      -1      23      0
     1       0       0       0       0       1       5       2       4
  1       4       0       1       0       1       1       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
      1       0       0       0       0       1       5       2       4
   1       4       0       1       0       1       1       1       0
0       0       0       0       0       0       1       0       0       0
     0       0       0       0       0       0       0       0       0
2008    1       10      0       2       1       -1      -1      29      0
     0       0       2       6       0       0       2       2       2
  1       3       0       1       0       0       0       1       2       0
       2       2       0       0       0       0       1       0       0
    0       0       1       0       0       1       0       0       0
 0       0       0       0       0       0       0       0       0       0
      0       0       2       6       0       0       2       2       2
   1       3       0       1       0       0       0       1       2
0       2       2       0       0       0       0       1       0       0
```

0 0 1 0 0 1 0 0 0
2009 1 10 0 2 1 −1 −1 39 0
0 2 3 6 6 1 0 1 2
2 5 3 1 0 0 1 1 1 0
0 0 0 1 0 2 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0
0 2 3 6 6 1 0 1 2
2 5 3 1 0 0 1 1 1
0 0 0 0 1 0 2 0 0 0
0 0 0 0 0 0 0 0 0
2010 1 10 0 2 1 −1 −1 23 0
0 0 2 1 2 1 2 2 0
0 1 3 1 0 0 0 0 2 0
2 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 0 2 1 2 1 2 2 0
0 1 3 1 0 0 0 0 2
0 2 1 0 1 1 0 0 0 0
1 0 0 0 0 0 0 0 0
2011 1 10 0 2 1 −1 −1 161 0
1 0 3 11 17 17 10 13 3
4 3 8 4 12 5 5 2 3 2
3 1 4 2 2 3 1 5 5
2 1 0 3 1 0 0 0 0
1 0 2 0 0 1 0 0 1 0
1 0 3 11 17 17 10 13 3
4 3 8 4 12 5 5 2 3
2 3 1 4 2 2 3 1 5 5
2 1 0 3 1 0 0 0 0
2012 1 10 0 2 1 −1 −1 33 0
0 0 0 3 3 9 2 0 3
0 0 1 2 2 0 2 0 1 0
0 0 1 0 1 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 3 3 9 2 0 3
0 0 1 2 2 0 2 0 1
0 0 0 1 0 1 1 1 0 0
1 0 0 0 0 0 0 0 0
2013 1 10 0 2 1 −1 −1 81 0

```
      1        0        0        3        3        8       12        3        4
   8        1        1        3        3        3        3        2        3        2
        3        3        2        1        0        2        1        2        1
     0        0        0        1        0        0        1        0        0
 0        0        0        0        0        0        0        0        1        0
       1        0        0        3        3        8       12        3        4
    8        1        1        3        3        3        3        2        3
2        3        3        2        1        0        2        1        2        1
      0        0        0        1        0        0        1        0        0

### WA Rec, South, All modes combined
### initially assigning to fleet: "12_WA_SouthernWA_Rec_PCPR"
#Yr     Seas    Flt/Svy Gender  Part    AgeError        LbinLo  LbinHi  Nsa
# mp   4yrs    5yrs    6yrs    7yrs    8yrs    9yrs    10yrs   11yrs   12yr
# s   13yrs   14yrs   15yrs   16yrs   17yrs   18yrs   19yrs   20yrs   21yrs
#    22yrs   23yrs   24yrs   25yrs   26yrs   27yrs   28yrs   29yrs   30yrs
#   31yrs   32yrs   33yrs   34yrs   35yrs   36yrs   37yrs   38yrs   39yrs
#  40yrs   41yrs   42yrs   43yrs   44yrs   45yrs   46yrs   47yrs   48yrs
# 49yrs   50+yrs  repeat
-2014    1       -12      0        2        1       -1       -1       15       0
       0        0        0        1        0        0        0        0        0
    0        0        0        1        1        1        0        0        0
 1        1        0        0        1        1        1        2        0        0
      0        0        1        0        1        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        1        1        1        0        0        0
  1        1        0        0        1        1        1        2        0        0
       0        0        1        0        1        0        0        0        0


##### conditional age-at-length observations

### OR commercial dead, South
### initially assigning to fleet: "5_OR_SouthernOR_Comm_Dead"
#Yr     Seas    Flt/Svy Gender  Part    AgeErr  LbinLo  LbinHi  Nsamp   4yr
# s    5yrs    6yrs    7yrs    8yrs    9yrs    10yrs   11yrs   12yrs   13yr
# s   14yrs   15yrs   16yrs   17yrs   18yrs   19yrs   20yrs   21yrs   22yrs
#    23yrs   24yrs   25yrs   26yrs   27yrs   28yrs   29yrs   30yrs   31yrs
#   32yrs   33yrs   34yrs   35yrs   36yrs   37yrs   38yrs   39yrs   40yrs
#  41yrs   42yrs   43yrs   44yrs   45yrs   46yrs   47yrs   48yrs   49yrs
# 50yrs   repeat
```

```
2001 1 5 0 2 1 28 28 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 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
2001 1 5 0 2 1 30 30 7 0
0 0 0 0 2 0 0 0 0
2 0 0 1 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 2 0 0 0 0
2 0 0 1 0 1 1 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2001 1 5 0 2 1 32 32 9 0
0 0 0 0 0 2 0 1 1
2 0 0 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 2 0 1 1
2 0 0 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
2001 1 5 0 2 1 34 34 12 0
0 0 0 0 0 2 1 0 1
1 1 2 0 0 1 1 0 0 0
0 0 1 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 2 1 0 1
1 1 2 0 0 1 1 0 0
0 0 0 1 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2001 1 5 0 2 1 36 36 11 0
0 0 0 0 0 0 0 0 0
```

```
0 0 0 3 0 2 0 1 1 0
0 0 0 0 0 0 0 0 1
0 0 0 0 0 1 1 0 0
0 0 0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0 0
0 0 0 3 0 2 0 1 1
0 0 0 0 0 0 0 0 0 1
0 0 0 0 0 1 1 0 0
2001 1 5 0 2 1 38 38 4 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 2 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 2 0
1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2001 1 5 0 2 1 40 40 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 1 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 0 0 0 0 1 1 0 0
0 0 0 0 0 0 0 0 0
2002 1 5 0 2 1 30 30 17 0
0 0 1 1 3 3 1 0 1
2 2 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 1 1 3 3 1 0 1
2 2 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
2002 1 5 0 2 1 32 32 37 0
0 0 0 0 6 4 2 0 3
3 2 4 0 3 3 2 0 0 1
1 0 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 6 4 2 0 3
3 2 4 0 3 3 2 0 0
1 1 0 0 0 0 2 0 0 0
0 0 0 0 1 0 0 0 0
2002 1 5 0 2 1 34 34 31 0
0 0 0 3 1 1 3 1 4
0 3 1 0 3 5 0 3 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 3 1 1 3 1 4
0 3 1 0 3 5 0 3 1
1 0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2002 1 5 0 2 1 36 36 21 0
0 0 1 0 0 1 0 0 1
2 1 2 2 0 5 1 0 0 2
1 0 0 0 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 1 0 0 1 0 0 1
2 1 2 2 0 5 1 0 0
2 1 0 0 0 0 1 0 1 0
0 0 0 0 0 0 0 0 0
2002 1 5 0 2 1 38 38 12 0
0 0 0 0 0 0 0 0 0
0 2 0 1 0 2 0 1 1 0
0 1 0 0 0 0 0 0 0
0 0 1 1 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 2 0 1 0 2 0 1 1
0 0 1 0 0 0 0 0 0 0
0 0 1 1 0 0 0 0 0
2002 1 5 0 2 1 40 40 3 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 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 0
0 0 0 0 0 0 0 0 0
2003 1 5 0 2 1 28 28 2 0
0 0 0 0 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
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2003 1 5 0 2 1 30 30 20 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 3 3 4 2 2
1 0 1 2 0 1 1 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2003 1 5 0 2 1 32 32 48 0
0 0 0 0 2 9 6 6 4
0 2 2 1 2 2 3 0 2 2
2 0 0 0 0 1 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 2 9 6 6 4
0 2 2 1 2 2 3 0 2
2 2 0 0 0 0 1 0 0 0
0 2 0 0 0 0 0 0 0
2003 1 5 0 2 1 34 34 48 0
0 0 0 0 1 2 3 2 2
3 5 5 3 5 3 3 6 1 1
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 1 2 3 2 2
3 5 5 3 5 3 3 6 1

1 0 2 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0
2003 1 5 0 2 1 36 36 39 0
0 0 0 0 1 0 2 1 2
2 2 3 1 0 1 3 4 3 0
1 3 1 1 1 2 0 1 1
2 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 2 1 2
2 2 3 1 0 1 3 4 3
0 1 3 1 1 1 2 0 1 1
2 0 0 0 0 0 1 0 0
2003 1 5 0 2 1 38 38 17 0
0 0 0 0 1 0 0 0 1
1 0 1 0 3 0 2 1 3 1
1 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
0 0 0 0 1 0 0 0 1
1 0 1 0 3 0 2 1 3
1 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2003 1 5 0 2 1 40 40 7 0
0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0 0
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 0 3 0
0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0
0 0 1 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0 0
2004 1 5 0 2 1 30 30 10 0
0 0 0 0 1 2 1 2 2
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 1 2 1 2 2
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

```
2004 1 5 0 2 1 32 32 13 0
0 0 0 0 0 1 3 3 1
0 2 0 0 0 0 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 1 0 0 0 0 0 0
0 0 0 0 0 1 3 3 1
0 2 0 0 0 0 0 1 0
1 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2004 1 5 0 2 1 34 34 17 0
0 0 0 0 0 0 2 2 0
0 1 1 2 1 1 2 1 1 0
1 0 0 0 0 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 2 2 0
0 1 1 2 1 1 2 1 1
0 1 0 0 0 0 1 0 0 0
1 0 0 0 0 0 0 0 0
2004 1 5 0 2 1 36 36 9 0
0 0 0 0 0 0 0 0 0
0 1 0 0 0 0 1 0 0 3
2 0 0 0 0 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 1 0 0 0 0 1 0 0
3 2 0 0 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0
2004 1 5 0 2 1 38 38 6 0
0 0 0 0 0 1 1 0 0
0 0 1 0 0 0 1 1 0 0
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0 0 0 0 0 0 0 0 0 0
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0 0 1 0 0 0 1 1 0
0 0 0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0
2004 1 5 0 2 1 40 40 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 1 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2005 1 5 0 2 1 30 30 2 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
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
2005 1 5 0 2 1 32 32 2 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 0 0 0 0 0 0 0 0
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2005 1 5 0 2 1 34 34 3 0
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0 0 0 0 0 0 0 0 0 0
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2005 1 5 0 2 1 36 36 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 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
2005 1 5 0 2 1 38 38 4 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 2 0 0 0 1
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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 2 0 0 0
1 0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0
2005 1 5 0 2 1 40 40 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 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 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2006 1 5 0 2 1 30 30 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 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
2006 1 5 0 2 1 32 32 8 0
0 0 0 0 0 0 2 0 3
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 2 0 3
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
2006 1 5 0 2 1 34 34 10 0
0 0 0 0 0 0 2 1 1
1 0 1 0 1 0 0 0 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 2 1 1
1 0 1 0 1 0 0 0 0
1 1 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2006 1 5 0 2 1 36 36 6 0
0 0 0 0 0 0 0 0 0
0 1 1 0 0 0 1 1 0 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 1 1 0 0 0 1 1 0
1 0 0 0 0 0 0 0 0 1
0 0 0 0 0 0 0 0 0
2006 1 5 0 2 1 38 38 4 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 1 0
0 0 0 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 1 0 0
2007 1 5 0 2 1 30 30 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 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
2007 1 5 0 2 1 32 32 10 0
0 0 0 0 0 0 0 3 1
1 1 0 0 0 2 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
0 0 0 0 0 0 0 3 1
1 1 0 0 0 2 0 1 0
0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0
2007 1 5 0 2 1 34 34 11 0
0 0 0 0 0 0 0 1 1
1 1 0 0 1 0 0 0 2 1
1 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 1 1
1 1 0 0 1 0 0 0 2
1 1 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2007 1 5 0 2 1 36 36 10 0
0 0 0 0 0 0 0 0 1
1 1 1 0 1 0 0 1 1 0
0 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 1
1 1 1 0 1 0 0 1 1
0 0 1 1 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0
2007 1 5 0 2 1 38 38 5 0
0 0 0 0 0 0 0 0 0
1 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
1 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

```
2007 1 5 0 2 1 40 40 2 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 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 1 0 0 0 0 0
 0 0 0 0 0 0 0 0 0
# change Lbin_lo and Lbin_hi for next line from 54
# to 48 (length bin plus group is 48+)
2007 1 5 0 2 1 48 48 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 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
2008 1 5 0 2 1 30 30 2 0
 0 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 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
2008 1 5 0 2 1 32 32 5 0
 0 0 0 0 0 0 0 0 2
 0 1 1 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 2
 0 1 1 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
```

```
2008 1 5 0 2 1 34 34 9 0
0 0 0 0 0 0 0 0 3
1 1 0 0 1 0 1 0 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 3
1 1 0 0 1 0 1 0 0
1 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2008 1 5 0 2 1 36 36 4 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 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 1 0 0 0 0 0 0
0 1 0 0 0 0 2 0 0 0
0 0 0 0 0 0 0 0 0
2008 1 5 0 2 1 38 38 3 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0 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 1 0 0
1 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2008 1 5 0 2 1 40 40 3 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 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 1 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0
2009 1 5 0 2 1 30 30 6 0
0 0 0 2 1 0 0 0 0
```

1 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 2 1 0 0 0 0
1 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
2009 1 5 0 2 1 32 32 20 0
0 0 0 0 1 2 1 2 2
1 3 1 2 1 0 1 0 1 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 1 2 1 2 2
1 3 1 2 1 0 1 0 1
0 1 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2009 1 5 0 2 1 34 34 23 0
0 0 0 0 0 1 3 0 0
1 2 2 4 0 0 1 0 1 2
3 0 1 0 0 1 1 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 1 3 0 0
1 2 2 4 0 0 1 0 1
2 3 0 1 0 0 1 1 0 0
0 0 0 0 0 0 0 0 0
2009 1 5 0 2 1 36 36 14 0
0 0 0 0 0 0 0 0 1
1 2 1 0 0 1 0 0 0 0
1 1 0 2 0 0 0 1 1
0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 1 0 0
0 0 0 0 0 0 0 0 1
1 2 1 0 0 1 0 0 0
0 1 1 0 2 0 0 0 1 1
0 0 0 0 0 0 0 0 0
2009 1 5 0 2 1 38 38 10 0
0 0 0 0 0 0 0 0 0
0 1 0 0 0 2 1 0 0 1
1 0 0 1 2 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 1 0 0 0 2 1 0 0
1 1 0 0 1 2 0 0 0 0
0 1 0 0 0 0 0 0 0
2009 1 5 0 2 1 40 40 3 0
0 0 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0 0 0
0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0
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0 1 0 0 0 0 0 0 0
0 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2009 1 5 0 2 1 42 42 3 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 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 1 1
0 0 1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2010 1 5 0 2 1 30 30 2 0
0 0 0 0 0 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 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
2010 1 5 0 2 1 32 32 13 0
0 0 0 0 0 0 3 1 1
3 1 1 0 0 0 0 1 0 0
0 0 0 0 0 1 1 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0

```
0 0 0 0 0 0 3 1 1
3 1 1 0 0 0 0 1 0
0 0 0 0 0 0 1 1 0 0
0 0 0 0 0 0 0 0 0
2010 1 5 0 2 1 34 34 17 0
0 0 0 0 0 1 0 0 1
0 1 2 4 1 0 2 0 0 0
1 0 1 0 0 0 1 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 1 0 0 1
0 1 2 4 1 0 2 0 0
0 1 0 1 0 0 0 1 0 1
0 0 0 0 0 0 0 0 0
2010 1 5 0 2 1 36 36 21 0
0 0 0 0 0 0 1 0 0
2 2 1 0 1 1 1 0 0 0
0 2 1 4 2 0 0 1 1
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
2 2 1 0 1 1 1 0 0
0 0 2 1 4 2 0 0 1 1
0 0 0 0 0 1 0 0 0
2010 1 5 0 2 1 38 38 7 0
0 0 0 0 0 0 0 0 0
0 1 0 1 1 0 0 0 0 0
1 0 0 1 0 0 0 0 0
1 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
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0 1 0 0 1 0 0 0 0 0
1 0 1 0 0 0 0 0 0
2010 1 5 0 2 1 40 40 5 0
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0 0 1 0 0 2 0 0 1
1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
```

0 0 0 1 0 0 2 0 0 1
1 0 0 0 0 0 0 0 0
2011 1 5 0 2 1 30 30 21 0
0 0 0 1 2 2 1 6 0
2 0 1 3 0 0 1 0 0 1
0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 1 2 2 1 6 0
2 0 1 3 0 0 1 0 0
1 0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2011 1 5 0 2 1 32 32 46 0
0 0 1 0 3 0 3 9 1
2 3 1 5 4 2 1 0 1 2
1 0 1 4 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 1 0 3 0 3 9 1
2 3 1 5 4 2 1 0 1
2 1 0 1 4 1 0 0 0 0
1 0 0 0 0 0 0 0 0
2011 1 5 0 2 1 34 34 84 0
0 0 0 0 0 1 3 8 1
2 2 9 6 10 6 4 2 6 2
3 2 3 2 2 2 2 1 0
0 0 0 2 0 0 0 1 0
0 0 1 0 1 0 0 0 0 0
0 0 0 0 0 1 3 8 1
2 2 9 6 10 6 4 2 6
2 3 2 3 2 2 2 2 1 0
0 0 0 2 0 0 0 1 0
2011 1 5 0 2 1 36 36 93 0
0 0 0 0 0 0 0 4 3
2 2 4 4 10 10 6 3 1 2
4 5 5 4 7 2 3 2 2
1 2 1 0 0 1 0 1 0
0 0 0 1 1 0 0 0 0 0
0 0 0 0 0 0 0 4 3
2 2 4 4 10 10 6 3 1
2 4 5 5 4 7 2 3 2 2
1 2 1 0 0 1 0 1 0

```
2011 1 5 0 2 1 38 38 43 0
0 0 0 0 0 0 0 0 1
2 1 1 3 2 3 4 1 1 1
2 2 3 3 2 0 1 1 3
1 2 0 0 1 0 0 0 2
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1
2 1 1 3 2 3 4 1 1
1 2 2 3 3 2 0 1 1 3
1 2 0 0 1 0 0 0 2
2011 1 5 0 2 1 40 40 15 0
0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0 0
0 1 0 1 2 1 1 1 0
0 0 0 0 1 0 0 0 0
1 1 0 0 0 0 0 0 3 0
0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 1 0 0
0 0 1 0 1 2 1 1 1 0
0 0 0 0 1 0 0 0 0
2011 1 5 0 2 1 42 42 4 0
0 0 0 0 0 0 0 0 0
0 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 2 0
0 0 0 0 0 0 0 0 0
0 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
2011 1 5 0 2 1 46 46 2 0
0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2012 1 5 0 2 1 26 26 1 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 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
2012 1 5 0 2 1 28 28 2 0
0 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 0 0
0 0 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 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
2012 1 5 0 2 1 30 30 8 0
0 0 0 0 1 1 4 2 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 1 1 4 2 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2012 1 5 0 2 1 32 32 21 0
0 0 0 1 1 2 2 2 3
0 1 0 2 0 2 1 0 1 0
0 1 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 0
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0 0 0 1 1 2 2 2 3
0 1 0 2 0 2 1 0 1
0 0 1 0 1 0 1 0 0 0
0 0 0 0 0 0 0 0 0
2012 1 5 0 2 1 34 34 29 0
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  1    0    0    0    0    0    0    0    0
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0    0    0    0    0    0    0    0    0    0
   1    0    0    0    0    0    0    0    0

### OR rec private, South
#Yr     Seas    Flt/Svy Gender  Part    AgeErr  LbinLo  LbinHi  Nsamp   4yr
# s    5yrs    6yrs    7yrs    8yrs    9yrs    10yrs   11yrs   12yrs   13yr
# s   14yrs   15yrs   16yrs   17yrs   18yrs   19yrs   20yrs   21yrs   22yrs
#    23yrs   24yrs   25yrs   26yrs   27yrs   28yrs   29yrs   30yrs   31yrs
#   32yrs   33yrs   34yrs   35yrs   36yrs   37yrs   38yrs   39yrs   40yrs
#  41yrs   42yrs   43yrs   44yrs   45yrs   46yrs   47yrs   48yrs   49yrs
# 50yrs   repeat
2005   1    7    0    2    1    30   30   1    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    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
2005   1    7    0    2    1    32   32   3    0
   0    0    0    1    0    1    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    1    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
2005   1    7    0    2    1    34   34   8    0
   0    0    0    0    0    2    1    2    0
 1    0    1    0    0    0    1    0    0    0
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0 0 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 1 0 0
0 0 0 0 0 1 0 0 0 0
0 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 1 0 0
0 0 0 0 0 1 0 0 0
0 0 1 1 0 0 0 1 0 0
0 0 0 0 0 0 0 0 0
2012 1 7 0 2 1 38 38 12 0
0 0 0 0 0 0 0 0 1
1 1 0 1 1 2 1 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 0 1
1 1 0 1 1 2 1 0 0
0 0 0 0 1 1 0 0 0 2
0 0 0 0 0 0 0 0 0
2012 1 7 0 2 1 40 40 2 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 0 0 0 0 0 0 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 0 0 0 0 0 0 0 0
2012 1 7 0 2 1 42 42 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 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 1 0 0 0 0 0 0
2013 1 7 0 2 1 24 24 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 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
2013 1 7 0 2 1 30 30 2 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 1 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 1 0
2013 1 7 0 2 1 32 32 3 0
0 0 0 0 0 0 0 1 0
0 1 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 1 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
2013 1 7 0 2 1 34 34 20 0
0 0 0 0 0 2 2 0 0
0 2 0 2 0 2 0 1 3 0
1 0 0 1 1 1 0 0 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 2 2 0 0
0 2 0 2 0 2 0 1 3
0 1 0 0 1 1 1 0 0 0
1 0 1 0 0 0 0 0 0
2013 1 7 0 2 1 36 36 23 0

```
0 0 0 0 0 0 0 0 0
1 1 1 2 3 1 1 0 2 1
1 2 2 1 0 0 2 0 0
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
1 1 1 2 3 1 1 0 2
1 1 2 2 1 0 0 2 0 0
1 0 0 0 1 0 0 0 0
2013 1 7 0 2 1 38 38 13 0
0 0 0 0 0 0 0 0 0
0 0 0 0 3 0 1 1 1 0
0 1 0 0 0 1 0 0 0
1 0 0 1 0 0 0 1 0
0 0 1 0 0 0 1 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 3 0 1 1 1
0 0 1 0 0 0 1 0 0 0
1 0 0 1 0 0 0 1 0
2013 1 7 0 2 1 40 40 2 0
0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0 0
0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0
0 0 0 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0
2013 1 7 0 2 1 42 42 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 0 0 0
0 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 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)
# 1971 1 1 3 0 1 2 29.8931 40.6872 44.7411 50.027 52.5794 56.1489 57.1033 6
# 1.1728 61.7417 63.368 64.4088 65.6889 67.616 68.5972 69.9177 71.0443 72.3
# 609 32.8188 39.5964 43.988 50.1693 53.1729 54.9822 55.3463 60.3509 60.743
# 9 62.3432 64.3224 65.1032 64.1965 66.7452 67.5154 70.8749 71.2768 20 20 2
# 0 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
#  20 20 20 20 20 20 20

0 #_N_environ_variables
0 #_N_environ_obs
0 # N sizefreq methods to read

0 # no tag data

0 # no morphcomp data

999
```

Southern Model

```
#V3.24u
#C data file for China rockfish South of 4010
# discard included as separate fleet
#_observed data:
1900 #_styr
2014 #_endyr
1 #_nseas
12 #_months/season
1  #_spawn_seas
5 #_Nfleet
4  #_Nsurveys
1  #_N_areas

## fleet names
1_CA_SouthOf4010_Comm_Dead%2_CA_SouthOf4010_Comm_Live%3_CA_SouthOf4010_Rec_
PC%4_CA_SouthOf4010_Rec_PR%5_CA_SouthOf4010_Comm_Discard%6_CA_SouthOf4010_R
ec_PC_DWV_index%7_CA_SouthOf4010_Rec_PC_onboard_index%8_CA_SouthOf4010_CCFR
P_comps_only%9_CA_SouthOf4010_Abrams_thesis_comps
## 1_CA_SouthOf4010_Comm_Dead
## 2_CA_SouthOf4010_Comm_Live
## 3_CA_SouthOf4010_Rec_PC
## 4_CA_SouthOf4010_Rec_PR
```

```
## 5_CA_SouthOf4010_Comm_Discard (THIS IS DEAD DISCARD)
## 6_CA_SouthOf4010_Rec_PC_DWV_index
## 7_CA_SouthOf4010_Rec_PC_onboard_index
## 8_CA_SouthOf4010_CCFRP_comps_only
## 9_CA_SouthOf4010_Abrams_thesis_comps

0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 #_surveytiming_in_season -- mid-year, n
# ot exactly like XDB-SRA
  1   1   1   1   1   1   1   1   1 #_area_assignments_for_each_fishery_and
# _survey
  1   1   1   1   1   #_units of catch:  1=bio; 2=num
0.1 0.1 0.1 0.1 0.1   #_se of log(catch) only used for init_eq_catch and fo
# r Fmethod 2 and 3

2 #_Ngenders
80 #_Nages
0   0   0   0   0 #_init_equil_catch_for_each_fishery

115 #_N_lines_of_catch_to_read
#_catch_biomass(mtons):_columns_are_fisheries,year,season
#fleet1 fleet2 fleet3 fleet4 fleet5 Year Season # total catch
0 0 0 0 0 1900 1 # 0
0.383 0 0 0 0 1901 1 # 0.383
0.766 0 0 0 0 1902 1 # 0.766
1.149 0 0 0 0 1903 1 # 1.149
1.532 0 0 0 0 1904 1 # 1.532
1.915 0 0 0 0 1905 1 # 1.915
2.299 0 0 0 0 1906 1 # 2.299
2.682 0 0 0 0 1907 1 # 2.682
3.065 0 0 0 0 1908 1 # 3.065
3.448 0 0 0 0 1909 1 # 3.448
3.831 0 0 0 0 1910 1 # 3.831
4.214 0 0 0 0 1911 1 # 4.214
4.597 0 0 0 0 1912 1 # 4.597
4.98 0 0 0 0 1913 1 # 4.98
5.363 0 0 0 0 1914 1 # 5.363
5.746 0 0 0 0 1915 1 # 5.746
6.129 0 0 0 0 1916 1 # 6.129
9.522 0 0 0 0 1917 1 # 9.522
11.133 0 0 0 0 1918 1 # 11.133
7.741 0 0 0 0 1919 1 # 7.741
7.895 0 0 0 0 1920 1 # 7.895
```

```
6.519 0 0 0 0 1921 1 # 6.519
5.609 0 0 0 0 1922 1 # 5.609
6.066 0 0 0 0 1923 1 # 6.066
3.514 0 0 0 0 1924 1 # 3.514
4.388 0 0 0 0 1925 1 # 4.388
7.084 0 0 0 0 1926 1 # 7.084
6.016 0 0 0 0 1927 1 # 6.016
7.266 0 0.104 0.311 0 1928 1 # 7.681
6.015 0 0.208 0.623 0 1929 1 # 6.846
8.519 0 0.239 0.716 0 1930 1 # 9.474
3.626 0 0.318 0.955 0 1931 1 # 4.899
9.266 0 0.398 1.193 0 1932 1 # 10.857
3.33 0 0.477 1.432 0 1933 1 # 5.239
7.089 0 0.557 1.67 0 1934 1 # 9.316
6.309 0 0.636 1.909 0 1935 1 # 8.854
6.221 0 0.716 2.147 0 1936 1 # 9.084
5.599 0 0.849 2.546 0 1937 1 # 8.994
3.261 0 0.835 2.504 0 1938 1 # 6.6
0.723 0 0.73 2.19 0 1939 1 # 3.643
0.298 0 1.05 3.149 0 1940 1 # 4.497
0.849 0 0.97 2.911 0 1941 1 # 4.73
0.519 0 0.516 1.547 0 1942 1 # 2.582
1.745 0 0.493 1.479 0 1943 1 # 3.717
0.49 0 0.405 1.214 0 1944 1 # 2.109
0.553 0 0.54 1.619 0 1945 1 # 2.712
1.449 0 0.929 2.786 0 1946 1 # 5.164
1.484 0 0.738 2.215 0 1947 1 # 4.437
3.253 0 1.475 4.426 0 1948 1 # 9.154
4.428 0 1.912 5.735 0 1949 1 # 12.075
1.807 0 2.33 6.989 0 1950 1 # 11.126
2.65 0 2.732 8.197 0 1951 1 # 13.579
2.419 0 2.383 7.149 0 1952 1 # 11.951
2.289 0 2.036 6.107 0 1953 1 # 10.432
0.746 0 2.553 7.658 0 1954 1 # 10.957
0.335 0 3.071 9.212 0 1955 1 # 12.618
0.192 0 3.433 10.299 0 1956 1 # 13.924
0.414 0 3.416 10.248 0 1957 1 # 14.078
0.24 0 5.617 16.85 0 1958 1 # 22.707
0.629 0 4.356 13.068 0 1959 1 # 18.053
0.475 0 3.633 10.9 0 1960 1 # 15.008
1.001 0 3.164 9.491 0 1961 1 # 13.656
0.375 0 2.976 8.928 0 1962 1 # 12.279
```

```
0.806 0 3.722 11.167 0 1963 1 # 15.695
0.026 0 2.518 7.555 0 1964 1 # 10.099
0.18 0 4.126 12.377 0 1965 1 # 16.683
0.252 0 4.653 13.96 0 1966 1 # 18.865
0.124 0 6.034 18.101 0 1967 1 # 24.259
0.01 0 5.283 15.848 0 1968 1 # 21.141
1.569 0 4.494 13.483 0 1969 1 # 19.546
1.841 0 7.588 22.764 0 1970 1 # 32.193
1.261 0 5.572 16.716 0 1971 1 # 23.549
2.1 0 7.839 23.516 0 1972 1 # 33.455
3.419 0 8.674 26.021 0 1973 1 # 38.114
2.526 0 9.839 29.518 0 1974 1 # 41.883
2.719 0 9.507 28.52 0 1975 1 # 40.746
3.813 0 10.278 30.834 0 1976 1 # 44.925
3.074 0 9.3 27.899 0 1977 1 # 40.273
1.448 0 7.331 21.994 0 1978 1 # 30.773
7.95 0 8.341 25.023 0 1979 1 # 41.314
5.009 0 10.936 21.847 0 1980 1 # 37.792
0.762 0 4.755 10.989 0 1981 1 # 16.506
0.556 0 5.676 24.998 0 1982 1 # 31.23
1.664 0 5.103 10.824 0 1983 1 # 17.591
3.342 0 1.047 12.167 0 1984 1 # 16.556
1.087 0 3.279 23.873 0 1985 1 # 28.239
1.06 0 7.754 31.95 0 1986 1 # 40.764
3.364 0 18.353 34.123 0 1987 1 # 55.84
4.218 0 8.276 26.826 0 1988 1 # 39.32
6.006 0 9.546 22.426 0 1989 1 # 37.978
6.156 0 8.462 22.738 0 1990 1 # 37.356
11.51 0 7.566 23.488 0.183 1991 1 # 42.747
20.992 0 6.737 24.48 0.326 1992 1 # 52.535
14.868 0.168 5.782 25.017 0.432 1993 1 # 46.267
21.46 11.07 4.882 25.246 1.544 1994 1 # 64.202
14.94 9.14 3.981 20.01 1.587 1995 1 # 49.658
8.783 6.158 3.123 14.766 1.347 1996 1 # 34.177
23.311 6.504 3.6 3.544 1.711 1997 1 # 38.670
5.307 5.388 0.839 6.4 1.205 1998 1 # 19.139
2.34 3.797 2.971 11.709 1.474 1999 1 # 22.291
0.667 2.288 5.638 11.244 1.918 2000 1 # 21.755
0.77 2.436 6.506 9.19 2.163 2001 1 # 21.065
0.677 2.106 5.144 9.996 1.754 2002 1 # 19.677
0.269 0.719 4.402 12.124 1.239 2003 1 # 18.753
0.567 1.41 3.717 4.086 0.351 2004 1 # 10.131
```

```
0.71 1.624 8.485 4.901 0.647 2005 1 # 16.367
0.526 1.49 4.859 5.863 0.478 2006 1 # 13.216
0.73 1.471 4.399 6.79 0.608 2007 1 # 13.998
0.771 1.57 5.236 7.58 0.810 2008 1 # 15.967
0.437 1.538 7.033 11.139 0.956 2009 1 # 21.103
0.761 1.053 7.813 9.134 1.684 2010 1 # 20.445
0.434 1.117 7.461 6.611 1.383 2011 1 # 17.006
0.709 0.669 6.149 6.258 1.815 2012 1 # 15.600
0.379 0.831 4.528 4.273 1.275 2013 1 # 11.286
0.251 1.334 4.336 5.249 1.275 2014 1 # 12.445
#
45 #_N_cpue_and_surveyabundance_observations
#_Units:  0=numbers; 1=biomass; 2=F
#_Errtype:  -1=normal; 0=lognormal; >0=T
#_Fleet Units Errtype
1       0     0 # 1_CA_SouthOf4010_Comm_Dead
2       0     0 # 2_CA_SouthOf4010_Comm_Live
3       0     0 # 3_CA_SouthOf4010_Rec_PC
4       0     0 # 4_CA_SouthOf4010_Rec_PR
5       0     0 # 5_CA_SouthOf4010_Comm_Discard
6       0     0 # 6_CA_SouthOf4010_Rec_PC_DWV_index
7       0     0 # 7_CA_SouthOf4010_Rec_PC_onboard_index
8       0     0 # 8_CA_SouthOf4010_CCFRP_comps_only
9       0     0 # 9_CA_SouthOf4010_Abrams_thesis_comps

### assigned to fleet "3_CA_SouthOf4010_Rec_PC"
### CA MRFSS dockside index, south of 4010
#_year seas index obs err
1980 1 3 0.060 0.260 # CA MRFSS dockside South of 4010
1981 1 3 0.048 0.389 # CA MRFSS dockside South of 4010
1982 1 3 0.079 0.320 # CA MRFSS dockside South of 4010
1983 1 3 0.087 0.307 # CA MRFSS dockside South of 4010
1984 1 3 0.050 0.299 # CA MRFSS dockside South of 4010
1985 1 3 0.060 0.245 # CA MRFSS dockside South of 4010
1986 1 3 0.078 0.180 # CA MRFSS dockside South of 4010
1987 1 3 0.128 0.245 # CA MRFSS dockside South of 4010
1988 1 3 0.116 0.282 # CA MRFSS dockside South of 4010
1989 1 3 0.071 0.274 # CA MRFSS dockside South of 4010
1995 1 3 0.088 0.213 # CA MRFSS dockside South of 4010
1996 1 3 0.038 0.137 # CA MRFSS dockside South of 4010
1998 1 3 0.035 0.271 # CA MRFSS dockside South of 4010
1999 1 3 0.025 0.184 # CA MRFSS dockside South of 4010
```

```
2000 1 3 0.037 0.350 # CA MRFSS dockside South of 4010
2001 1 3 0.060 0.296 # CA MRFSS dockside South of 4010
2002 1 3 0.062 0.289 # CA MRFSS dockside South of 4010
2003 1 3 0.049 0.403 # CA MRFSS dockside South of 4010

### CA historic onboard - south of 4010
### assigning to survey: "6_CA_SouthOf4010_Rec_PC_DWV_index" due to overlap
#  in years with other indices
#_year seas index obs err
1988 1 6 0.089 0.126 #CA onboard historic south 4010
1989 1 6 0.077 0.143 #CA onboard historic south 4010
1990 1 6 0.139 0.222 #CA onboard historic south 4010
1991 1 6 0.069 0.201 #CA onboard historic south 4010
1992 1 6 0.042 0.150 #CA onboard historic south 4010
1993 1 6 0.041 0.143 #CA onboard historic south 4010
1994 1 6 0.051 0.135 #CA onboard historic south 4010
1995 1 6 0.033 0.155 #CA onboard historic south 4010
1996 1 6 0.038 0.121 #CA onboard historic south 4010
1997 1 6 0.025 0.129 #CA onboard historic south 4010
1998 1 6 0.021 0.161 #CA onboard historic south 4010
1999 1 6 0.045 0.266 #CA onboard historic south 4010

### CA current onboard - south of 4010
### assigning to survey: "7_CA_SouthOf4010_Rec_PC_onboard_index" due to ove
# rlap in years with other indices
#_year seas index obs err
2000 1 7 0.0199 0.4302 #CA onboard current south 4010
2001 1 7 0.0465 0.2381 #CA onboard current south 4010
2002 1 7 0.0850 0.1685 #CA onboard current south 4010
2003 1 7 0.0691 0.1209 #CA onboard current south 4010
2004 1 7 0.0665 0.1336 #CA onboard current south 4010
2005 1 7 0.0694 0.1406 #CA onboard current south 4010
2006 1 7 0.0669 0.1328 #CA onboard current south 4010
2007 1 7 0.0774 0.1268 #CA onboard current south 4010
2008 1 7 0.0988 0.1124 #CA onboard current south 4010
2009 1 7 0.1266 0.1090 #CA onboard current south 4010
2010 1 7 0.0964 0.1115 #CA onboard current south 4010
2011 1 7 0.0925 0.0992 #CA onboard current south 4010
2012 1 7 0.0653 0.1322 #CA onboard current south 4010
2013 1 7 0.0457 0.1497 #CA onboard current south 4010
2014 1 7 0.0464 0.1495 #CA onboard current south 4010
```

```
0 #_N_fleets_with_discard
#Fleet units err_type
#2 1 0
0 #N discard obs (TOTAL DISCARD -- DEAD+SURVIVING)
#_year seas fleet obs(mt) err  # fraction average:
#2004 1 2 0.6147 0.505781  # 15.2% 33.9%
#2005 1 2 1.4013 0.509880  # 21.6%
#2006 1 2 0.8719 0.475889  # 19.1%
#2007 1 2 1.0594 0.190865  # 21.6%
#2008 1 2 1.3497 0.767199  # 26.2%
#2009 1 2 1.7689 0.643454  # 32.7%
#2010 1 2 2.6821 0.692105  # 48.3%
#2011 1 2 2.9231 0.445517  # 47.2%
#2012 1 2 2.7292 0.816548  # 55.8%
#2013 1 2 1.6141 0.528085  # 51.5%
#
0 #_N_meanbodywt_obs
30 #_DF_for_meanbodywt_T-distribution_like

2  # length bin method: 1=use databins; 2=generate from binwidth,min,max be
# low; 3=read vector
2  # binwidth for population size comp
8  # minimum size in the population (lower edge of first bin and size at ag
# e 0.00)
50 # maximum size in the population (lower edge of last bin)

-0.0001 #_comp_tail_compression
1e-003 #_add_to_comp
0 #_combine males into females at or below this bin number
15 #_N_LengthBins
18 20 22 24 26 28 30 32 34 36 38 40 42 44 46

120 #_N_Length_obs

### CA commercial landings, dead fish, south of 40-10
### assigned to fleet: "1_CA_SouthOf4010_Comm_Dead"
### Nsamp = number of clusters; dropped 1998 & 2006 (outliers); 1999 (borro
# wed size comp from adjacent port)
#Yr Seas Flt/Svy Gender Part Nsamp 18cm 20cm 22cm 24cm 26cm 28cm 30cm 32cm
# 34cm 36cm 38cm 40cm 42cm 44cm 46cm+
1992 1 1 0 2 26 0 6 886 381 765 4052 9331 5421 2889 1253 278 0 0 0 54 0 6 8
86 381 765 4052 9331 5421 2889 1253 278 0 0 0 54
```

```
1993 1 1 0 2 22 0 0 270 1521 2870 1482 2115 408 940 119 244 105 13 0 0 0 0
270 1521 2870 1482 2115 408 940 119 244 105 13 0 0
1994 1 1 0 2 54 57 263 695 1898 6424 6550 6693 2431 759 769 168 117 0 0 0 5
7 263 695 1898 6424 6550 6693 2431 759 769 168 117 0 0 0
1995 1 1 0 2 10 0 429 429 839 3844 5553 2608 2365 287 429 0 0 0 0 0 0 429 4
29 839 3844 5553 2608 2365 287 429 0 0 0 0 0
1996 1 1 0 2 16 4 0 150 164 1007 1383 1166 253 508 253 253 0 0 0 0 4 0 150
164 1007 1383 1166 253 508 253 253 0 0 0 0
1997 1 1 0 2 19 0 0 17 50 849 4200 5238 4028 1966 146 0 0 0 0 0 0 0 17 50 8
49 4200 5238 4028 1966 146 0 0 0 0 0
-1998 1 1 0 2 2 265 0 272 1346 333 68 68 0 0 0 0 0 0 0 0 265 0 272 1346 333
 68 68 0 0 0 0 0 0 0 0
-1999 1 1 0 2 0 0 0 0 0 0 59 236 118 118 59 0 0 0 0 0 0 0 0 0 0 59 236 118
118 59 0 0 0 0 0
-2006 1 1 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 36 0 0 0 0 0 0 0 0 0 0 0 0 0 0
36

### CA commercial RETAINED CATCH, live fish, south of 40-10
### assigned to fleet: "2_CA_SouthOf4010_Comm_Live"
### Nsamp = number of clusters
### Partition = 2 (retained catch)
#Yr Seas Flt/Svy Gender Part Nsamp 18cm 20cm 22cm 24cm 26cm 28cm 30cm 32cm
# 34cm 36cm 38cm 40cm 42cm 44cm 46cm+
1997 1 2 0 2 11 0 0 0 80 240 890 1140 600 220 310 0 80 0 0 0 0 0 0 80 240 8
90 1140 600 220 310 0 80 0 0 0
1999 1 2 0 2 24 0 0 0 0 72 216 1152 1008 576 360 72 0 0 0 0 0 0 0 0 72 216
1152 1008 576 360 72 0 0 0 0
2000 1 2 0 2 31 0 0 0 0 0 28 707 829 345 140 84 0 0 0 0 0 0 0 0 0 28 707 82
9 345 140 84 0 0 0 0
2001 1 2 0 2 17 0 0 0 0 34 96 784 844 322 192 32 32 0 0 0 0 0 0 0 34 96 784
 844 322 192 32 32 0 0 0
2002 1 2 0 2 8 0 0 0 0 0 0 512 672 416 96 64 0 0 64 0 0 0 0 0 0 0 512 672 4
16 96 64 0 0 64 0
2003 1 2 0 2 6 0 0 0 0 0 0 0 140 252 140 0 0 0 0 0 0 0 0 0 0 0 0 140 252 14
0 0 0 0 0 0
2004 1 2 0 2 29 0 0 0 0 0 0 0 153 427 497 79 0 0 0 0 0 0 0 0 0 0 0 153 427
497 79 0 0 0 0
2005 1 2 0 2 28 0 0 0 0 0 0 417 728 419 0 0 0 0 0 0 0 0 0 0 0 0 417 728 419
 0 0 0 0 0 0
2006 1 2 0 2 13 0 0 0 0 0 50 1949 4331 2432 1216 0 0 0 0 448 0 0 0 0 0 50 1
949 4331 2432 1216 0 0 0 0 448
2007 1 2 0 2 22 0 0 0 0 0 0 571 643 309 126 0 0 0 0 0 0 0 0 0 0 0 571 643 3
```

```
09 126 0 0 0 0 0
2008 1 2 0 2 29 0 0 0 0 0 0 63 336 588 420 0 0 0 0 0 0 0 0 0 0 0 63 336 588
 420 0 0 0 0 0
2009 1 2 0 2 22 0 0 0 0 6 26 329 862 1413 237 100 0 0 0 0 0 0 0 0 6 26 329
862 1413 237 100 0 0 0 0
2010 1 2 0 2 12 0 0 0 0 0 0 91 390 429 182 0 0 0 0 0 0 0 0 0 0 0 91 390 429
 182 0 0 0 0 0
2011 1 2 0 2 13 0 0 0 0 0 8 104 16 8 0 0 0 0 0 0 0 0 0 0 8 104 16 8 0 0 0
 0 0 0
2012 1 2 0 2 5 0 0 0 0 0 0 72 24 0 0 0 0 0 0 0 0 0 0 0 0 72 24 0 0 0 0 0
0 0

### CA commercial DISCARDED CATCH TREATED AS FISHERY, live+dead fish fisher
# ies, south of 40-10
### assigned to fleet: "5_CA_SouthOf4010_Comm_Discard"
### WCGOP Discards south of 40-10 (discards north of 40-10 too small to mod
# el with length comps)
#Yr Seas Flt/Svy Gender Part Nsamp 18cm 20cm 22cm 24cm 26cm 28cm 30cm 32cm
# 34cm 36cm 38cm 40cm 42cm 44cm 46cm+ repeat m20 m22 m24 m26 m28 m30 m32 m3
# 4 m36 m38 m40 m42 m44 m46
2004 1 5 0 2 11 0 0 2 1 6 15 10 0 1 0 0 0 0 0 0 0 0 2 1 6 15 10 0 1 0 0 0 0
 0 0
2005 1 5 0 2 19 1 1 1 4 5 6 8 5 1 0 0 0 0 0 0 1 1 1 4 5 6 8 5 1 0 0 0 0 0 0
2006 1 5 0 2 16 0 0 1 5 4 10 5 0 0 0 0 0 0 0 0 0 0 1 5 4 10 5 0 0 0 0 0 0 0
 0
2007 1 5 0 2 14 0 1 1 2 6 11 6 1 0 0 0 0 0 0 0 0 1 1 2 6 11 6 1 0 0 0 0 0 0
 0
2008 1 5 0 2 6 0 3 5 2 3 6 8 0 0 0 0 0 0 0 0 0 3 5 2 3 6 8 0 0 0 0 0 0 0 0
2009 1 5 0 2 16 1 1 3 3 13 12 15 4 0 1 0 0 0 0 0 1 1 3 3 13 12 15 4 0 1 0 0
 0 0 0
2010 1 5 0 2 31 3 13 41 64 71 30 6 1 0 0 0 0 0 0 0 3 13 41 64 71 30 6 1 0 0
 0 0 0 0 0
2011 1 5 0 2 44 1 15 20 47 30 19 11 1 2 0 0 0 0 0 0 1 15 20 47 30 19 11 1 2
 0 0 0 0 0 0
2012 1 5 0 2 38 0 13 46 105 103 22 7 0 0 0 0 0 0 0 0 0 13 46 105 103 22 7 0
 0 0 0 0 0 0 0
2013 1 5 0 2 20 0 0 8 3 16 26 6 7 0 0 0 0 0 0 0 0 0 8 3 16 26 6 7 0 0 0 0 0
 0 0

### CA rec landings, PC mode, south of 40-10 (combines Miller+Gotshall 1960
# , CA rec sampling 1978-1984, and MRFSS sampling 1980-2003)
### assigned to fleet: "3_CA_SouthOf4010_Rec_PC"
```

```
#Yr Seas Flt/Svy Gender Part Nsamp 18cm 20cm 22cm 24cm 26cm 28cm 30cm 32cm
# 34cm 36cm 38cm 40cm 42cm 44cm 46cm+
1960 1 -3 0 2 85 0 0 0 0 0 3 4 10 11 19 24 9 4 0 1 0 0 0 0 0 3 4 10 11 19 2
4 9 4 0 1
1978 1 3 0 2 25 0 0 0 0 3 2 8 4 6 1 0 0 1 0 0 0 0 0 3 2 8 4 6 1 0 0 1 0 0
1979 1 3 0 2 23 0 0 0 2 1 3 6 3 4 1 2 1 0 0 0 0 0 2 1 3 6 3 4 1 2 1 0 0 0
1980 1 3 0 2 72 0 1 0 1 3 10 18 13 14 5 4 3 0 0 0 0 1 0 1 3 10 18 13 14 5 4
 3 0 0 0
1981 1 3 0 2 28 0 0 0 1 0 4 9 5 3 2 2 1 1 0 0 0 0 0 1 0 4 9 5 3 2 2 1 1 0 0
1982 1 3 0 2 28 0 0 0 3 1 1 5 5 3 2 6 1 0 1 0 0 0 0 3 1 1 5 5 3 2 6 1 0 1 0
1983 1 3 0 2 34 0 0 0 0 1 5 9 9 2 5 3 0 0 0 0 0 0 0 0 1 5 9 9 2 5 3 0 0 0 0
1984 1 3 0 2 20 0 0 0 0 5 3 5 4 1 1 0 0 1 0 0 0 0 0 0 5 3 5 4 1 1 0 0 1 0 0
1985 1 3 0 2 42 1 1 5 4 3 8 7 7 2 1 3 0 0 0 0 1 1 5 4 3 8 7 7 2 1 3 0 0 0 0
1986 1 3 0 2 89 0 1 3 9 23 11 11 14 8 5 3 1 0 0 0 0 1 3 9 23 11 11 14 8 5 3
 1 0 0 0
1987 1 3 0 2 65 1 0 3 3 11 9 11 8 12 3 3 1 0 0 0 1 0 3 3 11 9 11 8 12 3 3 1
 0 0 0
1988 1 3 0 2 28 1 1 1 3 3 6 5 4 2 0 1 1 0 0 0 1 1 1 3 3 6 5 4 2 0 1 1 0 0 0
1989 1 3 0 2 65 0 0 2 7 5 15 10 7 10 2 3 4 0 0 0 0 0 2 7 5 15 10 7 10 2 3 4
 0 0 0
1993 1 3 0 2 5 0 0 0 0 1 3 1 0 0 0 0 0 0 0 0 0 0 0 0 1 3 1 0 0 0 0 0 0 0 0
1994 1 3 0 2 6 0 0 0 0 3 1 1 1 0 0 0 0 0 0 0 0 0 0 0 3 1 1 1 0 0 0 0 0 0 0
1995 1 3 0 2 39 0 1 2 0 11 12 7 3 3 0 0 0 0 0 0 0 1 2 0 11 12 7 3 3 0 0 0 0
 0 0
1996 1 3 0 2 91 0 4 5 4 18 29 18 6 4 3 0 0 0 0 0 0 4 5 4 18 29 18 6 4 3 0 0
 0 0 0
1998 1 3 0 2 20 0 0 0 3 4 8 2 0 0 0 2 0 1 0 0 0 0 0 3 4 8 2 0 0 0 2 0 1 0 0
1999 1 3 0 2 81 0 3 3 2 13 24 20 8 3 3 2 0 0 0 0 0 3 3 2 13 24 20 8 3 3 2 0
 0 0 0
2000 1 3 0 2 39 0 0 1 3 9 10 8 5 2 0 0 1 0 0 0 0 0 1 3 9 10 8 5 2 0 0 1 0 0
 0
2001 1 3 0 2 89 0 1 3 14 11 22 18 12 6 2 0 0 0 0 0 0 1 3 14 11 22 18 12 6 2
 0 0 0 0 0
2002 1 3 0 2 144 0 1 2 12 28 35 37 19 3 4 1 0 0 0 2 0 1 2 12 28 35 37 19 3
4 1 0 0 0 2
2003 1 3 0 2 241 0 0 7 15 47 62 58 32 13 4 2 0 0 0 1 0 0 7 15 47 62 58 32 1
3 4 2 0 0 0 1
2004 1 3 0 2 228 0 6 5 20 42 51 61 27 12 3 0 0 1 0 0 0 6 5 20 42 51 61 27 1
2 3 0 0 1 0 0
2005 1 3 0 2 169 0 1 6 8 23 42 48 32 8 1 0 0 0 0 0 0 1 6 8 23 42 48 32 8 1
0 0 0 0 0
2006 1 3 0 2 156 0 1 2 14 23 41 43 25 4 3 0 0 0 0 0 0 1 2 14 23 41 43 25 4
```

```
3 0 0 0 0 0
2007 1 3 0 2 275 0 0 12 13 31 63 73 49 20 8 3 1 0 1 1 0 0 12 13 31 63 73 49
 20 8 3 1 0 1 1
2008 1 3 0 2 347 0 4 8 28 42 80 105 62 8 7 3 0 0 0 0 0 4 8 28 42 80 105 62
8 7 3 0 0 0 0
2009 1 3 0 2 495 0 1 20 41 76 125 117 64 28 16 5 2 0 0 0 0 1 20 41 76 125 1
17 64 28 16 5 2 0 0 0
2010 1 3 0 2 481 2 6 13 32 75 130 119 65 32 3 4 0 0 0 0 2 6 13 32 75 130 11
9 65 32 3 4 0 0 0 0
2011 1 3 0 2 584 0 4 14 45 94 150 160 62 38 13 3 1 0 0 0 0 4 14 45 94 150 1
60 62 38 13 3 1 0 0 0
2012 1 3 0 2 406 0 1 2 19 44 103 110 73 27 16 10 1 0 0 0 0 1 2 19 44 103 11
0 73 27 16 10 1 0 0 0
2013 1 3 0 2 244 2 1 5 10 32 51 58 36 29 10 4 6 0 0 0 2 1 5 10 32 51 58 36
29 10 4 6 0 0 0
2014 1 3 0 2 325 1 3 4 5 24 61 85 90 35 9 6 1 1 0 0 1 3 4 5 24 61 85 90 35
9 6 1 1 0 0

### CA rec landings, PR mode, south of 40-10 (includes Miller and Gotshall,
#  MRFSS)
### assigned to fleet: "4_CA_SouthOf4010_Rec_PR"
#Yr Seas Flt/Svy Gender Part Nsamp 18cm 20cm 22cm 24cm 26cm 28cm 30cm 32cm
# 34cm 36cm 38cm 40cm 42cm 44cm 46cm+ repeat
1959 1 -4 0 2 51 0 0 0 1 0 0 1 5 10 15 14 5 0 0 0 0 0 0 1 0 0 1 5 10 15 14
5 0 0 0
1980 1 4 0 2 60 0 0 0 1 2 11 14 8 8 5 11 0 0 0 0 0 0 0 1 2 11 14 8 8 5 11 0
 0 0 0
1981 1 4 0 2 35 0 0 0 1 2 3 8 6 3 3 5 3 1 0 0 0 0 0 1 2 3 8 6 3 3 5 3 1 0 0
1982 1 4 0 2 71 1 0 1 2 2 11 12 9 7 5 10 8 1 1 1 1 0 1 2 2 11 12 9 7 5 10 8
 1 1 1
1983 1 4 0 2 34 0 1 0 1 4 12 3 6 0 3 3 1 0 0 0 0 1 0 1 4 12 3 6 0 3 3 1 0 0
 0
1984 1 4 0 2 54 2 0 1 1 2 12 13 5 7 6 5 0 0 0 0 2 0 1 1 2 12 13 5 7 6 5 0 0
 0 0
1985 1 4 0 2 100 1 4 2 1 6 17 28 13 14 3 5 4 2 0 0 1 4 2 1 6 17 28 13 14 3
5 4 2 0 0
1986 1 4 0 2 135 0 1 4 6 9 19 30 27 14 8 11 6 0 0 0 0 1 4 6 9 19 30 27 14 8
 11 6 0 0 0
1987 1 4 0 2 76 0 5 1 5 3 8 9 14 10 9 9 3 0 0 0 0 5 1 5 3 8 9 14 10 9 9 3 0
 0 0
1988 1 4 0 2 63 0 0 1 6 4 10 15 15 5 4 3 0 0 0 0 0 0 1 6 4 10 15 15 5 4 3 0
 0 0 0
```

1989 1 4 0 2 54 0 1 1 4 9 10 8 7 6 4 3 1 0 0 0 0 1 1 4 9 10 8 7 6 4 3 1 0 0
0
1993 1 4 0 2 144 0 2 5 7 25 40 26 14 18 3 3 1 0 0 0 0 2 5 7 25 40 26 14 18
3 3 1 0 0 0
1994 1 4 0 2 168 0 0 4 7 29 42 34 21 17 8 4 0 2 0 0 0 0 4 7 29 42 34 21 17
8 4 0 2 0 0
1995 1 4 0 2 60 0 0 0 7 7 11 15 9 6 4 1 0 0 0 0 0 0 0 7 7 11 15 9 6 4 1 0 0
0 0
1996 1 4 0 2 118 0 0 2 6 13 32 37 16 7 3 2 0 0 0 0 0 0 2 6 13 32 37 16 7 3
2 0 0 0 0
1997 1 4 0 2 27 0 0 2 4 1 6 7 6 0 1 0 0 0 0 0 0 0 2 4 1 6 7 6 0 1 0 0 0 0 0
1998 1 4 0 2 29 0 0 0 0 3 7 8 4 2 1 1 0 2 0 1 0 0 0 0 3 7 8 4 2 1 1 0 2 0 1
1999 1 4 0 2 63 0 1 0 5 9 7 16 10 6 6 1 0 1 1 0 0 1 0 5 9 7 16 10 6 6 1 0 1
1 0
2000 1 4 0 2 51 0 0 3 4 2 8 9 6 13 2 1 2 1 0 0 0 0 3 4 2 8 9 6 13 2 1 2 1 0
0
2001 1 4 0 2 18 0 0 0 0 2 6 6 4 0 0 0 0 0 0 0 0 0 0 0 2 6 6 4 0 0 0 0 0 0 0
2002 1 4 0 2 34 0 0 0 1 2 9 12 6 2 1 0 1 0 0 0 0 0 0 1 2 9 12 6 2 1 0 1 0 0
0
2003 1 4 0 2 62 0 0 0 1 8 16 17 15 2 3 0 0 0 0 0 0 0 0 1 8 16 17 15 2 3 0 0
0 0 0
2004 1 4 0 2 257 0 0 3 5 19 51 77 61 20 10 7 2 1 1 0 0 0 3 5 19 51 77 61 20
10 7 2 1 1 0
2005 1 4 0 2 537 0 6 6 28 52 112 162 107 45 10 7 0 1 1 0 0 6 6 28 52 112 16
2 107 45 10 7 0 1 1 0
2006 1 4 0 2 740 1 1 4 30 81 148 208 160 67 27 9 2 0 1 1 1 1 4 30 81 148 20
8 160 67 27 9 2 0 1 1
2007 1 4 0 2 689 0 1 14 26 76 141 168 157 79 18 7 1 1 0 0 0 1 14 26 76 141
168 157 79 18 7 1 1 0 0
2008 1 4 0 2 975 1 2 10 39 121 196 252 188 115 33 16 2 0 0 0 1 2 10 39 121
196 252 188 115 33 16 2 0 0 0
2009 1 4 0 2 1010 1 4 10 43 116 238 257 217 90 29 4 1 0 0 0 1 4 10 43 116 2
38 257 217 90 29 4 1 0 0 0
2010 1 4 0 2 771 0 1 10 37 109 180 220 134 52 15 10 2 1 0 0 0 1 10 37 109 1
80 220 134 52 15 10 2 1 0 0
2011 1 4 0 2 768 1 16 18 51 88 175 220 108 66 18 6 0 0 1 0 1 16 18 51 88 17
5 220 108 66 18 6 0 0 1 0
2012 1 4 0 2 529 0 2 6 34 72 133 146 75 33 15 8 3 0 0 2 0 2 6 34 72 133 146
75 33 15 8 3 0 0 2
2013 1 4 0 2 406 0 1 4 20 35 75 104 77 61 19 9 1 0 0 0 0 1 4 20 35 75 104 7
7 61 19 9 1 0 0 0
2014 1 4 0 2 356 2 3 2 8 25 76 100 70 47 14 6 1 2 0 0 2 3 2 8 25 76 100 70

```
47 14 6 1 2 0 0

### CA Rec onboard observer DWV; south of 40-10
### dropped 1987 (Monterey only)
### assigned to survey: "6_CA_SouthOf4010_Rec_PC_DWV_index"
#Yr     Seas    Flt/Svy Gender  Part    Nsamp   18cm    20cm    22cm    24c
# m    26cm    28cm    30cm    32cm    34cm    36cm    38cm    40cm    42cm
#     44cm    46cm+   repeat
-1987 1 6 0 0 15 0 0 4 1 2 3 3 2 0 0 0 0 0 0 0 0 4 1 2 3 3 2 0 0 0 0 0 0
0
1988 1 6 0 0 449 2 11 7 43 74 106 109 49 25 10 7 6 0 0 0 2 11 7 43 74 106 1
09 49 25 10 7 6 0 0 0
1989 1 6 0 0 360 1 5 17 35 70 66 73 43 20 18 9 3 0 0 0 1 5 17 35 70 66 73 4
3 20 18 9 3 0 0 0
1990 1 6 0 0 119 0 0 7 6 27 33 24 6 6 6 3 1 0 0 0 0 0 7 6 27 33 24 6 6 6 3
1 0 0 0
1991 1 6 0 0 138 1 0 1 4 24 55 32 13 5 3 0 0 0 0 0 1 0 1 4 24 55 32 13 5 3
0 0 0 0 0
1992 1 6 0 0 137 0 1 2 16 40 35 22 14 5 1 1 0 0 0 0 0 1 2 16 40 35 22 14 5
1 1 0 0 0 0
1993 1 6 0 0 211 0 2 9 27 44 50 37 28 12 0 1 0 1 0 0 0 2 9 27 44 50 37 28 1
2 0 1 0 1 0 0
1994 1 6 0 0 236 0 2 8 24 60 49 51 27 5 8 2 0 0 0 0 0 2 8 24 60 49 51 27 5
8 2 0 0 0 0
1995 1 6 0 0 212 0 5 7 26 50 58 30 18 14 2 2 0 0 0 0 0 5 7 26 50 58 30 18 1
4 2 2 0 0 0 0
1996 1 6 0 0 304 0 6 10 21 63 79 70 41 10 3 1 0 0 0 0 0 6 10 21 63 79 70 41
 10 3 1 0 0 0 0
1997 1 6 0 0 227 0 3 7 21 40 65 45 29 8 6 3 0 0 0 0 0 3 7 21 40 65 45 29 8
6 3 0 0 0 0
1998 1 6 0 0 106 0 1 1 16 24 33 19 7 1 1 1 1 1 0 0 0 1 1 16 24 33 19 7 1 1
1 1 1 0 0

### CCFRP Fishery-Independent Survey Comps, Central CA only (Point Buchon t
# o Ano Nuevo); all south of 40-10
### assigned to survey: "8_CA_SouthOf4010_CCFRP_comps_only"
#Yr Seas Flt/Svy Gender Part Nsamp 18cm 20cm 22cm 24cm 26cm 28cm 30cm 32cm
# 34cm 36cm 38cm 40cm 42cm 44cm 46cm+ repeat
2007 1 8 0 0 86 0 2 1 9 12 18 26 14 2 1 1 0 0 0 0 0 2 1 9 12 18 26 14 2 1 1
 0 0 0 0
2008 1 8 0 0 113 0 1 3 7 14 39 31 12 4 2 0 0 0 0 0 0 1 3 7 14 39 31 12 4 2
0 0 0 0 0
```

```
2009 1 8 0 0 91 0 1 1 8 10 27 29 13 2 0 0 0 0 0 0 0 1 1 8 10 27 29 13 2 0 0
 0 0 0 0
2010 1 8 0 0 106 2 1 4 10 17 27 31 12 1 0 1 0 0 0 0 2 1 4 10 17 27 31 12 1
0 1 0 0 0 0
2011 1 8 0 0 65 0 1 2 1 7 20 24 8 2 0 0 0 0 0 0 0 1 2 1 7 20 24 8 2 0 0 0 0
 0 0
2012 1 8 0 0 116 0 0 1 4 17 31 40 18 4 1 0 0 0 0 0 0 0 1 4 17 31 40 18 4 1
0 0 0 0 0
2013 1 8 0 0 39 1 0 0 1 3 12 11 8 3 0 0 0 0 0 0 1 0 0 1 3 12 11 8 3 0 0 0 0
 0 0

47 #_N_age_bins
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
2 #_N_ageerror_definitions
# Default ageing error matrix (1st row is expected age, 2nd is standard dev
# iation of age readings)
# Age 0 Age 1   Age 2   Age 3   Age 4   Age 5   Age 6   Age 7   Age 8   Age
#  9   Age 10  Age 11  Age 12  Age 13  Age 14  Age 15  Age 16  Age 17  Age
# 18  Age 19  Age 20  Age 21  Age 22  Age 23  Age 24  Age 25  Age 26  Age 2
# 7  Age 28  Age 29  Age 30  Age 31  Age 32  Age 33  Age 34  Age 35  Age 36
#   Age 37  Age 38  Age 39  Age 40  Age 41  Age 42  Age 43  Age 44  Age 45
#  Age 46  Age 47  Age 48  Age 49  Age 50  Age 51  Age 52  Age 53  Age 54
# Age 55  Age 56  Age 57  Age 58  Age 59  Age 60  Age 61  Age 62  Age 63  A
# ge 64  Age 65  Age 66  Age 67  Age 68  Age 69  Age 70  Age 71  Age 72  Ag
# e 73  Age 74  Age 75  Age 76  Age 77  Age 78  Age 79  Age 80  ### Age 81
#      Age 82  Age 83  Age 84  Age 85  Age 86  Age 87  Age 88  Age 89  Age
0.5     1.5     2.5     3.5     4.5     5.5     6.5     7.5     8.5     9.5
    10.5    11.5    12.5    13.5    14.5    15.5    16.5    17.5    18.5
  19.5    20.5    21.5    22.5    23.5    24.5    25.5    26.5    27.5    2
8.5    29.5    30.5    31.5    32.5    33.5    34.5    35.5    36.5    37.5
    38.5    39.5    40.5    41.5    42.5    43.5    44.5    45.5    46.5
 47.5    48.5    49.5    50.5    51.5    52.5    53.5    54.5    55.5    56
.5    57.5    58.5    59.5    60.5    61.5    62.5    63.5    64.5    65.5
   66.5    67.5    68.5    69.5    70.5    71.5    72.5    73.5    74.5
75.5    76.5    77.5    78.5    79.5    80.5    ### 81.5        82.5    83.
# 5    84.5    85.5    86.5    87.5    88.5    89.5    90.5    #Expected_ag
0.0968  0.0968  0.1936  0.2904  0.3872  0.4840  0.5807  0.6775  0.7743  0.8
711  0.9679  1.0647  1.1615  1.2583  1.3551  1.4519  1.5487  1.6455  1.7422
  1.8390  1.9358  2.0326  2.1294  2.2262  2.3230  2.4198  2.5166  2.6134  2
.7102  2.8070  2.9037  3.0005  3.0973  3.1941  3.2909  3.3877  3.4845  3.58
13  3.6781  3.7749  3.8717  3.9684  4.0652  4.1620  4.2588  4.3556  4.4524
```

```
 4.5492  4.6460  4.7428  4.8396  4.9364  5.0332  5.1299  5.2267  5.3235  5.
4203  5.5171  5.6139  5.7107  5.8075  5.9043  6.0011  6.0979  6.1946  6.291
4  6.3882  6.4850  6.5818  6.6786  6.7754  6.8722  6.9690  7.0658  7.1626
7.2594  7.3561  7.4529  7.5497  7.6465  7.7433  ### 7.8401      7.9369  8.0
# 337  8.1305  8.2273  8.3241  8.4209  8.5176  8.6144  8.7112  #SD








                                                ###
# Ageing error for ages associated with early years from former NWFSC age r
# eader (1st row is expected age, 2nd is standard deviation of age readings
# )
#
#
#
#
#
#                                                                ###
# Age 0 Age 1   Age 2   Age 3   Age 4   Age 5   Age 6   Age 7   Age 8   Age
#  9   Age 10  Age 11  Age 12  Age 13  Age 14  Age 15  Age 16  Age 17  Age
# 18  Age 19  Age 20  Age 21  Age 22  Age 23  Age 24  Age 25  Age 26  Age 2
# 7  Age 28  Age 29  Age 30  Age 31  Age 32  Age 33  Age 34  Age 35  Age 36
#   Age 37  Age 38  Age 39  Age 40  Age 41  Age 42  Age 43  Age 44  Age 45
#  Age 46  Age 47  Age 48  Age 49  Age 50  Age 51  Age 52  Age 53  Age 54
# Age 55  Age 56  Age 57  Age 58  Age 59  Age 60  Age 61  Age 62  Age 63  A
# ge 64  Age 65  Age 66  Age 67  Age 68  Age 69  Age 70  Age 71  Age 72  Ag
# e 73  Age 74  Age 75  Age 76  Age 77  Age 78  Age 79  Age 80  ### Age 81
#      Age 82  Age 83  Age 84  Age 85  Age 86  Age 87  Age 88  Age 89  Age
0.43    1.29    2.16    3.02    3.88    4.75    5.61    6.47    7.33    8.2
0    9.06    9.92    10.79   11.65   12.51   13.37   14.24   15.10   15.96
  16.83   17.69   18.55   19.41   20.28   21.14   22.00   22.86   23.73   2
4.59   25.45   26.32   27.18   28.04   28.90   29.77   30.63   31.49   32.3
6   33.22   34.08   34.94   35.81   36.67   37.53   38.40   39.26   40.12
 40.98   41.85   42.71   43.57   44.44   45.30   46.16   47.02   47.89   48
.75   49.61   50.47   51.34   52.20   53.06   53.93   54.79   55.65   56.51
   57.38   58.24   59.10   59.97   60.83   61.69   62.55   63.42   64.28
65.14   66.01   66.87   67.73   68.59   69.46   ### 70.32      71.18   72.
```

```
# 05   72.91   73.77   74.63   75.50   76.36   77.22   78.09   #Expected_ag
0.0968  0.0968  0.1936  0.2904  0.3872  0.4840  0.5807  0.6775  0.7743  0.8
711  0.9679  1.0647  1.1615  1.2583  1.3551  1.4519  1.5487  1.6455  1.7422
  1.8390  1.9358  2.0326  2.1294  2.2262  2.3230  2.4198  2.5166  2.6134  2
.7102  2.8070  2.9037  3.0005  3.0973  3.1941  3.2909  3.3877  3.4845  3.58
13  3.6781  3.7749  3.8717  3.9684  4.0652  4.1620  4.2588  4.3556  4.4524
 4.5492  4.6460  4.7428  4.8396  4.9364  5.0332  5.1299  5.2267  5.3235  5.
4203  5.5171  5.6139  5.7107  5.8075  5.9043  6.0011  6.0979  6.1946  6.291
4  6.3882  6.4850  6.5818  6.6786  6.7754  6.8722  6.9690  7.0658  7.1626
7.2594  7.3561  7.4529  7.5497  7.6465  7.7433  ### 7.8401      7.9369  8.0
# 337  8.1305  8.2273  8.3241  8.4209  8.5176  8.6144  8.7112  #SD

41 #_N_Agecomp_obs
3 #_Lbin_method: 1=poplenbins; 2=datalenbins; 3=lengths
0 #_combine males into females at or below this bin number

### Combined: "CA, Rec CPFV south 4010 (1977-1986)" plus "California Rec CP
# FV samples, 1980-84, south of 4010"
### assigned to fleet: "8_CA_SouthOf4010_Abrams_thesis_comps"
# year season fleet gender part ageErr LbinLo LbinHi Nsamps A4 A5 A6 A7 A8
# A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20 A21 A22 A23 A24 A25 A26 A2
# 7 A28 A29 A30 A31 A32 A33 A34 A35 A36 A37 A38 A39 A40 A41 A42 A43 A44 A45
#  A46 A47 A48 A49 A50 repeat
1977 1 3 0 0 1 -1 -1 14 0 0 0 2 1 5 0 0 0 0 0 1 0 1 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 1 0 0 0 0 0 0 0 0 0 2 1 5 0 0 0 0 0 1 0 1 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 1 0 0 0 0 0 0 0
1978 1 3 0 0 1 -1 -1 13 0 0 1 0 2 2 4 1 0 0 0 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 1 0 0 0 0 0 0 0 1 0 2 2 4 1 0 0 0 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 1 0 0 0 0 0
1979 1 3 0 0 1 -1 -1 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 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
1980 1 3 0 0 1 -1 -1 33 0 1 0 1 1 2 5 8 8 1 1 0 0 1 1 0 1 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 2 5 8 8 1 1 0 0 1 1 0
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0
1981 1 3 0 0 1 -1 -1 7 0 0 0 0 0 0 0 4 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 4 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
1982 1 3 0 0 1 -1 -1 15 3 0 0 1 0 1 1 0 0 3 2 1 0 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 1 3 0 0 1 0 1 1 0 0 3 2 1 0 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 1
1983 1 3 0 0 1 -1 -1 9 0 0 0 0 1 1 0 0 2 0 2 0 0 0 0 0 1 0 0 0 0 0 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 1 1 0 0 2 0 2 0 0 0 0 0 1
 0 0 0 0 0 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
1984 1 3 0 0 1 -1 -1 3 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 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
1985 1 3 0 0 1 -1 -1 3 0 0 0 0 0 0 0 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 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
1986 1 3 0 0 1 -1 -1 2 0 0 0 0 0 0 0 0 0 0 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 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

### MARGINAL AGES -- USE CAAL FORMAT IF POSSIBLE (SEE BELOW)
### Abrams thesis, CA south 4010, research
### assigned to fleet: "8_CA_SouthOf4010_Abrams_thesis_comps"
# year season fleet gender part ageErr LbinLo LbinHi Nsamps A4 A5 A6 A7 A8
# A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20 A21 A22 A23 A24 A25 A26 A2
# 7 A28 A29 A30 A31 A32 A33 A34 A35 A36 A37 A38 A39 A40 A41 A42 A43 A44 A45
#  A46 A47 A48 A49 A50 repeat
2010 1 -9 0 0 1 -1 -1 88 0 0 0 1 0 1 4 7 12 7 7 5 7 6 6 2 0 1 0 0 7 5 3 3 0
 1 2 1 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 4 7 12 7 7 5 7 6 6
 2 0 1 0 0 7 5 3 3 0 1 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2011 1 -9 0 0 1 -1 -1 83 0 0 0 0 5 2 1 1 7 6 10 4 2 9 9 3 1 2 2 6 1 2 4 1 1
 0 1 0 2 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5 2 1 1 7 6 10 4 2 9 9
 3 1 2 2 6 1 2 4 1 1 0 1 0 2 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0

### Abrams thesis, CA south 4010, research
### assigned to fleet: "8_CA_SouthOf4010_Abrams_thesis_comps"
# dropped 2010 10cm bin (10cm 14 yr-old?)
#Yr Seas Fly/Svy Gender Part AgeErr LbinLo LbinHi Nsamp 4yrs 5yrs 6yrs 7yrs
#  8yrs 9yrs 10yrs 11yrs 12yrs 13yrs 14yrs 15yrs 16yrs 17yrs 18yrs 19yrs 20
# yrs 21yrs 22yrs 23yrs 24yrs 25yrs 26yrs 27yrs 28yrs 29yrs 30yrs 31yrs 32y
# rs 33yrs 34yrs 35yrs 36yrs 37yrs 38yrs 39yrs 40yrs 41yrs 42yrs 43yrs 44yr
# s 45yrs 46yrs 47yrs 48yrs 49yrs 50yrs repeat
#
-2010 1 9 0 0 1 10 10 1 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 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
2010 1 9 0 0 1 24 24 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 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
2010 1 9 0 0 1 26 26 5 0 0 0 0 0 1 1 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 0 1 1 2 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
2010 1 9 0 0 1 28 28 13 0 0 0 1 0 0 0 1 5 1 2 0 0 0 1 0 0 0 0 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 1 0 0 0 1 5 1 2 0 0 0 1 0
0 0 0 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
2010 1 9 0 0 1 30 30 19 0 0 0 0 0 0 3 1 2 3 2 1 2 2 2 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 3 1 2 3 2 1 2 2 2 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
2010 1 9 0 0 1 32 32 32 0 0 0 0 0 0 0 1 2 3 2 4 5 3 2 1 0 1 0 0 2 2 1 2 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 2 3 2 4 5 3 2 1
0 1 0 0 2 2 1 2 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2010 1 9 0 0 1 34 34 7 0 0 0 0 0 0 0 0 1 0 0 0 0 1 1 0 0 0 0 0 1 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 1 0 0 0 0 1 1 0 0
0 0 0 1 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
2010 1 9 0 0 1 36 36 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 1 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 1 0
0 0 0 0 1 0 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2010 1 9 0 0 1 38 38 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 0 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 0 0 0 0 0 0 0 0 0 0 0 0 0
2011 1 9 0 0 1 24 24 2 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 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
2011 1 9 0 0 1 26 26 3 0 0 0 0 1 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 1 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2011 1 9 0 0 1 28 28 7 0 0 0 0 0 2 0 0 1 2 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 2 0 0 1 2 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
2011 1 9 0 0 1 30 30 24 0 0 0 0 2 0 0 0 2 2 5 1 2 3 2 0 0 1 2 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 2 0 0 0 2 2 5 1 2 3 2 0
0 1 2 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
2011 1 9 0 0 1 32 32 17 0 0 0 0 0 0 0 0 0 0 0 2 2 0 2 3 1 1 0 0 2 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 2 2 0 2 3 1
1 0 0 2 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
2011 1 9 0 0 1 34 34 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 2 0 1 1 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 1 1 0
0 0 2 0 1 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2011 1 9 0 0 1 36 36 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 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 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2011 1 9 0 0 1 38 38 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 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 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2011 1 9 0 0 1 42 42 1 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 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

### CA, Rec +Research 1972-1985, south 4010 (all locations with description
# s are S. of 4010, farthest North is Albion River)
### comps are a mixture of sources; use negative fleet number when working
# again
# year season fleet gender part ageErr LbinLo LbinHi Nsamps A4 A5 A6 A7 A8
# A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20 A21 A22 A23 A24 A25 A26 A2
# 7 A28 A29 A30 A31 A32 A33 A34 A35 A36 A37 A38 A39 A40 A41 A42 A43 A44 A45
#  A46 A47 A48 A49 A50 repeat
1972 1 -3 0 0 1 -1 -1 45 0 0 0 0 0 0 2 6 2 2 3 3 0 2 5 1 1 2 0 0 0 1 0 0 1
1 1 2 0 2 0 0 2 2 0 0 0 1 0 0 0 0 0 0 0 0 3 0 0 0 0 0 0 2 6 2 2 3 3 0 2 5 1
 1 2 0 0 0 1 0 0 1 1 1 2 0 2 0 0 2 2 0 0 0 1 0 0 0 0 0 0 0 0 3
1973 1 -3 0 0 1 -1 -1 15 0 1 0 0 0 0 0 0 1 1 0 3 0 1 1 1 0 0 0 0 0 0 0 0 0
0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 3 0 1 0 0 0 0 0 0 1 1 0 3 0 1 1 1
 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 3
1976 1 -3 0 0 1 -1 -1 12 0 0 0 2 1 0 0 0 0 0 0 1 0 0 1 1 0 1 1 0 1 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 1 0 0 0 2 1 0 0 0 0 0 0 1 0 0 1 1
 0 1 1 0 1 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 1
1977 1 -3 0 0 1 -1 -1 5 0 0 1 0 0 1 0 0 0 0 0 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0 1 0 1 0 0
0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1978 1 -3 0 0 1 -1 -1 10 0 0 0 0 2 2 2 0 0 0 0 0 0 0 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 2 0 0 0 0 2 2 2 0 0 0 0 0 0 0 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 2
1979 1 -3 0 0 1 -1 -1 7 0 0 1 1 0 2 1 0 0 0 0 0 0 0 0 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 1 1 0 2 1 0 0 0 0 0 0 0 0 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
1980 1 -3 0 0 1 -1 -1 6 3 0 0 0 0 0 0 1 0 1 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 3 0 0 0 0 0 0 1 0 1 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
1981 1 -3 0 0 1 -1 -1 2 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 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
1982 1 -3 0 0 1 -1 -1 10 2 0 0 0 0 1 2 0 2 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 2 0 0 0 0 1 2 0 2 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
1984 1 -3 0 0 1 -1 -1 3 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 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
1985 1 -3 0 0 1 -1 -1 7 0 0 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 0 0 0 0 1 1 0 0 1
 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 1 0 0 0 1 0
0 0 0 0 0 1 1 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 #_N_MeanSize-at-Age_obs
#Yr Seas Flt/Svy Gender Part Ageerr Ignore datavector(female-male)
#                                          samplesize(female-male)
# 1971 1 1 3 0 1 2 29.8931 40.6872 44.7411 50.027 52.5794 56.1489 57.1033 6
# 1.1728 61.7417 63.368 64.4088 65.6889 67.616 68.5972 69.9177 71.0443 72.3
# 609 32.8188 39.5964 43.988 50.1693 53.1729 54.9822 55.3463 60.3509 60.743
# 9 62.3432 64.3224 65.1032 64.1965 66.7452 67.5154 70.8749 71.2768 20 20 2
# 0 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
#  20 20 20 20 20 20 20

0 #_N_environ_variables
0 #_N_environ_obs
0 # N sizefreq methods to read

0 # no tag data

0 # no morphcomp data

999
```

Appendix B. SS control file

Northern Model

```
#V3.24u
#C China rockfish control file for north model (WA only)
1 #_N_Growth_Patterns
1 #_N_Morphs_Within_GrowthPattern
## 2 # Number of recruitment assignments
## 0 # Recruitment interaction requested?
## 1 1 1 # Recruitment assignment to GP 1, seas 1, area 1
## 1 1 2 # Recruitment assignment to GP 1, seas 1, area 2
0 #_Nblock_Patterns
#_Cond 0 #_blocks_per_pattern
# begin and end years of blocks
#
## 0 # N movement definitions

0.5     #_fracfemale
0       #_natM_type:_0=1Parm; 1=N_breakpoints;_2=Lorenzen;_3=agespecific;_4
# =agespec_withseasinterpolate
        #_no additional input for selected M option; read 1P per morph
1       # GrowthModel: 1=vonBert with L1&L2; 2=Richards with L1&L2; 3=age_s
# peciific_K; 4=not implemented
0       #_Growth_Age_for_L1
30      #_Growth_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)
# ; 4 logSD=F(A)
1       #_maturity_option: 1=length logistic; 2=age logistic; 3=read age-ma
# turity matrix by growth_pattern; 4=read age-fecundity; 5=read fec and wt
# from wtatage.ss
#0      0       0       0       1       1       1       1       1       1
#       1       1       1       1       1       1       1       1       1
#      1       1       1       1       1       1       1       1       1
#     1       1       1       1       1       1       1       1       1
#    1       1       1       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
#_placeholder for empirical age-maturity by growth pattern
```

```
1       #_First_Mature_Age
1       #_fecundity option:(1)eggs=Wt*(a+b*Wt);(2)eggs=a*L^b;(3)eggs=a*Wt^b
# ; (4)eggs=a+b*L; (5)eggs=a+b*W
0       #_hermaphroditism option: 0=none; 1=age-specific fxn
2       #_parameter_offset_approach (1=none, 2= M, G, CV_G as offset from f
# emale-GP1, 3=like SS2 V1.x)
2       #_env/block/dev_adjust_method (1=standard; 2=logistic transform kee
# ps in base parm bounds; 3=standard w/ no bound check)
#
#_growth_parms
#_LO    HI      INIT    PRIOR   PR_type SD   PHASE env-var use_dev dev_miny
# r dev_maxyr dev_SD Block Block_Fxn
# female growth
0.01    0.15    0.07    -2.94   3       0.53    -3      0       0       0
     0       0       0       0       #       NatM_p_1_Fem_GP_1 (with prior
# from Owen)
#0.01    0.15    0.06    0.06    -1      0.8      3      0       0       0
#       0       0       0       0       #       NatM_p_1_Fem_GP_1 - no prio
# r
-10     45        2       2      0       10      -2      0       0       0
     0       0       0       0       #       L_at_Amin_Fem_GP_1
20      50      34      34       0       10       6      0       0       0
     0       0       0       0       #       L_at_Amax_Fem_GP_1
0.01    0.3     0.1     0.1      0       0.8      6      0       0       0
     0       0       0       0       #       VonBert_K_Fem_GP_1
0.01    0.25    0.1     0.1     -1       0.8     -6      0       0       0
     0       0       0       0       #       CV_young_Fem_GP_1
0.01    0.25    0.1     0.1     -1       0.8      6      0       0       0
     0       0       0       0       #       CV_old_Fem_GP_1
### male growth with absolute offsets = 0 (effectively single gender model)
-1      0.15    0      0.053    -1      0.8     -3      0       0       0
   0       0       0       0       #       NatM_p_1_Mal_GP_1
-1      45      0       2       0       10      -2      0       0       0
  0       0       0       0       #       L_at_Amin_Mal_GP_1
-1      50      0      33.13    0       10      -4      0       0       0
  0       0       0       0       #       L_at_Amax_Mal_GP_1
-1      0.3     0      0.2461   0       0.8     -4      0       0       0
  0       0       0       0       #       VonBert_K_Mal_GP_1
-1      0.25    0      0.1     -1       0.8     -3      0       0       0
  0       0       0       0       #       CV_young_Mal_GP_1
-1      0.25    0      0.1     -1       0.8     -3      0       0       0
  0       0       0       0       #       CV_old_Mal_GP_1
```

```
# female weight-length, maturity, and fecundity
0       1       1.17E-5 1.17E-5 -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_1_Fem # converted to (cm
# ,kg) from Lea et al. 1999
2       4       3.177   3       -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_2_Fem # from Lea et al.
# 1999
1       100     28.5    28.5    -1      0.8     -3      0       0       0
     0       0       0       0       #       Mat50%_Fem
-9      9       -1.0    0       -1      0.8     -3      0       0       0
     0       0       0       0       #       Mat_slope_Fem
 -3 3 0.196 1 -1 0.8 -3 0 0 0 0 0 0 0 #       Eggs/kg_inter_Fem
 -3 3 0.0571 0 -1 0.8 -3 0 0 0 0 0 0 0 #       Eggs/kg_slope_wt_Fem
### male W-L with absolute offsets = 0 (effectively single gender model)
0       1       1.17E-5 1.17E-5 -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_1_Mal # converted to (cm
# ,kg) from Lea et al. 1999
2       4       3.177   3       -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_2_Mal # from Lea et al.
# 1999

0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       RecrDist_GP_1
# non-spatial model uses following recruit distribution parameter
0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       RecrDist_Area_1
# spatial model uses next 2 lines for recruit distribution, only 1 estimate
# d
## -4      4       0       1       -1      50      -1      0       0
# 0       0       0       0       0       #       RecrDist_Area_1
## -4      4       0       1       -1      50      1       0       0
# 0       0       0       0       0       #       RecrDist_Area_1
0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       RecrDist_Seas_1
0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       CohortGrowDev
#
#_Cond 0 #custom_MG-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-environ parameters
#
#_Cond 0 #custom_MG-block_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-block parameters
```

```
#_Cond No MG parm trends
#
#_seasonal_effects_on_biology_parms
 0 0 0 0 0 0 0 0 0 0 #_femwtlen1,femwtlen2,mat1,mat2,fec1,fec2,Malewtlen1,m
# alewtlen2,L1,K
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no seasonal MG parameters
#
#_Cond -4 #_MGparm_Dev_Phase
#
#_Spawner-Recruitment
3       #_SR_function: 2=Ricker; 3=std_B-H; 4=SCAA; 5=Hockey; 6=B-H_flattop
# ; 7=survival_3Parm
#_LO    HI      INIT    PRIOR   PR_type SD      PHASE
2       12       2.7       6       -1      10      1       #       SR_LN(R0
# )
0.2     1       0.773   0.773   2       0.147   -3       #       SR_BH_stee
# p
0       2       0.5     0.5     -1      0.8     -3      #       SR_sigmaR
-5      5       0.1     0       -1      1       -3      #       SR_envlink
-5      5       0       0       -1      1       -4      #       SR_R1_offse
# t
0       0       0       0       -1      0       -99     #       SR_autocorr
0 #_SR_env_link
0 #_SR_env_target_0=none;1=devs;_2=R0;_3=steepness
0   #do_recdev:  0=none; 1=devvector; 2=simple deviations
1971 # first year of main recr_devs; early devs can preceed this era
2001 # last year of main recr_devs; forecast devs start in following year
-2   #_recdev phase
1    # (0/1) to read 13 advanced options
0    #_recdev_early_start (0=none; neg value makes relative to recdev_start
# )
-4   #_recdev_early_phase
-4   #_forecast_recruitment phase (incl. late recr) (0 value resets to maxp
# hase+1)
1    #_lambda for Fcast_recr_like occurring before endyr+1
1980  #_last_early_yr_nobias_adj_in_MPD
1985 #_first_yr_fullbias_adj_in_MPD
2001 #_last_yr_fullbias_adj_in_MPD
2015 #_first_recent_yr_nobias_adj_in_MPD
1    #_max_bias_adj_in_MPD (-1 to override ramp and set biasadj=1.0 for all
#  estimated recdevs)
0    #_period of cycles in recruitment (N parms read below)
```

```
-5   #_min rec_dev
5    #_max rec_dev
0    #_read_recdevs
#_end of advanced SR options
#
#
#Fishing Mortality info
0.3 # F ballpark for tuning early phases
-2001 # F ballpark year (neg value to disable)
3 # F_Method: 1=Pope; 2=instan. F; 3=hybrid (hybrid is recommended)
2.9 # max F or harvest rate, depends on F_Method
# no additional F input needed for Fmethod 1
# if Fmethod=2; read overall start F value; overall phase; N detailed input
# s to read
# if Fmethod=3; read N iterations for tuning for Fmethod 3
5 # N iterations for tuning F in hybrid method (recommend 3 to 7)
#
#_initial_F_parms (1 per catch fleet)
#_LO HI INIT PRIOR PR_type SD PHASE
0    1  0    0.01  -1      99 -1   # 1_WA_SouthernWA_Rec_PCPR
0    1  0    0.01  -1      99 -1   # 2_WA_NorthernWA_Rec_PC
0    1  0    0.01  -1      99 -1   # 3_WA_NorthernWA_Rec_PR
#
#_Q_setup
# Q_type options: <0=mirror, 0=float_nobiasadj, 1=float_biasadj, 2=parm_nob
# iasadj, 3=parm_w_random_dev, 4=parm_w_randwalk, 5=mean_unbiased_float_ass
# ign_to_parm
#_for_env-var:_enter_index_of_the_env-var_to_be_linked

### NOTE: initially turning off extra sd parameters
###       until we sort out which fleets have indices
###       (changed 3rd column below from 1 to 0)

#_Den-dep env-var extra_se Q_type
0        0        0        1 # 1_WA_SouthernWA_Rec_PCPR
0        0        0        1 # 2_WA_NorthernWA_Rec_PC
0        0        1        1 # 3_WA_NorthernWA_Rec_PR
#
## #_LO HI INIT PRIOR PR_type SD PHASE
0    2  0.15  1     -1      99 2 # extra sd index for fleet 3

#_Cond 0 #_If q has random component, then 0=read one parm for each fleet w
```

```
# ith random q; 1=read a parm for each year of index
#_Q_parms(if_any)
# LO HI INIT PRIOR PR_type SD PHASE
#
#_size_selex_types
#discard_options:_0=none;_1=define_retention;_2=retention&mortality;_3=all_
# discarded_dead
#_Pattern Discard Male Special
24        0       0    0      # 1_WA_SouthernWA_Rec_PCPR
24        0       0    0      # 2_WA_NorthernWA_Rec_PC (no comp, mirrored b
# y Rec_PR)
15        0       0    2      # 3_WA_NorthernWA_Rec_PR
#
#_age_selex_types
#_Pattern ___ Male Special
10        0       0    0      # 1_WA_SouthernWA_Rec_PCPR
10        0       0    0      # 2_WA_NorthernWA_Rec_PC
10        0       0    0      # 3_WA_NorthernWA_Rec_PR

# ALL DOUBLE-NORMALS, BUT FIXED AS ASYMPTOTIC
#_LO    HI      INIT    PRIOR   PR_type SD      PHASE   env-var use_dev dev
# _minyr       dev_maxyr       dev_SD  Block   Block_Fxn
# Fleet 1 (1_WA_SouthernWA_Rec_PCPR)
# Note: First parameter hitting upper bounds, fixed at peak of other fleet(
# s)
19      36      34.89    30      -1      50      -4      0       0       0
      0       0       0       0 # PEAK (fixed at estimated value of other f
# leet)
-9      5       -4      -4      -1      50      -9      0       0       0
     0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
     0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
     0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
     0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
     0       0       0       0 # FINAL (logistic)
# Fleets 2-3 (2_WA_NorthernWA_Rec_PC and 3_WA_NorthernWA_Rec_PR)
19      36      34      30      -1      50      4       0       0       0
     0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
```

```
      0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
      0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
      0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
      0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
      0       0       0       0 # FINAL (logistic)
#_Cond 0 #_custom_sel-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no enviro fxns
#_Cond 0 #_custom_sel-blk_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no block usage
#_Cond No selex parm trends
#_Cond -4 # placeholder for selparm_Dev_Phase
#_Cond 0 #_env/block/dev_adjust_method (1=standard; 2=logistic trans to kee
# p in base parm bounds; 3=standard w/ no bound check)
#
# 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
#_fleet: 1 2 3
#F1    F2    F3
  0     0     0     #_add_to_survey_CV
  0     0     0     #_add_to_discard_stddev
  0     0     0     #_add_to_bodywt_CV
  0.189 1     0.089 #_mult_by_lencomp_N
  1     1      0.2428  #_mult_by_agecomp_N
  1     1     1     #_mult_by_size-at-age_N
#
4 #_maxlambdaphase
1 #_sd_offset
#
0 # number of changes to make to default Lambdas (default value is 1.0)
# Like_comp codes: 1=surv; 2=disc; 3=mnwt; 4=length; 5=age; 6=SizeFreq; 7=s
# izeage; 8=catch;
# 9=init_equ_catch; 10=recrdev; 11=parm_prior; 12=parm_dev; 13=CrashPen; 14
# =Morphcomp; 15=Tag-comp; 16=Tag-negbin
#like_comp fleet/survey phase value sizefreq_method
# 1 2 2 1 1
```

```
# 4 2 2 1 1
# 4 2 3 1 1
#
# lambdas (for info only; columns are phases)
# 0 0 0 0 #_CPUE/survey:_1
# 1 1 1 1 #_CPUE/survey:_2
# 1 1 1 1 #_CPUE/survey:_3
# 1 1 1 1 #_lencomp:_1
# 1 1 1 1 #_lencomp:_2
# 0 0 0 0 #_lencomp:_3
# 1 1 1 1 #_agecomp:_1
# 1 1 1 1 #_agecomp:_2
# 0 0 0 0 #_agecomp:_3
# 1 1 1 1 #_size-age:_1
# 1 1 1 1 #_size-age:_2
# 0 0 0 0 #_size-age:_3
# 1 1 1 1 #_init_equ_catch
# 1 1 1 1 #_recruitments
# 1 1 1 1 #_parameter-priors
# 1 1 1 1 #_parameter-dev-vectors
# 1 1 1 1 #_crashPenLambda
0 # (0/1) read specs for more stddev reporting
# 1 1 -1 5 1 5 1 -1 5 # selex type, len/age, year, N selex bins, Growth pat
# tern, N growth ages, NatAge_area(-1 for all), NatAge_yr, N Natages
# 5 15 25 35 43 # vector with selex std bin picks (-1 in first bin to self-
# generate)
# 1 2 14 26 40 # vector with growth std bin picks (-1 in first bin to self-
# generate)
# 1 2 14 26 40 # vector with NatAge std bin picks (-1 in first bin to self-
# generate)
999
```

Central Model

```
#V3.24u
#C China rockfish control file for central model (40-10 to OR/WA border)
1 #_N_Growth_Patterns
1 #_N_Morphs_Within_GrowthPattern
## 2 # Number of recruitment assignments
## 0 # Recruitment interaction requested?
## 1 1 1 # Recruitment assignment to GP 1, seas 1, area 1
## 1 1 2 # Recruitment assignment to GP 1, seas 1, area 2
```

```
0 #_Nblock_Patterns
#_Cond 0 #_blocks_per_pattern
# begin and end years of blocks
#
## 0 # N movement definitions

0.5     #_fracfemale
0       #_natM_type:_0=1Parm; 1=N_breakpoints;_2=Lorenzen;_3=agespecific;_4
# =agespec_withseasinterpolate
        #_no additional input for selected M option; read 1P per morph
1       # GrowthModel: 1=vonBert with L1&L2; 2=Richards with L1&L2; 3=age_s
# peciific_K; 4=not implemented
0       #_Growth_Age_for_L1
30      #_Growth_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)
# ; 4 logSD=F(A)
1       #_maturity_option: 1=length logistic; 2=age logistic; 3=read age-ma
# turity matrix by growth_pattern; 4=read age-fecundity; 5=read fec and wt
# from wtatage.ss
#0       0       0       0       1       1       1       1       1       1
#       1       1       1       1       1       1       1       1       1
#      1       1       1       1       1       1       1       1       1
#     1       1       1       1       1       1       1       1       1
#    1       1       1       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
#_placeholder for empirical age-maturity by growth pattern
1       #_First_Mature_Age
1       #_fecundity option:(1)eggs=Wt*(a+b*Wt);(2)eggs=a*L^b;(3)eggs=a*Wt^b
# ; (4)eggs=a+b*L; (5)eggs=a+b*W
0       #_hermaphroditism option: 0=none; 1=age-specific fxn
2       #_parameter_offset_approach (1=none, 2= M, G, CV_G as offset from f
# emale-GP1, 3=like SS2 V1.x)
2       #_env/block/dev_adjust_method (1=standard; 2=logistic transform kee
# ps in base parm bounds; 3=standard w/ no bound check)
#
#_growth_parms
#_LO    HI      INIT    PRIOR   PR_type SD   PHASE env-var use_dev dev_miny
# r dev_maxyr dev_SD Block Block_Fxn
```

```
# female growth
0.01    0.15    0.07    -2.94   3       0.53    -3      0       0       0
      0       0       0       0       #       NatM_p_1_Fem_GP_1 (with prior
#  from Owen)
#0.01    0.15    0.053    -2.94   3       0.53    -3      0       0
# 0       0       0       0       0       #       NatM_p_1_Fem_GP_1 (with p
# rior from Owen)
#0.01    0.15    0.06    0.06    -1      0.8     3       0       0       0
#       0       0       0       0       #       NatM_p_1_Fem_GP_1 - no prio
# r
-10     45        2       2       -1      10      -2      0       0       0
      0       0       0       0       #       L_at_Amin_Fem_GP_1
20      50      34      34      -1      10      6       0       0       0
      0       0       0       0       #       L_at_Amax_Fem_GP_1
0.01    0.3     0.1     0.1     -1      0.8     6       0       0       0
      0       0       0       0       #       VonBert_K_Fem_GP_1
0.01    0.25    0.1     0.1     -1      0.8     -6      0       0       0
     0       0       0       0       #       CV_young_Fem_GP_1
0.01    0.25    0.1     0.1     -1      0.8     6       0       0       0
     0       0       0       0       #       CV_old_Fem_GP_1
### male growth with absolute offsets = 0 (effectively single gender model)
-1      0.15    0     0.053    -1      0.8     -3      0       0       0
   0       0       0       0       #       NatM_p_1_Mal_GP_1
-1      45      0       2       -1      10      -2      0       0       0
  0       0       0       0       #       L_at_Amin_Mal_GP_1
-1      50      0       33.13   -1      10      -4      0       0       0
  0       0       0       0       #       L_at_Amax_Mal_GP_1
-1      0.3     0       0.2461  -1      0.8     -4      0       0       0
  0       0       0       0       #       VonBert_K_Mal_GP_1
-1      0.25    0       0.1     -1      0.8     -3      0       0       0
  0       0       0       0       #       CV_young_Mal_GP_1
-1      0.25    0       0.1     -1      0.8     -3      0       0       0
  0       0       0       0       #       CV_old_Mal_GP_1
# female weight-length, maturity, and fecundity
0       1       1.17E-5 1.17E-5 -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_1_Fem # converted to (cm
# ,kg) from Lea et al. 1999
2       4       3.177   3       -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_2_Fem # from Lea et al.
# 1999
1       100     28.5    28.5    -1      0.8     -3      0       0       0
     0       0       0       0       #       Mat50%_Fem
```

```
-9      9       -1.0    0       -1      0.8     -3      0       0       0
    0       0       0       0       #       Mat_slope_Fem
 -3 3 0.196 1 -1 0.8 -3 0 0 0 0 0 0 0 #       Eggs/kg_inter_Fem
 -3 3 0.0571 0 -1 0.8 -3 0 0 0 0 0 0 0 #       Eggs/kg_slope_wt_Fem
## -3      3       1       1       -1      0.8     -3      0       0
# 0       0       0       0       0       #       Eggs/kg_inter_Fem
## -3      3       0       0       -1      0.8     -3      0       0
# 0       0       0       0       0       #       Eggs/kg_slope_wt_Fem
### male W-L with absolute offsets = 0 (effectively single gender model)
0       1       1.17E-5 1.17E-5 -1      0.8     -3      0       0       0
    0       0       0       0       #       Wtlen_1_Mal # converted to (cm
# ,kg) from Lea et al. 1999
2       4       3.177   3       -1      0.8     -3      0       0       0
    0       0       0       0       #       Wtlen_2_Mal # from Lea et al.
# 1999

0       0       0       0       -1      0       -4      0       0       0
    0       0       0       0       #       RecrDist_GP_1
# non-spatial model uses following recruit distribution parameter
0       0       0       0       -1      0       -4      0       0       0
    0       0       0       0       #       RecrDist_Area_1
# spatial model uses next 2 lines for recruit distribution, only 1 estimate
# d
## -4      4       0       1       -1      50      -1      0       0
# 0       0       0       0       0       #       RecrDist_Area_1
## -4      4       0       1       -1      50       1      0       0
# 0       0       0       0       0       #       RecrDist_Area_1
0       0       0       0       -1      0       -4      0       0       0
    0       0       0       0       #       RecrDist_Seas_1
0       0       0       0       -1      0       -4      0       0       0
    0       0       0       0       #       CohortGrowDev
#
#_Cond 0 #custom_MG-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-environ parameters
#
#_Cond 0 #custom_MG-block_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-block parameters
#_Cond No MG parm trends
#
#_seasonal_effects_on_biology_parms
 0 0 0 0 0 0 0 0 0 0 #_femwtlen1,femwtlen2,mat1,mat2,fec1,fec2,Malewtlen1,m
# alewtlen2,L1,K
```

```
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no seasonal MG parameters
#
#_Cond -4 #_MGparm_Dev_Phase
#
#_Spawner-Recruitment
3       #_SR_function: 2=Ricker; 3=std_B-H; 4=SCAA; 5=Hockey; 6=B-H_flattop
# ; 7=survival_3Parm
#_LO    HI      INIT    PRIOR   PR_type SD      PHASE
3       12       6       6       -1      10      1       #       SR_LN(R0)
0.2     1       0.773   0.773   2       0.147   -3       #       SR_BH_stee
# p
0       2       0.5     0.5     -1      0.8     -3      #       SR_sigmaR
-5      5       0.1     0       -1      1       -3      #       SR_envlink
-5      5       0       0       -1      1       -4      #       SR_R1_offse
# t
0       0       0       0       -1      0       -99     #       SR_autocorr
0 #_SR_env_link
0 #_SR_env_target_0=none;1=devs;_2=R0;_3=steepness
1    #do_recdev:  0=none; 1=devvector; 2=simple deviations
1971 # first year of main recr_devs; early devs can preceed this era
2001 # last year of main recr_devs; forecast devs start in following year
-2   #_recdev phase
1    # (0/1) to read 13 advanced options
0    #_recdev_early_start (0=none; neg value makes relative to recdev_start
# )
-4   #_recdev_early_phase
-4   #_forecast_recruitment phase (incl. late recr) (0 value resets to maxp
# hase+1)
1    #_lambda for Fcast_recr_like occurring before endyr+1
900  #_last_early_yr_nobias_adj_in_MPD
1820 #_first_yr_fullbias_adj_in_MPD
2001 #_last_yr_fullbias_adj_in_MPD
2015 #_first_recent_yr_nobias_adj_in_MPD
1    #_max_bias_adj_in_MPD (-1 to override ramp and set biasadj=1.0 for all
#  estimated recdevs)
0    #_period of cycles in recruitment (N parms read below)
-5   #_min rec_dev
5    #_max rec_dev
0    #_read_recdevs
#_end of advanced SR options
#
#
```

```
#Fishing Mortality info
0.3 # F ballpark for tuning early phases
-2001 # F ballpark year (neg value to disable)
3 # F_Method: 1=Pope; 2=instan. F; 3=hybrid (hybrid is recommended)
2.9 # max F or harvest rate, depends on F_Method
# no additional F input needed for Fmethod 1
# if Fmethod=2; read overall start F value; overall phase; N detailed input
# s to read
# if Fmethod=3; read N iterations for tuning for Fmethod 3
5 # N iterations for tuning F in hybrid method (recommend 3 to 7)
#
#_initial_F_parms (1 per catch fleet)
#_LO HI INIT PRIOR PR_type SD PHASE
0    1  0    0.01  -1      99 -1   # 1_CA_NorthOf4010_Comm_Dead
0    1  0    0.01  -1      99 -1   # 2_CA_NorthOf4010_Comm_Live
0    1  0    0.01  -1      99 -1   # 3_CA_NorthOf4010_Rec_PC
0    1  0    0.01  -1      99 -1   # 4_CA_NorthOf4010_Rec_PR
0    1  0    0.01  -1      99 -1   # 5_OR_SouthernOR_Comm_Dead
0    1  0    0.01  -1      99 -1   # 6_OR_SouthernOR_Comm_Live
0    1  0    0.01  -1      99 -1   # 7_OR_SouthernOR_Rec_PC
0    1  0    0.01  -1      99 -1   # 8_OR_SouthernOR_Rec_PR
0    1  0    0.01  -1      99 -1   # 9_OR_NorthernOR_Comm
0    1  0    0.01  -1      99 -1   # 10_OR_NorthernOR_Rec_PC
0    1  0    0.01  -1      99 -1   # 11_OR_NorthernOR_Rec_PR
#
#_Q_setup
# Q_type options: <0=mirror, 0=float_nobiasadj, 1=float_biasadj, 2=parm_nob
# iasadj, 3=parm_w_random_dev, 4=parm_w_randwalk, 5=mean_unbiased_float_ass
# ign_to_parm
#_for_env-var:_enter_index_of_the_env-var_to_be_linked

### NOTE: initially turning off extra sd parameters
###       until we sort out which fleets have indices
###       (changed 3rd column below from 1 to 0)

#_Den-dep env-var extra_se Q_type
0        0        0        1 # 1_CA_NorthOf4010_Comm_Dead
0        0        0        1 # 2_CA_NorthOf4010_Comm_Live
0        0        0        1 # 3_CA_NorthOf4010_Rec_PC
0        0        0        1 # 4_CA_NorthOf4010_Rec_PR
0        0        0        1 # 5_OR_SouthernOR_Comm_Dead
0        0        1        1 # 6_OR_SouthernOR_Comm_Live # no extra_se beca
```

```
# use hit lower bound
0        0        0        1 # 7_OR_SouthernOR_Rec_PC
0        0        0        1 # 8_OR_SouthernOR_Rec_PR
0        0        0        1 # 9_OR_NorthernOR_Comm
0        0        0        1 # 10_OR_NorthernOR_Rec_PC
0        0        1        1 # 11_OR_NorthernOR_Rec_PR
0        0        1        1 # 15_OR_SouthernOR_Rec_PC_index
#
# additive variance parms for indices
#_LO HI INIT PRIOR PR_type SD PHASE
0    2  0.5  1     -1      99 2 # extra sd index for fleet 6 # was hitting
# lower bound
#0    2  0.5  1     -1      99 2 # extra sd index for fleet 7 # index remov
# ed
0    2  0.5  1     -1      99 2 # extra sd index for fleet 11
0    2  0.5  1     -1      99 2 # extra sd index for fleet 12

#_Cond 0 #_If q has random component, then 0=read one parm for each fleet w
# ith random q; 1=read a parm for each year of index
#_Q_parms(if_any)
# LO HI INIT PRIOR PR_type SD PHASE
#
#_size_selex_types
#discard_options:_0=none;_1=define_retention;_2=retention&mortality;_3=all_
# discarded_dead
#_Pattern Discard Male Special
24        0        0    0      # 1_CA_NorthOf4010_Comm_Dead
24        0        0    0      # 2_CA_NorthOf4010_Comm_Live
24        0        0    0      # 3_CA_NorthOf4010_Rec_PC
24        0        0    0      # 4_CA_NorthOf4010_Rec_PR
24        0        0    0      # 5_OR_SouthernOR_Comm_Dead
24        0        0    0      # 6_OR_SouthernOR_Comm_Live
24        0        0    0      # 7_OR_SouthernOR_Rec_PC
24        0        0    0      # 8_OR_SouthernOR_Rec_PR
15        0        0    5      # 9_OR_NorthernOR_Comm (no comp, mirroring So
# uthernOR_Comm_Dead)
24        0        0    0      # 10_OR_NorthernOR_Rec_PC
15        0        0   10      # 11_OR_NorthernOR_Rec_PR (no comp, mirroring
#  Rec_PC)
15        0        0    7      # 15_OR_SouthernOR_Rec_PC_index (should alway
# s match fleet 7)
#
```

```
#_age_selex_types
#_Pattern ___ Male Special
10        0       0    0      # 1_CA_NorthOf4010_Comm_Dead
10        0       0    0      # 2_CA_NorthOf4010_Comm_Live
10        0       0    0      # 3_CA_NorthOf4010_Rec_PC
10        0       0    0      # 4_CA_NorthOf4010_Rec_PR
10        0       0    0      # 5_OR_SouthernOR_Comm_Dead
10        0       0    0      # 6_OR_SouthernOR_Comm_Live
10        0       0    0      # 7_OR_SouthernOR_Rec_PC
10        0       0    0      # 8_OR_SouthernOR_Rec_PR
10        0       0    0      # 9_OR_NorthernOR_Comm
10        0       0    0      # 10_OR_NorthernOR_Rec_PC
10        0       0    0      # 11_OR_NorthernOR_Rec_PR
10        0       0    0      # 15_OR_SouthernOR_Rec_PC_index

# ALL DOUBLE-NORMALS, BUT FIXED AS ASYMPTOTIC
#_LO    HI      INIT    PRIOR   PR_type SD      PHASE   env-var use_dev dev
# _minyr       dev_maxyr       dev_SD  Block   Block_Fxn
# Fleet group 1
19      45      28      30      -1      50      4       0       0       0
     0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
     0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
     0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
     0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
     0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
     0       0       0       0 # FINAL (logistic)
# Fleet group 2
19      45      28      30      -1      50      4       0       0       0
     0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
     0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
     0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
     0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
     0       0       0       0 # INIT (logistic)
```

```
-9      9       8       5       -1      50      -9      0       0       0
    0       0       0       0 # FINAL (logistic)
# Fleet group 3
19      45      39.9    30      -1      50      -4      0       0       0
    0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
    0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
    0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
    0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
    0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
    0       0       0       0 # FINAL (logistic)
# Fleet group 4
19      45      39.9    30      -1      50      -4      0       0       0
    0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
    0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
    0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
    0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
    0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
    0       0       0       0 # FINAL (logistic)
# Fleet group 5
19      45      39.9    30      -1      50      4      0       0       0
   0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
    0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
    0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
    0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
    0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
    0       0       0       0 # FINAL (logistic)
# Fleet group 6
```

```
19      45      39.9    30      -1      50      4       0       0       0
        0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
        0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
        0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
        0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
        0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
        0       0       0       0 # FINAL (logistic)
# Fleet group 7
19      45      39.9    30      -1      50      -4      0       0       0
        0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
        0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
        0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
        0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
        0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
        0       0       0       0 # FINAL (logistic)
# Fleet group 8
19      45      39.9    30      -1      50      -4      0       0       0
        0       0       0       0 # PEAK
-9      5       -4      -4      -1      50      -9      0       0       0
        0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
        0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
        0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
        0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
        0       0       0       0 # FINAL (logistic)
# Fleet group 9
# Fleet 9 mirrors fleet 5, this is for fleet 10
19      45      39.9    30      -1      50      4       0       0       0
        0       0       0       0 # PEAK
```

```
-9      5       -4      -4      -1      50      -9      0       0       0
    0       0       0       0 # TOP (logistic)
0       9       3       4       -1      50      5       0       0       0
    0       0       0       0 # Asc WIDTH exp
0       9       8       8       -1      50      -9      0       0       0
    0       0       0       0 # Desc WIDTH exp
-9      9       -8      -5      -1      50      -9      0       0       0
    0       0       0       0 # INIT (logistic)
-9      9       8       5       -1      50      -9      0       0       0
    0       0       0       0 # FINAL (logistic)
#_Cond 0 #_custom_sel-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no enviro fxns
#_Cond 0 #_custom_sel-blk_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no block usage
#_Cond No selex parm trends
#_Cond -4 # placeholder for selparm_Dev_Phase
#_Cond 0 #_env/block/dev_adjust_method (1=standard; 2=logistic trans to kee
# p in base parm bounds; 3=standard w/ no bound check)
#
# 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
#F1   F2   F3   F4   F5    F6   F7    F8    F9   F10    F11    F15
  0    0    0    0    0     0    0     0     0     0      0      0 #_add_to
# _survey_CV
  0    0    0    0    0     0    0     0     0     0      0      0 #_add_to
# _discard_stddev
  0    0    0    0    0     0    0     0     0     0      0      0 #_add_to
# _bodywt_CV
#  .72  .28  .22  .11  .066  .027 .052  .046  1     .094   .123   1 #_mult_
# by_lencomp_N
  0.68 0.33 0.25 0.12 0.09  0.04 0.06  0.04  1     0.13   0.15   1 #_mult_b
# y_lencomp_N
  1    1    1    1    .259  1    .428  1     1     .470   1      1 #_mult_b
# y_agecomp_N
  1    1    1    1    1     1    1     1     1     1      1      1 #_mult_b
# y_size-at-age_N
#
4 #_maxlambdaphase
1 #_sd_offset
```

```
#
0 # number of changes to make to default Lambdas (default value is 1.0)
# Like_comp codes: 1=surv; 2=disc; 3=mnwt; 4=length; 5=age; 6=SizeFreq; 7=s
# izeage; 8=catch;
# 9=init_equ_catch; 10=recrdev; 11=parm_prior; 12=parm_dev; 13=CrashPen; 14
# =Morphcomp; 15=Tag-comp; 16=Tag-negbin
#like_comp fleet/survey phase value sizefreq_method
# 1 2 2 1 1
# 4 2 2 1 1
# 4 2 3 1 1
#
# lambdas (for info only; columns are phases)
# 0 0 0 0 #_CPUE/survey:_1
# 1 1 1 1 #_CPUE/survey:_2
# 1 1 1 1 #_CPUE/survey:_3
# 1 1 1 1 #_lencomp:_1
# 1 1 1 1 #_lencomp:_2
# 0 0 0 0 #_lencomp:_3
# 1 1 1 1 #_agecomp:_1
# 1 1 1 1 #_agecomp:_2
# 0 0 0 0 #_agecomp:_3
# 1 1 1 1 #_size-age:_1
# 1 1 1 1 #_size-age:_2
# 0 0 0 0 #_size-age:_3
# 1 1 1 1 #_init_equ_catch
# 1 1 1 1 #_recruitments
# 1 1 1 1 #_parameter-priors
# 1 1 1 1 #_parameter-dev-vectors
# 1 1 1 1 #_crashPenLambda
0 # (0/1) read specs for more stddev reporting
# 1 1 -1 5 1 5 1 -1 5 # selex type, len/age, year, N selex bins, Growth pat
# tern, N growth ages, NatAge_area(-1 for all), NatAge_yr, N Natages
# 5 15 25 35 43 # vector with selex std bin picks (-1 in first bin to self-
# generate)
# 1 2 14 26 40 # vector with growth std bin picks (-1 in first bin to self-
# generate)
# 1 2 14 26 40 # vector with NatAge std bin picks (-1 in first bin to self-
# generate)
999
```

Southern Model

```
#V3.24u
```

```
#C China rockfish REVISED base model 7/7/15
1 #_N_Growth_Patterns
1 #_N_Morphs_Within_GrowthPattern
0 #_Nblock_Patterns
#_Cond 0 #_blocks_per_pattern
# begin and end years of blocks
#
0.5     #_fracfemale
0       #_natM_type:_0=1Parm; 1=N_breakpoints;_2=Lorenzen;_3=agespecific;_4
# =agespec_withseasinterpolate
        #_no additional input for selected M option; read 1P per morph
1       # GrowthModel: 1=vonBert with L1&L2; 2=Richards with L1&L2; 3=age_s
# peciific_K; 4=not implemented
0       #_Growth_Age_for_L1
30      #_Growth_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)
# ; 4 logSD=F(A)
1       #_maturity_option: 1=length logistic; 2=age logistic; 3=read age-ma
# turity matrix by growth_pattern; 4=read age-fecundity; 5=read fec and wt
# from wtatage.ss
#0      0       0       0       1       1       1       1       1       1
#       1       1       1       1       1       1       1       1       1
#      1       1       1       1       1       1       1       1       1
#     1       1       1       1       1       1       1       1       1
#    1       1       1       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
#_placeholder for empirical age-maturity by growth pattern
1       #_First_Mature_Age
1       #_fecundity option:(1)eggs=Wt*(a+b*Wt);(2)eggs=a*L^b;(3)eggs=a*Wt^b
# ; (4)eggs=a+b*L; (5)eggs=a+b*W
0       #_hermaphroditism option: 0=none; 1=age-specific fxn
2       #_parameter_offset_approach (1=none, 2= M, G, CV_G as offset from f
# emale-GP1, 3=like SS2 V1.x)
2       #_env/block/dev_adjust_method (1=standard; 2=logistic transform kee
# ps in base parm bounds; 3=standard w/ no bound check)
#
#_growth_parms
#_LO    HI      INIT    PRIOR   PR_type SD   PHASE env-var use_dev dev_miny
```

```
# r dev_maxyr dev_SD Block Block_Fxn
# female growth
0.01    0.25    0.07   -2.94    3      0.53     -7      0       0       0
     0       0       0       0       #       NatM_p_1_Fem_GP_1 (with prior
# from Owen)
0       10        2       2      -1      10      -2      0       0       0
     0       0       0       0       #       L_at_Amin_Fem_GP_1
25      45      33      34      -1      10       6      0       0       0
     0       0       0       0       #       L_at_Amax_Fem_GP_1
0.05    0.3     0.15    0.1     -1      0.8      6      0       0       0
     0       0       0       0       #       VonBert_K_Fem_GP_1
0.01    0.2     0.1     0.1     -1      0.8     -6      0       0       0
     0       0       0       0       #       CV_young_Fem_GP_1
0.03    0.2     0.1     0.1     -1      0.8      6      0       0       0
     0       0       0       0       #       CV_old_Fem_GP_1
### male growth with absolute offsets = 0 (effectively single gender model)
-1      0.15    0      0       -1      0.8     -3      0       0       0
 0       0       0       0       #       NatM_p_1_Mal_GP_1
-1      45      0      0       -1      10      -2      0       0       0
 0       0       0       0       #       L_at_Amin_Mal_GP_1
-1      50      0      0       -1      10      -4      0       0       0
 0       0       0       0       #       L_at_Amax_Mal_GP_1
-1      0.3     0      0       -1      0.8     -4      0       0       0
 0       0       0       0       #       VonBert_K_Mal_GP_1
-1      0.25    0      0       -1      0.8     -3      0       0       0
 0       0       0       0       #       CV_young_Mal_GP_1
-1      0.25    0      0       -1      0.8     -3      0       0       0
 0       0       0       0       #       CV_old_Mal_GP_1
# female weight-length, maturity, and fecundity
0       1       1.17E-5 1.17E-5 -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_1_Fem # converted to (cm
# ,kg) from Lea et al. 1999
2       4       3.177   3       -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_2_Fem # from Lea et al.
# 1999
1       100     27      27      -1      0.8     -3      0       0       0
     0       0       0       0       #       Mat50%_Fem
-9      9       -1.0    0       -1      0.8     -3      0       0       0
     0       0       0       0       #       Mat_slope_Fem
0       1       0.196   1       -1      0.8     -3      0       0       0
     0       0       0       0       #       Eggs/kg_inter_Fem
0       1       0.0571  0       -1      0.8     -3      0       0       0
```

```
     0       0       0       0       #       Eggs/kg_slope_wt_Fem
# male W-L
0       1       1.17E-5 1.17E-5 -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_1_Mal # converted to (cm
# ,kg) from Lea et al. 1999
2       4       3.177   3       -1      0.8     -3      0       0       0
     0       0       0       0       #       Wtlen_2_Mal # from Lea et al.
# 1999

0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       RecrDist_GP_1
0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       RecrDist_Area_1
0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       RecrDist_Seas_1
0       0       0       0       -1      0       -4      0       0       0
     0       0       0       0       #       CohortGrowDev
#
#_Cond 0 #custom_MG-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-environ parameters
#
#_Cond 0 #custom_MG-block_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no MG-block parameters
#_Cond No MG parm trends
#
#_seasonal_effects_on_biology_parms
 0 0 0 0 0 0 0 0 0 0 #_femwtlen1,femwtlen2,mat1,mat2,fec1,fec2,Malewtlen1,m
# alewtlen2,L1,K
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no seasonal MG parameters
#
#_Cond -4 #_MGparm_Dev_Phase
#
#_Spawner-Recruitment
3       #_SR_function: 2=Ricker; 3=std_B-H; 4=SCAA; 5=Hockey; 6=B-H_flattop
# ; 7=survival_3Parm
#_LO    HI      INIT    PRIOR   PR_type SD      PHASE
4       7       5       4       -1      10       1      #       SR_LN(R0)
0.2     1       0.773   0.773    2      0.147   -3      #       SR_BH_steep
0       2       0.5     0.5     -1      0.8     -3      #       SR_sigmaR
-5      5       0.1     0       -1      1       -3      #       SR_envlink
-5      5       0       0       -1      1       -4      #       SR_R1_offse
# t
```

```
0       0       0       0       -1      0       -9      #       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
1971 # first year of main recr_devs; early devs can preceed this era
2001 # last year of main recr_devs; forecast devs start in following year
-2 #_recdev phase
1 # (0/1) to read 13 advanced options
 0 #_recdev_early_start (0=none; neg value makes relative to recdev_start)
 -4 #_recdev_early_phase
 -4 #_forecast_recruitment phase (incl. late recr) (0 value resets to maxph
# ase+1)
 1 #_lambda for Fcast_recr_like occurring before endyr+1
 900 #_last_early_yr_nobias_adj_in_MPD
 1820 #_first_yr_fullbias_adj_in_MPD
 2001 #_last_yr_fullbias_adj_in_MPD
 2015 #_first_recent_yr_nobias_adj_in_MPD
 1 #_max_bias_adj_in_MPD (-1 to override ramp and set biasadj=1.0 for all e
# stimated recdevs)
 0 #_period of cycles in recruitment (N parms read below)
 -5 #min rec_dev
 5 #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)
3 # F_Method: 1=Pope; 2=instan. F; 3=hybrid (hybrid is recommended)
2.9 # max F or harvest rate, depends on F_Method
# no additional F input needed for Fmethod 1
# if Fmethod=2; read overall start F value; overall phase; N detailed input
# s to read
# if Fmethod=3; read N iterations for tuning for Fmethod 3
5 # N iterations for tuning F in hybrid method (recommend 3 to 7)
#
#_initial_F_parms
#_LO HI INIT PRIOR PR_type SD PHASE
0    1  0    0.01  -1      99 -1   # 1_CA_SouthOf4010_Comm_Dead
0    1  0    0.01  -1      99 -1   # 2_CA_SouthOf4010_Comm_Live
0    1  0    0.01  -1      99 -1   # 3_CA_SouthOf4010_Rec_PC
```

```
0    1  0    0.01  -1      99 -1   # 4_CA_SouthOf4010_Rec_PR
0    1  0    0.01  -1      99 -1   # 5_CA_SouthOf4010_Comm_Discard
#
#_Q_setup
# Q_type options: <0=mirror, 0=float_nobiasadj, 1=float_biasadj, 2=parm_nob
# iasadj, 3=parm_w_random_dev, 4=parm_w_randwalk, 5=mean_unbiased_float_ass
# ign_to_parm
#_for_env-var:_enter_index_of_the_env-var_to_be_linked

#_Den-dep env-var extra_se Q_type
0        0        0        1 # 1_CA_SouthOf4010_Comm_Dead
0        0        0        1 # 2_CA_SouthOf4010_Comm_Live
0        0        1        1 # 3_CA_SouthOf4010_Rec_PC
0        0        0        1 # 4_CA_SouthOf4010_Rec_PR
0        0        0        1 # 5_CA_SouthOf4010_Comm_Discard
0        0        1        1 # 6_CA_SouthOf4010_Rec_PC_DWV_index
0        0        1        1 # 7_CA_SouthOf4010_Rec_PC_onboard_index
0        0        0        1 # 8_CA_SouthOf4010_CCFRP_comps_only
0        0        0        1 # 9_CA_SouthOf4010_Abrams_thesis_comps

# additive variance parms for indices
#_LO HI INIT PRIOR PR_type SD PHASE
0 2 0.5 1 -1 99 2 # extra sd index for fleet 3
0 2 0.5 1 -1 99 2 # extra sd index for "survey" 6
0 2 0.5 1 -1 99 2 # extra sd index for "survey" 7

#_Cond 0 #_If q has random component, then 0=read one parm for each fleet w
# ith random q; 1=read a parm for each year of index
#_Q_parms(if_any)
# LO HI INIT PRIOR PR_type SD PHASE
#
# Selectivity section
# Size-based setup
# A=Selex option: 1-24
# B=Do_retention: 0=no, 1=yes
# C=Male offset to female: 0=no, 1=yes, 2=Female offset to male
# D=Mirror selex (#)
# A B C D
 24 0 0 0 # 1_CA_SouthOf4010_Comm_Dead
 24 0 0 0 # 2_CA_SouthOf4010_Comm_Live
 24 0 0 0 # 3_CA_SouthOf4010_Rec_PC
 24 0 0 0 # 4_CA_SouthOf4010_Rec_PR
```

```
 24 0 0 0 # 5_CA_SouthOf4010_Comm_Discard
 24 0 0 0 # 6_CA_SouthOf4010_Rec_PC_DWV_index
#15 0 0 3 # 6_CA_SouthOf4010_Rec_PC_DWV_index
 15 0 0 3 # 7_CA_SouthOf4010_Rec_PC_onboard_index
#15 0 0 3 # 8_CA_SouthOf4010_CCFRP_comps_only
 24 0 0 0 # 8_CA_SouthOf4010_CCFRP_comps_only
 15 0 0 3 # 9_CA_SouthOf4010_Abrams_thesis_comps
#
#_age_selex_types
#_Pattern ___ Male Special
10         0       0    0      # 1_CA_SouthOf4010_Comm_Dead
10         0       0    0      # 2_CA_SouthOf4010_Comm_Live
10         0       0    0      # 3_CA_SouthOf4010_Rec_PC
10         0       0    0      # 4_CA_SouthOf4010_Rec_PR
10         0       0    0      # 5_CA_SouthOf4010_Comm_Discard
10         0       0    0      # 6_CA_SouthOf4010_Rec_PC_DWV_index
10         0       0    0      # 7_CA_SouthOf4010_Rec_PC_onboard_index
10         0       0    0      # 8_CA_SouthOf4010_CCFRP_comps_only
10         0       0    0      # 9_CA_SouthOf4010_Abrams_thesis_comps

# ALL SELEX ARE DOUBLE-NORMALS, SOME ARE FIXED AS ASYMPTOTIC
#_LO HI INIT PRIOR PR_type SD PHASE env-var use_dev dev_minyr dev_maxyr dev
# _SD Block Block_Fxn
# 1_CA_SouthOf4010_Comm_Dead
19 45 28 30 -1 50 4 0 0 0 0 0 0 0 # PEAK
-9 5 -4 -4 -1 50 -9 0 0 0 0 0 0 0 # TOP (logistic)
0 9 3 4 -1 50 5 0 0 0 0 0 0 0 # Asc WIDTH exp
0 9 8 8 -1 50 -9 0 0 0 0 0 0 0 # Desc WIDTH exp
-9 9 -8 -5 -1 50 -9 0 0 0 0 0 0 0 # INIT (logistic)
-9 9 8 5 -1 50 -9 0 0 0 0 0 0 0 # FINAL (logistic)
# 2_CA_SouthOf4010_Comm_Live
20 45 32 25 -1 50 4 0 0 0 0 0 0 0 # PEAK
-9 5 -4 -4 -1 50 -9 0 0 0 0 0 0 0 # TOP (logistic)
0 9 3 3 -1 50 5 0 0 0 0 0 0 0 # Asc WIDTH exp
0 9 8 8 -1 50 -9 0 0 0 0 0 0 0 # Desc WIDTH exp
-9 9 -8 -5 -1 50 -9 0 0 0 0 0 0 0 # INIT (logistic)
-9 9 8 5 -1 50 -9 0 0 0 0 0 0 0 # FINAL (logistic)
# 3_CA_SouthOf4010_Rec_PC
19 45 26 30 -1 50 4 0 0 0 0 0 0 0 # PEAK
-9 5 -4 -4 -1 50 -9 0 0 0 0 0 0 0 # TOP (logistic)
0 9 3 4 -1 50 5 0 0 0 0 0 0 0 # Asc WIDTH exp
0 9 8 8 -1 50 -9 0 0 0 0 0 0 0 # Desc WIDTH exp
```

```
-9 9 -8 -5 -1 50 -9 0 0 0 0 0 0 0 # INIT (logistic)
-9 9 8 5 -1 50 -9 0 0 0 0 0 0 0 # FINAL (logistic)
# 4_CA_SouthOf4010_Rec_PR
19 45 27 30 -1 50 4 0 0 0 0 0 0 0 # PEAK
-9 5 -4 -4 -1 50 -9 0 0 0 0 0 0 0 # TOP (logistic)
0 9 3 4 -1 50 5 0 0 0 0 0 0 0 # Asc WIDTH exp
0 9 8 8 -1 50 -9 0 0 0 0 0 0 0 # Desc WIDTH exp
-9 9 -8 -5 -1 50 -9 0 0 0 0 0 0 0 # INIT (logistic)
-9 9 8 5 -1 50 -9 0 0 0 0 0 0 0 # FINAL (logistic)
# 5_CA_SouthOf4010_Comm_Discard
19 45 27 30 -1 50 4 0 0 0 0 0 0 0 # PEAK
-9 5 -8 -4 -1 50 -9 0 0 0 0 0 0 0 # TOP (logistic)
0 9 3 4 -1 50 5 0 0 0 0 0 0 0 # Asc WIDTH exp
0 9 3 8 -1 50 5 0 0 0 0 0 0 0 # Desc WIDTH exp
-9 -8 -8 -5 -1 50 -9 0 0 0 0 0 0 0 # INIT (logistic)
-9 -8 -8 5 -1 50 -9 0 0 0 0 0 0 0 # FINAL (logistic)
# 6_CA_SouthOf4010_Rec_PC_DWV_index
19 45 30 30 -1 50 4 0 0 0 0 0 0 0 # PEAK
-9 9 -8 -4 -1 50 -9 0 0 0 0 0 0 0 # TOP (logistic)
0 9 3 4 -1 50 5 0 0 0 0 0 0 0 # Asc WIDTH exp
0 9 8 8 -1 50 -9 0 0 0 0 0 0 0 # Desc WIDTH exp
-9 9 -8 -5 -1 50 -9 0 0 0 0 0 0 0 # INIT (logistic)
-9 9 8 5 -1 50 -9 0 0 0 0 0 0 0 # FINAL (logistic)
# 8_CA_SouthOf4010_CCFRP_comps_only
19 45 30 30 -1 50 4 0 0 0 0 0 0 0 # PEAK
-9 9 -8 -4 -1 50 -9 0 0 0 0 0 0 0 # TOP (logistic)
0 9 3 4 -1 50 5 0 0 0 0 0 0 0 # Asc WIDTH exp
0 9 8 8 -1 50 -9 0 0 0 0 0 0 0 # Desc WIDTH exp
-9 9 -8 -5 -1 50 -9 0 0 0 0 0 0 0 # INIT (logistic)
-9 9 8 5 -1 50 -9 0 0 0 0 0 0 0 # FINAL (logistic)

#_Cond 0 #_custom_sel-env_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no enviro fxns
#_Cond 0 #_custom_sel-blk_setup (0/1)
#_Cond -2 2 0 0 -1 99 -2 #_placeholder when no block usage
#_Cond No selex parm trends
#_Cond -4 # placeholder for selparm_Dev_Phase
#_Cond 0 #_env/block/dev_adjust_method (1=standard; 2=logistic trans to kee
# p in base parm bounds; 3=standard w/ no bound check)
#
# 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
#F1 F2 F3 F4 F5 F6 F7 F8 F9
  0  0  0  0  0  0  0  0  0 #_add_to_survey_CV
  0  0  0  0  0  0  0  0  0 #_add_to_discard_stddev
  0  0  0  0  0  0  0  0  0 #_add_to_bodywt_CV
# 1  1  1  1  1  1  1  1  1 #_mult_by_lencomp_N
  0.4134  0.2527  0.2185  0.1412  0.2453  0.4895  1  0.76  1 #_mult_by_lenc
# omp_N
  1  1  0.2919  1  1  1  1  1  0.30825 #_mult_by_agecomp_N
  1  1  1  1  1  1  1  1  1 #_mult_by_size-at-age_N
#
4 #_maxlambdaphase
1 #_sd_offset
#
0 # number of changes to make to default Lambdas (default value is 1.0)
# Like_comp codes: 1=surv; 2=disc; 3=mnwt; 4=length; 5=age; 6=SizeFreq; 7=s
# izeage; 8=catch;
# 9=init_equ_catch; 10=recrdev; 11=parm_prior; 12=parm_dev; 13=CrashPen; 14
# =Morphcomp; 15=Tag-comp; 16=Tag-negbin
#like_comp fleet/survey phase value sizefreq_method
# 1 2 2 1 1
# 4 2 2 1 1
# 4 2 3 1 1
#
# lambdas (for info only; columns are phases)
# 0 0 0 0 #_CPUE/survey:_1
# 1 1 1 1 #_CPUE/survey:_2
# 1 1 1 1 #_CPUE/survey:_3
# 1 1 1 1 #_lencomp:_1
# 1 1 1 1 #_lencomp:_2
# 0 0 0 0 #_lencomp:_3
# 1 1 1 1 #_agecomp:_1
# 1 1 1 1 #_agecomp:_2
# 0 0 0 0 #_agecomp:_3
# 1 1 1 1 #_size-age:_1
# 1 1 1 1 #_size-age:_2
# 0 0 0 0 #_size-age:_3
# 1 1 1 1 #_init_equ_catch
# 1 1 1 1 #_recruitments
# 1 1 1 1 #_parameter-priors
```

```
# 1 1 1 1 #_parameter-dev-vectors
# 1 1 1 1 #_crashPenLambda
0 # (0/1) read specs for more stddev reporting
# 1 1 -1 5 1 5 1 -1 5 # selex type, len/age, year, N selex bins, Growth pat
# tern, N growth ages, NatAge_area(-1 for all), NatAge_yr, N Natages
# 5 15 25 35 43 # vector with selex std bin picks (-1 in first bin to self-
# generate)
# 1 2 14 26 40 # vector with growth std bin picks (-1 in first bin to self-
# generate)
# 1 2 14 26 40 # vector with NatAge std bin picks (-1 in first bin to self-
# generate)
999
```

Appendix C. SS starter file

Northern Model

```
#V3.24u
#C starter comment here
china_WAonly_data.ss
china_WAonly_control.ss
0 # 0=use init values in control file; 1=use ss3.par
1 # run display detail (0,1,2)
1 # detailed age-structured reports in REPORT.SSO (0,1)
0 # write detailed checkup.sso file (0,1)
0 # write parm values to ParmTrace.sso (0=no,1=good,active; 2=good,all; 3=e
# very_iter,all_parms; 4=every,active)
1 # write to cumreport.sso (0=no,1=like&timeseries; 2=add survey fits)
1 # Include prior_like for non-estimated parameters (0,1)
1 # Use Soft Boundaries to aid convergence (0,1) (recommended)
2 # Number of datafiles to produce: 1st is input, 2nd is estimates, 3rd and
#  higher are bootstrap
10 # Turn off estimation for parameters entering after this phase
0 # MCeval burn interval
1 # MCeval 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

1.0e-04 # final convergence criteria (e.g. 1.0e-04)
0 # retrospective year relative to end year (e.g. -4)
5 # 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 # SPR_report_basis:  0=skip; 1=(1-SPR)/(1-SPR_tgt); 2=(1-SPR)/(1-SPR_MSY)
# ; 3=(1-SPR)/(1-SPR_Btarget); 4=rawSPR
1 # F_report_units: 0=skip; 1=exploitation(Bio); 2=exploitation(Num); 3=sum
# (Frates); 4=true F for range of ages
#5 80 #_min and max age over which average F will be calculated
1 # F_report_basis: 0=raw; 1=F/Fspr; 2=F/Fmsy ; 3=F/Fbtgt
999 # check value for end of file
```

Central Model

```
#V3.24u
#C starter comment here
china_central_data.ss
china_central_control.ss
0 # 0=use init values in control file; 1=use ss3.par
1 # run display detail (0,1,2)
1 # detailed age-structured reports in REPORT.SSO (0,1)
0 # write detailed checkup.sso file (0,1)
0 # write parm values to ParmTrace.sso (0=no,1=good,active; 2=good,all; 3=e
# very_iter,all_parms; 4=every,active)
1 # write to cumreport.sso (0=no,1=like&timeseries; 2=add survey fits)
1 # Include prior_like for non-estimated parameters (0,1)
1 # Use Soft Boundaries to aid convergence (0,1) (recommended)
2 # Number of datafiles to produce: 1st is input, 2nd is estimates, 3rd and
#  higher are bootstrap
10 # Turn off estimation for parameters entering after this phase
0 # MCeval burn interval
1 # MCeval 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

1.0e-04 # final convergence criteria (e.g. 1.0e-04)
0 # retrospective year relative to end year (e.g. -4)
5 # 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 # SPR_report_basis:  0=skip; 1=(1-SPR)/(1-SPR_tgt); 2=(1-SPR)/(1-SPR_MSY)
# ; 3=(1-SPR)/(1-SPR_Btarget); 4=rawSPR
1 # F_report_units: 0=skip; 1=exploitation(Bio); 2=exploitation(Num); 3=sum
# (Frates); 4=true F for range of ages
#5 80 #_min and max age over which average F will be calculated
1 # F_report_basis: 0=raw; 1=F/Fspr; 2=F/Fmsy ; 3=F/Fbtgt
999 # check value for end of file
```

Southern Model

```
#V3.24u
#C starter comment here
```

```
china_south_data.ss
china_south_control.ss
0 # 0=use init values in control file; 1=use ss3.par
1 # run display detail (0,1,2)
1 # detailed age-structured reports in REPORT.SSO (0,1)
0 # write detailed checkup.sso file (0,1)
0 # write parm values to ParmTrace.sso (0=no,1=good,active; 2=good,all; 3=e
# very_iter,all_parms; 4=every,active)
1 # write to cumreport.sso (0=no,1=like&timeseries; 2=add survey fits)
1 # Include prior_like for non-estimated parameters (0,1)
1 # Use Soft Boundaries to aid convergence (0,1) (recommended)
2 # Number of datafiles to produce: 1st is input, 2nd is estimates, 3rd and
#  higher are bootstrap
10 # Turn off estimation for parameters entering after this phase
0 # MCeval burn interval
1 # MCeval 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

1.0e-04 # final convergence criteria (e.g. 1.0e-04)
0 # retrospective year relative to end year (e.g. -4)
5 # min age for calc of summary biomass
1 # Depletion basis:  denom is: 0=skip; 1=rel X*B0; 2=rel X*Bmsy; 3=rel X*B
# _styr
1 # Fraction (X) for Depletion denominator (e.g. 0.4)
1 # SPR_report_basis:  0=skip; 1=(1-SPR)/(1-SPR_tgt); 2=(1-SPR)/(1-SPR_MSY)
# ; 3=(1-SPR)/(1-SPR_Btarget); 4=rawSPR
1 # F_report_units: 0=skip; 1=exploitation(Bio); 2=exploitation(Num); 3=sum
# (Frates); 4=true F for range of ages
#5 80 #_min and max age over which average F will be calculated
1 # F_report_basis: 0=raw; 1=F/Fspr; 2=F/Fmsy ; 3=F/Fbtgt
999 # check value for end of file
```

Appendix D. SS forecast file

Northern Model

```
#V3.24U
#C  generic forecast file
# for all year entries except rebuilder; enter either: actual year, -999 fo
# r styr, 0 for endyr, neg number for rel. endyr
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(endy
# r)
0.5 # SPR target (e.g. 0.40)
0.4 # Biomass target (e.g. 0.40)
#_Bmark_years: beg_bio, end_bio, beg_selex, end_selex, beg_relF, end_relF (
# enter actual year, or values of 0 or -integer to be rel. endyr)
 0 0 0 0 0 0
1 #Bmark_relF_Basis: 1 = use year range; 2 = set relF same as forecast belo
# w
#
1 # Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=Ave F (uses first-las
# t relF yrs); 5=input annual F scalar
12 # N forecast years
1.0  # F scalar (only used for Do_Forecast==5)
#_Fcast_years:  beg_selex, end_selex, beg_relF, end_relF  (enter actual yea
# r, or values of 0 or -integer to be rel. endyr)
 -4 0 -4 0
1 # Control rule method (1=catch=f(SSB) west coast; 2=F=f(SSB) )
0.4 # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.4
# 0); (Must be > the no F level below)
0.1 # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
# multiplier below based on P*=0.45 and Category 2 Sigma = 0.72
# qlnorm(0.45, 0, 0.72) = 0.913
0.913 # Control rule target as fraction of Flimit (e.g. 0.75)
3   #_N forecast loops (1=OFL only; 2=ABC; 3=get F from forecast ABC catch
# with allocations applied)
3   #_First forecast loop with stochastic recruitment
0 #_Forecast loop control #3 (reserved for future bells&whistles)
0 #_Forecast loop control #4 (reserved for future bells&whistles)
0 #_Forecast loop control #5 (reserved for future bells&whistles)
2026  #FirstYear for caps and allocations (should be after years with fixed
#  inputs)
0 # stddev of log(realized catch/target catch) in forecast (set value>0.0 t
```

```
# o cause active impl_error)
0 # Do West Coast gfish rebuilder output (0/1)
-1 # Rebuilder:  first year catch could have been set to zero (Ydecl)(-1 to
#  set to 1999)
-1 # Rebuilder:  year for current age structure (Yinit) (-1 to set to endye
# ar+1)
1 # fleet relative F:  1=use first-last alloc year; 2=read seas(row) x flee
# t(col) below
# Note that fleet allocation is used directly as average F if Do_Forecast=4
#
2 # basis for fcast catch tuning and for fcast catch caps and allocation  (
# 2=deadbio; 3=retainbio; 5=deadnum; 6=retainnum)
# Conditional input if relative F choice = 2
# Fleet relative F:  rows are seasons, columns are fleets
#_Fleet:  1_CA_SouthOf4010_Comm_Dead 2_CA_SouthOf4010_Comm_Live 3_CA_SouthO
# f4010_Rec_PC 4_CA_SouthOf4010_Rec_PR
#  0 0 0 0
# max totalcatch by fleet (-1 to have no max) must enter value for each fle
# et
-1 -1 -1
# max totalcatch by area (-1 to have no max); must enter value for each are
# a
-1
# fleet assignment to allocation group (enter group ID# for each fleet, 0 f
# or not included in an alloc group)
 0  0  0
#_Conditional on >1 allocation group
# allocation fraction for each of: 0 allocation groups
# no allocation groups
6 # Number of forecast catch levels to input (else calc catch from forecast
#  F)
2 # code means to read fleet/time specific basis (2=dead catch; 3=retained
# catch; 99=F)  as below (units are from fleetunits; note new codes in SSV3
# .20)
# Input fixed catch values
#Year Seas Fleet Catch(or_F) Basis
#Scaled to ACLs Northern model average catches
#Year Seas Fleet Catch
2015 1 1 0.02
2015 1 2 0.19
2015 1 3 1.76
2016 1 1 0.02
```

```
2016 1 2 0.2
2016 1 3 1.81

999 # verify end of input
```

Central Model

```
#V3.24U
#C  forecast file for China Rockfish
#C  with 2015/16 fixed catches
#C  2017 and beyond based on SPR-50%, 40-10, and P*=0.45 for category 2 ass
# essment
#
# for all year entries except rebuilder; enter either: actual year, -999 fo
# r styr, 0 for endyr, neg number for rel. endyr
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(endy
# r)
0.5 # SPR target (e.g. 0.40)
0.4 # Biomass target (e.g. 0.40)
#_Bmark_years: beg_bio, end_bio, beg_selex, end_selex, beg_relF, end_relF (
# enter actual year, or values of 0 or -integer to be rel. endyr)
 0 0 0 0 0 0
1 #Bmark_relF_Basis: 1 = use year range; 2 = set relF same as forecast belo
# w
#
1 # Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=Ave F (uses first-las
# t relF yrs); 5=input annual F scalar
12 # N forecast years
1.0  # F scalar (only used for Do_Forecast==5)
#_Fcast_years:  beg_selex, end_selex, beg_relF, end_relF  (enter actual yea
# r, or values of 0 or -integer to be rel. endyr)
 -4 0 -4 0
1 # Control rule method (1=catch=f(SSB) west coast; 2=F=f(SSB) )
0.4 # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.4
# 0); (Must be > the no F level below)
0.1 # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
# multiplier below based on P*=0.45 and Category 2 Sigma = 0.72
# qlnorm(0.45, 0, 0.72) = 0.913
0.913 # Control rule target as fraction of Flimit (e.g. 0.75)
3   #_N forecast loops (1=OFL only; 2=ABC; 3=get F from forecast ABC catch
# with allocations applied)
```

```
3   #_First forecast loop with stochastic recruitment
0 #_Forecast loop control #3 (reserved for future bells&whistles)
0 #_Forecast loop control #4 (reserved for future bells&whistles)
0 #_Forecast loop control #5 (reserved for future bells&whistles)
2025  #FirstYear for caps and allocations (should be after years with fixed
#  inputs)
0 # stddev of log(realized catch/target catch) in forecast (set value>0.0 t
# o cause active impl_error)
0 # Do West Coast gfish rebuilder output (0/1)
-1 # Rebuilder:  first year catch could have been set to zero (Ydecl)(-1 to
#  set to 1999)
-1 # Rebuilder:  year for current age structure (Yinit) (-1 to set to endye
# ar+1)
1 # fleet relative F:  1=use first-last alloc year; 2=read seas(row) x flee
# t(col) below
# Note that fleet allocation is used directly as average F if Do_Forecast=4
2 # basis for fcast catch tuning and for fcast catch caps and allocation  (
# 2=deadbio; 3=retainbio; 5=deadnum; 6=retainnum)
# Conditional input if relative F choice = 2
# Fleet relative F:  rows are seasons, columns are fleets
#_Fleet:  1_CA_SouthOf4010_Comm_Dead 2_CA_SouthOf4010_Comm_Live 3_CA_SouthO
# f4010_Rec_PC 4_CA_SouthOf4010_Rec_PR
#  0 0 0 0
# max totalcatch by fleet (-1 to have no max) must enter value for each fle
# et
-1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
# max totalcatch by area (-1 to have no max); must enter value for each are
# a
-1
# fleet assignment to allocation group (enter group ID# for each fleet, 0 f
# or not included in an alloc group)
 0  0  0  0  0  0  0  0  0  0  0
#_Conditional on >1 allocation group
# allocation fraction for each of: 0 allocation groups
# no allocation groups
22 # Number of forecast catch levels to input (else calc catch from forecas
# t F)
2  # code means to read fleet/time specific basis (2=dead catch; 3=retained
#  catch; 99=F)  as below (units are from fleetunits; note new codes in SSV
# 3.20)
# Input fixed catch values
# these catches based on making the sum of northern and central models
```

```
# equal to the 2015/16 ACL contributions from John DeVore which are 6.6mt a
# nd 6.8mt
#Year Seas Fleet Catch
2015 1 1 0.02 # total for 2015: 4.64
2015 1 2 0.06
2015 1 3 0.06
2015 1 4 0.44
2015 1 5 0.48
2015 1 6 2.44
2015 1 7 0.12
2015 1 8 0.31
2015 1 9 0.02
2015 1 10 0.34
2015 1 11 0.35
#
2016 1 1 0.02 # total for 2016: 4.78
2016 1 2 0.06
2016 1 3 0.06
2016 1 4 0.45
2016 1 5 0.5
2016 1 6 2.52
2016 1 7 0.12
2016 1 8 0.32
2016 1 9 0.02
2016 1 10 0.35
2016 1 11 0.36
#
999 # verify end of input
```

Southern Model

```
#V3.24U
#C  generic forecast file
# for all year entries except rebuilder; enter either: actual year, -999 fo
# r styr, 0 for endyr, neg number for rel. endyr
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(endy
# r)
0.5 # SPR target (e.g. 0.40)
0.4 # Biomass target (e.g. 0.40)
#_Bmark_years: beg_bio, end_bio, beg_selex, end_selex, beg_relF, end_relF (
# enter actual year, or values of 0 or -integer to be rel. endyr)
```

```
 0 0 0 0 0 0
1 #Bmark_relF_Basis: 1 = use year range; 2 = set relF same as forecast belo
# w
#
1 # Forecast: 0=none; 1=F(SPR); 2=F(MSY) 3=F(Btgt); 4=Ave F (uses first-las
# t relF yrs); 5=input annual F scalar
10 # N forecast years
1.0  # F scalar (only used for Do_Forecast==5)
#_Fcast_years:  beg_selex, end_selex, beg_relF, end_relF  (enter actual yea
# r, or values of 0 or -integer to be rel. endyr)
 -4 0 -4 0
1 # Control rule method (1=catch=f(SSB) west coast; 2=F=f(SSB) )
0.4 # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.4
# 0); (Must be > the no F level below)
0.1 # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
1.0 # Control rule target as fraction of Flimit (e.g. 0.75)
3   #_N forecast loops (1=OFL only; 2=ABC; 3=get F from forecast ABC catch
# with allocations applied)
3   #_First forecast loop with stochastic recruitment
0 #_Forecast loop control #3 (reserved for future bells&whistles)
0 #_Forecast loop control #4 (reserved for future bells&whistles)
0 #_Forecast loop control #5 (reserved for future bells&whistles)
2025  #FirstYear for caps and allocations (should be after years with fixed
#  inputs)
0 # stddev of log(realized catch/target catch) in forecast (set value>0.0 t
# o cause active impl_error)
0 # Do West Coast gfish rebuilder output (0/1)
-1 # Rebuilder:  first year catch could have been set to zero (Ydecl)(-1 to
#  set to 1999)
-1 # Rebuilder:  year for current age structure (Yinit) (-1 to set to endye
# ar+1)
1 # fleet relative F:  1=use first-last alloc year; 2=read seas(row) x flee
# t(col) below
# Note that fleet allocation is used directly as average F if Do_Forecast=4
#
2 # basis for fcast catch tuning and for fcast catch caps and allocation  (
# 2=deadbio; 3=retainbio; 5=deadnum; 6=retainnum)
# Conditional input if relative F choice = 2
# Fleet relative F:  rows are seasons, columns are fleets
#_Fleet:  1_CA_SouthOf4010_Comm_Dead 2_CA_SouthOf4010_Comm_Live 3_CA_SouthO
# f4010_Rec_PC 4_CA_SouthOf4010_Rec_PR
#  0 0 0 0
```

```
# max totalcatch by fleet (-1 to have no max) must enter value for each fle
# et
-1 -1 -1 -1 -1
# max totalcatch by area (-1 to have no max); must enter value for each are
# a
-1
# fleet assignment to allocation group (enter group ID# for each fleet, 0 f
# or not included in an alloc group)
 0  0  0  0  0
#_Conditional on >1 allocation group
# allocation fraction for each of: 0 allocation groups
# no allocation groups
0 # Number of forecast catch levels to input (else calc catch from forecast
#  F)
2 # code means to read fleet/time specific basis (2=dead catch; 3=retained
# catch; 99=F)  as below (units are from fleetunits; note new codes in SSV3
# .20)
# Input fixed catch values
#Year Seas Fleet Catch(or_F) Basis
#
999 # verify end of input
```

Appendix E. Observed Angler Prediction

The 1987-1998 CDFW onboard observer program did not record the number of anglers at a fishing stop from 4/22/87 until 7/9/92. The goal of this analysis is to impute the number of observed anglers in the initial period of the sampling program from the number of observed anglers and onboard anglers from the later years of the program.

The number of observed anglers at a fishing stop is a subset of the number of total number of anglers onboard the vessel (paid plus free anglers); a quantity which is consistently recorded throughout the entire dataset. We explored the using the total number of observed anglers onboard the vessel in the following analyses, but it was not recorded in a consitent manner through time, e.g., recorded as the maximum number of anglers observed at a fishing stop during the trip, a sum of the observed anglers at each fishing stop, or the average number of observed anglers at all fishings stops, etc.

We explored a binomial regression model to predict the mean number of observed anglers at a fishing stop from the number of total anglers, in the initial period of the data. Binomial regression models of this general form were considered in this analysis, as well as a sensitivity analysis among the other potential covariates available in the dataset. Among the potential predictor variables in this study, effects related to the interviewer, and trip date were considered for inclusion in the final model by pairwise comparison of fitted model AIC values as well as analysis of parameter significance.

Effects related to interviewer were found to be very significant, although due to the high turn-over rate of the interviewers in these data, interviewer specific effects are not useful for prediction here. However, the total number of interviewers onboard the vessel (one or two interviewers) was found to be strongly significant and was included in the final models as a categorical effect.

For imputing the observed number of observed anglers for the early period of the dataset it is important to motivate an assumption of stationarity in the number of observed anglers through time. Thus trip date was considered for inclusion in the model to check for any possibility significance through time. Firstly, date was considered for inclusion in the model as a discrete time variable; secondly, a separate model was tested using only year as categorical variable to consider any temporal patterns. Given the number of total anglers, neither of the models considering temporal effects were able demonstrate that the number of observed anglers varied significantly through time. All models which included temporal effects produced higher overall AIC values, thus supporting the assumption of stationarity in time.

Log Model:

$$y_{ij} \sim \beta_{0j} + \beta_{1j}\log(x_{ij}) + \epsilon_{ij} \quad \epsilon_{ij} \sim N(0, \sigma_j) \tag{1}$$

Binomial Log Model:

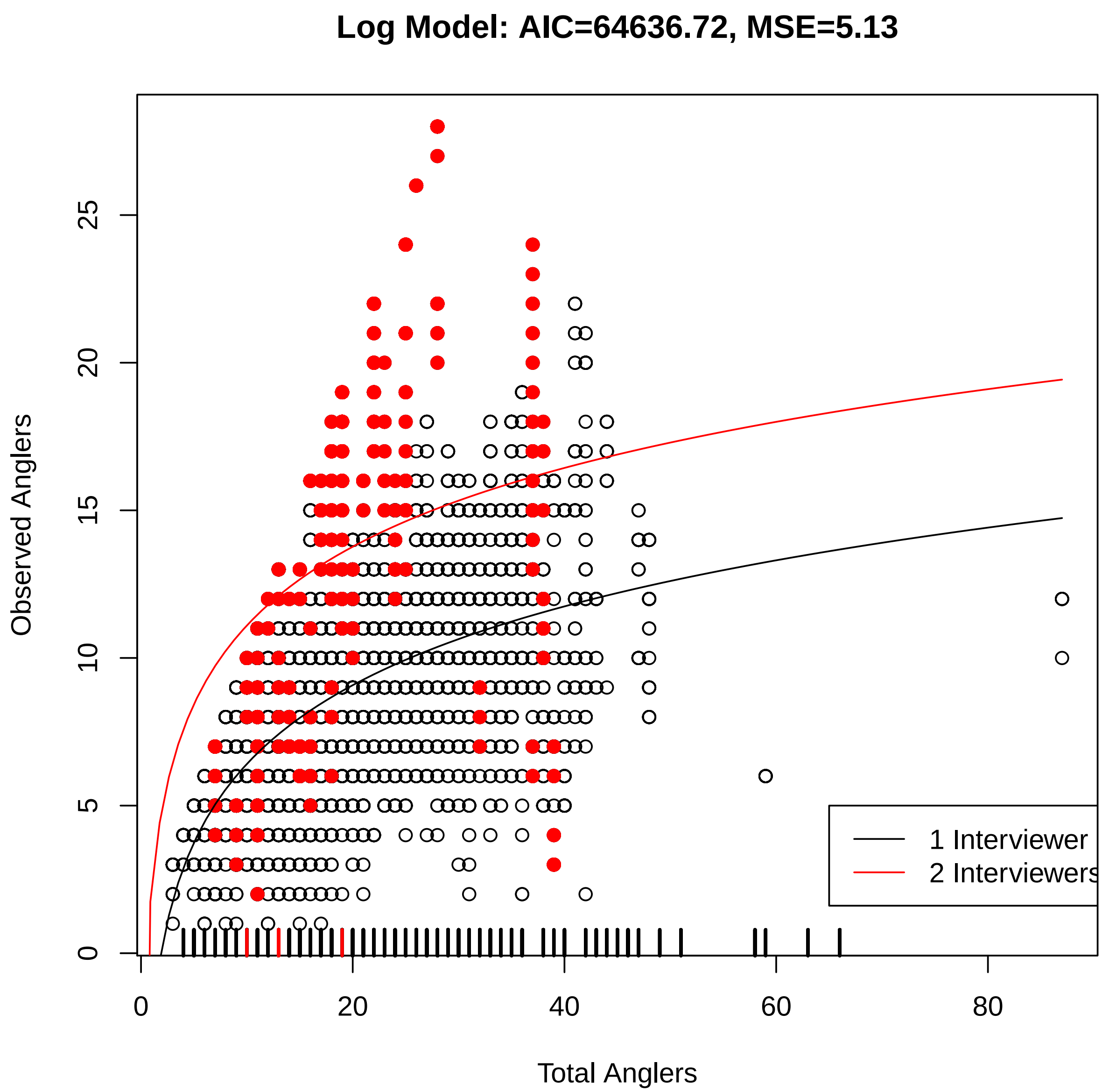

Figure E1: The number of observed anglers plotted as a function of the number of total anglers. The log-normal mean curves are plotted on the scale of the data, and colored to indicate if the data was collected in the presence of one or two interviewers. Additionally, a total anglers rug plot is included to show the total angler data for which the number of observed anglers needs to be imputed.

$$y_{ij} \sim B\bigg(\ N_{ij},\ \text{logit}\Big(\beta_{0j} + \beta_{1j}\log(x_{ij})\Big)\ \bigg) \tag{2}$$

	totAng	totAng + intNum	log(totAng) + intNum
Normal	67387.29	65317.02	64636.72
Binomial	66099.40	63753.06	62498.83

The log model considers a typical normal linear model for each interviewer level, except it uses the log of the number of total anglers as a predictor rather than the raw numbers of total anglers. The log model has several nice features for prediction in this case. Firstly by regressing on the log of the total anglers it improves the correlation and relative homoscedasticity of the joint data and improves the accuracy of sensitivity analysis by improving the standard error estimates for each parameter. Secondly the log transformation introduces the expected mean prediction shape, by emphasizing order of magnitude differences in the total number of anglers. The binomial log model considers the observed angler counts as independent draws from a binomial given the know number of total anglers. The log transformation in the binomial case is justified over the traditional binomial glm for similar reasons as the normal log model, as well as simple AIC support of the transformation. All models and model selection criterion were computed using the standard `glm` function in the R software environment for statistical computing (R Development Core Team 2013).

The binomial log model was chosen for its low AIC value and reasonable mean predictions. Untransformed binomial models were considered, however they produce unreasonable observed angler predictions associated with the high numbers of total anglers. The log transformed Normal model provides mostly reasonable predictions, but is not supported by AIC when compared to the binomial models. Additionally transforms of Normal likelihood models have no distributional way of producing observed angler predictions which do not exceed the total number of anglers. If a Normal likelihood model were to gather AIC support, predictions may require truncation. These data contain considerable noise, likely due to the high interviewer turnover rate, which would most effectively be modeled by including appropriate additional predictors to control for these effects. At this point no additional predictors from this dataset were considered to be both sensitive and appropriate for use with prediction in this case.

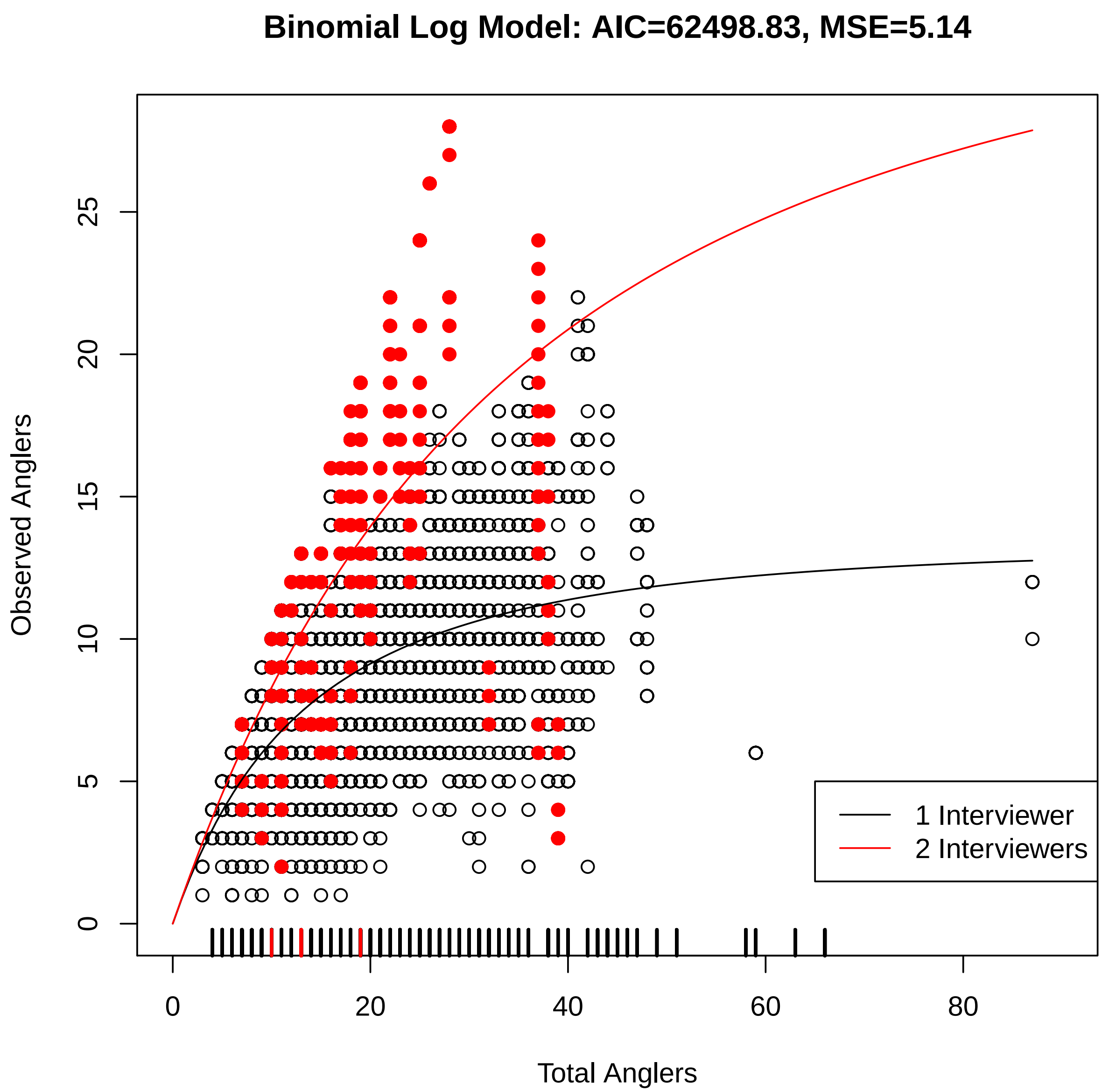

Figure E2: The number of observed anglers plotted as a function of the number of total anglers. The binomial mean curves are plotted on the scale of the data, and colored to indicate if the data was collected in the presence of one or two interviewers. Additionally, a total anglers rug plot is included to show the total angler data for which the number of observed anglers needs to be imputed.

Appendix F. Reef Delineation and Drift Selection Methodologies

Reef Delineation We identified reefs as potential habitat for China rockfish in California, Oregon and Washington using a variety of newly available spatial data sources, including 2, 3 and 5 m bathymetry, substrate, lithology and Habitat Suitability geodatabases. Available data sources varied by latitude. To delineate reefs from Point Conception to the Oregon border we used a 2 m binary raster layer (3 m for Cordell Bank) for substrate, where 1 = rough, and 0 = smooth habitat (California Seafloor Mapping Project "Tier 2" GIS Products, accessed 03.18.2013, data available from: http://seafloor.otterlabs.org/index.html). Rough and smooth substrate was identified by CSMP using 2 rugosity indices based upon bathymetric data, surface:planar area (SA:PA), and vector ruggedness measure (VRM). We considered areas identified as 'rough' as reef habitat. For reefs named Asilomar, Cypress Point, Portuguese Ledge, and Point Joe only a portion of the reefs were mapped at the 2 m resolution, therefore to identify the remaining reef, we used either a 5 m resolution VRM dataset, where the VRM cutoff was greater than 0.001 (Young et al. 2010). For all reefs derived from either 2 m, 3 m or 5 m resolution, we applied a 5 m buffer around each reef habitat for potential error in positional accuracy and all reefs with an area greater than or equal to 100 m^2 were included. We identified seven reefs outside of the 2 m layer that contained a significant number of CPFV points, which we decided to include in the indices. Big Reef, Blunts Reef, Isle of St. James, Point Sur Deep, Sandhill Ledge, portions of San Gregario and Soap Bank reefs were located just outside of 2 m, 3 m and 5 m 'footprint', therefore for these reefs we used the 2005 Habitat Suitability Probability (HSP) geodatabase for China rockfish (NMFS 2005). The HSP is a modeled output from Essential Fish Habitat geodatabase and is based upon habitat data, depth, and location, where input data are NMFS trawl datasets. In order to identify reef habitats from the Oregon border to Washington, we used a lithology shapefile (Goldfinger et al. 2014) that was based upon multiple seafloor mapping surveys including multibeam and sidescan sonar, sediment grab and core samples, and images. Seafloor types were classified according to established classification schemes (Greene et al. 1999). We considered the following lithology types as 'reef habitat:' Boulder, cobble, cobble mix, hard, rock, and rock mix. All spatial data was projected to NAD 1983 UTM Zone 10.

Reef systems were grouped and stratified by depth at a spatial scale biologically meaningful to China rockfish. China rockfish are typically sedentary and have high site fidelity, therefore we grouped reefs in consideration of how a China rockfish would experience its surroundings. Lea (1999) recaptured China rockfish in the same general location as where they were released, however a few individuals of other rockfish species (copper (*Sebastes caurinus*), gopher (*Sebastes carnatus*), olive (*Sebastes serranoides*) and yellowtail (*Sebastes flavidus*)) demonstrated movement up to 1.5 nautical miles (about 2,700 m), but all were captured within the same reef system. In the Puget Sound copper, brown and quillback were found to have a home range less than 30m^2 in high relief rocky areas (Matthews 1990). In other rockfish movement studies, China rockfish were tagged but never recaptured, or there was a sample size of 1 (Hannah and Rankin 2011), Hannah 2012). Using this limited information, we considered that China rockfish would swim no more than 200 m over smooth, sand, or muddy habitat to a neighboring reef, therefore if a reef was greater than ~200 m from rocky reef habitat it was considered a different reef system. If a reef system has contiguous habitat (no channels greater than 200 m) it remained intact, no matter how large the reef (Figures F1 and F2). A small number of reefs were merged into 'super reefs' to accommodate 1980s-1990s CDFW location codes that overlapped multiple reefs [. Reef areas were calculated using the zonal stats tool in ArcGIS, stratified by the depth bins 0-19 m, 20-39 m, 40-59 m, 60-79 m, 80-99 m and greater than 100 m using the CSMP depth raster (2 m, 3 m or 5 m resolution). To get depths for those reefs outside the CSMP 'footprint' we used the NOAA Coastal Relief Model raster dataset (90 m) for California, and 100 m digital elevation model (DEM) bathymetry from the Active Tectonics and Seafloor Mapping Lab for Oregon.

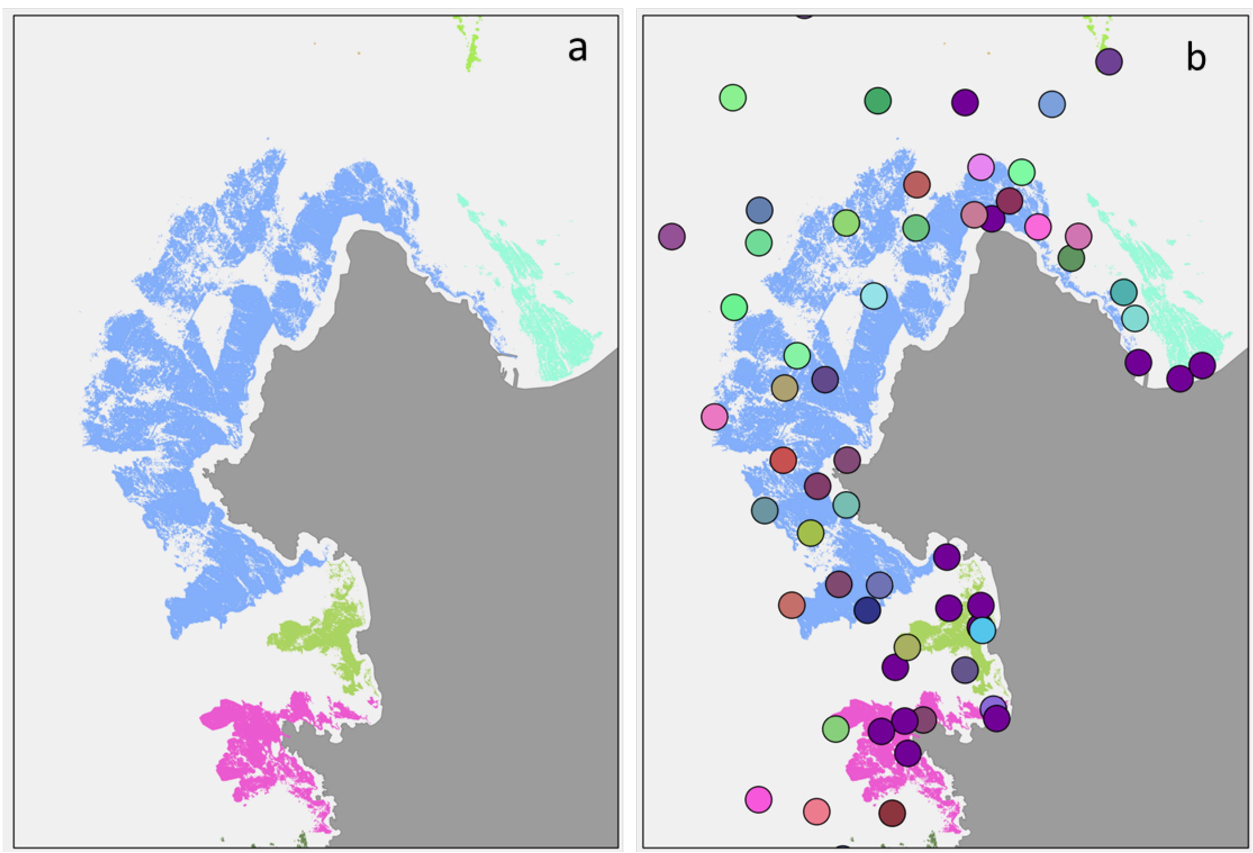

Figure F1: Map of the reefs near the Monterey peninsula in CA (a) and overlaid with the fishing location codes from the CDFW 1987-1998 onboard observer program. All fishing locations follow the confidentiality guidelines and were fished by at least three vessels during the study. Note that the size of the fishing location points does not reflect the area fished.

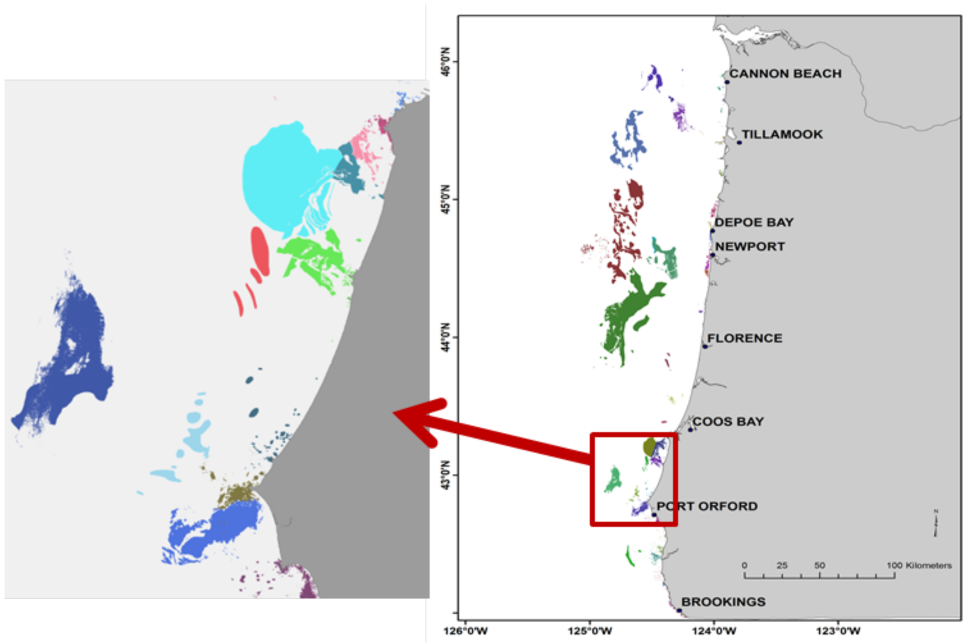

Figure F2: Example of the reefs in Oregon.

Regions were designated to gain appropriate sample sizes needed for modelling. For Oregon, region differences north and south of Florence were explored. In California, 12 regions north of Pt. Conception were defined as follows:

Region 1: Pt. Conception to Pt. Arguello
Region 2: Purisima Point to Pt. Sal
Region 3: San Luis Obispo Bay to Mill Creek (39.959° N)
Region 4: Lopez Point to Monterey Peninsula
Region 5: Moss Landing to San Francisco Bay
Region 6: Farallon Islands
Region 7: Point Bonita to Drakes Bay
Region 8: Point Reyes to Point Arena
Region 9: Point Arena to south of Ten Mile River
Region 10: north of Ten Mile River to Cape Mendocino (40.16667° N)
Region 11: Cape Mendocino to Eel River
Region 12: Trinidad Head to CA/OR border

CPFV drift selection During the 1987-1998 CDFW onboard observer program, fishing location was recorded as one of 459 location codes. When available, the observer also recorded coordinates, either latitude/longitude or Loran. The SWFSC converted all Loran coordinates to latitude/longitude. Using the fishing stops with available coordinates, we assigned a fishing location code to a reef. A handful of fishing location codes were obviously not associated with a reef, or a reef as identified in the above methods, and were not selected in the final dataset. If the coordinates spanned two reefs and we were unable to tell which reef was consistently fished for a given location code, we created aggregated the reefs. This most commonly occurred around the Monterey Bay peninsula. This was necessary as two-thirds of the fishing stops encountering China rockfish had no recorded coordinates and allowed us to retain all fishing location data. Therefore, for the 1987-1998 CDFW data, any fishing location that was assigned to a reef was included in the analyses as one of the filters applied to the data.

For each CPFV location in the California 1999-2014 and Oregon 2001-2014 data we calculated depth, nearest reef, distance from reef, nearest MPA, distance from MPA using ArcGIS. Geoprocessing steps used were 'near' and 'extract values to points.' For consistency across databases, we used the starting location of the drift to determine if the drift was targeting fish associated with a reef. Drifts that had a distance of 0 m, i.e., were fishing directly on the reef, were included in analyses. Recognizing that some drifts begin adjacent to a reef with the intention of drifting on to the reef, as well as the fact that the starting location may not be recorded at the very start of a drift, we devised a method for including drifts within a certain distance of a reef.
We compiled a list of rockfish species that are strictly reef associated (black and yellow rockfish (*Sebastes chrysomelas*), canary rockfish (*Sebastes pinniger*), China rockfish (*Sebastes nebulosus*), cowcod (*Sebastes levis*), flag rockfish (*Sebastes rubrivinctus*), gopher rockfish (*Sebastes carnatus*), grass rockfish (*Sebastes rastrelliger*), greenblotched rockfish (*Sebastes rosenblatti*), kelp rockfish (*Sebastes atrovirens*), quillback rockfish (*Sebastes maliger*), rosy rockfish (*Sebastes rosaceus*), starry rockfish (*Sebastes constellatus*), Treefish (*Sebastes serriceps*), vermilion rockfish (*Sebastes miniatus*), yelloweye rockfish (*Sebastes ruberrimus*)) (personal communication John Field and Tom Laidig, NMFS SWFSC). Using drifts that were greater than 0m from a reef and encountered one at least one of the fifteen species listed above, we calculated the depth for which 75% of the drifts were included. For Oregon this was 83 m, and for California it was 34 m for drifts within the 'footprint' and 141 m for drifts outside the 'footprint.' Any drift (with or without catch) greater than 83 m from a reef was excluded from the analyses.

Appendix G. Commercial Regulations Histories

Federal waters

For a list of the commercial regulations in federal waters see the Commercial Regulations Home Page, which is housed in the CALCOM database.

Washington

The following commercial regulations pertain to China rockfish species in Washington and were provided by the Washington Department of Fish and Wildlife.

2008
The groundfish trawl fishery was closed in Washington from the seaward RCA boundary to the shore north of 48°10′ N latitude to address increased encounters with yelloweye and canary rockfish

2002
Non-Trawl RCA closed from shore to 100 fm north of 46°16′ N latitude

1995
Commercial hook-and-line fishing in state waters (0-3 miles) was closed to preserve recreational fishing opportunities and avoid localized depletion; trawlers included in 1999

1992
Commercial hook-and-line limits reduced to 100 lbs north of Cape Alava and from Destruction Island to Leadbetter Pt.

Oregon

The following commercial regulations pertain to China rockfish in Oregon and were provided by the Oregon Department of Fish and Wildlife.

China rockfish are managed in the Other Nearshore Rockfish complex

Harvest cap: Total amount in regulation allowed to be impacted in a fishery (for a given season) including both discard mortality and landed catch mortality. Prior to 2007 this term was synonymous with "landing cap."

Landing cap: Total amount in regulation allowed to be landed in a fishery (for a given season). Includes only landed catch mortality (known as a harvest cap before 2007).

Incidental Catch Limits in Other Fisheries (established in 2004)

Non-permitted vessels: 15 lbs per day of black rockfish, blue rockfish, and nearshore fish, combined, for no more than one landing per day. These species must make-up 25% or less of landed poundage, and must be taken with gear legal in the permitted fishery.

Groundfish trawl fishery: Vessels may land no more than 1,000 lbs of dead black rockfish, blue rockfish, and nearshore fish combined per calendar year if these species make-up 25% or less of landing.

Non-profit aquaria or vessels contracted by non-profit aquaria may land black rockfish, blue rockfish, and nearshore fish for purposes of display or for conducting research on these species.

Regulations History

A minimum size limit of 12 inches (measured from the tip of the snout to the extreme end of the tail) was implemented for China rockfish in 2000. A sorting requirement for China rockfish was implemented in 2003.

2014

Other Nearshore Rockfish landing cap: 14.3 mt

Other Nearshore Rockfish Period Limits:All Periods 700 lbs

Rockfish Conservation Area: fishing restricted to inside 30 fm

2013

Other Nearshore Rockfish landing cap: 14.3 mt (excluding tiger and vermillion rockfishes)

Other Nearshore Rockfish Period Limits:All Periods 700 lbs

Legal Gear Types: hook-and-line (including pole and line, troll, longline, and stick gear) and pot gear (max 35 pots) if a Developmental Fisheries permit for Nearshore species using pot gear was issued in 2003

Rockfish Conservation Area: fishing restricted to inside 30 fm

2012

Other Nearshore Rockfish landing cap: 14.3 mt (excluding tiger and vermillion rockfishes)

Other Nearshore Rockfish Period Limits: All Periods 700 lbs

Rockfish Conservation Area: fishing restricted to inside 30 fm north of 43° N, restricted to inside 20 fm from 42° – 43° N

2011

Other Nearshore Rockfish landing cap: 14.3 mt (excluding tiger and vermillion rockfishes)

Other Nearshore Rockfish Period Limits: All Periods 700 lbs

Rockfish Conservation Area: fishing restricted to inside 30 fm north of 43° N, restricted to inside 20 fm from 42° – 43° N

2010

Other Nearshore Rockfish landing cap: 14.3 mt (excluding tiger and vermillion rockfishes)

Other Nearshore Rockfish Period Limits: All Periods 700 lbs

Rockfish Conservation Area: fishing restricted to inside 30 fm north of 43° N, restricted to inside 20 fm from 42° – 43° N

2009

Other Nearshore Rockfish landing cap: 14.3 mt (excluding tiger and vermillion rockfishes)

Other Nearshore Rockfish Period Limits: All Periods 700 lbs

Legal Gear Types: hook-and-line (including pole and line, troll, longline, and stick gear) and pot gear (max 35 pots) if a Developmental Fisheries permit for Nearshore species using pot gear was issued in 2003

Rockfish Conservation Area: fishing restricted to inside 30 fm north of 43° N, restricted to inside 20 fm from 42° – 43° N

2008

Other Nearshore Rockfish landing cap: 12.0 mt (excluding tiger and vermillion rockfishes)

Other Nearshore Rockfish Period Limits:All Periods 700 lbs

Sorting Requirement for All Nearshore Rockfish to Species: first year of all nearshore rockfish recorded to species on commercial fish tickets

Rockfish Conservation Area: fishing restricted to inside 30 fm

2007

First year of commercial landing caps (formerly known as harvest caps)

Other Nearshore Rockfish landing cap: 12.0 mt (excluding tiger and vermillion rockfishes)

Other Nearshore Rockfish Period Limits: All Periods 600 lbs

Rockfish Conservation Area: fishing restricted to inside 30 fm

9/1: Other Nearshore Rockfish changes: Period 5 increase to 700 lbs; Period 6 increase to 700 lbs

11/28: Other Nearshore Rockfish change: Period 6 closed

2006

First and only year with 1-month trip limits

Other Nearshore Rockfish harvest cap: 13.5 mt (including tiger and vermillion rockfishes)

Other Nearshore Rockfish 1-month Period Limits: All Periods 200 lbs per month

Rockfish Conservation Area: fishing restricted to inside 30 fm

7/1: Other Nearshore Rockfish change: July increase to 300 lbs

8/11: Other Nearshore Rockfish changes: increase to 350 lbs per month for all remaining months

2005

Other Nearshore Rockfish harvest cap: 12.0 mt 16.0 mt (excluding tiger and vermillion rockfishes, 13.5 mt including these fish)

Other Nearshore Rockfish Period Limits (Sub-limit from black and blue Rockfish trip limits): (includes tiger and vermillion rockfishes, sublimit of black and blue Rockfish limit): All Periods: 450 lbs

Rockfish Conservation Area: fishing restricted to inside 30 fm

5/1: Other Nearshore Rockfish changes: Periods 3 thru 5 decrease to 325 lbs

10/11: Other Nearshore Rockfish changes: Period 5 and 6 increase to 400 lbs

2004

Permit required for vessels to land black and blue rockfishes and other nearshore fish identified in House Bill 3108

Nearshore logbook required for all vessels participating in the fishery

ODFW allowed to prescribe legal gear under this permit except: 1. Diving gear may not be used 2. Pots may not be used unless a vessel was previously issued a pot endorsement in the Interim Nearshore Fisheries Plan through the Developmental Fisheries Program during 2003

Other Nearshore Rockfish harvest cap: 16.0 mt (including tiger and vermillion rockfishes)

Other Nearshore Rockfish 1-month Period Limits (Sub-limit from black and blue Rockfish trip limits): (includes tiger and vermillion Rockfish), All Periods: 450 lbs

Rockfish Conservation Area: fishing restricted to inside 30 fm

9/28: Other Nearshore Rockfish change: Period 5 decrease to 100 lbs

11/1: Other Nearshore Rockfish change: Period 6 closed

2003

Commercial Nearshore Fishery (21 nearshore species) placed in the Developmental Fisheries Program

House Bill 3108 establishes formal management of the commercial nearshore fishery, comprised of landings of species on the ‘nearshore fish’ list beginning, January 1, 2004

Oregon Fish and Wildlife Commission first establishes harvest caps for nearshore species: Other Nearshore Rockfish harvest cap: 21.3 mt

Bi-monthly trip limits first put into place mid-season (July 16th) in 2003

Other Nearshore Rockfish (Sub-limit from black and blue rockfish): All periods 300 lbs

Rockfish Conservation Area: fishing restricted to inside 27 fm from January – October

2002

In October, the Pacific Fishery Management Council adopted conservative harvest limits for 2003 equal to landings from 2000

Oregon Fish and Wildlife Commission directs the Marine Resources Program to evaluate a harvest reduction equal to or greater than 20

Interim commercial harvest management plan implemented place a cap on fishery participants and reduced the nearshore fleet by 50

National Marine Fishery Service begins collecting fishery-dependent data at-sea from vessels participating in the fishery

2000

Pacific City Open Access Minor Nearshore Rockfish Limit (including black and blue rockfish here): May 1 - September 30 limit 2,200 lbs per month of which no more than 700 lbs can be rockfish other than black and blue rockfishes

1997

New live fish markets in California accelerate growth of the Commercial Nearshore Fishery

Early to mid 1990s

Commercial Nearshore Fishery develops as an open access fishery

California

The following commercial regulations pertain to China rockfish species in California and were provided by the California Department of Fish and Wildlife. There has been a 12 inch minimum size limit on China rockfish since 2001.

Gear Restrictions

2001

hook-and-line limited to 150 hooks with 15 hooks per line within 1 mile of shore

1996

Finfish trap permit required

1994

Proposition 132 implemented to prohibit gill nets within state waters

1953

Legislation prohibits trawl within 3 miles of shore

Trip Limits and Depth Restrictions

Trips limits now vary according to constraints from bycatch of canary and yelloweye rockfishes

2003

A shallow nearshore permit is needed in 4 management regions

Trip limits for restricted access fishery, with differential trip limits north and south of 40°10′ N

Subject to depth restrictions consistent with the shoreward non-trawl RCA

2002

Closed all waters January and February south of 34°27′ N

Closed all waters March and April between 40°10′ N and 34°27′ N March-April

2001

Closed January and February outside of 20 fm south of 34°27′ N

Closed March and April all waters between 40°10′ N and 34°27′ N

2000

Closed January and February south of 36° N

Closed March and April between 40°10′ N and 36° N

1999

Nearshore fishery permit required

1994

Limited entry permits and open access fishery established for *Sebastes* complex

Limited entry and open access trip limits on the *Sebastes* complex

Nearshore Fishery Bycatch Permit This special non-transferable permit is issued as of 2003 to those qualifying individuals who use either trawl or entangling nets (gill nets). It allows a minimal bycatch of minor nearshore species (which includes China rockfish) as per the following:

South Central Coast Region 25 pounds of nearshore fish stocks may be taken per trip

South Coast Region – 50 pounds of nearshore fish stocks may be taken per trip

No permits are issued for either the North Coast or North-Central Coast Regions.

Appendix H. Recreational Regulations Histories

Washington

The following recreational regulations pertain to nearshore rockfish species in Washington and were provided by the Washington Department of Fish and Wildlife. The sport regulations run from 1 May to 30 April the following year. Depth restrictions were implemented late in the summer of 2005 by emergency rule and became permanent in 2006.

North Coast (MCA 3 and 4)

2014-2013

May 1 - Sept 30: Groundfish retention is prohibited seaward of 20 fathoms except lingcod; Pacific cod and sablefish on days open to halibut fishing

2012-2011

June 1 - Sept 30: Groundfish retention is prohibited seaward of 20 fathoms, except on days open to halibut fishing

2010-2009

May 21 - Sept 30: Groundfish retention is prohibited seaward of 20 fathoms except on days open to halibut fishing

2008-2007

May 21 - Sept 30: Groundfish retention is prohibited seaward of 20 fathoms

2006

May 21 - Sept 30: Rockfish and lingcod retention is prohibited seaward of 20 fathoms

South Coast (MCA 2)

2014-2013

March 18 - June 15: Groundfish retention is prohibited seaward of 30 fathoms except rockfish; Pacific cod and sablefish allowed May 1 June 15; lingcod allowed on days open to halibut

2012-2011

March 18 - June 15: Groundfish retention is prohibited seaward of 30 fathoms except rockfish; Pacific cod and sablefish allowed May 1 June 15; lingcod allowed on days open to halibut

2010-2009

March 18 - June 15: Groundfish retention is prohibited seaward of 30 fathoms; Pacific cod and sablefish allowed May 1 June 15

2008-2007

March 18 - June 15: Groundfish retention is prohibited seaward of 30 fathoms; Pacific cod and sablefish allowed May 1 June 15

2006

March 18 - June 15: Rockfish and lingcod retention is prohibited seaward of 30 fathoms

Columbia River (MCA 1) This area has no depth restriction.

2014-2006

Year-round: No groundfish except Pacific cod and sablefish allowed with halibut on board

Daily Groundfish and Rockfish Limits

Groundfish includes: rockfish, Pacific cod, flatfish (except halibut), lingcod, ratfish, sablefish, cabezon, greenling, sculpins, sharks, skates, and surfperch excluding shiner perch. There are sub-bag limits for lingcod (2) coastwide and cabezon (1) in Marine Area 4. The groundfish daily bag limit in Marine Area 4B was reduced to 10 in 2011.

Groundfish Daily Limits

2015-2011: 12 fish

2010-1961: 15 fish

1960-1938: 20 lbs/day

Rockfish Daily Limits

There is no minimum size limit for rockfish. Marine Area 4B bag limit allows retention of 6 blue and black rockfish only (2010-2015).

2015-1995: 10 fish

1994-1992: 12 fish

1991-1961: 15 fish

1960-1954: 20 lb/day

Oregon

The following regulations pertain to nearshore rockfish species in Oregon and were provided by the Oregon Department of Fish and Wildlife. There were no bag limits prior to 1976. Gear restrictions have remained the same for all years, i.e., three hooks.

2015

All rockfish, greenlings, Cabezon, skates, and other marine fish species not listed in the 2015 Oregon Sport Fishing Regulations in the Marine Zone: 7-fish daily bag limit in aggregate, of which no more than three may be blue rockfish and no more than one may be a Cabezon (when Cabezon is open), and no more than one may be a canary rockfish.

Retention of Yelloweye, Canary, China, Copper and Quillback rockfish is prohibited.

2014 - 2013

Same a 2012

2012

Rockfish, Cabezon, greenlings (10” min.), and other marine species not listed under Marine Zone in the Oregon Sport Fishing Regulations: 7 daily in aggregate of which no more than 1 may be a Cabezon April 1 – Sept. 30.

30-fathom curve: Seaward closed April 1-Sept. 30 [for groundfish group].

2011

Rockfish, Cabezon, greenling (10” min.), and other marine species not listed under Marine Zone in the Oregon Sport Fishing Regulations: 7 daily in aggregate of which no more than 1 may be a Cabezon April 1 – Sept. 30

40-fm curve: Seaward closed April 1-Sept. 30

7/21: Offshore of 20-fm line closed due to relloweye rockfish impacts

8/13: Groundfish retention with nearshore halibut (central coast) prohibited

10/1: All depths reopened for groundfish (yelloweye rockfish impacts sufficiently slowed); Groundfish retention with nearshore halibut allowed again

2010

Same as 2009 including ”rockfish” et al bag limit: 7 (misprinted in regulations booklet as 6)

Definition of ”groundfish group” added

7/24: Offshore of 20-fm line closed through Dec. 31 due to yelloweye rockfish impacts

2009

Same as 2008 through April 30 (adopted late), then increase in ”marine fish” bag limit

Rockfish, Cabezon, greenling (10” min.), and other marine species not listed: 6

40-fm curve: Seaward closed April 1-Sept. 30

5/1: ”Rockfish” et al. bag limit increased to 7 (in permanent rule)

2008

Same as 2007

7/7: ”Rockfish” et al bag limit reduced from 6 to 5 and closed outside 20-fm line through Dec. 31 [sic – see 9/7 change] and flatfish closed outside 40-fm line through Dec. 31 [sic]

9/7: Return to preseason regs., i.e., ”rockfish” et al bag limit back to 6 and waters closed offshore of 40-fm line only through Sept. 30 (open offshore Oct-Dec)

2007

Rockfish, Cabezon, greenling (10” min.), and other marine species not listed: 6

40-fm curve: Seaward closed April 1-Sept. 30

2006

Rockfish, Cabezon, greenling (10” min.), flounder, sole and other marine species not listed: 6

40-fm curve: Seaward closed June 1-Sept. 30

2005

Rockfish, Cabezon, greenling (10” min.), flounder, sole and other marine species not listed: 8

40-fm curve: Seaward closed June 1-Sept. 30

7/16: Rockfish et al. bag limit reduced to 5

10/18: Black RF prohibited for boats, Groundfish closed seaward of 40 fm

2004

Rockfish, Cabezon, greenling (10” min.), flounder, sole and other marine species not listed: 10, no more than 1 P. Halibut

Retention of yelloweye rockfish and canary rockfish prohibited

40-fm curve: Seaward closed June 1-Sept. 30

9/3: Rockfish, lingcod and greenling prohibited

2003

Rockfish, Cabezon, greenling, flounder, sole and other marine species not listed: 10, no more than 1 Canary RF, 1 Yelloweye RF and 1 P. Halibut

11/21: ocean closed to GF outside 27-fm line

2002

Rockfish: 10, no more than 1 Canary RF and 1 Yelloweye RF

2001

Rockfish: 10, no more than 1 Canary RF

2000

Rockfish: 10, no more than 3 canary RF

1999-1994

Rockfish: 15, no more than 10 black rockfish

1993-1986

Rockfish, Cabezon and greenling: 15

1985-1979

Other fish: 25, no more than 3 lingcod, 2 halibut and 15 rockfish/Cabezon/greenling

1978

Other fish: 10 Then effective 4/1 = - other fish: 25, no more than 3 lingcod, 2 halibut and 15 rockfish/Cabezon/greenling

1977

Other fish: 25, no more than 5 lingcod and 2 halibut

1976

Other fish: 25

California

The following regulations pertain to nearshore rockfish species in Oregon and were provided by the California Department of Fish and Wildlife. In 2000, a 3-hook and 1-line gear restriction was enacted. As of 2001, the gear restriction is 2-hooks and 1-line per angler. The general rockfish (Rockfish/Cabezon/Greenling as of 2002) bag limit was 15 fish statewide in 1999. As of 2000, it is 10 rockfish. The nearshore rockfish bag limit is the same as the general rockfish bag limit except in 2003 and 2004. In 2003, the nearshore rockfish bag limit was 2 fish south of Cape Mendocino in 2003 and for a portion of 2004.

CDFW Recreational Season Lengths and Depth Restrictions for Select California Groundfish (1999-2014)

The following are summarized recreational season and depth limit regulations for select California groundfish from 1999 through 2014, including most inseason changes. Information was compiled from California's sport fishing booklet and supplemental booklets, as well as some emergency rulemakings.

Nearshore rockfish is defined as: black, black-and-yellow, blue, brown, calico, China, copper, gopher, grass, kelp, olive, quillback, and treefish rockfishes.

Shelf rockfish is defined as: bocaccio, canary, cowcod, widow, yelloweye, yellowtail, shortbelly, bronzespotted, chameleon, chilipepper, dwarf-red, flag, freckled, greenblotched, greenspotted, greenstriped, halfbanded, honeycomb, Mexican, pink, pinkrose, pygmy, redstripe, rosethorn, rosy, silvergrey, speckled, squarespot, starry, stripetail, swordspine, tiger, and vermilion rockfishes.

Key:

	Allowed in all waters				
20	Depth closed greater than 20fm				
30	Depth closed greater than 30fm				
40	Depth closed greater than 40fm				
50	Depth closed greater than 50fm				
60	Depth closed greater than 60fm				
30-60	Depth open between 30-60fm				
	Closed	depth	In-season change		In-season closure

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 1999

Statewide

California/Oregon Border to California/Mexico border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish, Lingcod, Sanddabs												

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2000

Northern Management Area

California/Oregon Border to Near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish												
Lingcod[1]												
Sanddabs												

Central Management Area

Near Cape Mendocino (40° 10′ N lat.) to Lopez Point (36° 00′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean Whitefish												
Nearshore rockfish, Shelf rockfish												
Lingcod[1]												
Sanddabs												

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Figure H2

Southern Management Area
Lopez Point (36° 00′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish												
Nearshore rockfish, Shelf rockfish												
Lingcod[1]												
Sanddabs												

Notes for 2000:
1. Statewide emergency lingcod closure in November and December; closure did not apply to shore-based anglers.

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2001

Northern Management Area [1, 2, 3]
California/Oregon Border to Near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), & Ocean whitefish												
Shelf rockfish[3], Lingcod[3]												
Sanddabs												

Central Management Area [1, 2, 3]
Near Cape Mendocino (40° 10′ N lat.) to Point Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish					20	20					20	20
California sheephead, Ocean whitefish												
Cabezon, Greenlings (rock, kelp)											20	20
Shelf rockfish[3], Lingcod[3]												
Sanddabs												

Southern Management Area [1, 2, 3]
Point Conception (34° 27′ N lat.) to the U.S./Mexico border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish											20	20
California scorpionfish, Ocean whitefish	20	20									20	20
California sheephead												
Cabezon, Greenlings (rock, kelp)											20	20
Shelf rockfish[3], Lingcod[3]												
Sanddabs												

Notes for 2001:
1. Emergency action was taken by the Commission in order to conform to federal regulations; closures did not apply to shore-based anglers.
2. Inseason emergency closure on October 29 prohibited angling for shelf and slope rockfishes and lingcod. Possession of these fishes was prohibited in state waters. In waters less than 20 fathoms, fishing for nearshore rockfishes, California scorpionfish, cabezon, and greenlings continued to be permitted (including waters around offshore rocks and islands less than 20 fathoms). Fishing for California sheephead continued to be permitted in all waters except the Cowcod Conservation Areas.
3. On January 1, 2000 the California Fish and Game Commission adopted regulations to be effective through 2002 that closed lingcod, nearshore, and shelf rockfishes as follows: south of Lopez Point to the Mexico border Jan. - Feb.; and north of Lopez Point to Cape Mendocino Mar. - Apr. New regulations that superceded the regulations adopted January 1, 2000 went into effect Mar. 5, 2001. These new regulations included a different regional management boundary between the central and southern management areas – Point Conception instead of Lopez Point. Because of the delay in implementation (March instead of January), the area between Lopez Point and Point Conception was closed from Jan. 1 - Feb. 28, 2001 (as part of the southern area under the 2000 regulations). This area then was open to fishing from March

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Figure H3

1- 4, 2001 (as part of the 2000 open fishing period for the southern area). However, once the 2001 regulations took affect on Mar. 5, 2001, this section of coast was closed again from Mar. 5 – Apr. 30 (as part of the central area under the 2001 regulations).

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2002

Northern Management Area [1, 2, 3]
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, Ocean whitefish, Shelf rockfish, Lingcod												
California sheephead[1]												
Cabezon[1]												
Greenlings (rock, kelp) [1]												
Sanddabs												

Central Management Area [1, 2, 3]
Near Cape Mendocino (40° 10′ N lat.) to Point Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish					20	20	20	20	20	20		
California sheephead[1]												
Cabezon[1]												
Greenlings (rock, kelp) [1]												
Ocean whitefish[2]							20	20	20	20	20	20
Shelf rockfish[2], Lingcod[2]					20	20	20	20	20	20		
Sanddabs												

Southern Management Area [1, 2, 3]
Point Conception (34° 27′ N lat.) to the U.S./Mexico border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish[2]							20	20	20	20		
California sheephead[1]												
Cabezon[1]												
Greenlings (rock, kelp) [1]												
Ocean whitefish[2]							20	20	20	20	20	20
Shelf rockfish[2], Lingcod[2]							20	20	20	20		
Sanddabs												

Notes for 2002:
1. Inseason emergency closure took effect for greenlings on July 1, cabezon on July 29, and California sheephead on November 1. Closures do not apply to shore-based anglers, or spearfishing from shore or a man-made structure.
2. The emergency closure for shelf rockfish, lingcod, California scorpionfish, and ocean whitefish went into effect July 1. Nearshore fishing was still allowed in waters shallower than 20 fathoms for nearshore rockfishes, California scorpionfish, and ocean whitefish. There was a special allowance for two shelf rockfish ONLY if taken incidental to nearshore fishing in less than 20 fathoms EXCLUDING bocaccio, canary, cowcod, and yelloweye rockfish, which could not be taken.
3. Management Area boundaries changed January 10, 2002.

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2003

Northern Management Area [2, 3]
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish[3], California scorpionfish[3]												
California sheephead[2], Cabezon[2], Greenlings (rock, kelp) [2]												
Ocean whitefish												
Shelf rockfish[3], Lingcod[3]												
Sanddabs												

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Figure H4

Central Management Area [2, 3]

Near Cape Mendocino (40° 10′ N lat.) to Point Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
California scorpionfish[3]	20	20					20	20	20	20	20	
California sheephead[2]												
Cabezon[2], Greenlings (rock, kelp) [2]							20	20	20			
Ocean whitefish							20	20	20	20	20	20
Nearshore rockfish[3], Shelf rockfish[3], Lingcod[3]							20	20	20	20	20	
Sanddabs												

Southern Management Area [1, 2, 3]

Point Conception (34° 27′ N lat.) to the U.S./Mexico border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
California scorpionfish[1, 3]	20	20					20	20	30	30	30	
California sheephead[2]												
Cabezon[2], Greenlings (rock,kelp) [2]							20	20	30			
Ocean whitefish							20	20	30	30	30	30
Nearshore rockfish[3], Shelf rockfish[3], Lingcod[3]							20	20	30	30	30	
Sanddabs												

Notes for 2003:

1. Fishing for California scorpionfish was allowed in less than 50 fathoms during July and August, only in the area of Huntington Flats, as defined by California Code of Regulations, Title 14, subsection 27.82(d)(7).
2. Inseason emergency closures on October 8 for cabezon, greenlings, and California sheephead to all recreational take in all waters at all depths..
3. Inseason emergency closure on December 8 for nearshore rockfishes, California scorpionfish, shelf rockfishes, and lingcod.

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2004

Northern Management Area [1, 2]

California/Oregon Border to near Cape Mendocino (40°10'N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish					30	30	30	30	30	30	30	30
Black rockfish[1]						30	30	30				
Lingcod[2]					30	30	30	30	30	30		
Sanddabs												

North-Central Management Area [2, 3]

Near Cape Mendocino (40°10'N lat.) to Lopez Point (36°00'N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish	30	30						20	20	20		
Lingcod[2]	30	30						20	20	20		
Sanddabs												

South-Central Management Area [2]

Lopez Point (36° 00′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish	30	30			20	20		20	20	20	20	20
Lingcod[2]	30	30			20	20		20	20	20		
Sanddabs												

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Figure H5

Southern Management Area[2]
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish			60	60	60	60	60	60	30	30	60	60
California scorpionfish			60	60							60	60
Lingcod[2]			60	60	60	60	60	60	30	30		
Sanddabs												

Notes for 2004:

1. Inseason change on May 16 reduced rockfish bag limit to zero in May, and September through December.
2. Inseason change on April 1 decreased lingcod bag limit from two to one fish and increased size limit from 24 to 30 inches.
3. Inseason change on March 1 closed rockfish, lingcod and associated species on Cordell Bank (Marin County).

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2005

Northern Management Area[1]
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish					30	30	30	30	30	30	30	30
Cabezon[1]					30	30	30	30	30	30	30	
Lingcod					30	30	30	30	30	30	30	
Sanddabs												

North-Central Management Area[1]
Near Cape Mendocino (40° 10′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish							20	20	20	20	20	20
Cabezon[1]							20	20	20	20	20	
Lingcod							20	20	20	20	20	
Sanddabs												

Monterey South – Central Management Area[1]
Pigeon Point (37° 11′ N lat.) to Lopez Point (36° 00′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish							20	20	20	20	20	20
Cabezon[1]							20	20	20	20	20	
Lingcod							20	20	20	20	20	
Sanddabs												

Morro Bay South – Central Management Area[1]
Lopez Point (36° 00′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon[1], Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40			
Sanddabs												

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Figure H6

Southern Management Area[1]
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Greenlings, Ocean whitefish, Shelf rockfish			30-60	60	60	60	60	60	30	30	60	60
California scorpionfish										30	60	60
Cabezon[1]			30-60	60	60	60	60	60	30	30	60	
Lingcod				60	60	60	60	60	30	30	60	
Sanddabs												

Notes for 2005:

1. Inseason change on November 18 closed cabezon statewide for December.

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2006

Northern Management Area[1]
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish					30	30	30	30	30	30	30	30
Lingcod					30	30	30	30	30	30	30	
Sanddabs												

North-Central Management Area[2, 3]
Near Cape Mendocino (40° 10′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish							30	30	30	30	30	30
Lingcod							30	30	30	30	30	
Sanddabs												

Monterey South – Central Management Area[2, 3]
Pigeon Point (37° 11′ N lat.) to Lopez Point (36° 00′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish							30	30	30	30	30	30
Lingcod							30	30	30	30	30	
Sanddabs												

Morro Bay South – Central Management Area[4]
Lopez Point (36° 00′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40		
Sanddabs												

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Figure H7

Southern Management Area [5, 6]
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean Whitefish, Shelf rockfish			60	60	60	60	60	60	60	60	60	60
Lingcod				60	60	60	60	60	60	60	60	
Sanddabs												

Notes for 2006:

1. Inseason change on March 28 decreased the fishing depth limit from 40 to 30 fathoms in the Northern management area, and opened the months of November and December to recreational fishing (except for lingcod which was closed).
2. Inseason change on March 28 kept depth limit at 20 fathoms in the North-Central and Monterey South-Central management areas, but opened December to recreational fishing (except for lingcod which was closed).
3. Inseason change on July 1 liberated the fishing depth limit from 20 fathoms to 30 fathoms in the North-Central and Monterey South-Central management areas (except for lingcod which was cloased).
4. Inseason change on July 1 opened October to recreational fishing in the Morro Bay South-Central management area.
5. Inseason change on March 28 allowed recreational fishing in the Southern Management area during October (with 30 fathom depth limit), November (60 fathom depth limit), and December (60 fathom depth limit), except for lingcod which was closed to all fishing.
6. Inseason change on July 1 liberated the fishing depth limit from 30 fathoms to 60 fathoms in the Southern Management area for the remainder of the season (except for lingcod which remained closed in December).

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2007

Northern Management Area [1]
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, Cabezon, Greenlings (rock, kelp), Shelf rockfish, Lingcod					30	30	30	30	30			
California sheephead, Ocean whitefish					30	30	30	30	30	30	30	30
Sanddabs												

North-Central Management Area [1]
Near Cape Mendocino (40° 10′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, Cabezon, Greenlings (rock, kelp), Shelf rockfish, Lingcod						30	30	30	30			
California sheephead, Ocean whitefish						30	30	30	30	30	30	
Sanddabs												

Monterey South – Central Management Area
Pigeon Point (37° 11′ N lat.) to Lopez Point (36° 00′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

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Figure H8

Morro Bay South – Central Management Area
Lopez Point (36° 00′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

Southern Management Area [2]
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings (rock, kelp), Ocean whitefish, Shelf rockfish			60	60	60	60	60	60	60	60	60	60
California scorpionfish	40	40	60	60	60	60	60	60	60	60	60	60
Lingcod				60	60	60	60	60	60	60	60	
Sanddabs												

Notes for 2007:
1. Inseason emergency closure on October 1 north of Pigeon Point (37°11'N. lat) for nearshore rockfish, black rockfish, cabezon, greenlings, shelf rockfish and lingcod.
2. Cowcod Conservation area (west of San Diego) was open to recreational fishing from March through December from shore to 20 fathoms (see http://www.dfg.ca.gov/marine/cowcod.asp)

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2008

Northern Management Area [1, 3]
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish					20	20	20	20				
Lingcod					20	20	20	20				
Sanddabs												

North-Central North of Point Arena Management Area [1, 2, 3]
Near Cape Mendocino (40° 10′ N lat.) to Point Arena (38° 57′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						20	20	20				
Sanddabs												

North - Central South of Point Arena Management Area [1, 2]
Point Arena (38° 57′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						20	20	20	20	20	20	
Sanddabs												

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Figure H9

Monterey South – Central Management Area
Pigeon Point (37° 11′ N lat.) to Lopez Point (36° 00′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

Morro Bay South – Central Management
Lopez Point (36° 00′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

Southern Management Area [4]
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish			60	60	60	60	60	60	60	60	60	60
California scorpionfish	40	40	60	60	60	60	60	60	60	60	60	60
Lingcod				60	60	60	60	60	60	60	60	
Sanddabs												

Notes for 2008:

1. Inseason change on May 9 decreased depth limit from 30 fathoms to 20 fathoms in the Northern and North-Central Management Areas.
2. Inseason emergency change on September 2 split the North-Central Management Area into two areas: North-Central North of Point Arena, and North-Central South of Point Arena.
3. Inseason emergency closure on September 2 for nearshore rockfish, California sheephead, California scorpionfish, cabezon, greenlings, Ocean whitefish, shelf rockfish and lingcod for the Northern and North-Central North of Point Arena Management areas.
4. Cowcod Conservation area (west of San Diego) was open to recreational fishing from March through December from shore to 20 fathoms (see http://www.dfg.ca.gov/marine/cowcod.asp)

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2009

Northern Management Area
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20	20			
Sanddabs												

North-Central - North of Point Arena Management Area
Near Cape Mendocino (40° 10′ N lat.) to Point Arena (38° 57′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20				
Sanddabs												

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Figure H10

North-Central South of Point Arena Management Area
Point Arena (38° 57′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						20	20	20	20	20	20	
Sanddabs												

Monterey South – Central Management Area
Pigeon Point (37° 11′ N lat.) to Lopez Point (36° 00′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

Morro Bay South – Central Management Area
Lopez Point (36° 00′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

Southern Management Area
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish			60	60	60	60	60	60	60	60	60	60
California scorpionfish	40	40	60	60	60	60	60	60	60	60	60	60
Lingcod				60	60	60	60	60	60	60	60	
Sanddabs												

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2010

Northern Management Area
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20				
Sanddabs												

North-Central - North of Point Arena Management Area
Near Cape Mendocino (40° 10′ N lat.) to Point Arena (38° 57′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20				
Sanddabs												

Version 05/21/15

Figure H11

North-Central South of Point Arena Management Area
Point Arena (38° 57′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						30	30	30	30	30		
Sanddabs												

Monterey South – Central Management Area
Pigeon Point (37° 11′ N lat.) to Lopez Point (36° 00′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

Morro Bay South – Central Management Area
Lopez Point (36° 00′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	
Sanddabs												

Southern Management Area
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish			60	60	60	60	60	60	60	60	60	60
California scorpionfish	40	40	60	60	60	60	60	60	60	60	60	60
Lingcod				60	60	60	60	60	60	60	60	
Sanddabs												

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2011

Northern Management Area
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20	20	20		
Sanddabs												

Mendocino Management Area
Near Cape Mendocino (40° 10′ N lat.) to Point Arena (38° 57′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20				
Sanddabs												

Version 05/21/15

Figure H12

San Francisco Management Area
Point Arena (38° 57′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						30	30	30	30	30	30	30
Sanddabs												

Central Management Area
Pigeon Point (37° 11′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	40
Sanddabs												

Southern Management Area
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish			60	60	60	60	60	60	60	60	60	60
California scorpionfish	60	60	60	60	60	60	60	60	60	60	60	60
Lingcod			60	60	60	60	60	60	60	60	60	60
Sanddabs												

Notes for 2011:
1. As part of the biennial management specification process, the North-Central North of Point Arena Management area was renamed the Mendocino Management Area, the North-Central South of Point Arena Management Area was renamed the San Francisco Management Area, and the Monterey South-Central and Morro Bay South-Central Management Areas were combined into the Central Management Area.
2. Due to a delay in the federal regulatory process, recreational regulations for 2011 in California did not go into effect until June 11, 2011.

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2012

Northern Management Area
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20	20	20		
Sanddabs												

Mendocino Management Area
Near Cape Mendocino (40° 10′ N lat.) to Point Arena (38° 57′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20				
Sanddabs												

Version 05/21/15

Figure H13

San Francisco Management Area
Point Arena (38° 57′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						30	30	30	30	30	30	30
Sanddabs												

Central Management Area
Pigeon Point (37° 11′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	40
Sanddabs												

Southern Management Area
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish			60	60	60	60	60	60	60	60	50	50
California scorpionfish	60	60	60	60	60	60	60	60	60	60	50	50
Lingcod			60	60	60	60	60	60	60	60	50	50
Sanddabs												

Notes for 2012:

1. Sub-bag limit for greenling increased from two fish to 10 fish within the 10 fish daily RGC bag limit.
2. High encounter rates for cowcod in the SMA lead to inseason action to restrict anglers' maximum fishing depth from 60fm to 50fm.

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2013

Northern Management Area
California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, Black rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20	20	20		
Sanddabs												

Mendocino Management Area
Near Cape Mendocino (40° 10′ N lat.) to Point Arena (38° 57′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20				
Sanddabs												

Version 05/21/15

Figure H14

San Francisco Management Area

Point Arena (38° 57′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						30	30	30	30	30	30	30
Sanddabs												

Central Management Area

Pigeon Point (37° 11′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	40
Sanddabs												

Southern Management Area

Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish			50	50	50	50	50	50	50	50	50	50
California scorpionfish	50	50	50	50	50	50	50	50	50	50	50	50
Lingcod			50	50	50	50	50	50	50	50	50	50
Sanddabs												

Notes for 2013-2014:

1. Season in Mendocino Management Area was extended two weeks from previous years.
2. More optimistic results from 2011 bocaccio stock assessment allowed increase of daily sub-bag limit from two fish to three fish, and removal of minimum size limit.

CALIFORNIA RECREATIONAL REGULATORY HISTORY, 2014

Northern Management Area

California/Oregon Border to near Cape Mendocino (40° 10′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20	20	20		
Sanddabs												

Mendocino Management Area

Near Cape Mendocino (40° 10′ N lat.) to Point Arena (38° 57′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfsh, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					20	20	20	20				
Sanddabs												

Version 05/21/15

Figure H15

San Francisco Management Area
Point Arena (38° 57′ N lat.) to Pigeon Point (37° 11′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California scorpionfish California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod						30	30	30	30	30	30	30
Sanddabs												

Central Management Area
Pigeon Point (37° 11′ N lat.) to Pt. Conception (34° 27′ N lat.)

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod					40	40	40	40	40	40	40	40
California scorpionfish					40	40	40	40	40	40		
Sanddabs												

Southern Management Area
Pt. Conception (34° 27′ N lat.) to US/Mexico Border

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Nearshore rockfish, California sheephead, Cabezon, Greenlings, Ocean whitefish, Shelf rockfish, Lingcod			50	50	50	50	50	50	50	50	50	50
California scorpionfish	50	50	50	50	50	50	50	50	50	50		
Sanddabs												

Notes for 2014:

1. Based on projected estimates for 2014, it was predicted that the California scorpionfish annual catch limit would be exceeded unless closed. Thus, in-season action was taken to close the fishery from November 15 through the end of year.

Version 05/21/15

Figure H16

References

Abrams, J. 2014. The effect of local fishing pressure on the size and age structure of fishes associated with rocky habitats along California's north coast. PhD thesis, Humboldt State University.

Alverson, D.L., Pruter, a T., and Ronholt, L.L. 1964. A Study of Demersal Fishes and Fisheries of the Northeastern Pacific Ocean. Institute of Fisheries, University of British Columbia.

Anderson, T. 1983. Identification and development of nearshore juvenile rockfishes (genus *Sebastes*) in central California kelp forests. PhD thesis, Fresno State University.

Beamish, R. 1979. New information on the longevity of Pacific ocean perch (*Sebastes alutus*). Journal of the Fisheries Board of Canada **36**: 1395–1400.

Bertalanffy, L. von. 1938. A quantitative theory of organic growth. Human Biology **10**: 181–213.

Bodkin, J. 1986. Fish assemblages in *Macrocystis* and *Nereocystis* kelp forests off central California. Fishery Bulletin **84**: 799–808.

Botsford, L., and Lawrence, C. 2002. Patterns of co-variability among California Current chinook salmon, coho salmon, Dungeness crab, and physical oceanographic conditions. Progress in Oceanography **53**: 283–305.

Buckley, R. 1967. 1965 bottomfish sport fishery. Sport fishery investigations 1965. Supplemental progress report. Department of Fisheries. State of Washington.

Buonaccorsi, V. 2002. Population structure of copper rockfish (*Sebastes caurinus*) reflects postglacial colonization and contemporary patterns of larval dispersal. Canadian Journal of Fisheries and Aquatic Sciences **59**: 1374–1384.

Buonaccorsi, V., Westerman, M., and Stannard, J. 2004. Molecular genetic structure suggests limited larval dispersal in grass rockfish, *Sebastes rastrelliger*. Marine Biology **145**: 779–788.

Burford, M., and Bernardi, G. (n.d.). Incipient speciation within a subgenus of rockfish (*{*Sebastosomus) provides evidence of recent radiations within an ancient species flock. Marine Biology: 701–717.

CDFG. 2002. Review of Some California Fisheries for 2001: market squid, sea urchin, dungeness crab, lobster, prawn, abalone, groundfish, swordfish and shark, coastal pelagic finfish, ocean salmon, nearshore live-fish, Pacific herring, white seabass, and kelp. California Cooperative Oceanic Fisheries Investigations Reports **43**: 13–30.

Checkley, D., and Barth, J. 2009. Patterns and processes in the California Current System. Progress in Oceanography **83**: 49–64.

Cope, J. 2004. Population genetics and phylogeography of the blue rockfish (Sebastes mystinus) from Washington to California. Canadian Journal of Fisheries and Aquatic Sciences **61**: 332–342.

Cope, J., Dick, E., Maccall, A., Monk, M., Soper, B., and Wetzel, C. 2015. Data-moderate stock assessments for brown, China, copper, sharpchin, stripetail, and yellowtail rockfishes and English and rex soles in 2013. Pacific Fisheries Management Council, Portland, OR.

Dick, E. 2009. Modeling the reproductive potential of rockfishes (*Sebastes* spp.). PhD thesis, University of California Santa Cruz.

Dick, E.J., and MacCall, A.D. 2010. Estimates of sustainable yield for 50 data-poor stocks in the Pacific Coast Groundfish Fishery Management Plan. NOAA Technical Memorandum NMFS NOAA-TM-NMFS-SWFSC-460.

Dick, E.J., and MacCall, A.D. 2011. Depletion-Based Stock Reduction Analysis: A catch-based method for determining sustainable yields for data-poor fish stocks. Fisheries Research **110**(2): 331–341.

Douglas, D. 1998. Species composition of rockfish catches by Oregon trawlers, 1963-93. Oregon Deptartment of Fish and Wildlife. Marine Program Data Series Report.

Drake, P., and Edwards, C. 2013. Influence of larval behavior on transport and population connectivity in a realistic simulation of the California Current System. Journal of Marine Research **71**: 317–350.

Echeverria, T. 1987. Thirty-four species of California rockfishes: maturity and seasonality of reproduction. Fishery Bulletin **85**: 229–250.

Field, J., and Ralston, S. 2005. Spatial variability in rockfish (Sebastes spp.) recruitment events in the California Current System. Canadian Journal of Fisheries and Aquatic Sciences **62**: 2199–2210.

Fisk, M., Duncan, R., Fox, C., and Witter, J. 1993. Emergence and petrology of the Mendocino Ridge. Marine Geophysical Researches **15**: 283–296.

Francis, R. 2011. Data weighting in statistical fisheries stock assessment models. Canadian Journal of Fisheries and Aquatic Sciences **68**: 1124–1138.

Francis, R., Little, J., and Bloeser, J. 2009. Matching spatial scales of ecology, economy, and management for groundfish of the U.S. West Coast marine ecosystem: a state of the science review. A report to the Lensfest Ocean Program at The Pew Charitable Trust.

Goldfinger, C., Henkel, S., Romsos, C., and Andrea Havron, B.B. 2014. Benthic habitat characterization offshore the Pacific Northwest volume 1: evaluation of continental shelf feology. US Dept. of the Interior, Bureau of Ocean Energy Management, Pacific OCS Region. OCS Study BOEM 2014-662.

Gottscho, A. 2014. Zoogeography of the San Andreas Fault system: Great Pacific Fracture Zones correspond with spatially concordant phylogeographic boundaries in western North. Biological Reviews **2014**: 1–21.

Greene, H.G., Yoklavich, M.M., Starr, R.M., O'Connell, V.M., Wakefield, W.W., Sullivan, D.E., McRea, J.E., and Cailliet, G.M. 1999. A classification scheme for deep seafloor habitats. Oceanologica Acta **22**: 663–678.

Hamel, O. 2015. A method for calculating a meta-analytical prior for the natural mortality rate using multiple life history correlates. ICES Journal of Marine Science **72**: 62–69.

Hanan, D., and Curry, B. 2012. Long-term movement patterns and habitat use of nearshore groundfish: tag-recapture in central and southern California waters. Open Fish Science Journal **5**: 30–43.

Hannah, R.W., and Rankin, P.S. 2011. Site fidelity and movement of eight species of Pacific rockfish at a high-relief rocky reef on the Oregon coast. North American Journal of Fisheries Management **31**: 483–494.

Harry, G., and Morgan, A. 1961. History of the trawl fishery, 1884-1961. Oregon Fish Commission Research Briefs **19**: 5–26.

Hickey, B.M. 1979. The California current system—hypotheses and facts. Progress in Oceanography **8**(4): 191–279.

Hoenig, J. 1983. Empirical use of longevity data to estimate mortality-rates. Fishery Bulletin **82**: 898–903.

Karnowski, M., Gertseva, V., and Stephens, A. 2014. Historic reconstruction of Oregon's commercial fisheries landings. Oregon Deptartment of Fish and Wildlife. Marine Program Data Series Report.

Kimura, D., Mandapat, R., and Oxford, S. 1979. Method, validity, and variability in the age determination of yellowtail rockfish (*Sebastes flavidus*), using otoliths. Journal of the Fisheries Research Board of Canada **35**: 377–383.

Lea, R., McAllister, R., and VenTresca, D. 1999. Biological aspects of nearshore rockfishes of the genus *Sebastes* from Central California, with notes on ecologically related sport fishes. California Department of Fish and Game, Fish Bulletin **177**.

Lee, J., and Berejikian, B. 2009. Structural complexity in relation to the habitat preferences, territoriality, and hatchery rearing of juvenile China rockfish (*Sebastes nebulosus*). Environmental biology of fishes **84**: 411–419.

Lenarz, W., and Echeverria, T. 1991. Sexual dimorphism in *Sebastes*. Environmental Biology of Fishes **30**: 71–80.

Lo, N., Jacobson, L.D., and Squire, J.L. 1992. Indices of relative abundance from fish spotter data based on delta-lognornial models. Canadian Journal of Fisheries and Aquatic Sciences **49**: 2515–2526.

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

Love, M.S., Caselle, J., and Buskirk, W.V. 1998. A severe decline in the commercial passenger fishing vessel rockfish (*Sebastes* spp.) catch in the Southern California Bight, 1980-1996. California Cooperative Oceanic Fisheries Investigations Reports **39**: 180–195.

MacCall, A.D. 2009. Depletion-corrected average catch: A simple formula for estimating sustainable yields in data-poor situations. ICES Journal of Marine Science **66**: 2267–2271.

Magnell, B., Bray, N., and Winant, C. 1990. Convergent shelf flow at Cape Mendocino. Oceanography **3**: 4–11.

Matthews, K. 1990. An experimental study of the habitat preferences and movement patterns of copper, quillback, and brown rockfishes (*Sebastes* spp.). Environmental Biology of Fishes **29**: 161–178.

McAllister, M.K., and Ianelli, J.N. 1997. Bayesian stock assessment using catch-age data and the sampling - importance resampling algorithm. Canadian Journal of Fisheries and Aquatic Sciences **54**(2): 284–300.

Methot, R.D. 2015. User manual for Stock Synthesis model version 3.24s. NOAA Fisheries, US Department of Commerce.

Methot, R.D., and Wetzel, C.R. 2013. Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management. Fisheries Research **142**: 86–99.

Miller, D., and Gotshall, D. 1965. Ocean sportfish catch and effort from Oregon to Point Arguello, California July 1, 1957-June 30, 1961. State of California, The Resources Agency Department of Fish and Game, Fish Bulletin **130**.

Monk, M., Dick, E., and Pearson, D. 2014. Documentation of a relational database for teh California recreational fisheries survey onboard observer sampling program, 1999-2011. NOAA-TM-NMFS-SWFSC-529.

Monk, M., Dick, E., Buell, T., ZumBrunnen, L., Dauble, A., and Pearson, D. 2013. Documentation of a relational database for the Oregon Sport Groundfish Onboard Sampling Program. NOAA-TM-NMFS-SWFSC-519.

Munk, K. 2001. Maximum ages of groundfishes in waters off Alaska and British Columbia and considerations of age determination. Alaska Fishery Research Bulletin **8**: 12–21.

NMFS. 2005. Pacific Coast Fishery Management Plan: Essential Fish Habitat Designation and Minimization of Adverse Impacts: Final Environmental Impact Statement. Seattle, WA.

Pacific Fishery Managment Council. 2013. Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 101, Portland, Oregon 97220-1384.

Pikitch, E., Erickson, D., and Wallace, J. 1988. An evaluation of the effectiveness of trip limits as a management tool. Northwest and Alaska Fisheries Center, National Marine Fisheries Service, US Department of Commerce.

R Development Core Team. 2013. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Ralston, S., Pearson, D., Field, J., and Key, M. 2010. Documentation of California catch reconstruction project. NOAA-TM-NMFS-SWFSC-461.

Reilly, P.N., Wilson-Vandenberg, D., Wilson, C.E., and Mayer, K. 1998. Onboard sampling of the rockfish and lingcod commercial passenger fishing vessel industry in northern and central California, January through December 1995. Marine region, Admin. Rep. **98-1**: 1–110.

Rodomsky, B., Krutzikowsky, G., Ireland, R., and Calavan, R. 2014. The 2013 Oregon commercial nearshore fishery summary. Oregon Dept of Fish & Wildlife. Marine Program Data Series Report.

Rogers, J., and Pikitch, E. 1992. Numerical definition of groundfish assemblages caught off the coasts of Oregon and Washington using commercial fishing strategies. Canadian Journal of Fisheries and and Aquatic Sciences **49**: 2648–2656.

Sivasundar, A., and Palumbi, S. 2010. Life history, ecology and the biogeography of strong genetic breaks among 15 species of Pacific rockfish, *Sebastes*. Marine Biology **157**: 1433–1452.

Sotka, E., Wares, J., and Barth, J. 2004. Strong genetic clines and geographical variation in gene flow in the rocky intertidal barnacle Balanus glandula. Molecular Ecology **13**: 2143–2156.

Starr, R., Wendt, D., Barnes, C., Marks, C., Malone, D., Waltz, G., Schmidt, K., Chiu, J., Launer, A., Hall, N., and Yochum, N. 2015. Variation in responses of fishes across multiple reserves within a network of marine protectes areas in temperate waters. PLoS one **10**: e0118502.

Stefánsson, G. 1996. Analysis of groundfish survey abundance data: combining the GLM and delta approaches. ICES Journal of Marine Science **53**: 577–588.

Stephens, A., and MacCall, A. 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. Fisheries Research **70**: 299–310.

Stephens, J., Wilson-vandenberg, D., Wendt, D., Carroll, J., Nakamura, R., Nakada, E., Reinecke, S.J., and Wilson, J. 2006. Rockfish resouces of the south central California coast: analysis of the resource from partyboat data, 1980 – 2005. The California Cooperative Oceanic Fisheries Investigations Reports **47**: 140–155.

Tolimieri, N., and Levin, P. 2006. Assemblage structure of eastern Pacific groundfishes on the US continental slope in relation to physical and environmental variables. Transactions of the American Fisheries Society **135**: 317–332.

Van Voorhees, D., Hoffman, A., Lowther, A., Van Buskirk, W., Weinstein, J., and White, J. 2000. An evaluation of alternative estimators of ocean boat fish effort and catch in Oregon. The Pacific RecFIN Statistics Subcommittee, http://old.recfin.org/lib/RecFIN_ORBS_MRFSS_Comparison.PDF.

Williams, E.H., and Ralston, S. 2002. Distribution and co-occurrence of rockfishes (family: Sebastidae) over trawlable shelf and slope habitats of California and southern Oregon.

Fishery Bulletin **100**: 836–855.

Young, M.A., Iampietro, P.J., Kvitek, R.G., and Garza, C.D. 2010. Multivariate bathymetry-derived generalized linear model accurately predicts rockfish distribution on Cordell Bank, California, USA. Marine Ecology Progress Series **415**: 247–261.