Assessment of Lingcod
(*Ophiodon elongatus*)

for the

Pacific Fishery Management Council

in 2005

by

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Executive Summary

Stock

This assessment applies to lingcod (*Ophiodon elongatus*) in the full Pacific Fishery Management Council (PFMC) management zone (the US-Vancouver, Columbia, Eureka, Monterey, and Conception INPFC areas). Separate assessment models were constructed to describe population trends in the northern (LCN: US-Vancouver, Columbia) and southern (LCS: Eureka, Monterey, Conception) areas.

Catches

Commercial Landings

Commercial lingcod catch history in California waters is available beginning 1916 (personal communication Brenda Erwin, PSMFC) and averaged 428 mt between 1916 and 1955 (Table 4). Commercial lingcod landings in Oregon were first reported in 1950 (Mark Freeman, personal communication) and averaged 264 mt between 1950 and 1953. Washington commercial lingcod landings were first reported in 1937 (anonymous, 1956, WDFW report) and averaged 106 mt until 1955.

Catch data were compiled from agency reports and personal communication for all years preceding 1981 (Table 5). The PacFIN database was queried for catch information in subsequent years and catch detail is presented by gear and INPFC area in Table 6.

Commercial landings peaked in 1985 at 3,129 mt in northern waters (Columbia and Vancouver INPFC areas) and in 1974 at 1,735 mt in southern waters (Eureka, Monterey and Conception INPFC Areas)(Table 5). Average catch between 1990-1997 declined 40 % and 35% since the 1980's in northern and southern waters, respectively. Under rebuilding management, commercial fishery restrictions in recent years (1998-present) reduced coastwide catches to an annual average of less than 225 mt (Figure 3).

From 1981-1997, trawl gear has made up the majority of commercial landings for the northern (83%) and southern (63%) coast. In recent years (1998-2004), commercial fishery restrictions constrained the trawl portion of the commercial catch to 65% and 40% for the northern and southern coast, respectively. In 2004, coastwide commercial landings totaled 174 mt and were distributed as follows by INPFC area: U.S.-Vancouver (41.7 mt), Columbia (44.6 mt) , Eureka 39.5 mt), Monterey (33.2 mt), Conception (14.8 mt).

Recreational Landings

Recreational fishers in California have targeted lingcod since the early 1940's. Catch averaged 65.3 mt annually between 1947-1954 (Leet et al., 1992). Recreational lingcod catch information is not available until 1977 for Oregon waters and averaged 52.3 mt annually between 1977 and 1979. Recreational lingcod catch in Washington was first estimated in 1967 to be 25.3 mt and annual catch estimates have been provided since 1975.

Recreational catch estimates were extracted from the RecFIN database for years 1980–1989 and 1993 to present for California waters. California recreational catch estimates for all other years were previously compiled in the 2000 lingcod assessment (Jagielo et al., 2000). Oregon recreational catch data were provided by ODFW (Don Bodenmiller personal communication). The recreational catch in Washington was provided by the WDFW Ocean Sampling Program.

Recreational catch in southern waters has declined since catch peaked in 1980 at 2,226 mt (Table 5, Figure 4). In contrast, recreational catch in northern waters peaked at 236 mt in 1994. Estimated coastwide recreational landings averaged 500 mt. from 1998-2004 and were 1175 mt. and 316 mt. in 2003 and 2004, respectively.

Historically, recreational landings have comprised a larger proportion of the total landings for the southern area, compared to the northern area. In recent years, the recreational portion of the total landings has increased substantially in both the southern and northern areas. In 2004 recreational fisheries harvested 65% of the total lingcod catch coastwide (Figure 5).

Data and Assessment

Present Modeling Approach and Assessment Program

The present assessment updates the previous coastwide assessment (Jagielo et al. 2003) and is implemented in Stock Synthesis II using the executable code SS2 version 1.19d (Methot 2005).

As in the previous assessment, separate age structured models were constructed to analyze stock dynamics for the northern (LCN: US-Vancouver, Columbia) and southern (LCS: Eureka, Monterey, Conception) areas.

The LCN model incorporated the following likelihood components, which are described mathematically in Methot 2005). Input data sources are specified by Table number in the body of the 2003 assessment document which follows:

1) Commercial Catch-At-Age: 1979-2004 (Table 9, Table 15).
2) Recreational Catch-At-Age: 1980, 1986-2004 (Table 10, Table 15).
3) Commercial Catch-At-Length: 1975-1978 (Table 13).
4) Recreational Catch-At-Length: 1981-1983 (Table 13).
5) NMFS Trawl Survey Catch-At-Age: 1992, 1995, 1998, 2001, and 2004 (Table 11).
6) NMFS Trawl Survey Catch-At-Length: 1986 and 1989 (Table 12).
7) WDFW Tag Survey Catch-At-Age: 1994-1997 (Table 11).
8) WDFW Tag Survey Catch-At-Length: 1986-1993 (Table 12).
9) NMFS Trawl Survey Biomass (mt): 1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001 (Table20) and 2004 (Table 21).
10) WDFW Tag Survey Abundance (Numbers of Fish): 1986-1992 (Table 22).
NOTE: THIS DATASET WAS OMITTED IN FINAL BASE MODEL AT THE REQUEST OF THE STAR PANEL CONDUCTED AUGUST 15-19, 2005.
11) Trawl Fishery Logbook CPUE Index: Washington and Oregon lingcod CPUE estimates (lbs/hr) derived from a Delta GLM analysis of trawl logbook information, 1976-1997 (Table 24).

The LCS model incorporated the following likelihood components:

1) Commercial Catch-At-Age: 1992-1998, 2000-2004 (Table 14, Table 15).
2) Recreational Catch-At-Age: 1992-1998, 2000-2004 (Table 14, Table 15).
3) NMFS Trawl Survey Catch-At-Age: 1995, 1998, 2001, and 2004 (Table 14, Table 15).
4) NMFS Trawl Survey Biomass (mt): 1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001 (Table20) and 2004 (Table 20, Table 21).
5) Trawl Fishery Logbook CPUE Index: Oregon and California lingcod CPUE estimates (lbs/hr) derived from a Delta GLM analysis of trawl logbook information, 1978-1997 (Table 25).

Unresolved Problems and Major Uncertainties

At the STAR Panel review (August 15-19, 2005) concern was raised regarding the apparent lack of evidence in the data for the northern (LCN) model estimates of high 1999 and 2000 year class strength. In particular, doubts were raised concerning the reliability of the 2001 and 2004 NMFS triennial survey estimates, in which these two year classes were abundant. Furthermore, the STAR Panel did not find compelling evidence from the fishery age composition data to corroborate the high year classes seen in those two surveys. As a result of these uncertainties, the lingcod assessment was recommended for further review at the follow-up STAR Panel meeting (September 26-30, 2005).

At the follow-up STAR Panel meeting, additional analyses and information were provided to document the LCN model estimates of high 1999 and 2000 year class strength. Additional model runs with sequential removal of the 2001 and 2004 NMFS trawl surveys, and age compositions from the commercial and recreational fisheries from 2000-2004 indicted that both survey and commercial data supported the two strong year classes. As a result, the STAT Team recommended and the STAR Panel approved the base LCN model for management.

The STAT team very much appreciated the constructive August 15-19, 2005 and September 26-30 STAR Panel reviews, which resulted in improved LCN and LCS models for fisheries management.

The STAT team additionally notes that:

1) Uncertainty regarding stock status is higher for the southern area relative to the northern area, primarily because historical data from the southern area were sparse relative to the northern area. The time series of fishery age data available for the southern (LCS) model is short and samples sizes are small, resulting in greater uncertainty in the estimation of assessment parameters and stock productivity for the southern area. Age data for the NMFS trawl survey were sparse for both regions in early years, but particularly for the southern region. Recreational fishery catch at age data were not available for the southern region in 2003.

2) Management-implemented minimum size limits have resulted in limiting the utility of fishery information for estimation of recent stock recruitment in both regions, and fishery trip limits have compromised the utility of recent fishery CPUE data as viable indices of abundance.

Management Reference Points

Management reference points derived from the 2005 lingcod stock assessment are summarized in Table ES-1. The estimates of unfished spawning biomass (Bzero) were determined as the product of mean recruitment from 1956-2005 and the estimated Spawners Per Recruit. On a coastwide basis the lingcod population is fully rebuilt; estimated spawning biomass was 34,017 mt in 2005, which is 0.60 of the unfished spawning biomass estimate (52,850 mt). The estimated ratio of 2005 spawning biomass to unfished spawning biomass is higher in the north (0.87) compared to the south (0.24).

Spawning Stock Biomass

SS2 estimates of the coastwide female spawning stock biomass declined from 60,106 mt in 1956 to 6,004 mt in 1994, and subsequently increased to 34017 mt in 2005 (Table ES-2, Figure ES1-Top). Female spawning biomass depletion (B_0/B_t) fell to 0.11 in 1994 and subsequently increased to 0.64 in 2005 (Table ES-2, Figure ES1-Bottom).

Recruitment

The model estimate of virgin recruitment was higher for the northern area (3750 thousand age 0 fish) compared to the southern area (2503 thousand age 0 fish). Recruitments were generally similar in magnitude in both the north and south from 1972-1992, averaging 2008 in the north, and 2071 in the south (Table ES-2. Figure ES-1, bottom). Subsequently, from 1993-2005, recruitments tended to be higher in the north, and averaged 4503 compared to 1309 for the same period in the south. Recent, historically strong, 1999 and 2000 year classes were estimated in the north.

Exploitation Status

In the northern area, the exploitation rate (catch/available biomass) peaked at 0.20 in 1991 and averaged 0.03 from 1956-1980, 0.12 from 1981-1997, and 0.02 from 1998-2005 (Table ES-3). Exploitation rates were generally higher in the southern area, peaking at 0.26 in 1989 and averaging 0.05 from 1956-1980, 0.20 from 1981-1997, and 0.10 from 1998-2005.

Management Performance

The first lingcod ABC's based on a quantitative assessment were implemented in 1995. A comparison of reported landings and ABC values shows good correspondence through 2001, when landings were typically at or below the target ABC values (Figure ES2). In 2002, landings exceeded the coastwide ABC by 17% and the coastwide OY was exceeded by 51%.

Forecasts and Decision Table

Projected yield was forecasted using the SS2 software for the northern (LCN) and southern (LCS) base models (Table ES-4). Coastwide yield forecasts (sum of LCN and LCS) are summarized in Table ES-5. Forecasts were run with and without the 40:10 adjustment option. These forecasts assumed that fishery removals in 2005 and 2006 were taken at the level projected by the Groundfish Management Team for 2005 (970mt) (John Devore, Personal Communication).

Additional model forecast runs were made for a set of alternative conditions to establish decision tables. For LCN, the decision table was constructed with the base model and one alternate model in which both: 1) the NMFS 2001 and 2004 shelf triennial trawl survey data were omitted, and 2) the age composition data for the recreational and commercial fishery were omitted for the years 2000 through 2004 (Table ES-6). For LCS, the decision table was constructed with the base model and two alternate models (Table ES-7). The first “low” alternate model assumed that spawning biomass in 2005 was approximately 1.25 standard deviations below the base model estimate of spawning biomass in 2005 (3375 mt); the second “high” alternate model assumed that spawning biomass in 2005 was approximately 1.25 standard deviations above the base model estimate of spawning biomass in 2005 (5827 mt).

In both decision tables (Table ES-6 and Table ES-7), the base case model using the base case catch projection is highlighted with a bold outline. The additional cells in the decision tables contrast the results obtained when the models are run with catch projections from the alternate (State of Nature) models. For instance, in the northern area, when base model projected catches are used with the alternate State of Nature model, a depletion level of 0.27 is predicted in the year 2016 (Table ES-6). In the southern area, the predicted depletion level of 0.39 in the year 2016 results when the “high” ending biomass model catches are applied to the “low” ending biomass State of Nature model (Table ES-7).

Recommendations: Research and Data Collection Needs

Emphasis should be placed on improving fishery age structure sampling size and geographical coverage in both regions. More frequent and synoptic fishery independent surveys should be conducted in both regions to aid in determination of stock status and recent recruitment.

Table ES1. Management reference points derived from the 2005 lingcod stock assessment.

Northern (LCN)	Base model
B2005 (mt)	29416
Rinit (Thousands)	3750
Spawners Per Recruit	10.52
Rmean56-05 (Thousands)	3207
Bzero (mt)	33749
Depletion	0.87
Southern (LCS)	**Base model**
B2005 (mt)	4601
Rinit (Thousands)	2503
Spawners Per Recruit	9.43
Rmean56-05 (Thousands)	2025
Bzero (mt)	19101
Depletion	0.24
Coastwide	**Base models-Pooled**
B2005 (mt)	34017
Bzero (Thousands)	52850
Depletion	0.64

Table ES2. Estimates of lingcod spawning biomass, depletion, and recruitment (1956-2005), derived from the 2005 lingcod stock assessment.

	Spawning Biomass (mt)			Depletion			Recruitment-Age 0 (Thousands)		
Bzero:	33749	19101	52850						
Year	LCN	LCS	Coastwide	LCN	LCS	Coastwide	LCN	LCS	Coastwide
1956	38357	21749	60106	1.14	1.14	1.14	3747	2497	6244
1957	37696	21500	59196	1.12	1.13	1.12	3745	2496	6241
1958	36979	20998	57977	1.10	1.10	1.10	3743	2494	6237
1959	36181	20480	56660	1.07	1.07	1.07	3740	2493	6233
1960	34816	20046	54862	1.03	1.05	1.04	3736	2491	6227
1961	33381	19675	53057	0.99	1.03	1.00	3731	2489	6220
1962	32166	19304	51470	0.95	1.01	0.97	3726	2488	6214
1963	31513	19065	50578	0.93	1.00	0.96	3724	2487	6210
1964	31280	18854	50134	0.93	0.99	0.95	3723	2486	6208
1965	30866	18781	49647	0.91	0.98	0.94	3721	2485	6206
1966	30281	18737	49018	0.90	0.98	0.93	3719	2485	6204
1967	29522	18700	48221	0.87	0.98	0.91	3715	2485	6200
1968	29283	18639	47922	0.87	0.98	0.91	3714	2485	6199
1969	28785	18539	47324	0.85	0.97	0.90	3712	2484	6196
1970	28723	18458	47181	0.85	0.97	0.89	3711	2484	6195
1971	28946	18228	47174	0.86	0.95	0.89	3712	2483	6195
1972	29065	17758	46823	0.86	0.93	0.89	3375	2480	5855
1973	29236	16829	46065	0.87	0.88	0.87	1176	2475	3652
1974	29073	15671	44744	0.86	0.82	0.85	2706	2468	5174
1975	28628	14435	43063	0.85	0.76	0.81	1515	2460	3975
1976	27545	13407	40952	0.82	0.70	0.77	1326	3967	5293
1977	26402	12480	38882	0.78	0.65	0.74	2318	1099	3417
1978	24918	12195	37113	0.74	0.64	0.70	2477	1227	3704
1979	23504	11994	35498	0.70	0.63	0.67	6619	5522	12141
1980	21260	11539	32800	0.63	0.60	0.62	1539	1403	2942
1981	19384	9664	29049	0.57	0.51	0.55	955	586	1541
1982	18112	8393	26505	0.54	0.44	0.50	1442	483	1925
1983	17140	7626	24766	0.51	0.40	0.47	1244	928	2172
1984	15700	7063	22763	0.47	0.37	0.43	1972	5487	7459
1985	13790	6212	20002	0.41	0.33	0.38	1298	1124	2422
1986	11454	5108	16562	0.34	0.27	0.31	2576	4621	7198
1987	10562	4512	15074	0.31	0.24	0.29	282	514	796
1988	9524	4384	13908	0.28	0.23	0.26	986	578	1563
1989	8615	4270	12885	0.26	0.22	0.24	1610	1581	3191
1990	7296	3934	11230	0.22	0.21	0.21	1357	1664	3021
1991	6328	3397	9725	0.19	0.18	0.18	2589	2015	4604
1992	4796	2720	7515	0.14	0.14	0.14	2806	800	3605
1993	4266	2255	6522	0.13	0.12	0.12	1120	1500	2620
1994	3864	2141	6004	0.11	0.11	0.11	3841	1067	4908
1995	3924	2226	6150	0.12	0.12	0.12	3607	985	4592
1996	4449	2215	6664	0.13	0.12	0.13	1694	2606	4300
1997	5034	2145	7179	0.15	0.11	0.14	1666	314	1979
1998	5886	2075	7961	0.17	0.11	0.15	4601	860	5462
1999	7245	2331	9576	0.21	0.12	0.18	11733	2016	13750
2000	8675	2630	11306	0.26	0.14	0.21	12945	1587	14532
2001	10702	3099	13801	0.32	0.16	0.26	3320	1750	5070
2002	13758	3558	17316	0.41	0.19	0.33	3552	1106	4658
2003	18370	3859	22229	0.54	0.20	0.42	3434	788	4221
2004	24077	3919	27996	0.71	0.21	0.53	3318	1075	4393
2005	29416	4601	34017	0.87	0.24	0.64	3715	1362	5076

Table ES3. Estimates of exploitation rate derived from the 2005 lingcod stock assessment.

Year	LCN Exploitation Rate	LCS Exploitation Rate
1956	0.016	0.018
1957	0.018	0.029
1958	0.021	0.029
1959	0.035	0.026
1960	0.039	0.024
1961	0.037	0.026
1962	0.027	0.021
1963	0.020	0.022
1964	0.027	0.017
1965	0.033	0.018
1966	0.039	0.019
1967	0.028	0.021
1968	0.036	0.023
1969	0.026	0.023
1970	0.020	0.031
1971	0.023	0.043
1972	0.022	0.068
1973	0.031	0.083
1974	0.037	0.093
1975	0.050	0.088
1976	0.043	0.090
1977	0.046	0.055
1978	0.040	0.066
1979	0.065	0.092
1980	0.063	0.193
1981	0.064	0.164
1982	0.079	0.178
1983	0.115	0.151
1984	0.128	0.139
1985	0.149	0.171
1986	0.074	0.152
1987	0.098	0.195
1988	0.109	0.226
1989	0.161	0.262
1990	0.146	0.261
1991	0.204	0.252
1992	0.130	0.256
1993	0.156	0.233
1994	0.131	0.191
1995	0.092	0.198
1996	0.097	0.198
1997	0.085	0.206
1998	0.049	0.125
1999	0.037	0.131
2000	0.011	0.062
2001	0.009	0.057
2002	0.009	0.103
2003	0.006	0.158
2004	0.008	0.039

Table ES4. Projected yield for the LCN Base Model (Top) and LCS Base Model (Bottom).

LCN Base Model

FORECAST:_Without_40:10

year	4010	bio-all	SpawnBio	recruit-0	Yield	ABC
2007	1	56321	36250	3741	5830	5830
2008	1	52212	34135	3734	5025	5025
2009	1	48734	31802	3725	4473	4473
2010	1	45743	29533	3715	4058	4058
2011	1	43170	27454	3705	3741	3741
2012	1	40976	25614	3694	3484	3484
2013	1	39145	24046	3684	3259	3259
2014	1	37670	22768	3675	3059	3059
2015	1	36525	21776	3667	2903	2903
2016	1	35653	21023	3661	2810	2810

FORECAST:__with_40:10

year	4010	bio-all	SpawnBio	recruit-0	Yield	ABC
2007	1	56321	36250	3741	5830	5830
2008	1	52212	34135	3734	5025	5025
2009	1	48734	31802	3725	4473	4473
2010	1	45743	29533	3715	4058	4058
2011	1	43170	27454	3705	3741	3741
2012	1	40976	25614	3694	3484	3484
2013	1	39145	24046	3684	3259	3259
2014	1	37670	22768	3675	3059	3059
2015	1	36525	21776	3667	2903	2903
2016	1	35653	21023	3661	2810	2810

LCS Base Model

FORECAST:_Without_40:10

year	4010	bio-all	SpawnBio	recruit-0	Yield	ABC
2007	1	9123	5451	1390	876	876
2008	1	9260	5398	2289	828	828
2009	1	9524	5374	2287	805	805
2010	1	10013	5419	2290	771	771
2011	1	10715	5609	2298	794	794
2012	1	11519	5973	2313	907	907
2013	1	12279	6429	2330	1025	1025
2014	1	12945	6884	2345	1134	1134
2015	1	13503	7291	2357	1218	1218
2016	1	13966	7643	2366	1275	1275

FORECAST:__with_40:10

year	4010	bio-all	SpawnBio	recruit-0	Yield	ABC
2007	0.756	9123	5451	1390	662	876
2008	0.767	9475	5558	2296	658	857
2009	0.778	9906	5667	2301	664	853
2010	0.792	10529	5819	2307	656	828
2011	0.817	11332	6091	2318	698	855
2012	0.85	12214	6517	2333	824	969
2013	0.885	13035	7022	2349	965	1090
2014	0.914	13736	7509	2362	1097	1200
2015	0.936	14299	7928	2373	1200	1282
2016	0.953	14743	8273	2381	1269	1332

Table ES-5. Projected coastwide yield (Sum of LCN and LCS).

Coastwide-Pooled (Sum of LCN and LCS)					
FORECAST:_Without_40:10					
year	**bio-all**	**SpawnBio**	**recruit-0**	**Yield**	**ABC**
2007	65445	41701	5130	6706	6706
2008	61471	39533	6022	5853	5853
2009	58257	37175	6012	5278	5278
2010	55756	34952	6005	4829	4829
2011	53885	33062	6003	4535	4535
2012	52495	31587	6008	4390	4390
2013	51424	30474	6014	4284	4284
2014	50615	29652	6020	4193	4193
2015	50028	29067	6024	4121	4121
2016	49619	28665	6026	4085	4085
FORECAST:__with_40:10					
year	**bio-all**	**SpawnBio**	**recruit-0**	**Yield**	**ABC**
2007	65445	41701	5130	6493	6706
2008	61686	39693	6030	5683	5883
2009	58640	37468	6026	5136	5326
2010	56271	35352	6022	4714	4886
2011	54502	33544	6023	4440	4597
2012	53190	32131	6027	4308	4453
2013	52181	31067	6033	4224	4349
2014	51405	30277	6037	4156	4259
2015	50824	29704	6040	4103	4184
2016	50396	29295	6041	4080	4142

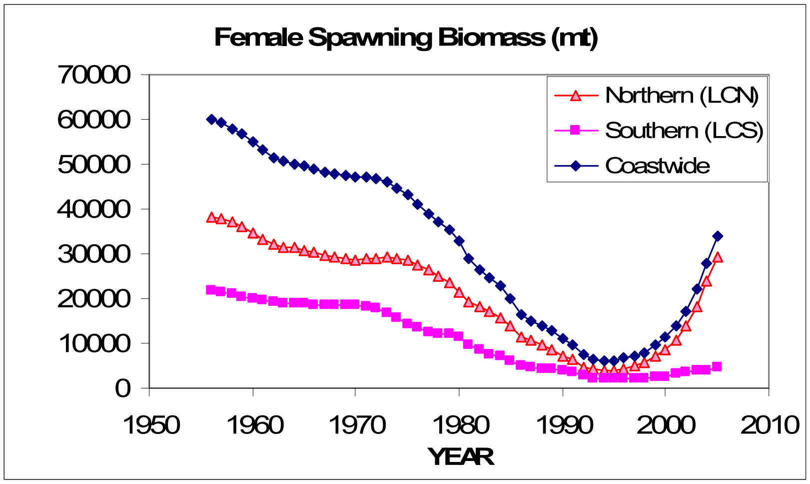
Table ES6. Decision table for the northern (LCN) area.

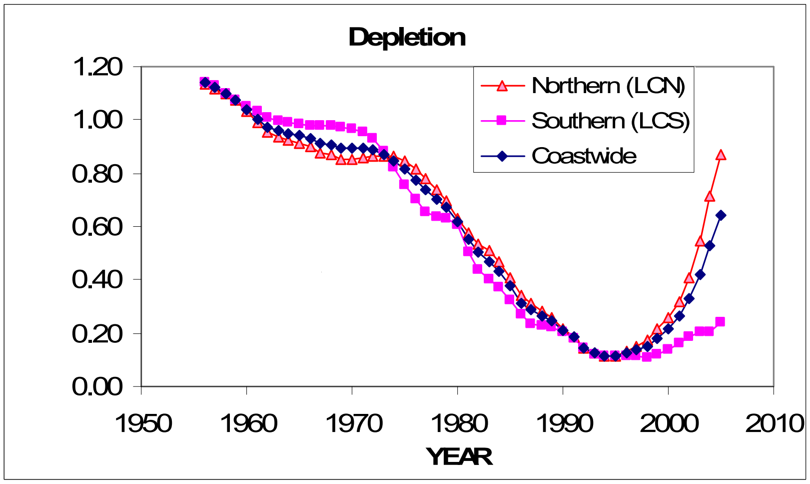
LCN						
			State of Nature			
B0: 33749			**Base Case**		**Alternate Case**	
	Year	**Catch**	**SSB**	**Depletion**	**SSB**	**Depletion**
Management Decision						
			RUN BB		**RUN AB**	
Base Case Catch (With 40:10)	2007	5830	36250	1.07	20327	0.60
Full Model	2008	5025	34135	1.01	17713	0.52
	2009	4473	31802	0.94	15461	0.46
	2010	4058	29533	0.88	13614	0.40
	2011	3741	27454	0.81	12167	0.36
	2012	3484	25614	0.76	11067	0.33
	2013	3259	24046	0.71	10257	0.30
	2014	3059	22768	0.67	9695	0.29
	2015	2903	21776	0.65	9346	0.28
	2016	2810	21023	0.62	9159	0.27
			RUN BA		**RUN AA**	
Alternate Case Catch (With 40:10)	2007	3267	36250	1.07	20327	0.60
Delete:	2008	3042	36057	1.07	19584	0.58
2001, 2004 Survey	2009	2869	35277	1.05	18845	0.56
2000-2004 Fishery Age Comps.	2010	2729	34157	1.01	18170	0.54
	2011	2625	32927	0.98	17594	0.52
	2012	2555	31650	0.94	17116	0.51
	2013	2500	30396	0.90	16720	0.50
	2014	2456	29224	0.87	16396	0.49
	2015	2424	28171	0.83	16139	0.48
	2016	2402	27238	0.81	15933	0.47

Table ES7. Decision table for the southern (LCS) area.

LCS								
B0: 19101			**Base Case**		**Alternate Case-Low**		**Alternate Case-High**	
	Year	**Catch**	**SSB**	**Depletion**	**SSB**	**Depletion**	**SSB**	**Depletion**
Management Decision								
			RUN BB		**RUN LB**		**RUN HB**	
Base Case Catch (With 40:10)	2007	662	5451	0.29	4251	0.22	6568	0.34
Full Model	2008	658	5558	0.29	4420	0.23	6653	0.35
	2009	664	5667	0.30	4607	0.24	6713	0.35
	2010	656	5819	0.30	4839	0.25	6796	0.36
	2011	698	6091	0.32	5189	0.27	6988	0.37
	2012	824	6517	0.34	5694	0.30	7325	0.38
	2013	965	7022	0.37	6280	0.33	7739	0.41
	2014	1097	7509	0.39	6850	0.36	8135	0.43
	2015	1200	7928	0.42	7354	0.38	8464	0.44
	2016	1269	8273	0.43	7784	0.41	8722	0.46
			RUN BL		**RUN LL**		**RUN HL**	
Alternate Case Catch (With 40:10)	2007	414	5451	0.29	4251	0.22	6568	0.34
Ending Biomass-Low	2008	491	5745	0.30	4600	0.24	6840	0.36
	2009	557	5984	0.31	4920	0.26	7031	0.37
	2010	602	6218	0.33	5237	0.27	7195	0.38
	2011	672	6525	0.34	5627	0.29	7421	0.39
	2012	808	6959	0.36	6144	0.32	7764	0.41
	2013	956	7459	0.39	6732	0.35	8171	0.43
	2014	1096	7936	0.42	7297	0.38	8554	0.45
	2015	1203	8337	0.44	7788	0.41	8862	0.46
	2016	1280	8660	0.45	8201	0.43	9095	0.48
			RUN BH		**RUN LH**		**RUN HH**	
Alternate Case Catch (With 40:10)	2007	853	5451	0.29	4251	0.22	6568	0.34
Ending Biomass-High	2008	799	5415	0.28	4280	0.22	6509	0.34
	2009	761	5412	0.28	4357	0.23	6458	0.34
	2010	706	5490	0.29	4512	0.24	6467	0.34
	2011	740	5727	0.30	4823	0.25	6626	0.35
	2012	849	6131	0.32	5302	0.28	6943	0.36
	2013	979	6628	0.35	5874	0.31	7351	0.38
	2014	1101	7116	0.37	6441	0.34	7752	0.41
	2015	1195	7545	0.39	6949	0.36	8094	0.42
	2016	1258	7908	0.41	7393	0.39	8374	0.44

Figure ES1. Female spawning biomass (top) depletion (middle), and recruitment (bottom) 1956-2005.





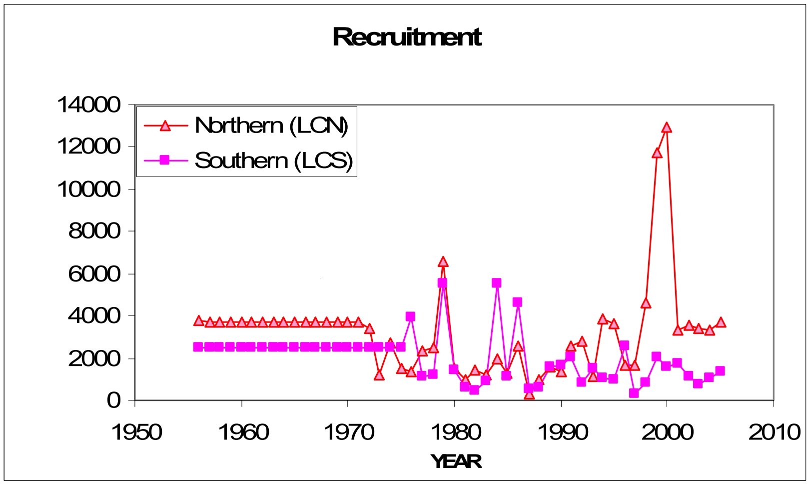
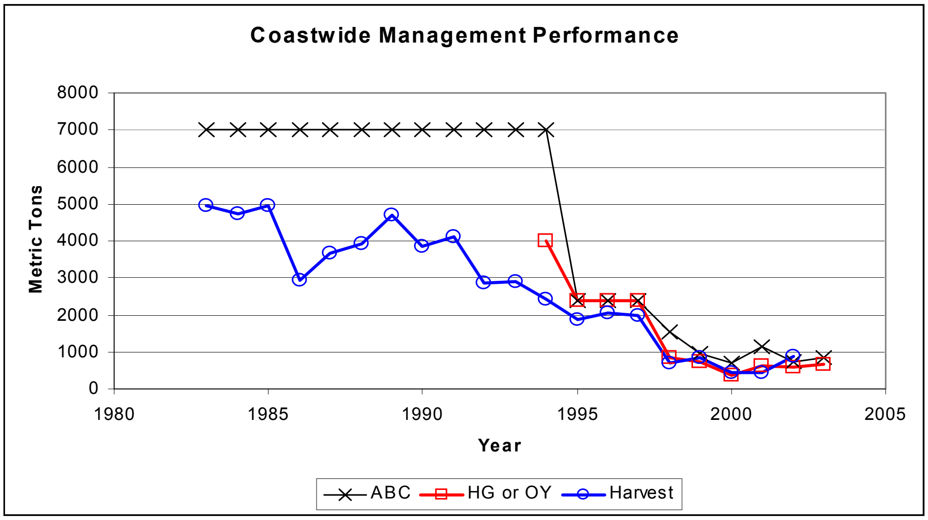


Figure ES2 Comparison of lingcod ABC, OY and landings (mt) between 1983 and 2003.



Introduction

Stock Structure and management Units

This document provides an updated coastwide assessment of the lingcod population in 2005 for the full PFMC management zone. Evidence from genetics analysis (Jagielo et al. 1996) and tagging studies (Cass et al. 1990, Jagielo 1995, Jagielo 1999a) suggest that the fish found within this entire area are of one intermingling stock unit. However, because of regional differences in data sources and data availability, the assessment was divided into two separately modeled units: Lingcod-North (LCN) and Lingcod-South (LCS), as it was in recent previous assessments (Jagielo et al. 2000, Jagielo et al. 2003) (Figure 1).

Life History

Lingcod (*Ophiodon elongatus*) are top order predators of the family *Hexagrammidae*. The species ranges from Kodiak Island in the Gulf of Alaska to Baja California, and its center of abundance is near British Columbia and Washington (Hart 1973). An analysis of genetic variation indicates that lingcod are genetically similar throughout the range (Jagielo et al. 1996). Among the *Hexagrammidae*, the genus *Ophiodon* is ecologically intermediate between the more littoral genera *Hexagrammos*, *Agrammus*, and *Oxylebius* and the more pelagic *Pleurogrammus* (Rutenberg 1962). Lingcod are demersal on the continental shelf, most abundant in waters less than 200 m deep, and patchily distributed among areas of hard bottom and rocky relief (Smith and Forrester 1973; Jagielo 1988). Lingcod are considered non-migratory, though some tagged individuals have moved exceptional distances and indirect evidence suggests a seasonal onshore movement associated with spawning (Jagielo 1995, 1999). Larval lingcod hatch in late winter and become epipelagic. When about 3 months old, juveniles settle on sandy bottom near eelgrass or kelp beds. By age 1 or 2, lingcod move into rocky habitats similar to those occupied by adults, but shallower. Fishery and survey data indicate that male lingcod tend to be more abundant than females in shallow waters, and the size of both sexes increases with depth (Jagielo 1994). In late fall, male lingcod aggregate and become territorial in areas suitable for spawning. Mature females are rarely seen at the spawning grounds and it is assumed that they move into spawning areas for only a brief time to deposit eggs. Following egg nest deposition, males assume a guardian role through the period of hatch-out. Hatch out is typically complete by April in Washington but has been reported as early as January and as late as June throughout the species range (Jagielo 1994). A more detailed review of lingcod life history can be found in Jagielo (1994), Adams and Hardwick (1992), and Cass et al. (1990).

History of the fishery

Lingcod have been a target of commercial fisheries since the early 1900’s in California (CDFG Reports), and since the late 1930’s in Oregon (Unpublished, ODFW Report, 1950) and Washington (Anonymous WDF Report, 1955) waters (Table 4). Recreational fishers have targeted lingcod since the 1920’s in California. A modest recreational fishery (less than 20 mt annually) has taken place in Washington and Oregon since at least the 1970’s.

Management

History

From 1983 through 1994, a coastwide ABC of 7,000 mt was in effect with the INPFC area components: US Vancouver (1000 mt), Columbia (4,000 mt), Eureka (500 mt), Monterey (1,100 mt) and Conception (400 mt) (Table 1). In 1994 a coastwide harvest guideline (HG) of 4,000 mt was established. Following an assessment for the northern area (Jagielo 1994), the coastwide ABC and Harvest Guideline were reduced for 1995 through 1997 to 2,400 mt with separate ABC's for the US Vancouver-Columbia (1,300 mt), Eureka (300 mt), Monterey (700 mt), and Conception (100 mt) areas. In 1998, following an updated assessment for the northern area (Jagielo et al.1997), the coastwide ABC was reduced to 1,532 mt with a Harvest Guideline of 838 mt. Separate ABC's by area were: Vancouver (including a portion of Canadian waters)-Columbia (1,021 mt), Eureka (139 mt), Monterey (325 mt), and Conception (46 mt). For 1999, the Council established a coastwide ABC of 960 mt and a Harvest Guideline of 730 mt, with area specific ABC's of US Vancouver-Columbia (450 mt), Eureka (139 mt), Monterey (325 mt), and Conception (46 mt). Following a new assessment for the southern area (Adams et al.1999) and a rebuilding analysis (Jagielo 1999b), the coastwide ABC for 2000 was reduced to 700 mt which included area values of US Vancouver-Columbia (450 mt) and Eureka-Monterey-Conception (250 mt). Subsequently, a coastwide stock assessment (Jagielo et al. 2000) provided a northern ABC was of 610 mt and a southern ABC of 509 mt. Based on a revised rebuilding analysis (Jagielo and Hastie 2001) the 2001-coastwide lingcod OY was set at 611 mt, which is the harvest level derived from a constant exploitation rate that was expected to have a 60-percent probability of rebuilding the stock to B_{msy} within 9 years. The coastwide lingcod OY was similarly set at 577 mt in 2002 and 651 mt in 2003.

Regulations

A history of lingcod commercial trawl trip limits is summarized in Table 2. No trip limits were in effect prior to 1995, and trip limits have become increasingly restrictive since then as annual harvest guidelines have decreased.

A history of PFMC enacted recreational size and bag limits is summarized in Table 3. In California, a 5 fish bag limit was enacted in 1980 followed by a 22 inch size limit in 1981. These regulations remained in effect for 17 years. In March 1998, the bag limit was reduced from 5 to 3 fish and concurrently the size limit was increased to 24 inches. The bag limit was lowered again from 3 fish to 2 fish with in January 1999. In January 2000, the size limit increased from 24 to 26 in. and a seasonal closure (January through February) was implemented from the U.S.-Mexico border north to Lopez Point (36 deg 00 min N., Monterey County), and for March through April from Lopez Point north to Cape Mendocino (40 deg 10 min N., Humboldt County) The bag limit remained at 2 fish. A gear restriction was also enacted at this time limiting the number of hooks to 3, although this was primarily directed toward rockfish effort.

Performance

The first lingcod ABC's based on a quantitative assessment were implemented in 1995. A comparison of reported landings and ABC values shows good correspondence through 2001, when landings were typically at or below the target ABC values (Figure 2). In 2002, landings exceeded the coastwide ABC by 17% and the coastwide OY was exceeded by 51%.

DATA

Catch

Commercial Landings

Commercial lingcod catch history in California waters is available beginning 1916 (personal communication Brenda Erwin, PSMFC) and averaged 428 mt between 1916 and 1955 (Table 4). Commercial lingcod landings in Oregon were first reported in 1950 (Mark Freeman, personal communication) and averaged 264 mt between 1950 and 1953. Washington commercial lingcod landings were first reported in 1937 (anonymous, 1956, WDFW report) and averaged 106 mt until 1955.

Catch data were compiled from agency reports and personal communication for all years preceding 1981 (Table 5). The PacFIN database was queried for catch information in subsequent years and catch detail is presented by gear and INPFC area in Table 6.

Commercial landings peaked in 1985 at 3,129 mt in northern waters (Columbia and Vancouver INPFC areas) and in 1974 at 1,735 mt in southern waters (Eureka, Monterey and Conception INPFC Areas)(Table 5). Average catch between 1990-1997 declined 40 % and 35% since the 1980's in northern and southern waters, respectively. Under rebuilding management, commercial fishery restrictions in recent years (1998-present) reduced coastwide catches to an annual average of less than 225 mt (Figure 3).

From 1981-1997, trawl gear has made up the majority of commercial landings for the northern (83%) and southern (63%) coast. In recent years (1998-2004), commercial fishery restrictions constrained the trawl portion of the commercial catch to 65% and 40% for the northern and southern coast, respectively. In 2004, coastwide commercial landings totaled 174 mt and were distributed as follows by INPFC area: U.S.-Vancouver (41.7 mt), Columbia (44.6 mt) , Eureka 39.5 mt), Monterey (33.2 mt), Conception (14.8 mt).

Recreational Landings

Recreational fishers in California have targeted lingcod since the early 1940's. Catch averaged 65.3 mt annually between 1947-1954 (Leet et al., 1992). Recreational lingcod catch information is not available until 1977 for Oregon waters and averaged 52.3 mt annually between 1977 and 1979. Recreational lingcod catch in Washington was first estimated in 1967 to be 25.3 mt and annual catch estimates have been provided since 1975.

Recreational catch estimates were extracted from the RecFIN database for years 1980–1989 and 1993 to present for California waters. California recreational catch estimates for all other years were previously compiled in the 2000 lingcod assessment (Jagielo et al., 2000). Oregon recreational catch data were provided by ODFW (Don Bodenmiller personal communication). The recreational catch in Washington was provided by the WDFW Ocean Sampling Program.

Recreational catch in southern waters has declined since catch peaked in 1980 at 2,226 mt (Table 5, Figure 4). In contrast, recreational catch in northern waters peaked at 236 mt in 1994. Estimated coastwide recreational landings averaged 500 mt. from 1998-2004 and were 1175 mt. and 316 mt. in 2003 and 2004, respectively.

Historically, recreational landings have comprised a larger proportion of the total landings for the southern area, compared to the northern area. In recent years, the recreational portion of the total landings has increased substantially in both the southern and northern areas. In 2004 recreational fisheries harvested 65% of the total lingcod catch coastwide (Figure 5).

Discard

There are three sources of discard information for lingcod. These include the federal Marine Recreational Fisheries Statistical Survey (MRFSS), and both the Washington Department of Fish and Wildlife (WDFW) and the NMFS West-Coast Groundfish Observer Programs. MRFSS have collected B1 (reported by angler to be dead) and B2 (reported by angler to be alive) catches since 1980. Estimates of lingcod discarded alive have increased substantially in response to 1) management changes in 1998 (the size limit increased from 22 to 24 inches), and 2) a seasonal closure in California waters beginning in 2000 (Table 7). It is interesting to note that estimates of fish discarded dead have decreased over time. Estimated live lingcod discarded in southern California was 306,000 fish in 2002. This compares to a total landed catch of 25,000 fish. WDFW began collecting discard information from the recreational fishery in 2002 and estimated that 57% of the catch was discarded. WDFW does not collect information on the portion of the catch discarded live or dead.

Based on an earlier study (Ricky, WDFW unpublished report), the PFMC Groundfish Management Team used a 20% inflation factor to adjust landed catch to account for unobserved lingcod mortality (personal communication, PFMC) in the commercial fishery beginning in 2002. Data collected by the Groundfish Observer program in 2001-2004 estimated that the percent discard of total observed catch ranged from 60-85% (Table 8). Because lingcod lack a swim bladder, it is likely that there is a relatively good survival rate for these fish.

Based on the advice provided by the STAR Panel conducted August 15-19, 2005, a catch dataset incorporating discard assumptions was prepared (Table 5a). The discard-adjusted data were used in the base models for both the northern (LCN) and southern (LCS) models.

Age and Size Composition

Age composition data from the northern area are summarized for the commercial fishery in Table 9. These data were derived by weighting the raw age frequencies from each WDFW vessel sample by the total landed weight of lingcod from that vessel. The recreational fishery age composition data, compiled from WDFW and ODFW recreational fishery samples, are summarized in Table 10. Age compositions derived from samples taken on board the NMFS Triennial Trawl shelf survey and age compositions obtained from sub-samples of lingcod taken for aging as part of the WDFW Cape Flattery Tag survey are summarized in Table 11. Northern area age composition data new to the present assessment are summarized in Table 15. Survey and fishery size composition data (cm) used in the northern model, with associated sample sizes, are summarized by data source in Tables 12 and 13, respectively.

Age composition data and sample size information for the southern area are summarized for the commercial and recreational fisheries, and the NMFS Triennial Trawl shelf survey in Table 14. Southern area age composition data new to the present assessment are summarized in Table 15.

Natural Mortality, Length, Weight, and Maturity at Age

Vectors of length, weight, and maturity-at-age by sex are summarized for the northern area in Table 16. Parameter estimates for these relationships, and natural mortality estimates used in the LCN model are summarized in Table 17. Comparable information for the southern area is summarized in Tables 18 and 19. Figure 6 shows the fit of female and male LCS and LCN lingcod to the von Bertalanffy growth equation.

Abundance Indices

NMFS Triennial Shelf Trawl Survey

Survey estimates of biomass (metric tons) and the associated coefficients of variation (CV's) from the triennial survey for 1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, and 2001 are summarized in Table 20. Results from the 2004 survey are summarized in Table 21. The total sum of lingcod abundance estimates from the US Vancouver and Columbia area for all depth strata (55-183 m, 184-366 m and 367-500 m) was incorporated into the LCN model. The total sum of the Eureka and Monterey biomass estimates for each year and depth strata was used in the LCS model.

Biomass estimates have been revised using a filtered dataset that excluded "water hauls". A complete description of the tow analysis and identification procedures of "water hauls" can be found in AFSC Processed Report 2001-03 (Zimmermann et al., 2001). Generally, lingcod biomass estimates from the filtered dataset increased with one exception. The 1980 Columbia INPFC lingcod biomass estimate was reduced from 8,699 mt to 3,219 mt, a difference of 5,480 mt (Table 18 and Figure 10). The difference resulted from a single large lingcod tow that was identified as a "water haul" and excluded from the dataset.

WDFW Cape Flattery Tag Survey

Annually, from 1986-1992, WDFW sampled lingcod from an established survey area in a consistent manner using bottomfish troll (dingle bar) hook and line gear. This sampling was initiated for the purpose of capturing fish for release as part of a multiple-year mark-recapture experimental design (Jagielo 1991, 1995). From 1986-1992, estimates of lingcod abundance in the Cape Flattery survey area were derived using external tags (Table 22). Voluntary tag returns from the recreational lingcod fishery at Neah Bay, Washington were used as the method for obtaining tag recaptures. Annual sampling with bottomfish troll gear continued beyond 1992 to extend the length composition time series, which had shown value as a recruitment index for previous lingcod stock assessments (Jagielo 1994, Jagielo et al.1997, Jagielo et al. 2000). **NOTE: THIS DATASET WAS OMITTED IN FINAL BASE MODEL AT THE REQUEST OF THE STAR PANEL CONDUCTED AUGUST 15-19, 2005.**

Trawl Fishery Logbook Catch-Per-Unit-Effort (CPUE) Index

As was the case in the previous two lingcod assessments (Jagielo et al 2000, Jagielo et al. 2003) two independently estimated trawl fishery CPUE indices were incorporated into the northern and southern assessment models. They were constructed from Washington, Oregon and California trawl fishery logbook and fish ticket data dating back to 1976 (Table 23). Skipper's tow-by-tow estimates of retained catch were reconciled with fish ticket data (landing receipts). The adjusted catch and the skipper's estimate of tow duration was used to compute lingcod CPUE (lbs/hour).

The bathymetric and geographic distribution of trawl logbook CPUE is shown in Figures 7 and 8, respectively.

Following data verification and screening, a total of 490,971 tows in the northern area and 474,946 tows in the southern area were used in the analysis (Table 23). Because of significant changes in management beginning in 1998 both the northern and southern time series were truncated after 1997. Furthermore, the 1976 and 1977 tow data from the southern area were deemed of insufficient sample size and were dropped from the time series used in the assessment model. Tow-by-tow catch rates (CPUE) were fitted in a two-stage model process using Delta-Lognormal GLM procedure to predict abundance indices across the time series for each area. The model included a year, month, depth, and location (PFMC area) effect. A bootstrap procedure was previously used to estimate the standard errors of the year by year index values; however, the previous STAT Star Panel concluded that the bootstrap estimates of standard errors were unrealistically low and recommended using an assumed annual CV of 0.20 in both the southern and northern index in the 2003 assessment (Jagielo et al. 2003).

The northern trawl logbook index trend shows a sharply declining stock since 1976, and the southern trawl logbook index indicates a declining stock since 1979 (Table 24, Table 25, Figure 9).

Ageing error

Age reading error was modeled by incorporation of an age error transition matrix, which was developed from estimates of between-reader (within-lab) variability obtained from repeat age readings by two WDFW lingcod age readers (Figure 10). This age error transition matrix has not been modified since the last assessment.

Assessment

History of Modeling Approaches

The first assessment of lingcod provided to PFMC consisted of a yield-per-recruit analysis Adams (1986). Subsequently, an age structured assessment was prepared for a portion the northern area (PMFC areas 3A, 3B, and 3C-including Canada) by Jagielo (1994), using the Stock Synthesis model (Methot 1990). The assessment was subsequently updated to include the full Columbia INPFC area through 3C-N in Canada (Jagielo et al. 1997). Adams et al. (1999) subsequently conducted a length-based, age-structured assessment for the southern area (Eureka, Monterey, and Conception INPFC areas), using AD Model Builder (Fournier 1996). The first coastwide assessment of lingcod for the full PFMC management zone was conducted by Jagielo et al. 2000; that assessment (implemented in AD Model Builder) employed two age-structured models, conceptually and mathematically similar to the previous Stock Synthesis assessments of the northern area (Jagielo 1994, Jagielo et al. 1997). The 2003 assessment updated the previous coastwide assessment (Jagielo et al. 2000) and was implemented in Coleraine using the executable code COLERA20.EXE (Hilborn et al. 2000).

Present Modeling Approach and Assessment Program

The present assessment updates the previous coastwide assessment (Jagielo et al. 2003) and is implemented in Stock Synthesis II using the executable code SS2 ver. 1.19d (Methot 2005).

As in the previous assessment, separate age structured models were constructed to analyze stock dynamics for the northern (LCN: US-Vancouver, Columbia) and southern (LCS: Eureka, Monterey, Conception) areas.

The following discussion covers the modeled data, model structure, and base model results; first for the northern area (LCN), followed by a discussion of the same topics for the southern area (LCS).

Lingcod-North (LCN): US-Vancouver and Columbia INPFC Areas

Model Description

List and Description of Likelihood Components in the LCN Model

The LCN model incorporated the following likelihood components; input data sources are specified by Table number:

1) Commercial Catch-At-Age: 1979-2004 (Table 9, Table 15).
2) Recreational Catch-At-Age: 1980, 1986-2004 (Table 10, Table 15).
3) Commercial Catch-At-Length: 1975-1978 (Table 13).
4) Recreational Catch-At-Length: 1981-1983 (Table 13).
5) NMFS Trawl Survey Catch-At-Age: 1992, 1995, 1998, 2001, and 2004 (Table 11).
6) NMFS Trawl Survey Catch-At-Length: 1986 and 1989 (Table 12).
7) WDFW Tag Survey Catch-At-Age: 1994-1997 (Table 11). **NOTE: THIS DATASET WAS OMITTED IN FINAL BASE MODEL AT THE REQUEST OF THE STAR PANEL CONDUCTED AUGUST 15-19, 2005.**
8) WDFW Tag Survey Catch-At-Length: 1986-1993 (Table 12).
9) NMFS Trawl Survey Biomass (mt): 1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001 (Table20) and 2004 (Table 21).
10) WDFW Tag Survey Abundance (Numbers of Fish): 1986-1992 (Table 22).
11) Trawl Fishery Logbook CPUE Index: Washington and Oregon lingcod CPUE estimates (lbs/hr) derived from a Delta GLM analysis of trawl logbook information, 1976-1997 (Table 24).

The NMFS Trawl Survey Biomass and Trawl Fishery Logbook CPUE Index likelihood components were fit under a lognormal error structure; fishery and survey catch-at-age and catch-at-length likelihood components were fit assuming a multinomial distribution (Methot 2005). In addition to the likelihood components listed above, a likelihood penalty component was included which constrained the maximum annual instantaneous fishing mortality (F) to be less than or equal to 0.9 (Methot 2005).

Base Model Configuration

The LCN base model employed a Beverton-Holt stock-recruitment relationship with lognormal error structure (with a steepness parameter h = 0.9 and SD = 1.0) to constrain wide variations in recruitment, with an emphasis factor (lambda=1.0). Selectivity for the commercial and recreational fisheries and the NMFS and WDFW surveys was parameterized by a curve formed from two logistic distributions referred to as “SS2 Type 18: double logistic with defined peak and smooth joiners” (Methot 2005). Twelve parameters are used in this formulation, including eight parameters for female selectivity and four parameters to characterize male selectivity as offsets to female selectivity. The model used a catch dataset adjusted to account for discards (Table 5a).

Model Selection and Evaluation

A summary of negative log likelihood values, and both estimated and fixed model parameters of the LCN base model are provided in Appendix I (Tables 1-4).

Base-Run Results

Base run model results are presented in Appendix I (Tables 1-4 and Figures 1-14). Base run SS2 files including the control file (LCNCTL05.ctl), the data file (LCNData05.dat), the names file (SS2names.nam) and the forecast file (Forecast.ss2) are presented in Appendix Ia).

Uncertainty and Sensitivity Analyses

The results of model profiling over selected fixed values used in the assessment are included in Appendix I (Figures 4-6a).

A series of base model runs were conducted to examine the effect of different values of the assumed standard deviation of recruitment (SD-r) (Appendix I, Figure 4). SD-r was varied from 0.7 to 1.0. Little sensitivity was observed near the end of the time series, where data were available to estimate recruitments; more sensitivity was noted early in the time series where recruitment was primarily a function of the spawner-recruit curve assumptions. The value of SD-r=1.0 was selected for the final base model.

The base model was also profiled over different fixed values of the Beverton-Holt stock-recruitment steepness parameter (*h*) (Appendix I, Figure 5). The profile over *h* ranged from 0.8 to 1.0. Little sensitivity was observed near the end of the time series, where data were available to estimate recruitments; more sensitivity was noted early in the time series where recruitment was primarily a function of the spawner-recruit curve assumptions. This parameter was set at the fixed value of 0.9 for the final base model. Spawner-recruit emphasis was set at (lambda=1.0) in the base model.

The base model was also profiled over different fixed values of natural mortality (M) (Appendix I, Figure 6). The profile over M ranged from 0.14 and 0.26 (females and males, respectively) to 0.22-0.38). The values of 0.18 (females) and 0.32 (males), as used in previous assessments, were chosen for use in the 2005 final base model.

An historic analysis was conducted by plotting the estimates of recruitment and spawning biomass from the 2003 assessment (Jagielo et al. 2003) with the same from the present assessment (Appendix I Figure 1). The 2003 assessment time series started in 1973. The present assessment extended the time series of spawning biomass and recruitment back to 1956. The time series trend of spawning biomass follows generally the same shape for both assessments; however, the present assessment estimates of spawning biomass are consistently higher than those from the 2003 assessment for the entire time series.

A retrospective analysis was conducted by sequentially decrementing the end-year of the assessment from 2004 to 2000 (Appendix I, Figure 6b). No obvious model pathologies were detected. Curiously, the 1999 year class of recruits was anomalously high for the run ending in 2001 compared to the other retrospective runs. This can be explained in part by the large proportion of age 2 fish in the 2001 NMFS trawl survey.

An analysis of model stability was conducted by running the base model 30 times, using an SS2 jitter factor of 0.01 (Appendix I, Figure 6a). The SS2 jitter factor is applied as a multiplier to the minimum and maximum parameter bounds specified in the LCNCTL05.ctl file to vary the parameter seed values. The model appeared to be stable at this level of imposed "jitter"; of the 30 model runs, 25 returned to the same total likelihood (648.675) and depletion (0.612) values. The remaining 5 runs did not differ substantially from the most common solution.

Lingcod South (LCS): Eureka, Monterey, and Conception INPFC Areas

Model Description

List and Description of Likelihood Components in the LCS Model

The LCS model incorporated the following likelihood components; input data sources are specified by Table number:

1) Commercial Catch-At-Age: 1992-1998, 2000-2004 (Table 14, Table 15).
2) Recreational Catch-At-Age: 1992-1998, 2000-2004 (Table 14, Table 15).
3) NMFS Trawl Survey Catch-At-Age: 1995, 1998, 2001, and 2004 (Table 14, Table 15).
4) NMFS Trawl Survey Biomass (mt): 1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001 (Table20) and 2004 (Table 20, Table 21).
5) Trawl Fishery Logbook CPUE Index: Oregon and California lingcod CPUE estimates (lbs/hr) derived from a Delta GLM analysis of trawl logbook information, 1978-1997 (Table 25).

The NMFS Trawl Survey Biomass, and Trawl Fishery Logbook CPUE Index likelihood components were fit under a lognormal error structure; fishery and survey catch-at-age and catch-at-length likelihood components were fit assuming a multinomial distribution (Methot 2005). In addition to the likelihood components listed above, a likelihood penalty component was included which constrained the maximum annual instantaneous fishing mortality (F) to be less than or equal to 0.9 (Methot 2005).

Base Model Configuration

The LCS base model employed a Beverton-Holt stock-recruitment relationship with lognormal error structure (with a steepness parameter h = 0.9 and SD = 1.0) to constrain wide variations in recruitment, with an emphasis factor (lambda=1.0). Selectivity for the commercial and recreational fisheries and the NMFS survey was parameterized by a curve formed from two logistic distributions referred to as "SS2 Type 18: double logistic with defined peak and smooth joiners" (Methot 2005). Twelve parameters are used in this formulation, including eight parameters for female selectivity and four parameters to characterize male selectivity as offsets to female selectivity. The model did not incorporate an explicit treatment of discards.

Model Selection and Evaluation

A summary of negative log likelihood values, and both estimated and fixed model parameters of the LCS base model is provided in Appendix II (Tables 1-4).

Base-Run Results

Base run model results are presented in Appendix II (Tables 1-4 and Figures 1-11). Base run SS2 files including the control file (LCSCTL05.ctl), the data file (LCSData05.dat), the names file (SS2names.nam) and the forecast file (Forecast.ss2) are presented in Appendix IIa).

Uncertainty and Sensitivity Analyses

The results of model profiling over selected fixed values used in the assessment are included in Appendix II (Figures 4-6).

A series of base model runs were conducted to examine the effect of different values of the assumed standard deviation of recruitment (SD-r) (Appendix II, Figure 4). SD-r was varied from 0.7 to 1.0. Little sensitivity was observed near the end of the time series, where data were available to estimate recruitments; more sensitivity was noted early in the time series where recruitment was primarily a function of the spawner-recruit curve assumptions. The value of SD-r=1.0 was selected for the final base model.

The base model was also profiled over different fixed values of the Beverton-Holt stock-recruitment steepness parameter (*h*) (Appendix II, Figure 5). The profile over *h* ranged from 0.8 to 1.0. Little sensitivity was observed near the end of the time series, where data were available to estimate recruitments; more sensitivity was noted early in the time series where recruitment was primarily a function of the spawner-recruit curve assumptions. This parameter was set at the fixed value of 0.9 for the final base model. Spawner-recruit emphasis was set at (lambda=1.0) in the base model.

The base model was also profiled over different fixed values of natural mortality (M) (Appendix II, Figure 6). The profile over M ranged from 0.14 and 0.26 (females and males, respectively) to 0.22-0.38). The values of 0.18 (females) and 0.32 (males), as used in previous assessments, were chosen for use in the 2005 final base model.

An historic analysis was conducted by plotting the estimates of recruitment and spawning biomass from the 2003 assessment (Jagielo et al. 2003) with the same from the present assessment (Appendix II, Figure 1). The 2003 assessment time series started in 1973. The base model from the current assessment extended the time series of spawning biomass and recruitment back to 1956 and suggests historically less depletion in the population relative to the 2003 assessment. The correspondence in spawning biomass is close for the two assessments near the end of the time series, and diverges going back to the beginning of the time series.

A retrospective analysis was conducted by sequentially decrementing the end-year of the assessment from 2004 to 2000 (Appendix II, Figure 6b). No obvious model pathologies were detected.

An analysis of model stability was conducted by running the base model 30 times, using an SS2 jitter factor of 0.01 (Appendix II, Figure 6a). The SS2 jitter factor is applied as a multiplier to the minimum and maximum parameter bounds specified in the LCSCTL05.ctl file to vary the parameter seed values. The model appeared to be stable at this level of imposed “jitter”; of the 30 model runs, 17 returned to the same total likelihood (170.275) and depletion (0.177) values. The remaining 13 runs did not differ substantially from the most common solution.

Coastwide Summary

Management Reference Points

Management reference points derived from the 2005 lingcod stock assessment are summarized in Table ES-1. The estimates of unfished spawning biomass (Bzero) were determined as the product of mean recruitment from 1956-2005 and the estimated Spawners Per Recruit. On a coastwide basis the lingcod population is fully rebuilt; estimated spawning biomass was 34,017 mt in 2005, which is 0.60 of the unfished spawning biomass estimate (52,850 mt). The estimated ratio of 2005 spawning biomass to unfished spawning biomass is higher in the north (0.87) compared to the south (0.24).

Spawning Stock Biomass

SS2 estimates of the coastwide female spawning stock biomass declined from 60,106 mt in 1956 to 6,004 mt in 1994, and subsequently increased to 34017 mt in 2005 (Table ES-2, Figure ES1-Top). Female spawning biomass depletion (B_0/B_t) fell to 0.11 in 1994 and subsequently increased to 0.64 in 2005 (Table ES-2, Figure ES1-Bottom).

Recruitment

The model estimate of virgin recruitment was higher for the northern area (3750 thousand age 0 fish) compared to the southern area (2503 thousand age 0 fish). Recruitments were generally similar in magnitude in both the north and south from 1972-1992, averaging 2008 in the north, and 2071 in the south (Table ES-2. Figure ES-1, bottom). Subsequently, from 1993-2005, recruitments tended to be higher in the north, and averaged 4503 compared to 1309 for the same period in the south. Recent, historically strong, 1999 and 2000 year classes were estimated in the north.

Exploitation Status

In the northern area, the exploitation rate (catch/available biomass) peaked at 0.20 in 1991 and averaged 0.03 from 1956-1980, 0.12 from 1981-1997, and 0.02 from 1998-2005 (Table ES-3). Exploitation rates were generally higher in the southern area, peaking at 0.26 in 1989 and averaging 0.05 from 1956-1980, 0.20 from 1981-1997, and 0.10 from 1998-2005.

Management Performance

The first lingcod ABC's based on a quantitative assessment were implemented in 1995. A comparison of reported landings and ABC values shows good correspondence through 2001, when landings were typically at or below the target ABC values (Figure ES2). In 2002, landings exceeded the coastwide ABC by 17% and the coastwide OY was exceeded by 51%.

Forecasts and Decision Table

Projected yield was forecasted using SS2 for the northern (LCN) and southern (LCS) base models (Table ES-4). Coastwide yield forecasts (sum of LCN and LCS) are summarized in Table ES-5. Forecasts were run with and without the 40:10 adjustment option. These forecasts assumed that fishery removals in 2005 and 2006 were taken at the level projected by the Groundfish Management Team for 2005 (970mt) (John Devore, Personal Communication).

Additional model forecast runs were made for a set of alternative conditions to establish decision tables. For LCN, the decision table was constructed with the base model and one alternate model in which both: 1) the NMFS 2001 and 2004 shelf triennial trawl survey data were omitted, and 2) the age composition data for the recreational and commercial fishery were omitted for the years 2000 through 2004 (Table ES-6). For LCS, the decision table was constructed with the base model and two alternate models (Table ES-7). The first "low" alternate model assumed that spawning biomass in 2005 was approximately 1.25 standard deviations below the base model estimate of spawning biomass in 2005 (3375 mt); the second "high" alternate model assumed that spawning biomass in 2005 was approximately 1.25 standard deviations above the base model estimate of spawning biomass in 2005 (5827 mt).

In both decision tables (Table ES-6 and Table ES-7), the base case model using the base case catch projection is highlighted with a bold outline. The additional cells in the decision tables contrast the results obtained when the models are run with catch projections from the alternate (State of Nature) models. For instance, in the northern area, when base model projected catches are used with the alternate State of Nature model, a depletion level of 0.27 is predicted in the year 2016 (Table ES-6). In the southern area, the predicted depletion level of 0.39 in the year 2016 results when the "high" ending biomass model catches are applied to the "low" ending biomass State of Nature model (Table ES-7).

Recommendations: Research and Data Needs

1) Emphasis should be placed on improving fishery age structure sampling size and geographical coverage in both regions.

2) More frequent and synoptic fishery independent surveys should be conducted in both regions to aid in determination of stock status and recent recruitment. Surveys of areas inaccessible to trawl survey gear should be conducted to address the issue of the habitat bias of trawl surveys.

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The STAT Team would like to thank Jason Cope (UW-SAFS), Ian Stewart (NWFSC), and Richard Methot (NOAA Fisheries) for providing helpful advice on the use of the SS2 stock assessment model. The STAT Team also thanks the STAR Panels of August 15-19, and September 26-30 for their constructive reviews.

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Table 1. History of PFMC lingcod Acceptable Biological catches (ABC's), Harvest guidelines or Optimum yields (OT's) and landings. Source:PFMC SAFE 2001 document and personal communication with the PFMC Groundfish Management Team for most recent year's information.

	US Vancouver	Columbia	US Vancouver-Columbia		Eureka	Monterey	Conception	Eureka-Monterey-Conception		Coastwide		
Year	ABC	ABC	ABC	Landings	ABC	ABC	ABC	ABC	Landings	ABC	HG or OY	Harvest
1983	1,000	4,000	5,000	3,155	500	1,100	400	2,000	1,691	7,000		4,971
1984	1,000	4,000	5,000	3,163	500	1,100	400	2,000	1,555	7,000		4,719
1985	1,000	4,000	5,000	3,215	500	1,100	400	2,000	1,726	7,000		4,945
1986	1,000	4,000	5,000	1,396	500	1,100	400	2,000	1,517	7,000		2,934
1987	1,000	4,000	5,000	1,724	500	1,100	400	2,000	1,922	7,000		3,667
1988	1,000	4,000	5,000	1,763	500	1,100	400	2,000	2,044	7,000		3,930
1989	1,000	4,000	5,000	2,373	500	1,100	400	2,000	2,316	7,000		4,705
1990	1,000	4,000	5,000	1,868	500	1,100	400	2,000	1,966	7,000		3,845
1991	1,000	4,000	5,000	2,437	500	1,100	400	2,000	1,647	7,000		4,095
1992	1,000	4,000	5,000	1,391	500	1,100	400	2,000	1,467	7,000		2,870
1993	1,000	4,000	5,000	1,659	500	1,100	400	2,000	1,374	7,000		2,907
1994	1,000	4,000	5,000	1,449	500	1,100	400	2,000	1,091	7,000	4,000	2,424
1995			1,300	971	300	700	100	1,100	1,067	2,400	2,400	1,882
1996			1,300	1,120	300	700	100	1,100	937	2,400	2,400	2,070
1997			1,300	1,049	300	700	100	1,100	912	2,400	2,400	1,981
1998			1,021	225	139	325	46	510	496	1,532	838	707
1999			450	262	139	325	46	510	545	960	730	831
2000			450					250		700	378	446
2001			610					510		1,120	611	445
2002										745	577	873
2003										841	651	

Table 2. History of lingcod commercial trawl trip limits (thousand lbs) Source:PFMC SAFE 2001 document and personal communication with the PFMC Groundfish Management Team for most recent year's information. Note: Exception to commercial size limits: starting in 1996, trawl gear was allowed retention of 100 lb. at size less than minimum size limit.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
< 1995	No trip limit regulations											
1995	20	20	20	20	20	20	20	20	20	20	20	20
1996	40		40		40		40		40		40	
1997	40		40		40		40		40		40	
1998	1		1		1		1		1		1	
1999	1.5			1.5			1			0.5	0.5	0.5
2000	Prohibited				0.4	0.4	0.4	0.4	0.4	0.4	Prohibited	
2001	Prohibited				0.4	0.4	0.4	0.4	0.4	0.5	Prohibited	
2002 1/	0.8		0.8		1		1		0.5	0.5	0.5	0.5
2003	0.8		0.8		1		1		0.8		0.8	

Prohibited Periods
Commercial size limit 0f 22" `1995-1997 then 24" thereafter
Gear restrictions for rockfish retention beginning in 2001
1/ South of 40^0 10' lingcod prohibited beginning July 1st

Table 3. History of lingcod size limits (inches) and recreational bag limits (number of fish): Source: PFMC SAFE 2001 document and personal communication with the PFMC Groundfish Management Team for most recent year's information.

State	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
				Daily Bag Limits						
Washington	3	3	3	3	3	2	2	2	2	2
Oregon	3	3	3	3	3	2	2	2	2	2
California	5	5	5	5	5	2	2	2	2	2
				Size Limits (inches)						
Washington	none	22	22	22	24	24	24	24	24	24
Oregon	none	22	22	22	24	24	24	24	24	24
California [1/]	none	22	22	22	24	24	26	26	22	22

[1/] Beginning in 2000; South of 34^{0} 27' N. Lat lingcod prohibited January-February and South of Cape Mendencino and north of 34^{0} 27' N. Lat lingcod prohibited March-June

Table 4. Estimated commercial lingcod catch (mt) for California (1916-1955), Oregon (1950-1953) and Washington ()1935-1955).

Historical Commercial lingcod landings

Year	California [1/] Total (mt)	Oregon 2[/] Total (mt)	Washington [3/] Total (mt)
1916	280		
1917	422		
1918	415		
1919	482		
1920	312		
1921	193		
1922	258		
1923	212		
1924	182		
1925	310		
1926	295		
1927	252		
1928	387		
1929	529		
1930	584		
1931	558		
1932	408		
1933	494		
1934	389		
1935	462		0
1936	344		0
1937	439		1
1938	293		0
1939	262		0
1940	314		10
1941	240		51
1942	143		41
1943	326		162
1944	338		523
1945	344		237
1946	524		229
1947	880		65
1948	933		132
1949	751		109
1950	869	312	92
1951	758	379	106
1952	620	224	93
1953	432	139	40
1954	430		66
1955	438		63
	428	264	106

[1/] Leet et al. 1992. California's living marine resources and their utilization

[1/] Forrester, 1973.

[2/] "Fisheries Statistics for Oregon 1950-1953" author Harrison S. Smith

[3/] Anonymous, 1955 WDF Commercial Fishing Statistical Report.

Table 5. Estimated commercial and recreational lingcod catch (mt) for northern (1916-1955) and southern areas (Eureka, Monterey and Conception), 1956 to 2004

	Northern Area			Southern Area			
	U.S. Vancouver - Columbia			Eureka-Monterrey-Conception			Coastwide
Year	Commercial [1]	Recreation [2]	Total (mt)	Commercial [3]	Recreation [4]	Total (mt)	Total (mt)
1956	920		920	422	113	536	1,455
1957	1,000		1,000	744	114	858	1,858
1958	1,133		1,133	726	120	845	1,979
1959	1,863		1,863	638	94	732	2,594
1960	2,028		2,028	593	85	678	2,706
1961	1,875		1,875	653	70	724	2,599
1962	1,323		1,323	504	76	581	1,904
1963	938		938	514	83	597	1,534
1964	1,257		1,257	379	76	455	1,712
1965	1,538		1,538	369	100	469	2,006
1966	1,813		1,813	363	134	497	2,311
1967	1,244		1,244	426	131	557	1,800
1968	1,626		1,626	496	128	624	2,250
1969	1,148		1,148	505	98	603	1,751
1970	851		851	695	-	695	1,546
1971	1,009		1,009	952	-	952	1,961
1972	952		952	1,472	-	1,472	2,425
1973	1,326		1,326	1,615	403	2,018	3,344
1974	1,549		1,549	1,735	399	2,134	3,683
1975	2,019	85	2,104	1,447	429	1,876	3,981
1976	1,662	69	1,731	1,415	422	1,837	3,568
1977	1,671	76	1,747	769	284	1,053	2,799
1978	1,346	70	1,416	914	334	1,248	2,664
1979	2,211	82	2,292	1,434	340	1,774	4,066
1980	2,004	93	2,097	1,275	2,226	3,501	5,598
1981	1,905	128	2,033	1,404	1,169	2,572	4,605
1982	2,241	128	2,368	1,599	877	2,476	4,844
1983	3,051	114	3,165	1,221	586	1,807	4,972
1984	3,005	156	3,161	1,047	509	1,555	4,716
1985	3,127	90	3,217	753	974	1,726	4,943
1986	1,305	95	1,399	602	928	1,531	2,930
1987	1,620	111	1,731	982	950	1,932	3,663
1988	1,646	115	1,760	1,141	1,036	2,177	3,938
1989	2,231	146	2,377	1,358	964	2,322	4,699
1990	1,746	125	1,871	1,188	785	1,973	3,844
1991	2,320	121	2,441	844	807	1,651	4,092
1992	1,207	210	1,417	676	795	1,471	2,888
1993	1,429	252	1,681	778	469	1,247	2,928
1994	1,214	255	1,469	691	283	974	2,443
1995	858	117	975	610	291	901	1,876
1996	999	129	1,128	559	381	940	2,068
1997	933	120	1,053	636	289	924	1,978
1998	155	73	228	198	269	466	694
1999	169	101	270	190	357	547	817
2000	73	75	148	71	206	277	425
2001	70	86	156	88	178	266	422
2002	97	140	237	108	526	634	871
2003 [5]	104	144	247	78	1,031	1,109	1,356
2004 [5]	86	168	254	88	148	236	490

1/ Early catch estimates from Forrest (1973) and Lynde (1983) then PacFIN estimates beginning 1981.
2/ Revised catch estimates for this assessment provided by ODFW for 1990-2004 and WDFW catch revised to exclude catch taken in Canadian waters.
3/ Early catch estimates from CDF&G Fish Bulletins and then PacFIN estimates beginning 1981.
4/ Early catch estimates from Leet et.al. (1982) and MRFSS estimates used from 1980-2004, Oregon catches south of Cape Blanco provided by ODFW.
5/ MRFSS estimates in 2003 and CRFS estimates from 2004 are not standardized and not comparable.

Table 5a. Estimated commercial and recreational lingcod catch (mt) for northern (1916-1955) and southern areas (Eureka, Monterey and Conception), 1956 to 2004, **with adjustment for catch discarded.**

	Northern Area			Southern Area			
	U.S. Vancouver - Columbia			Eureka-Monterey-Conception			Coastwide
Year	Commercial [1]	Recreation [2]	Total (mt)	Commercial [3]	Recreation [4]	Total (mt)	Total (mt)
1956	920	0	920	422	113	536	1,455
1957	1,000	5	1,005	744	114	858	1,863
1958	1,133	9	1,143	726	120	845	1,988
1959	1,863	14	1,876	638	94	732	2,608
1960	2,028	18	2,046	593	85	678	2,724
1961	1,875	23	1,897	653	70	724	2,621
1962	1,323	27	1,350	504	76	581	1,931
1963	938	32	969	514	83	597	1,566
1964	1,257	36	1,293	379	76	455	1,748
1965	1,538	40	1,578	369	100	469	2,047
1966	1,813	45	1,858	363	134	497	2,355
1967	1,244	49	1,293	426	131	557	1,850
1968	1,626	54	1,680	496	128	624	2,304
1969	1,148	58	1,206	505	98	603	1,809
1970	851	63	914	695	119	814	1,728
1971	1,009	67	1,076	952	179	1,131	2,207
1972	952	72	1,024	1,472	269	1,741	2,765
1973	1,326	76	1,402	1,615	403	2,018	3,420
1974	1,549	81	1,630	1,735	399	2,134	3,763
1975	2,019	85	2,104	1,447	429	1,876	3,981
1976	1,662	69	1,731	1,415	422	1,837	3,568
1977	1,671	76	1,747	769	284	1,053	2,799
1978	1,346	70	1,416	914	334	1,248	2,664
1979	2,211	82	2,292	1,434	340	1,774	4,066
1980	2,004	93	2,097	1,275	2,229	3,504	5,601
1981	1,905	128	2,033	1,404	1,173	2,577	4,610
1982	2,241	128	2,368	1,599	882	2,481	4,849
1983	3,051	114	3,165	1,221	589	1,810	4,975
1984	3,005	156	3,161	1,047	514	1,561	4,722
1985	3,127	90	3,217	753	981	1,733	4,950
1986	1,305	95	1,399	602	950	1,552	2,951
1987	1,620	111	1,731	982	969	1,950	3,682
1988	1,646	115	1,760	1,141	1,054	2,195	3,955
1989	2,231	146	2,377	1,358	980	2,338	4,715
1990	1,746	125	1,871	1,188	799	1,987	3,857
1991	2,320	121	2,441	844	820	1,665	4,106
1992	1,207	210	1,417	676	808	1,484	2,901
1993	1,429	252	1,681	778	479	1,257	2,939
1994	1,214	255	1,469	691	289	980	2,449
1995	1,018	117	1,135	705	300	1,005	2,139
1996	1,186	129	1,315	648	391	1,039	2,354
1997	1,106	120	1,226	736	299	1,035	2,262
1998	718	73	791	349	279	629	1,420
1999	665	101	766	347	375	722	1,487
2000	223	75	298	120	240	360	658
2001	206	86	292	151	226	377	669
2002	226	140	366	152	608	759	1,125
2003	147	144	291	100	1,125	1,226	1,516
2004	208	168	376	107	188	295	671

1/ Early catch estimates from Forrest (1973) and Lynde (1983) then PacFIN estimates beginning 1981.
2/ Revised catch estimates for this assessment provided by ODFW for 1990-2004 and WDFW catch revised to exclude catch taken in Canadian waters.
3/ Early catch estimates from CDF&G Fish Bulletins and then PacFIN estimates beginning 1981.
4/ Early catch estimates from Leet et.al. (1982) and MRFSS estimates used from 1980-2004, Oregon Catches South of Blanco provided by ODFW
5/ MRFSS estimates in 2003 and CRFS estimates from 2004 are not standardized and not comparable. Awaiting explaination from CDFG?
6/ Catch estimates beginning in 1995 are expanded to include regulatory discard mortality

Table 6. Estimated commercial lingcod catch (mt) by gear and INPFC area, 1981 to 2004.

U.S Vancouver INPFC Area - lingcod landings in metric tons

Year	Hook&Line	Other	Net	Pot	Trolls	Trawls	Shrimp Trawl	Total
1981	65.3	0.0	26.6	0.0	53.5	367.5	1.3	514.2
1982	67.6	0.0	76.6	0.4	115.3	336.3	0.2	596.4
1983	36.6	0.0	119.7	0.0	201.3	802.0	18.4	1178.0
1984	63.9	0.0	131.3	3.0	201.5	1344.4	2.1	1746.2
1985	100.2	0.0	247.2	0.5	178.0	1324.7	1.5	1852.1
1986	50.3	0.0	0.0	0.0	70.8	441.7	6.1	568.9
1987	94.5	0.0	0.2	0.0	43.6	584.9	4.3	727.5
1988	69.0	0.0	0.2	0.0	74.9	478.3	0.4	622.8
1989	91.2	0.0	0.1	0.0	119.1	789.0	0.2	999.6
1990	139.9	0.0	0.0	0.0	85.0	761.9	0.5	987.3
1991	80.9	0.0	0.0	0.0	26.0	1344.9	0.3	1452.1
1992	54.6	0.0	0.0	0.0	31.4	469.5	0.1	555.6
1993	35.9	0.0	0.0	0.0	20.3	594.2	0.8	651.2
1994	34.8	0.0	0.0	0.0	21.2	471.3	1.4	528.7
1995	21.3	0.0	0.0	0.0	8.8	257.2	2.8	290.1
1996	35.2	0.0	0.0	0.0	5.8	314.8	4.7	360.5
1997	35.5	0.0	0.0	0.0	12.1	253.1	0.2	300.9
1998	8.4	0.0	0.0	0.0	2.2	39.4	0.0	50.0
1999	15.1	0.0	0.0	0.0	1.8	29.8	0.1	46.8
2000	10.5	0.0	0.0	0.0	3.3	8.1	0.0	21.9
2001	12.4	0.0	0.0	0.0	1.7	10.9	0.1	25.1
2002	10.4	0.0	0.0	0.0	1.9	30.2	0.0	42.5
2003	11.4	0.0	0.0	0.0	1.5	35.5	0.0	48.4
2004	8.7	0.0	0.0	0.0	2.3	30.7	0.0	41.7

Columbia INPFC Area - lingcod landings in metric tons

Year	Hook&Line	Other	Net	Pot	Trolls	Trawls	Shrimp Trawl	Total
1981	27.2	0.0	45.5	3.5	29.0	1208.4	76.8	1390.4
1982	47.8	0.0	0.2	3.2	24.2	1497.9	71.0	1644.3
1983	37.0	0.0	10.8	2.1	31.5	1706.9	84.4	1872.7
1984	34.7	0.0	3.0	0.8	17.3	1154.2	49.1	1259.1
1985	54.0	0.0	0.0	1.4	43.3	1131.8	44.2	1274.7
1986	53.0	0.0	0.0	0.6	43.8	556.3	82.3	736.0
1987	81.1	0.1	0.0	0.7	20.3	721.7	68.5	892.4
1988	70.8	0.0	0.0	0.7	16.4	904.6	30.6	1023.1
1989	100.0	0.0	0.0	0.2	28.8	1056.4	45.7	1231.1
1990	62.5	0.0	0.0	0.1	11.6	663.5	21.1	758.8
1991	32.2	0.0	0.0	0.5	4.1	814.0	16.7	867.5
1992	55.1	0.0	0.0	0.1	8.8	573.3	14.1	651.4
1993	59.0	0.3	0.0	0.3	12.1	680.1	25.9	777.7
1994	102.4	0.0	0.0	1.0	5.8	535.2	40.7	685.1
1995	39.3	0.0	0.0	0.3	4.4	483.2	40.8	568.0
1996	48.4	0.0	0.0	0.2	5.9	555.3	28.6	638.4
1997	58.0	0.0	0.0	0.5	9.0	546.2	18.3	632.0
1998	10.7	0.0	0.0	0.3	3.0	83.7	6.9	104.6
1999	12.0	0.0	0.0	0.2	4.8	77.8	27.3	122.1
2000	6.9	0.0	0.0	0.1	6.3	24.0	14.0	51.3
2001	10.7	0.0	0.0	1.3	5.3	20.8	6.5	44.6
2002	8.4	0.0	0.0	0.9	2.9	36.6	6.0	54.8
2003	12.4	0.0	0.0	1.1	1.8	40.0	0.0	55.3
2004	13.1	0.0	0.0	2.4	3.3	25.8	0.0	44.6

Note: Assumes that OR-Wa "Unknown" catch area is Columbia

Table 6 (continued). Estimated commercial lingcod catch (mt) by gear and INPFC area, 1981 to 2004.

Eureka INPFC Area - lingcod landings in metric tons							Shrimp	
Year	Hook&Line	Other	Net	Pot	Trolls	Trawls	Trawl	Total
1981	13.8	0.3	0.0	0.0	8.4	349.2	8.8	380.5
1982	15.9	0.9	0.0	0.4	13.6	510.9	12.8	554.5
1983	27.8	12.1	0.0	1.3	3.5	364.5	0.5	409.7
1984	5.4	13.7	0.0	0.2	4.7	262.4	1.6	288.0
1985	47.8	2.6	0.1	0.9	1.3	183.2	2.2	238.1
1986	85.6	5.3	0.0	1.8	8.6	98.4	7.4	207.1
1987	107.4	3.7	0.0	0.3	0.6	202.4	7.2	321.6
1988	117.8	0.8	0.0	0.3	3.4	196.9	6.6	325.8
1989	189.7	0.6	0.0	1.5	1.1	190.8	5.5	389.2
1990	179.9	0.8	0.0	0.3	4.1	228.2	8.5	421.8
1991	65.9	0.0	0.0	0.0	0.0	139.0	7.8	212.7
1992	60.1	0.0	0.0	0.1	0.0	105.8	3.8	169.8
1993	39.0	0.0	0.2	0.1	0.3	154.4	3.3	197.3
1994	53.9	0.1	0.3	0.2	0.2	160.3	12.9	227.9
1995	91.4	0.0	0.7	0.2	0.2	133.5	6.1	232.1
1996	73.9	0.0	0.0	0.2	2.8	117.4	9.1	203.4
1997	109.1	0.0	0.1	0.2	0.1	149.6	5.1	264.2
1998	40.4	0.1	0.0	0.2	0.6	56.7	1.1	99.1
1999	43.3	0.1	0.0	0.3	1.1	56.7	3.8	105.3
2000	21.6	0.0	0.0	0.5	0.3	19.6	0.5	42.5
2001	32.4	0.0	0.0	0.3	0.2	19.4	0.4	52.7
2002	38.3	0.0	0.0	1.1	0.1	23.6	0.1	63.2
2003	33.4	0.0	0.0	0.8	0.4	5.4	0.0	40.0
2004	32.3	0.0	0.0	0.5	0.1	6.6	0.0	39.5

Monterey INPFC Area - lingcod landings in metric tons							Shrimp	
Year	Hook&Line	Other	Net	Pot	Trolls	Trawls	Trawl	Total
1981	39.2	2.5	9.7	2.7	22.8	771.7	0.3	848.9
1982	24.8	7.3	55.1	1.3	16.1	737.6	0.1	842.3
1983	13.9	48.4	112.7	0.7	5.2	581.1	0.6	762.6
1984	4.6	126.3	43.7	0.0	4.2	558.0	0.4	737.2
1985	18.4	97.1	144.3	1.7	6.1	222.0	0.1	489.7
1986	60.7	31.9	118.6	2.1	0.8	152.9	0.3	367.3
1987	69.3	26.4	175.3	0.9	1.2	343.4	0.8	617.3
1988	102.5	19.1	289.9	2.8	1.4	333.0	1.3	750.0
1989	218.3	9.7	235.5	2.2	0.5	434.7	2.6	903.5
1990	162.3	6.6	189.3	1.1	8.9	339.1	0.6	707.9
1991	135.8	4.2	106.3	0.9	0.7	311.0	0.3	559.2
1992	133.4	2.2	87.3	0.7	1.0	216.7	0.0	441.3
1993	111.5	0.1	107.6	0.3	2.6	277.5	0.2	499.8
1994	85.7	0.3	72.5	0.3	12.5	224.3	1.3	396.9
1995	74.4	0.2	48.9	0.9	9.2	185.2	0.4	319.2
1996	92.8	0.0	7.6	1.2	4.8	205.4	1.8	313.6
1997	89.8	0.0	27.4	2.0	1.9	218.1	1.6	340.8
1998	30.4	0.0	3.8	8.9	0.4	35.8	0.4	79.7
1999	24.3	0.1	0.8	1.6	0.6	42.1	0.5	70.0
2000	10.3	0.0	3.3	0.2	0.4	10.7	0.2	25.1
2001	14.8	0.0	0.4	0.6	1.2	9.4	0.1	26.5
2002	18.3	0.1	0.0	0.2	0.7	15.8	0.1	35.2
2003	13.7	0.1	0.0	0.8	2.1	8.5	0.0	25.2
2004	21.3	0.0	0.9	0.7	1.2	8.9	0.2	33.2

Table 6 (continued). Estimated commercial lingcod catch (mt) by gear and INPFC area, 1981 to 2004.

Conception INPFC Area - lingcod landings in metric tons							Shrimp	
Year	Hook&Line	Other	Net	Pot	Trolls	Trawls	Trawl	Total
1981	11.1	0.0	10.4	0.5	1.4	144.6	6.3	174.3
1982	4.5	0.0	27.5	0.1	0.2	159.8	10.0	202.1
1983	0.9	0.4	4.8	0.0	0.1	41.4	0.8	48.4
1984	0.6	0.3	3.9	0.0	0.0	11.8	4.7	21.3
1985	1.3	0.1	12.4	0.0	0.0	9.0	2.0	24.8
1986	3.3	0.3	15.1	0.2	0.3	8.3	0.2	27.7
1987	6.5	0.8	19.2	0.2	0.7	15.2	0.0	42.6
1988	5.3	0.3	40.3	0.0	0.0	19.5	0.0	65.4
1989	4.7	0.3	37.7	0.5	0.0	21.8	0.0	65.0
1990	5.9	0.5	26.8	0.3	0.0	24.4	0.1	58.0
1991	12.1	0.2	44.6	0.1	0.0	15.4	0.1	72.5
1992	21.5	0.3	25.6	0.2	0.0	17.3	0.1	65.0
1993	24.3	0.0	46.5	0.1	0.0	9.3	0.7	80.9
1994	18.9	0.0	21.7	1.5	0.2	20.8	3.2	66.3
1995	27.9	0.2	8.1	3.1	0.2	16.0	3.3	58.8
1996	24.2	0.6	4.8	6.7	0.2	4.1	1.6	42.2
1997	17.4	0.0	2.4	5.2	0.1	4.4	1.1	30.6
1998	10.2	0.0	1.4	3.0	0.1	3.2	1.0	18.9
1999	10.3	0.0	0.4	2.1	0.0	1.5	0.2	14.5
2000	2.9	0.0	0.0	0.6	0.0	0.1	0.1	3.7
2001	5.8	0.0	0.3	1.2	0.0	0.8	0.2	8.3
2002	8.3	0.0	0.1	1.4	0.1	0.1	0.0	10.0
2003	9.7	0.0	0.1	2.1	0.0	0.2	0.2	12.3
2004	10.6	0.0	0.1	1.8	0.0	2.3	0.0	14.8

Table 7. Estimates of lingcod discard, live and dead, in the recreational fishery by State.

MRFSS estimates of % lingcod catch (#'s of fish) that was discarded dead (B1 catches)

YEAR	SOUTHERN CALIFORNIA	NORTHERN CALIFORNIA	OREGON	WASHINGTON	ALL SUBREGIONS
1980	2%	36%	37%	40%	21%
1981	11%	23%	18%	140%	31%
1982	12%	10%	14%	126%	23%
1983	13%	7%	43%	57%	19%
1984	8%	6%	7%	33%	8%
1985	18%	6%	8%	45%	10%
1986	5%	12%	17%	150%	13%
1987	25%	16%	18%	106%	23%
1988	60%	44%	3%	1100%	45%
1989	5%	24%	2%	100%	17%
1993	50%	12%	na	na	9%
1994	13%	6%	na	na	3%
1995	14%	6%	na	na	4%
1996	0%	12%	na	na	8%
1997	0%	1%	na	na	1%
1998	0%	9%	na	na	6%
1999	0%	7%	na	na	5%
2000	0%	10%	na	na	6%
2001	0%	14%	na	na	7%
2002	20%	5%	na	na	14%
2003	0%	0%	na	na	7%

MRFSS estimates of % lingcod catch (#'s of fish) that was discarded live (B2 catches)

YEAR	SOUTHERN CALIFORNIA	NORTHERN CALIFORNIA	OREGON	WASHINGTON	SUBREGIONS
1980	6%	4%	0%	0%	5%
1981	35%	7%	4%	37%	12%
1982	16%	14%	6%	23%	12%
1983	31%	12%	17%	10%	14%
1984	27%	13%	0%	22%	13%
1985	59%	10%	0%	9%	16%
1986	162%	35%	0%	0%	59%
1987	107%	38%	2%	29%	46%
1988	122%	39%	3%	0%	52%
1989	70%	39%	2%	0%	38%
1993	117%	57%	57%	na	52%
1994	88%	61%	41%	na	45%
1995	157%	65%	58%	na	60%
1996	400%	46%	83%	na	68%
1997	75%	78%	477%	na	163%
1998	250%	81%	767%	na	220%
1999	378%	73%	76%	na	89%
2000	1867%	428%	253%	na	397%
2001	1733%	590%	147%	na	514%
2002	1224%	271%	95%	57%	374%
2003	3100%	167%	200%		387%

Note: the 2002 Washington estimate is derived from data collected by WDFW.

Table 8. Estimates of lingcod discards using trawl gear from onboard observer data. (Source: Jim Hastie, NWFSC - July 2005).

Estimated annnual trawl discard and discard rate for lingcod by INPFC area groups

Year	Area	Landed catch (mt)	Estimated Discard[1] (mt)	Discard/Catch	Discard mortality (with 50% survival) mt	% of total mortality
2000	Col-Van	24.3	220.9	90%	110.4	82%
	Eureka	23.6	54.4	70%	27.2	54%
	Mon-Con	10.5	46.5	82%	23.2	69%
	Coastwide	58.4	321.7	85%	160.9	73%
2001	Col-Van	21.0	176.1	89%	88.0	81%
	Eureka	25.5	72.5	74%	36.2	59%
	Mon-Con	9.3	62.8	87%	31.4	77%
	Coastwide	55.8	311.4	85%	155.7	74%
2002	Col-Van	50.4	189.2	79%	94.6	65%
	Eureka	33.2	60.1	64%	30.1	48%
	Mon-Con	15.0	29.0	66%	14.5	49%
	Coastwide	98.6	278.3	74%	139.2	59%
2003	Col-Van	38.6	41.5	52%	20.8	35%
	Eureka	11.4	22.1	66%	11.1	49%
	Mon-Con	7.7	22.9	75%	11.4	60%
	Coastwide	57.6	86.5	60%	43.3	43%
2004	Col-Van	33.0	139.0	81%	69.5	68%
	Eureka	10.7	11.1	51%	5.5	34%
	Mon-Con	9.7	17.7	65%	8.9	48%
	Coastwide	53.4	167.8	76%	83.9	61%

1 Amounts in this column represent gross amounts of estimated discard, not mortality due to discards. The GMT currently assumes a 50% mortality rate for trawl lingcod discards.

Note: Discard estimates for 2002-04 are based on year-specific observer data. For 2000-01, observer data from September 2001 to August 2004 were pooled. Caution should be used in interpreting the 2000-01 estimates, particularly if there has been a high degree of recruitment variability over the past 10 years.

Bycatch of lingcod in the fixed-gear sablefish fishery was projected to be less than 10 mt for the 2005 fishery, based on the model used by the GMT. It is unlikely that discard mortality would amount to more than 3 mt.

Table 9. Commercial fishery lingcod age composition used in the northern (LCN) model (1979-2002).

Fishery	Year	Tot. No.Fish	Female Proportion-at-age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Com	1979	694	0.000	0.003	0.004	0.015	0.031	0.052	0.094	0.207	0.236	0.145	0.050	0.018	0.017	0.017	0.030	0.031	0.006	0.000	0.000	0.000
Com	1980	1853	0.000	0.004	0.019	0.029	0.051	0.113	0.120	0.128	0.134	0.087	0.049	0.038	0.025	0.015	0.015	0.008	0.006	0.002	0.000	0.001
Com	1981	1325	0.000	0.007	0.053	0.070	0.067	0.059	0.073	0.073	0.085	0.119	0.050	0.013	0.012	0.006	0.009	0.000	0.000	0.000	0.000	0.000
Com	1982	469	0.000	0.013	0.039	0.093	0.124	0.160	0.136	0.067	0.037	0.052	0.054	0.010	0.030	0.000	0.009	0.009	0.000	0.001	0.000	0.000
Com	1983	443	0.000	0.019	0.110	0.137	0.161	0.085	0.052	0.044	0.021	0.018	0.037	0.039	0.020	0.014	0.011	0.008	0.014	0.005	0.003	0.003
Com	1984	339	0.000	0.000	0.036	0.121	0.206	0.196	0.080	0.048	0.022	0.016	0.010	0.018	0.013	0.001	0.001	0.001	0.001	0.000	0.000	0.000
Com	1985	312	0.000	0.000	0.002	0.040	0.101	0.235	0.285	0.078	0.077	0.040	0.016	0.009	0.016	0.000	0.008	0.000	0.000	0.000	0.000	0.000
Com	1986	663	0.000	0.003	0.026	0.069	0.106	0.147	0.160	0.156	0.084	0.054	0.043	0.018	0.006	0.012	0.018	0.004	0.005	0.006	0.000	0.000
Com	1987	741	0.000	0.008	0.046	0.085	0.127	0.172	0.137	0.104	0.102	0.041	0.015	0.005	0.001	0.003	0.001	0.003	0.004	0.000	0.001	0.000
Com	1988	821	0.000	0.031	0.144	0.064	0.097	0.101	0.079	0.094	0.058	0.045	0.022	0.013	0.007	0.000	0.000	0.000	0.000	0.005	0.003	0.000
Com	1989	786	0.000	0.004	0.120	0.309	0.161	0.075	0.048	0.024	0.022	0.017	0.008	0.000	0.008	0.000	0.001	0.000	0.000	0.000	0.001	0.000
Com	1990	887	0.000	0.013	0.041	0.179	0.167	0.088	0.072	0.049	0.032	0.021	0.036	0.004	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1991	999	0.000	0.034	0.082	0.119	0.199	0.157	0.099	0.057	0.032	0.028	0.011	0.013	0.006	0.000	0.007	0.000	0.001	0.002	0.000	0.000
Com	1992	1140	0.000	0.175	0.142	0.119	0.085	0.071	0.083	0.042	0.026	0.010	0.015	0.009	0.000	0.004	0.008	0.001	0.000	0.000	0.000	0.000
Com	1993	1022	0.000	0.116	0.173	0.100	0.102	0.071	0.135	0.032	0.010	0.073	0.004	0.015	0.006	0.002	0.005	0.000	0.001	0.000	0.000	0.000
Com	1994	1034	0.000	0.107	0.308	0.194	0.095	0.039	0.019	0.025	0.011	0.006	0.002	0.003	0.001	0.001	0.004	0.000	0.000	0.000	0.000	0.000
Com	1995	1093	0.000	0.021	0.187	0.347	0.144	0.055	0.018	0.004	0.007	0.003	0.003	0.002	0.000	0.000	0.001	0.006	0.000	0.000	0.000	0.000
Com	1996	820	0.000	0.058	0.124	0.266	0.276	0.058	0.043	0.027	0.012	0.008	0.008	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000
Com	1997	673	0.000	0.028	0.165	0.200	0.159	0.135	0.041	0.032	0.020	0.033	0.024	0.001	0.002	0.003	0.008	0.002	0.000	0.002	0.000	0.000
Com	1998	706	0.000	0.023	0.224	0.269	0.155	0.081	0.041	0.018	0.007	0.004	0.001	0.001	0.003	0.000	0.001	0.000	0.001	0.000	0.000	0.000
Com	1999	750	0.000	0.011	0.087	0.247	0.223	0.105	0.064	0.049	0.027	0.007	0.002	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Com	2000	310	0.000	0.003	0.057	0.136	0.273	0.147	0.064	0.035	0.030	0.015	0.004	0.009	0.005	0.000	0.003	0.000	0.000	0.000	0.000	0.000
Com	2001	548	0.000	0.031	0.079	0.151	0.142	0.155	0.099	0.027	0.026	0.015	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2002	694	0.000	0.021	0.135	0.138	0.098	0.091	0.060	0.050	0.022	0.026	0.004	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-age																			
Com	1979	694	0.000	0.001	0.003	0.005	0.018	0.007	0.008	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1980	1853	0.000	0.000	0.009	0.014	0.031	0.053	0.018	0.016	0.009	0.001	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1981	1325	0.000	0.001	0.010	0.045	0.048	0.060	0.064	0.050	0.020	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1982	469	0.000	0.004	0.013	0.016	0.044	0.025	0.032	0.019	0.010	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1983	443	0.000	0.005	0.034	0.061	0.077	0.015	0.002	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1984	339	0.000	0.000	0.003	0.030	0.034	0.094	0.052	0.003	0.006	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1985	312	0.000	0.000	0.000	0.016	0.015	0.015	0.044	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1986	663	0.000	0.005	0.005	0.013	0.019	0.025	0.004	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1987	741	0.000	0.007	0.020	0.008	0.044	0.033	0.023	0.006	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1988	821	0.000	0.020	0.050	0.050	0.033	0.008	0.005	0.004	0.004	0.030	0.008	0.016	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.000
Com	1989	786	0.000	0.001	0.066	0.076	0.024	0.019	0.010	0.000	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1990	887	0.000	0.006	0.041	0.106	0.066	0.026	0.026	0.004	0.013	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1991	999	0.000	0.027	0.018	0.032	0.029	0.018	0.015	0.008	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1992	1140	0.000	0.074	0.072	0.017	0.013	0.014	0.005	0.008	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1993	1022	0.000	0.050	0.051	0.040	0.006	0.002	0.004	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1994	1034	0.000	0.024	0.091	0.047	0.013	0.002	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1995	1093	0.000	0.009	0.052	0.107	0.028	0.002	0.002	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1996	820	0.000	0.011	0.038	0.025	0.018	0.011	0.000	0.003	0.001	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1997	673	0.000	0.014	0.068	0.022	0.023	0.011	0.006	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1998	706	0.000	0.005	0.064	0.045	0.018	0.019	0.013	0.003	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1999	750	0.000	0.005	0.032	0.046	0.041	0.015	0.021	0.007	0.004	0.003	0.002	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Com	2000	310	0.000	0.000	0.013	0.023	0.107	0.054	0.010	0.009	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2001	548	0.000	0.014	0.015	0.069	0.062	0.048	0.028	0.017	0.011	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2002	694	0.000	0.031	0.069	0.069	0.062	0.018	0.044	0.015	0.015	0.013	0.007	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 10. Recreational fishery lingcod age composition used in the northern (LCN) model (1980-2002).

Fishery	Year	Tot. No.Fish	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
			Female Proportion-at-age																			
Rec	1980	226	0.000	0.004	0.022	0.022	0.018	0.031	0.049	0.009	0.013	0.013	0.009	0.000	0.004	0.013	0.004	0.000	0.000	0.000	0.000	0.000
Rec	1986	341	0.000	0.003	0.015	0.056	0.062	0.053	0.062	0.062	0.050	0.032	0.026	0.018	0.012	0.009	0.009	0.003	0.006	0.006	0.003	0.000
Rec	1987	274	0.000	0.018	0.018	0.062	0.077	0.036	0.033	0.036	0.018	0.015	0.004	0.000	0.007	0.004	0.004	0.000	0.000	0.000	0.000	0.004
Rec	1988	250	0.004	0.044	0.112	0.044	0.024	0.008	0.004	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1989	227	0.000	0.013	0.044	0.062	0.040	0.031	0.040	0.013	0.013	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1990	207	0.005	0.019	0.029	0.068	0.063	0.034	0.010	0.000	0.010	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1991	247	0.000	0.004	0.065	0.040	0.032	0.077	0.057	0.012	0.028	0.012	0.012	0.016	0.012	0.004	0.016	0.008	0.016	0.000	0.000	0.000
Rec	1992	499	0.000	0.048	0.070	0.068	0.048	0.044	0.030	0.024	0.014	0.010	0.004	0.006	0.004	0.002	0.002	0.000	0.000	0.000	0.000	0.000
Rec	1993	530	0.002	0.049	0.096	0.081	0.049	0.038	0.023	0.015	0.006	0.008	0.002	0.002	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Rec	1994	449	0.000	0.009	0.076	0.114	0.085	0.085	0.024	0.011	0.007	0.009	0.009	0.004	0.011	0.000	0.000	0.002	0.002	0.000	0.000	0.000
Rec	1995	643	0.000	0.005	0.042	0.096	0.106	0.059	0.058	0.019	0.012	0.006	0.005	0.002	0.000	0.002	0.002	0.000	0.002	0.000	0.000	0.000
Rec	1996	461	0.000	0.007	0.098	0.143	0.117	0.069	0.048	0.015	0.013	0.007	0.004	0.002	0.000	0.002	0.004	0.000	0.000	0.000	0.000	0.000
Rec	1997	446	0.000	0.007	0.087	0.108	0.092	0.085	0.029	0.020	0.009	0.004	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1998	416	0.002	0.007	0.067	0.147	0.127	0.079	0.067	0.024	0.019	0.002	0.002	0.007	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1999	609	0.000	0.000	0.053	0.138	0.149	0.085	0.053	0.033	0.011	0.003	0.003	0.002	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000
Rec	2000	610	0.000	0.002	0.036	0.110	0.159	0.098	0.079	0.028	0.011	0.005	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2001	961	0.000	0.000	0.019	0.087	0.149	0.134	0.083	0.040	0.020	0.011	0.007	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2002	1098	0.000	0.001	0.054	0.160	0.147	0.095	0.074	0.036	0.015	0.015	0.011	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-age																			
Rec	1980	226	0.000	0.009	0.080	0.146	0.173	0.142	0.137	0.049	0.040	0.009	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1986	341	0.000	0.006	0.053	0.100	0.059	0.041	0.053	0.067	0.044	0.029	0.018	0.021	0.006	0.006	0.006	0.003	0.000	0.003	0.003	0.000
Rec	1987	274	0.000	0.091	0.113	0.109	0.109	0.073	0.073	0.044	0.015	0.015	0.000	0.015	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1988	250	0.000	0.216	0.372	0.080	0.056	0.020	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1989	227	0.000	0.044	0.194	0.220	0.123	0.057	0.035	0.031	0.018	0.009	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1990	207	0.000	0.034	0.135	0.242	0.237	0.072	0.019	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
Rec	1991	247	0.000	0.028	0.113	0.109	0.069	0.126	0.028	0.065	0.012	0.012	0.012	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.004	0.000
Rec	1992	499	0.002	0.072	0.166	0.124	0.092	0.080	0.052	0.014	0.012	0.004	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1993	530	0.000	0.070	0.230	0.138	0.075	0.038	0.025	0.021	0.004	0.013	0.011	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1994	449	0.002	0.024	0.151	0.156	0.078	0.049	0.029	0.027	0.013	0.004	0.011	0.002	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1995	643	0.000	0.014	0.082	0.221	0.134	0.075	0.023	0.012	0.011	0.006	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.003	0.000
Rec	1996	461	0.000	0.007	0.087	0.111	0.121	0.078	0.028	0.024	0.002	0.002	0.007	0.000	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000
Rec	1997	446	0.000	0.013	0.099	0.173	0.110	0.067	0.056	0.004	0.013	0.007	0.009	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1998	416	0.000	0.010	0.058	0.120	0.127	0.065	0.041	0.022	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1999	609	0.000	0.000	0.048	0.128	0.123	0.087	0.043	0.021	0.010	0.000	0.005	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2000	610	0.000	0.002	0.034	0.077	0.148	0.108	0.054	0.026	0.007	0.003	0.003	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2001	961	0.000	0.002	0.016	0.083	0.106	0.114	0.058	0.034	0.020	0.009	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2002	1098	0.000	0.000	0.028	0.100	0.118	0.066	0.045	0.020	0.006	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 11. NMFS Trawl Survey (1992-2001) and WDFW Cape Flattery Survey (1994-1997) age composition used in the northern (LCN) model.

Survey	Year	Tot. No.Fish	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
			Female Proportion-at-age																			
NMFS	1992	74	0.068	0.149	0.149	0.135	0.014	0.054	0.014	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.000
NMFS	1995	208	0.091	0.101	0.207	0.130	0.058	0.043	0.019	0.005	0.005	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	1998	367	0.114	0.101	0.120	0.112	0.109	0.090	0.049	0.014	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	2001	563	0.108	0.206	0.121	0.036	0.021	0.027	0.027	0.025	0.016	0.012	0.004	0.002	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-age																			
NMFS	1992	74	0.054	0.203	0.027	0.027	0.014	0.054	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	1995	208	0.043	0.067	0.077	0.058	0.034	0.029	0.014	0.005	0.000	0.000	0.005	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
NMFS	1998	367	0.065	0.068	0.084	0.030	0.019	0.005	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	2001	563	0.085	0.171	0.091	0.021	0.005	0.005	0.005	0.004	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Female Proportion-at-age																			
WDFW	1994	100	0.000	0.000	0.000	0.040	0.150	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1995	281	0.000	0.107	0.053	0.046	0.018	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1996	511	0.022	0.147	0.104	0.051	0.012	0.002	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1997	498	0.010	0.197	0.139	0.024	0.010	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-age																			
WDFW	1994	100	0.000	0.000	0.000	0.280	0.420	0.080	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1995	281	0.000	0.206	0.185	0.295	0.060	0.014	0.007	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1996	511	0.031	0.319	0.225	0.070	0.012	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1997	498	0.014	0.309	0.227	0.046	0.014	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table12. NMFS Trawl Survey (1986-1989) and WDFW Cape Flattery Survey (1986-1993) size composition data (cm) used in the northern (LCN) model.

Survey	Year	Tot. No.Fish	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
			Female Proportion-at-size (cm)																					
NMFS	1986	220	0.000	0.000	0.000	0.001	0.007	0.005	0.014	0.002	0.006	0.010	0.000	0.000	0.000	0.001	0.017	0.000	0.010	0.053	0.011	0.029	0.108	0.010
NMFS	1989	470	0.001	0.000	0.003	0.038	0.019	0.020	0.003	0.000	0.008	0.039	0.006	0.020	0.002	0.002	0.012	0.009	0.026	0.061	0.034	0.061	0.060	0.013
			Male Proportion-at-size (cm)																					
NMFS	1986	220	0.000	0.001	0.000	0.022	0.003	0.009	0.002	0.001	0.000	0.000	0.012	0.001	0.000	0.005	0.006	0.031	0.066	0.022	0.003	0.012	0.028	0.051
NMFS	1989	470	0.020	0.000	0.002	0.003	0.008	0.002	0.001	0.000	0.000	0.025	0.016	0.039	0.004	0.005	0.008	0.012	0.009	0.040	0.043	0.039	0.012	0.003
			Female Proportion-at-size (cm)																					
WDFW	1986	484	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.006	0.004	0.008	0.008	0.010	0.014	0.008	0.025	0.000	0.006	0.002	0.004
WDFW	1987	542	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.011	0.022	0.013	0.022	0.006	0.006	0.006	0.011	0.009	0.011	0.011	0.006	0.011	0.004	0.006
WDFW	1988	978	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.002	0.009	0.015	0.028	0.028	0.021	0.009	0.005	0.005	0.006	0.004	0.000
WDFW	1989	964	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.006	0.004	0.001	0.001	0.008	0.012	0.007	0.007	0.016	0.018	0.012	0.010	0.003
WDFW	1990	971	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.020	0.041	0.014	0.014	0.004	0.011	0.028	0.028	0.009	0.007	0.005	0.009	0.007	0.009
WDFW	1991	1017	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.017	0.024	0.010	0.010	0.013	0.025	0.036	0.029	0.013	0.007	0.005	0.011	0.003	0.004
WDFW	1992	1003	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.015	0.027	0.038	0.011	0.008	0.014	0.034	0.024	0.021	0.013	0.017	0.009	0.005	0.003	0.005
WDFW	1993		0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.015	0.024	0.040	0.030	0.012	0.013	0.019	0.025	0.026	0.012	0.005	0.006	0.003	0.003	0.003
			Male Proportion-at-size (cm)																					
WDFW	1986	484	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.017	0.029	0.017	0.045	0.056	0.089	0.085	0.066	0.103	0.058	0.074	0.074	0.029	0.029	0.019
WDFW	1987	542	0.000	0.000	0.000	0.000	0.000	0.006	0.020	0.042	0.046	0.031	0.015	0.018	0.054	0.066	0.055	0.089	0.083	0.089	0.057	0.042	0.031	0.028
WDFW	1988	978	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.004	0.017	0.045	0.102	0.137	0.131	0.072	0.043	0.049	0.044	0.049	0.040	0.021	0.021
WDFW	1989	964	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.004	0.015	0.017	0.015	0.015	0.032	0.058	0.141	0.150	0.150	0.103	0.054	0.025	0.025	0.022
WDFW	1990	971	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.024	0.037	0.039	0.020	0.019	0.036	0.050	0.044	0.025	0.062	0.080	0.115	0.071	0.051	0.016
WDFW	1991	1017	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.017	0.060	0.052	0.026	0.045	0.085	0.102	0.076	0.043	0.043	0.040	0.033	0.048	0.034	0.033
WDFW	1992	1003	0.000	0.000	0.001	0.000	0.000	0.011	0.028	0.080	0.103	0.060	0.029	0.044	0.074	0.077	0.067	0.039	0.027	0.021	0.022	0.013	0.013	0.012
WDFW	1993		0.000	0.000	0.000	0.000	0.000	0.002	0.027	0.084	0.114	0.107	0.062	0.059	0.069	0.076	0.047	0.032	0.017	0.022	0.014	0.007	0.003	0.003

Survey	Year	Tot. No.Fish	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
			Female Proportion-at-size (cm)																			
NMFS	1986	220	0.012	0.050	0.033	0.096	0.023	0.026	0.013	0.026	0.026	0.012	0.001	0.026	0.000	0.007	0.013	0.000	0.000	0.000	0.000	0.006
NMFS	1989	470	0.027	0.014	0.007	0.015	0.010	0.011	0.017	0.003	0.017	0.006	0.014	0.023	0.005	0.001	0.006	0.002	0.003	0.005	0.000	0.003
			Male Proportion-at-size (cm)																			
NMFS	1986	220	0.022	0.010	0.001	0.012	0.028	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	1989	470	0.018	0.052	0.000	0.003	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Female Proportion-at-size (cm)																			
WDFW	1986	484	0.002	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1987	542	0.007	0.006	0.000	0.002	0.000	0.004	0.000	0.000	0.000	0.002	0.002	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1988	978	0.004	0.006	0.005	0.006	0.002	0.003	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000
WDFW	1989	964	0.002	0.002	0.002	0.003	0.001	0.003	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.001
WDFW	1990	971	0.014	0.012	0.014	0.004	0.002	0.000	0.002	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1991	1017	0.004	0.001	0.001	0.002	0.003	0.001	0.002	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1992	1003	0.002	0.003	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1993		0.000	0.002	0.000	0.002	0.001	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-size (cm)																			
WDFW	1986	484	0.029	0.019	0.019	0.010	0.010	0.000	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1987	542	0.013	0.015	0.002	0.009	0.002	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1988	978	0.024	0.011	0.007	0.007	0.001	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1989	964	0.016	0.017	0.004	0.004	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1990	971	0.009	0.009	0.012	0.004	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1991	1017	0.020	0.005	0.006	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1992	1003	0.011	0.009	0.002	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
WDFW	1993		0.002	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 13. Commercial (1975-1978) and Recreational (1981-1983) fishery size composition data (cm) used in the northern (LCN) model.

Fishery	Year	Tot. No.Fish	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
			Female Proportion-at-size (cm)																					
Com	1975	146	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.002	0.001	0.003	0.003	0.007	0.007	0.011	0.021	0.021	0.033
Com	1976	483	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.006	0.010	0.019	0.015	0.023	0.023	0.039
Com	1977	262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1978	223	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.001	0.006	0.000	0.018	0.091	0.041	0.037	0.035	0.014	0.011
			Male Proportion-at-size (cm)																					
Com	1975	146	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.002	0.003	0.003	0.008	0.011	0.017	0.037	0.053	0.069	0.053
Com	1976	483	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.004	0.004	0.002	0.013	0.010	0.023	0.037	0.043
Com	1977	262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1978	223	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.022	0.006	0.011	0.028	0.001	0.000	0.000
			Female Proportion-at-size (cm)																					
Rec	1981	98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.010	0.000	0.000	0.000	0.010	0.010	0.000	0.000	0.000	0.010
Rec	1982	72	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.014	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1983	39	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.026	0.000	0.051	0.000	0.000	0.026	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-size (cm)																					
Rec	1981	98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.000	0.020	0.000	0.020	0.082	0.061	0.102	0.071	0.071	0.041	0.071	0.031	0.031	0.133
Rec	1982	72	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.000	0.014	0.014	0.000	0.014	0.069	0.069	0.097	0.097	0.111	0.083	0.014	0.069	0.042	0.069
Rec	1983	39	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.026	0.051	0.000	0.026	0.000	0.000	0.051	0.000	0.128	0.103	0.051	0.128	0.026	0.103	0.000

Fishery	Year	Tot. No.Fish	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
			Female Proportion-at-size (cm)																			
Com	1975	146	0.058	0.075	0.078	0.049	0.038	0.030	0.027	0.017	0.012	0.014	0.017	0.012	0.013	0.011	0.009	0.003	0.005	0.002	0.002	0.003
Com	1976	483	0.042	0.076	0.065	0.083	0.060	0.069	0.047	0.043	0.033	0.016	0.014	0.008	0.025	0.021	0.008	0.004	0.002	0.002	0.004	0.008
Com	1977	262	0.008	0.008	0.011	0.004	0.023	0.053	0.069	0.088	0.038	0.073	0.050	0.042	0.023	0.050	0.073	0.042	0.061	0.061	0.050	0.172
Com	1978	223	0.011	0.025	0.014	0.030	0.002	0.032	0.023	0.025	0.055	0.099	0.037	0.055	0.051	0.032	0.022	0.054	0.023	0.037	0.004	0.017
			Male Proportion-at-size (cm)																			
Com	1975	146	0.052	0.033	0.022	0.016	0.009	0.008	0.002	0.002	0.002	0.002	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Com	1976	483	0.039	0.017	0.014	0.012	0.004	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1977	262	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1978	223	0.000	0.006	0.011	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Female Proportion-at-size (cm)																			
Rec	1981	98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.010	0.000	0.000	0.000
Rec	1982	72	0.000	0.000	0.000	0.000	0.014	0.000	0.014	0.000	0.014	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1983	39	0.000	0.000	0.000	0.026	0.051	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-size (cm)																			
Rec	1981	98	0.031	0.031	0.000	0.051	0.031	0.010	0.010	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1982	72	0.014	0.028	0.028	0.000	0.000	0.028	0.000	0.014	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1983	39	0.000	0.026	0.026	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 14. Age composition of fisheries (1992-2002) and surveys (1995-2001) used in the southern (LCS) model.

Fishery	Year	Tot. No.Fish	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
			Female Proportion-at-age																			
Com	1992	289	0.000	0.138	0.289	0.091	0.041	0.041	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1993	787	0.000	0.267	0.301	0.083	0.034	0.012	0.009	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1994	538	0.000	0.088	0.241	0.135	0.041	0.047	0.017	0.005	0.023	0.001	0.011	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1995	267	0.000	0.016	0.079	0.261	0.107	0.068	0.033	0.014	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1996	302	0.000	0.028	0.226	0.138	0.097	0.104	0.019	0.005	0.004	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1997	728	0.000	0.031	0.173	0.198	0.160	0.053	0.055	0.033	0.009	0.008	0.001	0.001	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000
Com	1998	287	0.000	0.053	0.253	0.142	0.055	0.000	0.145	0.073	0.000	0.000	0.019	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2000	61	0.000	0.000	0.000	0.048	0.286	0.000	0.333	0.095	0.000	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2001	262	0.000	0.000	0.111	0.250	0.083	0.167	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2002	249	0.000	0.011	0.055	0.313	0.168	0.127	0.050	0.022	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-age																			
Com	1992	289	0.000	0.092	0.120	0.079	0.063	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1993	787	0.000	0.076	0.077	0.064	0.023	0.037	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1994	538	0.000	0.082	0.147	0.081	0.032	0.024	0.012	0.001	0.007	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1995	267	0.000	0.002	0.101	0.194	0.080	0.027	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1996	302	0.000	0.038	0.126	0.075	0.056	0.048	0.021	0.009	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1997	728	0.000	0.036	0.126	0.083	0.000	0.013	0.000	0.000	0.000	0.005	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	1998	287	0.000	0.000	0.093	0.036	0.038	0.019	0.019	0.019	0.036	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2000	61	0.000	0.000	0.000	0.048	0.095	0.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2001	262	0.000	0.000	0.056	0.083	0.194	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Com	2002	249	0.000	0.000	0.024	0.037	0.066	0.032	0.033	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Female Proportion-at-age																			
Rec	1992	49	0.000	0.000	0.020	0.061	0.020	0.082	0.000	0.041	0.041	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1993	294	0.000	0.024	0.156	0.173	0.099	0.065	0.041	0.037	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1994	196	0.000	0.010	0.107	0.133	0.117	0.082	0.051	0.046	0.015	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1995	525	0.000	0.006	0.053	0.215	0.114	0.040	0.029	0.013	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1996	545	0.002	0.007	0.110	0.110	0.180	0.101	0.040	0.020	0.013	0.004	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1997	212	0.000	0.000	0.052	0.151	0.118	0.085	0.038	0.024	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1998	70	0.000	0.000	0.014	0.114	0.214	0.086	0.100	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2000	48	0.000	0.000	0.000	0.083	0.125	0.104	0.063	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2001	396	0.000	0.000	0.000	0.040	0.114	0.149	0.093	0.056	0.043	0.028	0.008	0.005	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2002	409	0.000	0.000	0.010	0.049	0.144	0.095	0.095	0.059	0.020	0.017	0.005	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-age																			
Rec	1992	49	0.000	0.082	0.102	0.184	0.122	0.082	0.061	0.082	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1993	294	0.000	0.020	0.136	0.116	0.054	0.031	0.014	0.007	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1994	196	0.000	0.010	0.082	0.184	0.082	0.046	0.020	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1995	525	0.002	0.010	0.091	0.261	0.080	0.055	0.013	0.008	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1996	545	0.000	0.002	0.095	0.088	0.138	0.055	0.022	0.007	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1997	212	0.000	0.000	0.075	0.222	0.123	0.104	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	1998	70	0.000	0.000	0.014	0.129	0.129	0.100	0.057	0.000	0.014	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2000	48	0.000	0.000	0.000	0.104	0.167	0.146	0.083	0.042	0.042	0.021	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2001	396	0.000	0.000	0.003	0.040	0.111	0.162	0.073	0.040	0.020	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rec	2002	409	0.000	0.000	0.017	0.071	0.178	0.115	0.081	0.032	0.005	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Survey	Year	Tot. No.Fish	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
			Female Proportion-at-age																			
NMFS	1995	208	0.260	0.168	0.048	0.034	0.024	0.014	0.005	0.000	0.010	0.005	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	1998	221	0.226	0.231	0.072	0.027	0.032	0.018	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	2001	197	0.183	0.274	0.056	0.005	0.036	0.010	0.010	0.010	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
			Male Proportion-at-age																			
NMFS	1995	208	0.163	0.178	0.014	0.019	0.014	0.024	0.000	0.010	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	1998	221	0.122	0.149	0.036	0.036	0.018	0.018	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NMFS	2001	197	0.157	0.157	0.061	0.005	0.010	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000

Table 15. Fishery (2003, 2004) and NMFS trawl survey (2001, 2004) age composition data, new to the 2005 stock assessment (LCN-Top; LCS-Bottom).

Source	**Year**	**Tot.**	**Female Proportion-at age**																			
		No. Fish	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
LCN Com	2003	779	0.000	0.017	0.131	0.246	0.128	0.058	0.044	0.017	0.018	0.008	0.015	0.005	0.006	0.001	0.000	0.000	0.001	0.000	0.000	0.000
LCN Com	2004	453	0.000	0.013	0.084	0.258	0.124	0.053	0.024	0.011	0.002	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCN Rec	2003	1035	0.000	0.007	0.080	0.178	0.112	0.060	0.036	0.027	0.015	0.006	0.007	0.004	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000
LCN Rec	2004	566	0.000	0.000	0.025	0.154	0.143	0.071	0.039	0.018	0.019	0.000	0.002	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCN NMFS Survey	2001	618	0.120	0.211	0.140	0.031	0.021	0.034	0.045	0.032	0.016	0.007	0.004	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000
LCN NMFS Survey	2004	408	0.004	0.063	0.097	0.152	0.147	0.051	0.029	0.019	0.022	0.017	0.014	0.014	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000

			Male Proportion-at-age																			
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
LCN Com	2003	779	0.000	0.014	0.069	0.122	0.049	0.026	0.004	0.013	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCN Com	2004	453	0.000	0.011	0.049	0.126	0.148	0.053	0.011	0.007	0.000	0.009	0.007	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCN Rec	2003	1035	0.000	0.005	0.066	0.144	0.109	0.065	0.038	0.030	0.008	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCN Rec	2004	566	0.000	0.000	0.027	0.155	0.175	0.097	0.048	0.011	0.005	0.002	0.004	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCN NMFS Survey	2001	618	0.065	0.150	0.085	0.021	0.004	0.003	0.002	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCN NMFS Survey	2004	408	0.004	0.031	0.103	0.126	0.068	0.019	0.003	0.004	0.010	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

			Female Proportion-at age																			
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
LCS Com	2003	98	0.000	0.000	0.041	0.184	0.133	0.082	0.082	0.020	0.041	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCS Com	2004	138	0.014	0.014	0.181	0.210	0.138	0.043	0.065	0.014	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCS Rec	2003	383	0.013	0.000	0.029	0.162	0.112	0.099	0.063	0.039	0.026	0.013	0.010	0.000	0.005	0.000	0.000	0.003	0.000	0.000	0.000	0.000
LCS NMFS Survey	2001	248	0.155	0.307	0.070	0.012	0.017	0.007	0.019	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCS NMFS Survey	2004	384	0.096	0.094	0.107	0.099	0.119	0.066	0.027	0.015	0.032	0.004	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

			Male Proportion-at-age																			
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
LCS Com	2003	98	0.000	0.000	0.020	0.204	0.082	0.031	0.051	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCS Com	2004	138	0.014	0.029	0.058	0.072	0.094	0.022	0.014	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCS Rec	2003	383	0.008	0.000	0.016	0.162	0.097	0.060	0.044	0.018	0.013	0.005	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LCS NMFS Survey	2001	248	0.118	0.153	0.088	0.005	0.017	0.019	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
LCS NMFS Survey	2004	384	0.083	0.073	0.051	0.064	0.036	0.009	0.007	0.000	0.000	0.000	0.015	0.001	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 16. Lingcod length, weight, and fraction mature at age data used in the northern (LCN) model.

Males						Females					
	Length		Weight		Fraction		Length		Weight		Fraction
Age	(Cm.)	(In.)	(Kg.)	(Lbs.)	Mature	Age	(Cm.)	(In.)	(Kg.)	(Lbs.)	Mature
1	42.0	16.5	0.65	1.4	0.17	1	43.0	16.9	0.62	1.4	0.04
2	48.9	19.3	1.07	2.4	0.37	2	51.6	20.3	1.16	2.6	0.09
3	54.9	21.6	1.54	3.4	0.63	3	59.4	23.4	1.87	4.1	0.21
4	60.0	23.6	2.06	4.5	0.83	4	66.4	26.1	2.73	6.0	0.42
5	64.4	25.4	2.58	5.7	0.93	5	72.7	28.6	3.72	8.2	0.66
6	68.2	26.8	3.11	6.8	0.98	6	78.4	30.9	4.80	10.6	0.84
7	71.5	28.1	3.61	8.0	0.99	7	83.5	32.9	5.95	13.1	0.93
8	74.3	29.2	4.09	9.0	1.00	8	88.1	34.7	7.15	15.8	0.97
9	76.7	30.2	4.54	10.0	1.00	9	92.3	36.3	8.36	18.4	0.99
10	78.8	31.0	4.95	10.9	1.00	10	96.0	37.8	9.57	21.1	1.00
11	80.6	31.7	5.32	11.7	1.00	11	99.4	39.1	10.77	23.7	1.00
12	82.2	32.4	5.66	12.5	1.00	12	102.4	40.3	11.93	26.3	1.00
13	83.5	32.9	5.96	13.1	1.00	13	105.2	41.4	13.05	28.8	1.00
14	84.7	33.3	6.23	13.7	1.00	14	107.7	42.4	14.12	31.1	1.00
15	85.7	33.7	6.46	14.3	1.00	15	109.9	43.3	15.14	33.4	1.00
16	86.5	34.1	6.67	14.7	1.00	16	111.9	44.1	16.10	35.5	1.00
17	87.2	34.3	6.86	15.1	1.00	17	113.7	44.8	17.00	37.5	1.00
18	87.9	34.6	7.02	15.5	1.00	18	115.3	45.4	17.85	39.3	1.00
19	88.4	34.8	7.16	15.8	1.00	19	116.8	46.0	18.63	41.1	1.00
20	88.9	35.0	7.28	16.1	1.00	20	118.1	46.5	19.36	42.7	1.00
Growth Parameters:		Weight Parameters:		Maturity Parameters:		Growth Parameters:		Weight Parameters:		Maturity Parameters:	
Linf	91.816869	a	0.003953	Alpha	1.060	Linf	130.18329	a	0.00176	Alpha	0.994
K	0.149260	b	3.214900	Beta	2.506	K	0.104103	b	3.397800	Beta	4.323
L1	41.999173					L1	42.98222				

Table 17. Lingcod biological parameters used in the northern (LCN) model.

Parameter	Male Estimate	Female Estimate
Growth[1]		
Linf	91.817	130.183
K	0.149	0.104
L1	41.999	42.982
T_0	-3.097	-2.850
n	6274	16884
Length-Weight[2]		
a	0.003953	0.001760
b	3.214900	3.397800
R sq	0.52	0.71
n	5149	12079
Maturity[3]		
Alpha	1.060	0.994
Beta	2.506	4.323
n	15	21
Natural Mortality[4]		
M	0.32	0.18
Fecundity[5]		
a		2.82406E-04
b		3.0011

[1] Growth Model: L = Linf + (L1-Linf) * exp(K * (1-Age))

[2]Length Weight Model: W = a*L^b

[3]Maturity Model: P = 1/(1+exp(-Alpha * (Age-Beta)))

[4]Natural Mortality: Data source: Jagielo (1994); derived from an average of values using methods of Hoenig (1983), Alverson and Carney (1975), and Pauly (1980).

Table 18. Mean length, weight and fraction of lingcod mature at age used in the LCS model. Survey data only were used for ages 1-3. Survey and fishery data were used for ages 4+.

Males						Females					
	Length		Weight		Fraction		Length		Weight		Fraction
Age	(Cm.)	(In.)	(Kg.)	(Lbs.)	Mature	Age	(Cm.)	(In.)	(Kg.)	(Lbs.)	Mature
1	34.3	13.5	0.34	0.7	0.06	1	35.1	13.8	0.31	0.7	0.04
2	43.7	17.2	0.75	1.6	0.18	2	45.6	18.0	0.76	1.7	0.11
3	51.3	20.2	1.25	2.7	0.43	3	54.7	21.5	1.41	3.1	0.29
4	57.4	22.6	1.79	3.9	0.72	4	62.5	24.6	2.23	4.9	0.55
5	62.3	24.5	2.32	5.1	0.90	5	69.3	27.3	3.16	7.0	0.79
6	66.2	26.0	2.82	6.2	0.97	6	75.2	29.6	4.17	9.2	0.92
7	69.3	27.3	3.27	7.2	0.99	7	80.2	31.6	5.20	11.5	0.97
8	71.8	28.2	3.66	8.1	1.00	8	84.6	33.3	6.24	13.7	0.99
9	73.7	29.0	3.99	8.8	1.00	9	88.4	34.8	7.24	16.0	1.00
10	75.3	29.7	4.28	9.4	1.00	10	91.7	36.1	8.20	18.1	1.00
11	76.6	30.2	4.51	10.0	1.00	11	94.6	37.2	9.09	20.0	1.00
12	77.6	30.6	4.71	10.4	1.00	12	97.0	38.2	9.92	21.9	1.00
13	78.4	30.9	4.87	10.7	1.00	13	99.2	39.0	10.68	23.5	1.00
14	79.1	31.1	5.00	11.0	1.00	14	101.0	39.8	11.37	25.1	1.00
15	79.6	31.3	5.11	11.3	1.00	15	102.6	40.4	11.99	26.4	1.00
16	80.0	31.5	5.20	11.5	1.00	16	104.0	40.9	12.55	27.7	1.00
17	80.4	31.6	5.27	11.6	1.00	17	105.2	41.4	13.04	28.8	1.00
18	80.6	31.7	5.32	11.7	1.00	18	106.2	41.8	13.48	29.7	1.00
19	80.8	31.8	5.37	11.8	1.00	19	107.1	42.2	13.87	30.6	1.00
20	81.0	31.9	5.40	11.9	1.00	20	107.9	42.5	14.22	31.3	1.00
Growth Parameters:		Weight Parameters:		Maturity Parameters:		Growth Parameters:		Weight Parameters:		Maturity Parameters:	
Linf	81.693959	a	0.003953	Alpha	1.240	Linf	112.81069	a	0.00176	Alpha	1.129
K	0.223233	b	3.214900	Beta	3.233	K	0.144902	b	3.397800	Beta	3.814
L1	34.252704					L1	35.113463				

Table 19. Lingcod biological parameters used in the southern (LCS) model.

Parameter	Male Estimate	Female Estimate
Growth[1]		
Linf	81.694	112.811
K	0.223	0.145
L1	34.253	35.113
T_0	-1.435	-1.573
n	986	1780
Length-Weight[2]		
a	0.003953	0.001760
b	3.214900	3.397800
R sq	0.52	0.71
n	5149	12079
Maturity[3]		
Alpha	1.240	1.129
Beta	3.233	3.814
R sq	0.989	0.994
Natural Mortality[4]		
M	0.32	0.18
Fecundity[5]		
a		2.82406E-04
b		3.0011

[1] Growth Model: L = Linf + (L1-Linf) * exp(K * (1-Age))

[2] Length Weight Model: $W = a*L^b$

[3] Maturity Model: P = 1/(1+exp(-Alpha * (Age-Beta)))

[4] Natural Mortality: Data source: Jagielo (1994); derived from an average of values using methods of Hoenig (1983), Alverson and Carney (1975), and Pauly (1980).

Table 20. NMFS trawl survey lingcod biomass estimates by INPFC area for combined depth strata. Note: The shallow depth strata was 50-100 fm. in 1977, and 30-100 fm. for all other years.

NMFS Trawl Survey lingcod biomass (mt) estimates for combined depth strata by INPFC

Standard analysis which includes all good perfromance hauls.

Year	Conception	Monterey	Eureka	Columbia	US Vancouver	Monterey + Eureka	CV	Columbia +US Vancouver	CV
1977	69	1,800	274	12,648	2,277	2,074	0.32	14,925	0.77
1980		671	431	8,699	1,281	1,102	0.29	9,979	0.65
1983		1,467	494	4,026	1,805	1,962	0.33	5,831	0.15
1986		611	316	1,828	988	926	0.21	2,816	0.12
1989	54	2,107	473	3,649	1,863	2,580	0.20	5,512	0.29
1992	27	484	148	3,071	1,069	632	0.24	4,140	0.49
1995	42	703	179	1,320	552	881	0.28	1,872	0.16
1998	34	651	219	2,002	1,018	871	0.27	3,020	0.26
2001	85	693	654	3,903	1,324	1,347	0.12	5,227	0.27

Including all good perfrmance hauls, but excluding tows identified as "water hauls"

Year	Conception	Monterey	Eureka	Columbia	US Vancouver	Monterey + Eureka	CV	Columbia +US Vancouver	CV
1977	74	2,368	624	12,773	2,270	2,993	0.14	15,043	0.77
1980		929	608	3,219	1,361	1,537	0.31	4,580	0.31
1983		1,523	556	4,306	1,962	2,079	0.33	6,268	0.16
1986		611	315	1,860	951	926	0.21	2,812	0.12
1989	54	2,168	540	3,933	1,922	2,708	0.20	5,856	0.30
1992	32	476	154	3,071	1,084	630	0.25	4,155	0.49
1995	46	703	199	1,329	555	901	0.27	1,884	0.16
1998	34	651	219	2,002	1,018	871	0.27	3,020	0.26
2001	85	693	654	3,903	1,324	1,347	0.12	5,227	0.27

Difference in estimated biomass (mt) by including and excluding "water hauls"

Year	Conception	Monterey	Eureka	Columbia	US Vancouver	Monterey + Eureka	Columbia +US Vancouver
1977	5	569	350	125	-7	919	118
1980	0	258	177	-5,480	81	435	-5,399
1983	0	55	61	280	157	117	437
1986	0	0	-1	33	-37	-1	-4
1989	1	61	67	284	60	128	344
1992	6	-8	6	0	15	-2	15
1995	3	0	20	9	3	20	12
1998	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0

Table 21. NMFS trawl survey lingcod biomass estimates by INPFC area for the 2004 Triennial Shelf Survey. (Source: Mark Wilkins, AFSC, July 2005).

INPFC Area	Depth Stratum	Biomass (mt)	CV (Biomass)
US Vancouver			
	55-183 m	2665	0.36
	184-366 m	450	0.73
	367-500 m	0	
	55-366 m	3115	0.32
	55-500 m	3115	0.32
Columbia			
	55-183 m	6793	0.42
	184-366 m	1458	0.74
	367-500 m	0	
	55-366 m	8251	0.37
	55-500 m	8251	0.37
North (LCN) Total		11366	0.35
Eureka			
	55-183 m	622	0.34
	184-366 m	802	0.49
	367-500 m	0	
	55-366 m	1424	0.31
	55-500 m	1424	0.31
Monterey			
	55-183 m	1628	0.33
	184-366 m	535	0.34
	367-500 m	129	0.68
	55-366 m	2163	0.27
	55-500 m	2292	0.25
Conception			
	55-183 m	40	0.34
	184-366 m	118	0.49
	367-500 m	0	
	55-366 m	159	0.37
	55-500 m	159	0.37
South (LCS) Total		3746	0.32

Table 22. WDFW Cape Flattery tag survey index used in the northern (LCN) assessment. Estimates for the years 1986-1992 were obtained from Jagielo (1995).

Year	Number of Fish	Standard Deviation
1986	119700	18800
1987	208500	31800
1988	165400	19000
1989	149000	13500
1990	123800	10300
1991	114400	9500
1992	127300	11000

Table 23. Number of logbook tows used to develop trawl logbook CPUE indices in southern and northern waters.

Total number of logbook tows by PMFC Area

Year	1A	1B	1C	2A	2B	2C	2C	3A	3B	3C
1976	0	0	0	673	2783	1433	1433	3966	0	0
1977	0	0	0	447	1290	1747	1747	2051	0	0
1978	2048	9495	8702	985	1951	1638	1638	3142	0	0
1979	2472	10552	12756	1764	3007	1981	1981	5583	0	0
1980	2036	8895	7958	1137	1101	1048	1048	4479	0	0
1981	5566	19492	16002	3701	3806	1396	1396	5270	0	0
1982	2412	10345	7970	2845	5267	4503	4503	8446	0	0
1983	1494	9416	7465	2330	5324	1195	1195	4912	0	0
1984	1683	6883	7629	1657	2320	1927	1927	5644	0	0
1985	2699	8366	7142	1140	2784	2928	2928	3606	0	0
1986	2865	9941	5151	770	1432	2053	2053	5520	4338	3816
1987	3030	6630	5070	1415	5016	2765	2765	10821	3520	3287
1988	3182	6847	6209	1456	5117	7490	3751	11027	4607	4077
1989	4338	8000	5777	1431	5232	12348	6183	12492	5711	5352
1990	3622	6483	5601	1504	4786	10598	5319	9211	4491	5759
1991	3296	8931	5197	1736	6713	14917	7504	12067	5630	6460
1992	3393	10158	4210	1487	5468	14288	7190	10485	4936	5905
1993	2450	9936	4205	1827	5674	8702	8702	8491	4797	5711
1994	2662	8995	3940	1531	3888	7176	7176	7130	3674	4951
1995	2721	8688	4986	1372	3699	9378	4696	7205	3825	3230
1996	2697	9568	4968	1424	3320	9388	4699	8199	3605	2643
1997	1867	8000	4763	1717	3550	9194	4603	5706	2072	2271
1998	2673	5792	3776	2184	3228	7516	3759	4236	2066	2262
1999	3403	5258	4064	1637	2712	6026	3014	4341	1809	1841
2000	1702	3692	3278	728	2095	5423	2716	4451	2045	1638
2001	2261	3090	3078	1161	2140	6376	3195	3574	2072	1935
2002	3310	4640	3114	726	1278	4345	2176	3337	2560	1577
	69,882	208,093	153,011	39,665	90,908	154,599	96,117	169,375	61,758	62,715

Table 24. Summary of estimated Delta GLM logbook index results in the northern region, indicating: 1) sample size (# of tows), 2) the percentage of tows with lingcod present (2003 index % positive), and 3) the computed index values used in the 2003 LCN stock assessment model. The logbook index values used in the 2000 assessment are provided for comparison.

Northern Area Trawl Logbook Index

	2000 Index	2003 Index		
Year	Index Value	# of Tows	% Positive	Index Value
1976		9,615	62%	20.33
1977		6,835	52%	16.16
1978		8,369	54%	10.79
1979		12,552	58%	11.37
1980		7,676	64%	11.32
1981		11,868	63%	13.33
1982		22,719	50%	9.29
1983	335.9	12,626	51%	9.32
1984	218.3	11,818	44%	6.99
1985	296.7	12,246	36%	6.26
1986	271.6	19,212	23%	3.58
1987	287.0	28,174	31%	4.24
1988	218.1	39,808	27%	4.56
1989	201.2	53,483	25%	5.45
1990	201.1	45,443	23%	4.36
1991	157.4	60,704	22%	3.94
1992	153.8	55,370	19%	2.23
1993	102.9	42,077	28%	2.74
1994	157.6	33,995	28%	2.82
1995	40.6	36,715	21%	2.47
1996	127.3	36,543	22%	2.54
1997	123.0	31,987	21%	2.36

Table 25. Summary of estimated Delta GLM logbook index results in the southern region, indicating: 1) sample size (# of tows), 2) the percentage of tows with lingcod present (2003 index % positive), and 3) the computed index values used in the 2003 LCS stock assessment model. The logbook index values used in the 2000 assessment are provided for comparison.

Southern Area Trawl Logbook Index

	2000 Index	2003 Index		
Year	Index Value	# of Tows	% Positive	Index Value
1978	44.51	21,230	34%	5.80
1979	49.23	27,544	47%	11.75
1980	45.79	20,026	47%	9.57
1981	49.65	44,761	46%	7.29
1982	45.62	23,572	47%	7.37
1983	29.16	20,705	43%	8.88
1984	25.46	17,852	39%	7.56
1985	15.53	19,347	31%	3.56
1986	17.41	18,727	24%	3.10
1987	27.25	16,145	33%	5.42
1988	26.32	17,694	31%	5.63
1989	28.99	19,546	32%	7.30
1990	29.97	17,210	28%	6.18
1991	22.27	19,160	31%	3.75
1992	18.58	19,248	27%	3.12
1993	20.51	18,418	28%	3.84
1994	21.56	17,128	25%	3.63
1995	20.35	17,767	25%	3.87
1996	16.65	18,657	26%	3.12
1997	18.81	16,347	28%	3.30

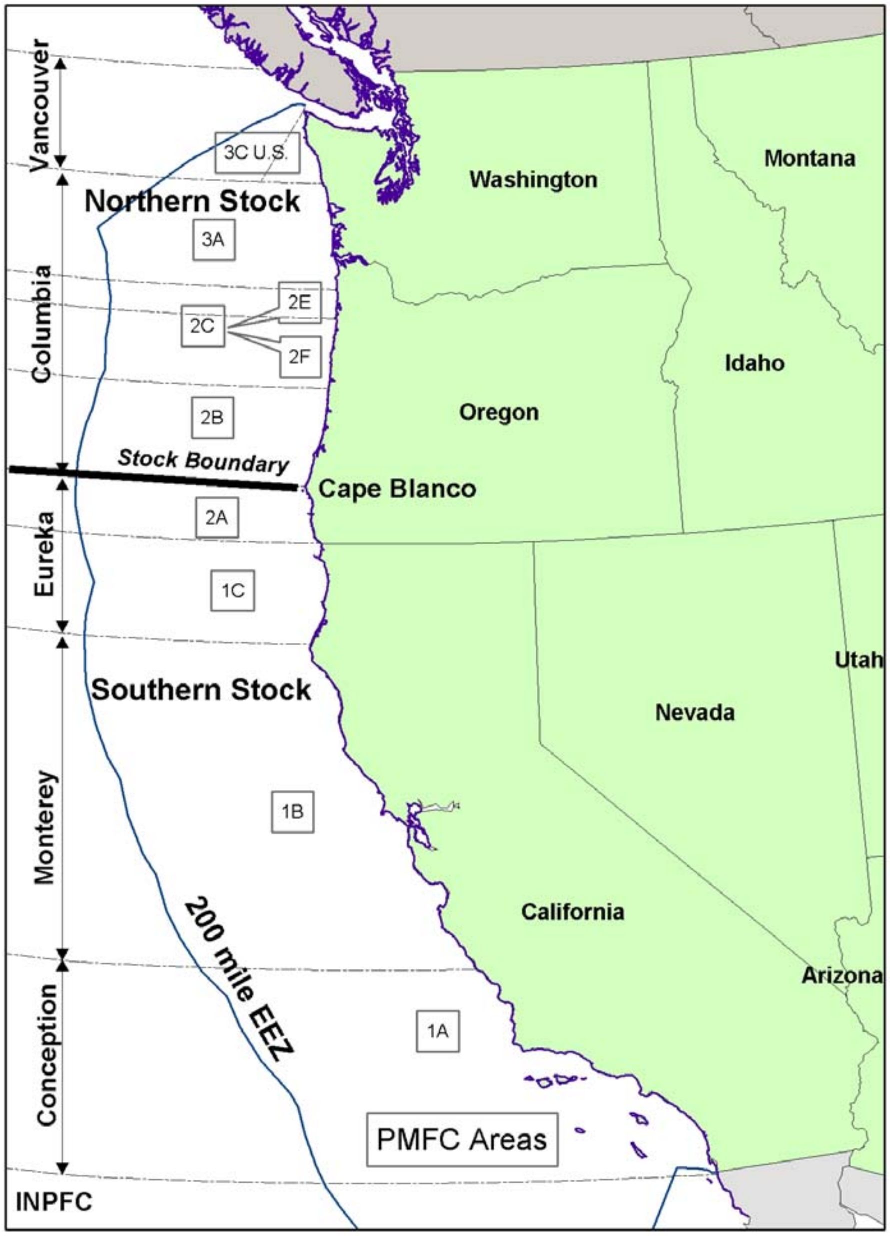


Figure 1. Lingcod stock boundaries and location of PMFC and INPFC Areas.

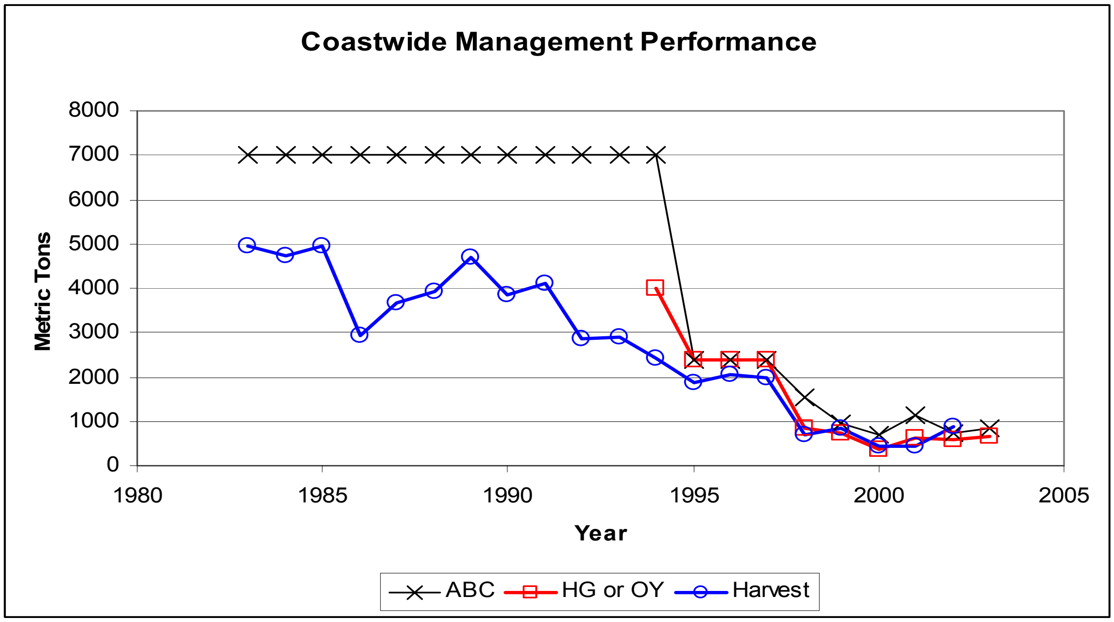


Figure 2. Comparison of lingcod ABC, OY and landings (mt).

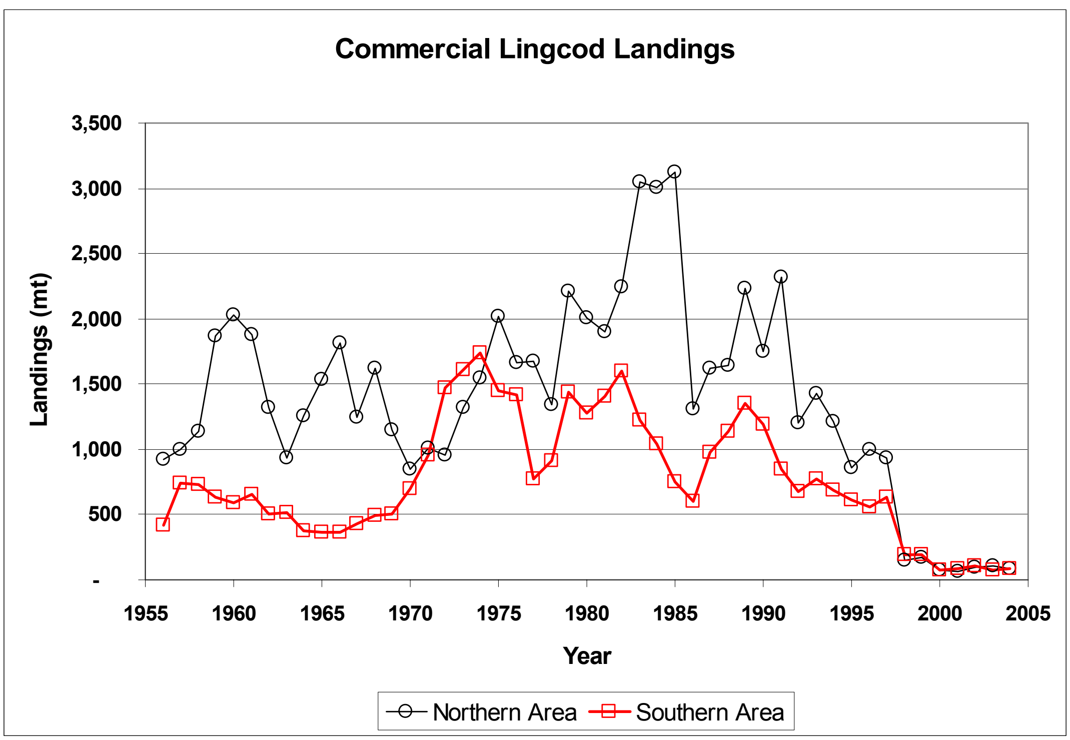


Figure 3. Comparison of commercial lingcod landings in the northern (U.S. Vancouver and Columbia) and southern (Eureka, Monterey and conception) areas.

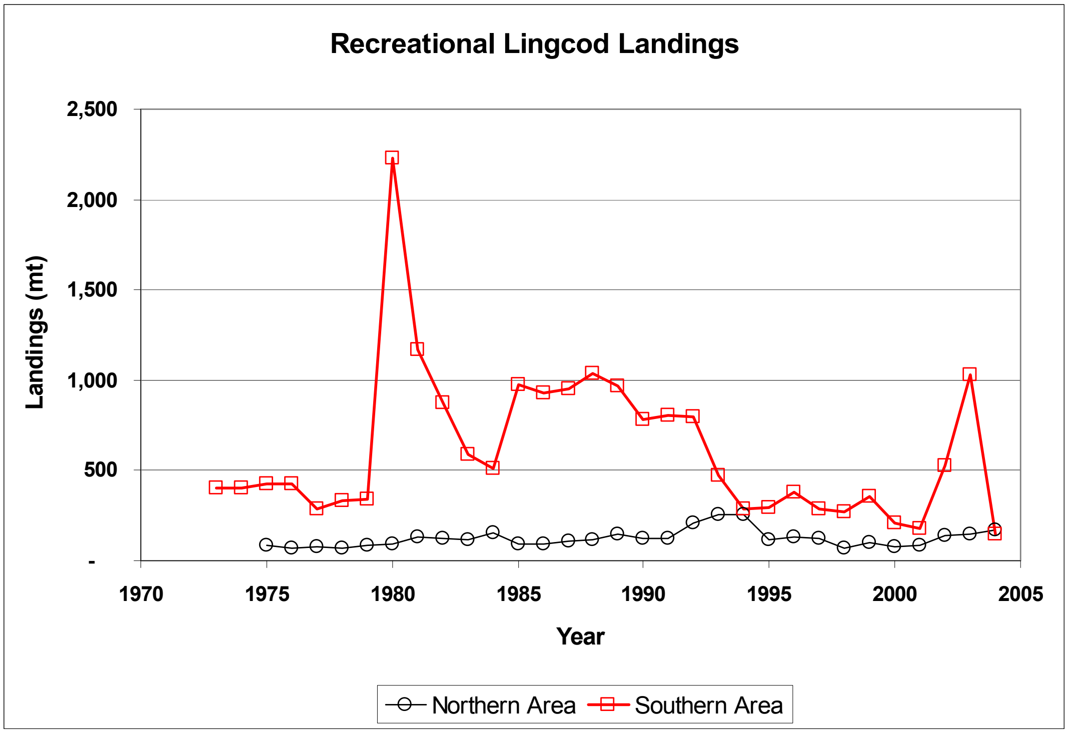


Figure 4. Comparison of recreational lingcod landings in the northern (U.S. Vancouver and Columbia) and southern (Eureka, Monterey and conception) areas.

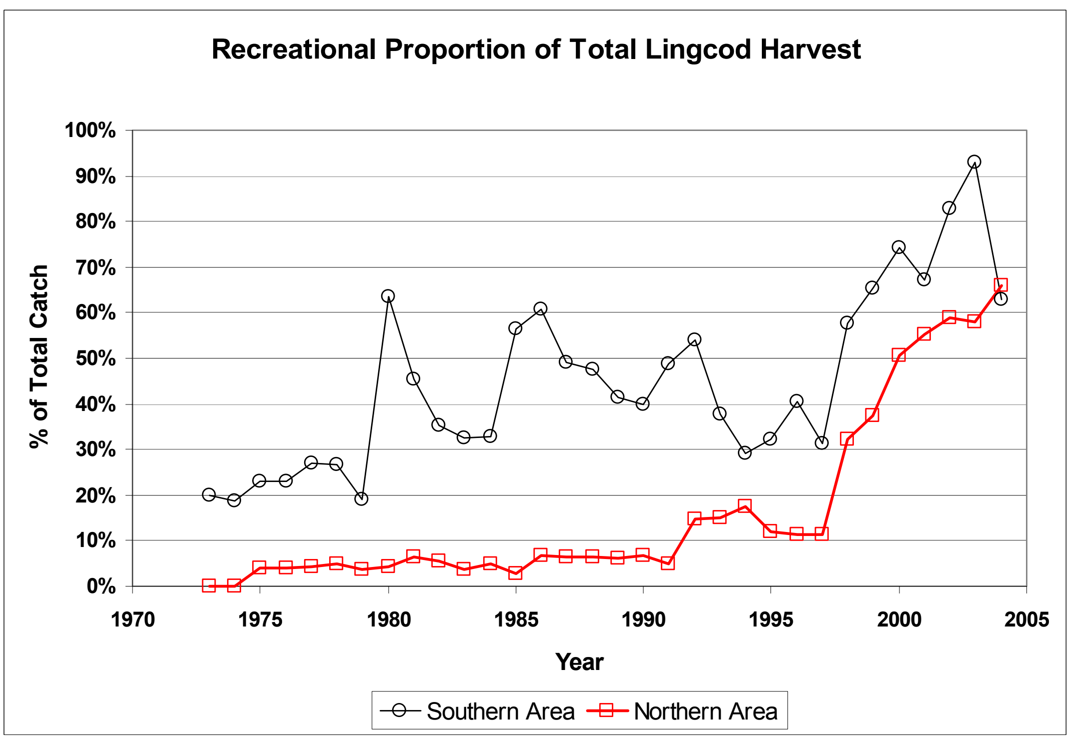


Figure 5. Recreational proportion of total lingcod harvest in the southern (Eureka, Monterey and Conception) and northern (Columbia and U.S. Vancouver) areas.

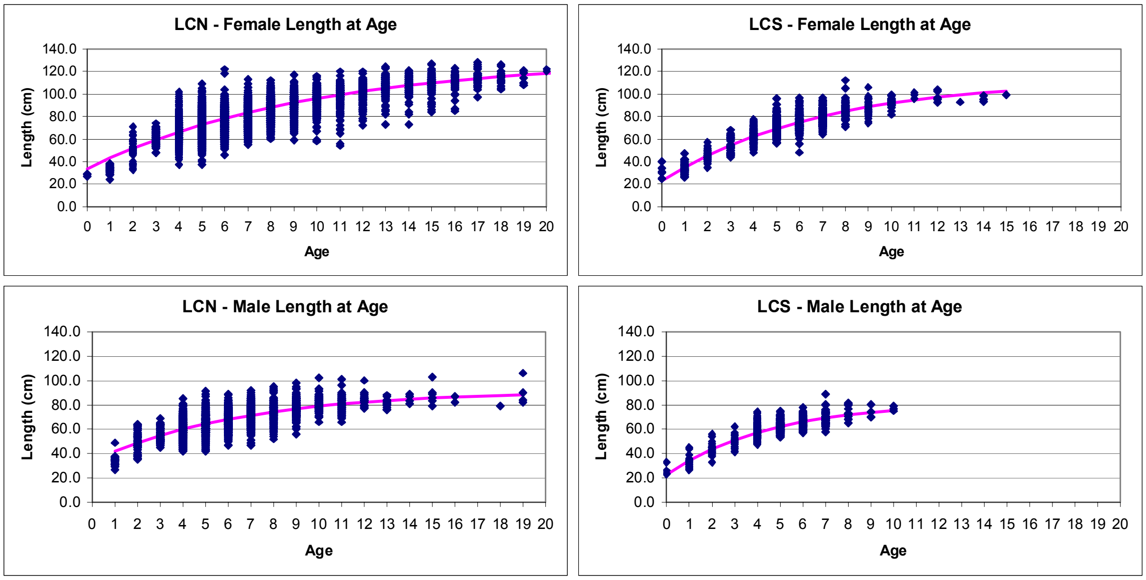


Figure 6. Length-at-age data fit to the von Bertalanffy growth model for the northern (LCN) and southern (LCS) areas. Survey data only were used for ages 1-3. Both survey and fishery data were used for ages 4+.

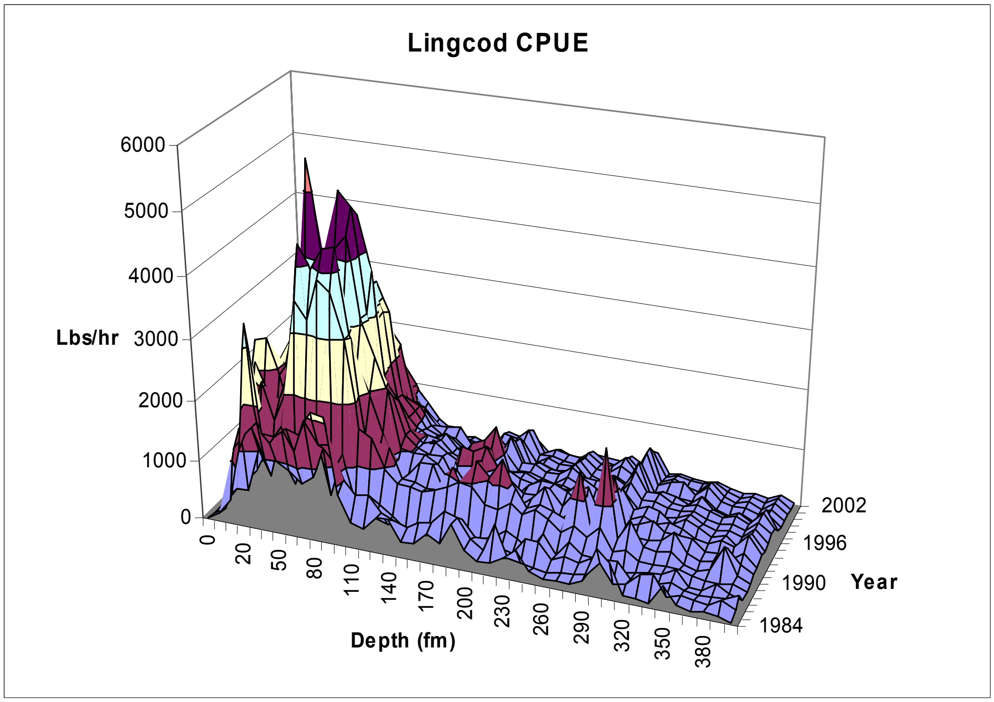


Figure 7. Mean lingcod CPUE calculated from raw data for all tows with a recorded depth.

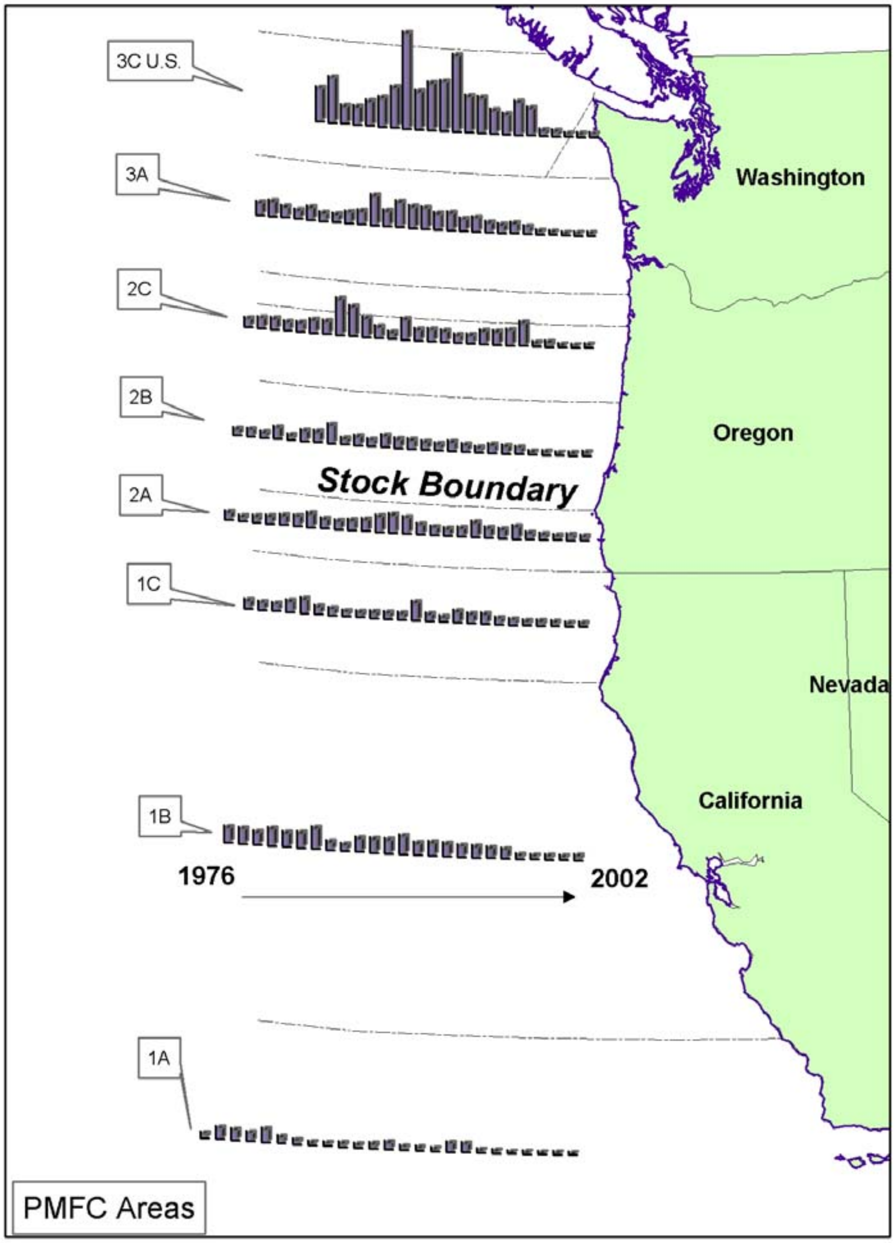


Figure 8. Time series (1976-2002) of observed lingcod trawl logbook CPUE (lbs/hr) by PMFC Area.

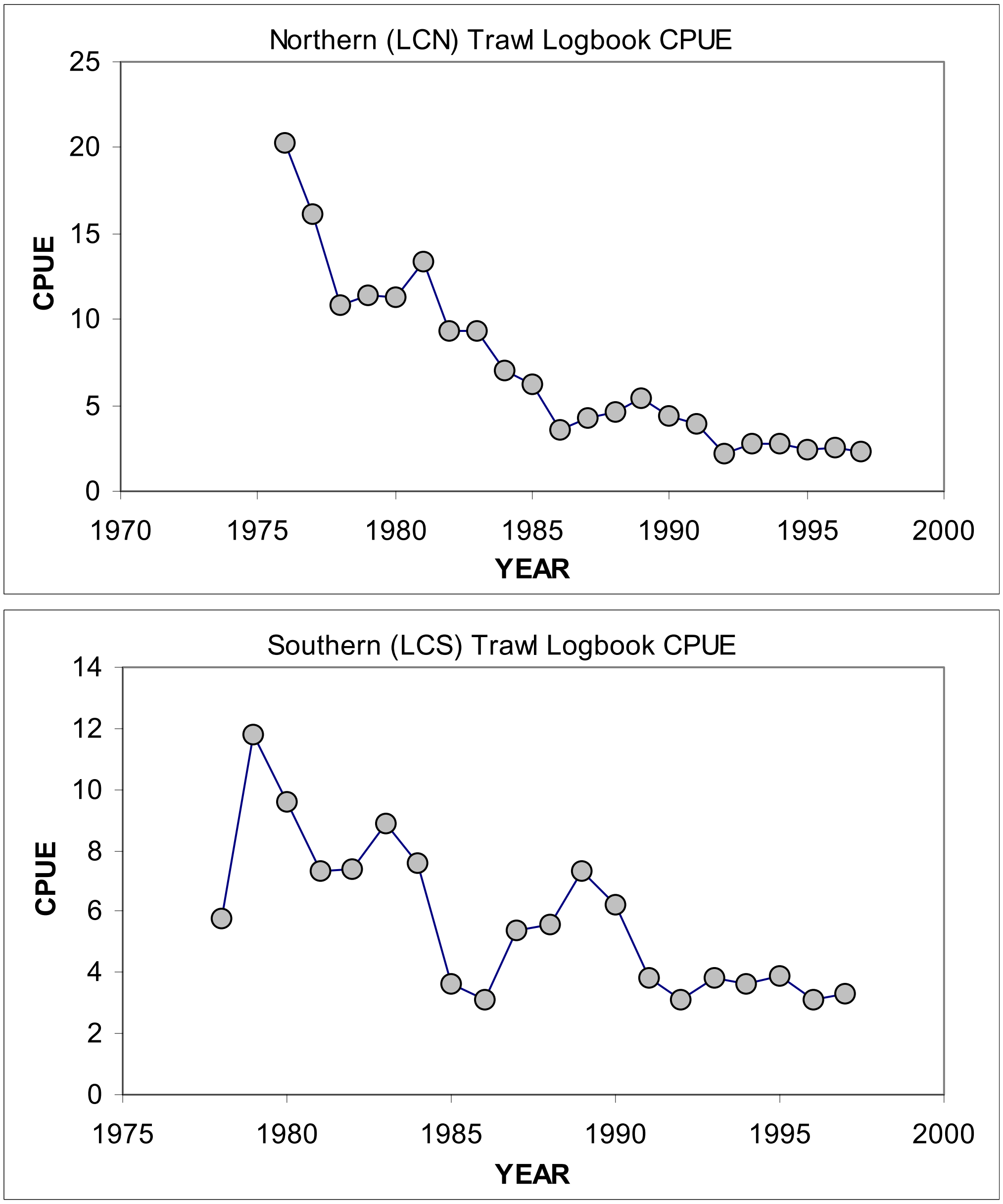


Figure 9. Trawl logbook CPUE indices for the northern (LCN) and southern (LCS) areas.

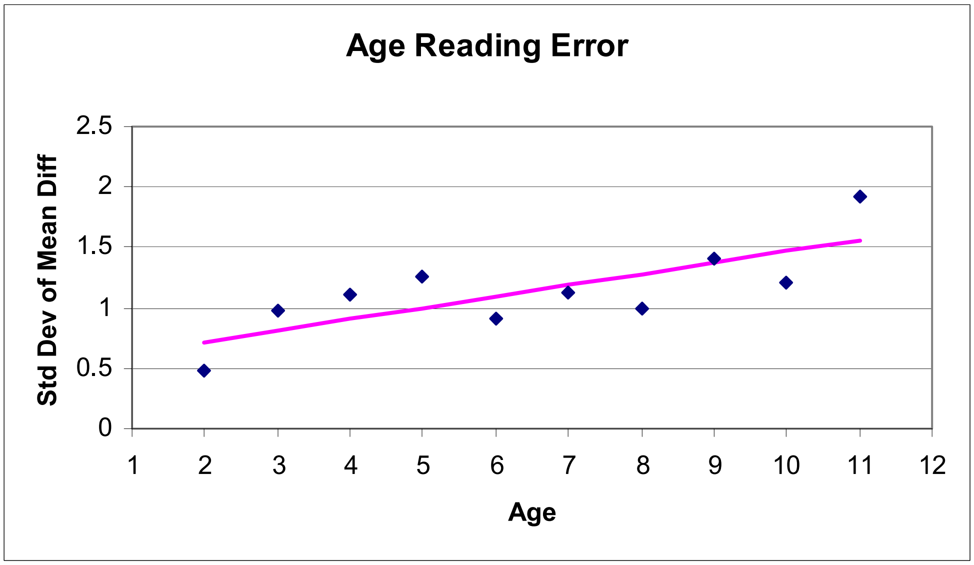


Figure 10. Between-reader (within-lab) estimates of WDFW age reading error variability.

Appendix I. Northern Area (LCN) Base Model Output.

Assessment of Lingcod for the Pacific Fishery Management Council in 2005

Table 1. Negative log likelihood and lambda (likelihood weighting factor) values for the northern area (LCN) base model.

Component	-Log(L)	Lambda
Total Likelihood	**648.58**	
Indices	**22.26**	
Trawl Logbook	14.89	1
NMFS Trawl Survey	7.37	1
WDFW Tagging Survey	0.00	0
Length_comps	**252.14**	
Commercial Fishery	40.57	1
Recreational	22.91	1
NMFS Trawl Survey	96.54	1
WDFW Tagging Survey	92.13	1
Age_comps	**365.35**	
Commercial Fishery	175.10	1
Recreational	112.36	1
NMFS Trawl Survey	20.88	1
WDFW Tagging Survey	57.02	1
Equil_catch	**0.00**	1
Recruitment	**8.73**	1
Parm_priors	**0.02**	1
Parm_devs	**0.00**	1
Penalties	**0.00**	0
Forecast_Recruitment	**0.08**	

Table 2. Parameters used in the northern area (LCN) base model; mortality-growth and biology.

Parameter Name	Value	Min	Max	Active_Cnt	Bound
M-G_parms					
Females					
M-Young	0.18				
M-Old	0				
Lmin	43				
Lmax	118				
VBK	0.1041				
CV-Young	0.0633				
CV-Old	0.28857				
Males					
M-Young	0.5754				
M-Old	0				
Lmin	-0.0231				
Lmax	-0.2842				
VBK	0.3603				
CV-Young	-0.2379				
CV-Old	0.5324				
biology_parms					
Females					
Wt-Len a	0.5754				
Wt-Len b	0.0000				
Mat-Len 1	-0.0231				
Mat-Len 2	-0.2842				
Males					
Wt-Len a	3.95E-06				
Wt-Len b	3.2149				

Table 3. Parameters used in the northern area (LCN) base model; spawner-recruit, recruitment deviations, and initial F.

Parameter Name		Value	Min	Max	Active_Cnt	Bound
SR_parms						
LN(R0)		8.22947	1	100	1	0
H		0.9				
SD-r		1				
Init_R_Mult		0				
Recr_Devs						
	1972	0.404478			2	0
	1973	-0.649724			3	0
	1974	0.183462			4	0
	1975	-0.395553			5	0
	1976	-0.527238			6	0
	1977	0.032428			7	0
	1978	0.101296			8	0
	1979	1.08686			9	0
	1980	-0.366912			10	0
	1981	-0.839416			11	0
	1982	-0.423642			12	0
	1983	-0.56783			13	0
	1984	-0.101602			14	0
	1985	-0.510362			15	0
	1986	0.190429			16	0
	1987	-2.01354			17	0
	1988	-0.752335			18	0
	1989	-0.250904			19	0
	1990	-0.401023			20	0
	1991	0.265252			21	0
	1992	0.392935			22	0
	1993	-0.502319			23	0
	1994	0.751929			24	0
	1995	0.685574			25	0
	1996	-0.096639			26	0
	1997	-0.137624			27	0
	1998	0.85178			28	0
	1999	1.7572			29	0
	2000	1.83304			30	0
init_F_parms						
Com		0.003945	0	1	31	0
Rec		0.000697	0	1	32	0

Table 4. Parameters used in the northern area (LCN) base model; selectivity.

Parameter Name	Value	Min	Max	Active_Cnt	Bound
sel_parms					
Com-Fem					
age@peak	5				
sel@minA	0				
asc_infl (logit)	0.737617	-10	10	33	0
asc_slope	4.19387	0.1	20	34	0
sel@maxA (logit)	-10.5291	-20	30	35	0
desc_infl (logit)	-1.06958	-10	10	36	0
desc_slope	1.25993	-10	2	37	0
width_of_top	1.5				
Com-Male					
Age_@transition	5				
MinL Offset	0	0	0	0	0
M1 Offset	-0.499987	-10	30	38	0
MaxL Offset	-6.46127	-10	10	39	0
Rec-Fem					
age@peak	5				
sel@minA	0				
asc_infl (logit)	0.572743	-10	10	40	0
asc_slope	9.4277	0	20	41	0
sel@maxA (logit)	-10.2262	-20	30	42	0
desc_infl (logit)	-2.41048	-10	10	43	0
desc_slope	0.213336	0	2	44	0
width_of_top	1.5				
Rec-Male					
Age_@transition	5				
MinL Offset	0	0	0	0	0
M1 Offset	1.06322	-10	30	45	0
MaxL Offset	0	0	0	0	0
NMFS-Female					
age@peak	3				
sel@minA	0.149				
asc_infl (logit)	4.62712	-10	10	46	0
asc_slope	0.161997	0	30	47	0
sel@maxA (logit)	-3.2613	-15	30	48	0
desc_infl (logit)	-1.32554	-10	10	49	0
desc_slope	9.89498	0	20	50	0
width_of_top	1				
NMFS-Male					
Age_@transition	3				
MinL Offset	0	0	0	0	0
M1 Offset	-0.030891	-10	0	51	0
MaxL Offset	0	0	0	0	0
WDFW-Female					
age@peak	3				
sel@minA	0				
asc_infl (logit)	-2.50203	-10	10	52	0
asc_slope	6.25441	-10	10	53	0
sel@maxA (logit)	-8.28019	-20	30	54	0
desc_infl (logit)	-2.5929	-10	10	55	0
desc_slope	0.680645	0	10	56	0
width_of_top	1				
WDFW-Male					
Age_@transition	3				
MinL Offset	0				
M1 Offset	2.26672				
MaxL Offset	0				

Figure 1. SS2 output for the northern area (LCN) base model; From the top: recruitment, female spawning biomass, total biomass, and spawner-recruit relationship. Triangular symbols are present assessment estimates; square symbols are 2003 assessment estimates.

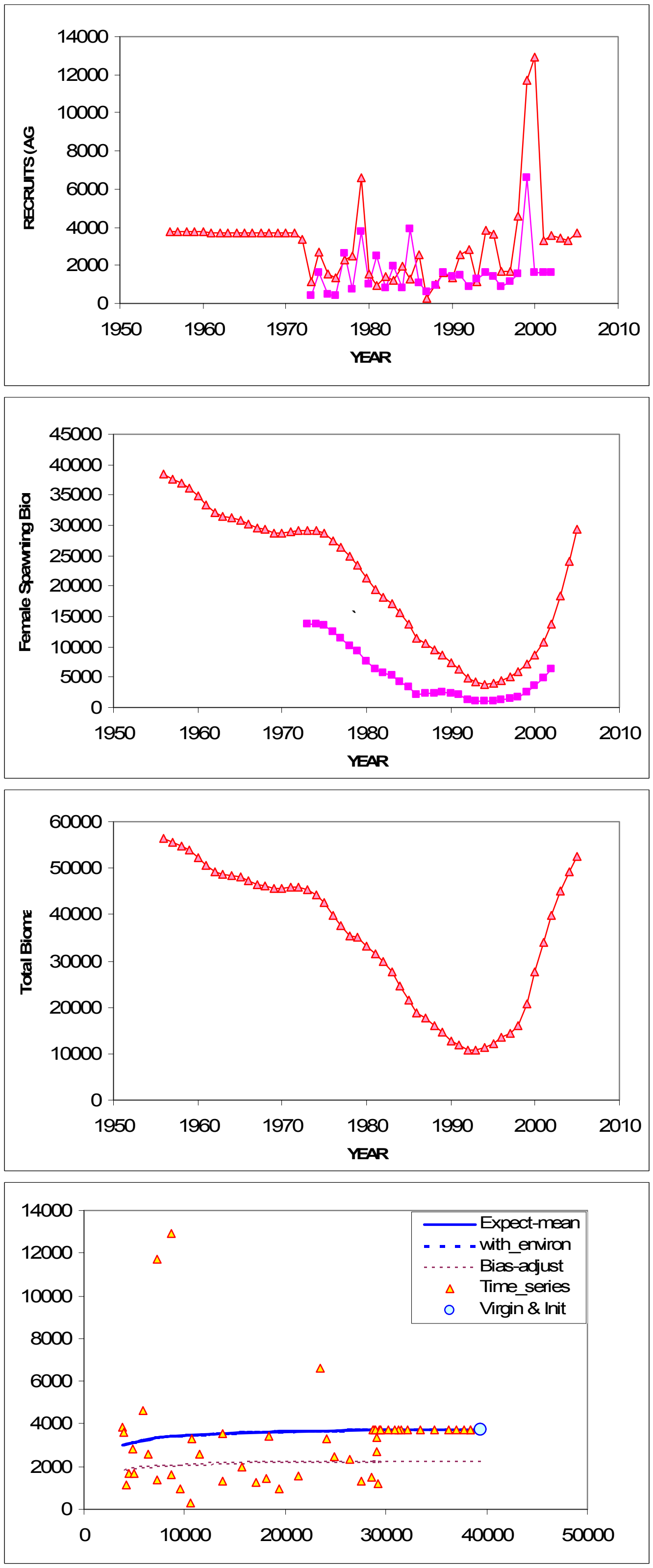


Figure 2. SS2 output for the northern area (LCN) base model: Model fits to indices of abundance; Top: trawl logbook, Bottom: NMFS trawl survey.

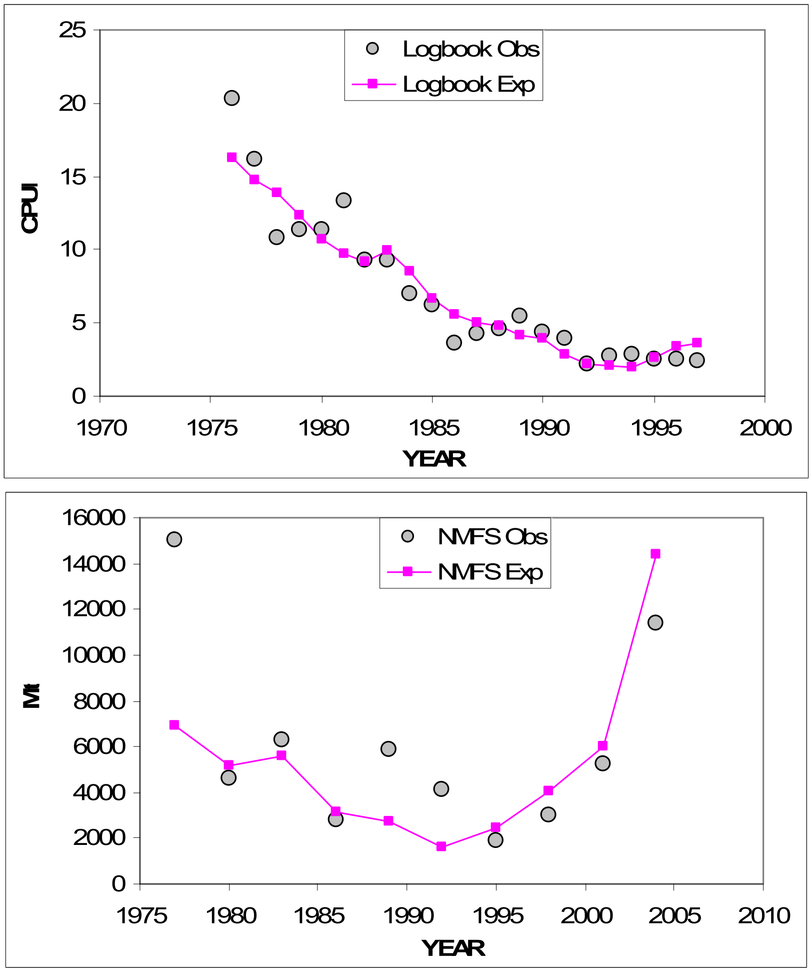


Figure 3. SS2 output for the northern area (LCN) base model: Estimated selectivity for the commercial fishery, recreational fishery, NMFS trawl survey, and WDFW tagging survey.

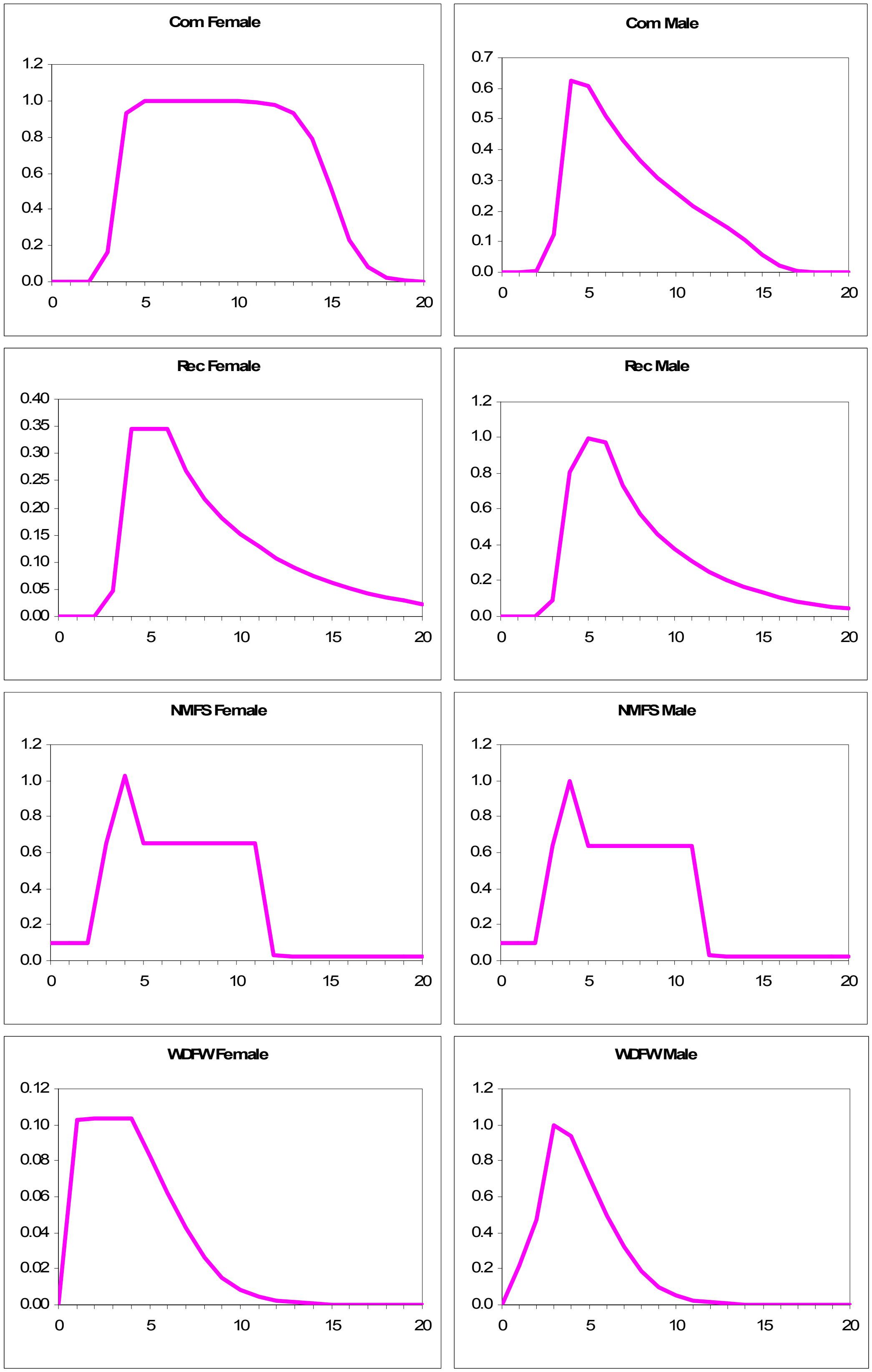
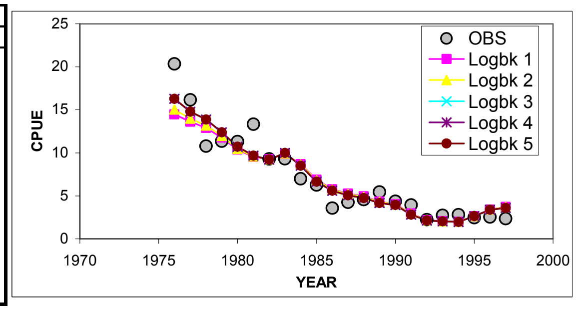
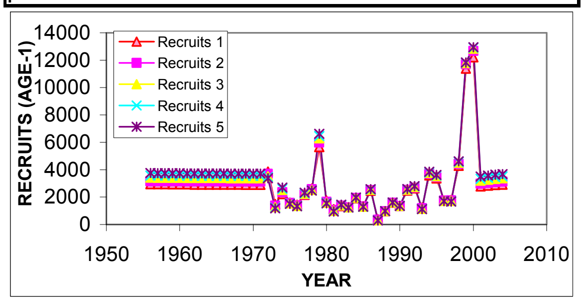
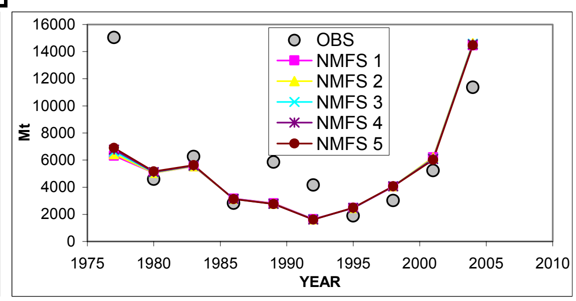


Figure 4. SS2 output for the northern area (LCN) base model: Profile of the base model over the standard deviation of recruitment. Clockwise from top left: negative log likelihood values, trawl logbook index, NMFS trawl survey, female spawning biomass, recruitment.

SD-r	0.7	0.8	0.9	0.95	1.0
Component	Run 1	Run 2	Run 3	Run 4	Run 5
total	668.2	660.6	654.2	651.3	648.7
indices	23.4	23.0	22.6	22.5	22.3
discard	0.000	0.000	0.000	0.000	0.000
mean_body_wt	0.000	0.000	0.000	0.000	0.000
length_comps	259.5	256.7	254.2	253.1	252.1
age_comps	370.5	368.6	367.1	366.3	365.5
size-age	0.000	0.000	0.000	0.000	0.000
Equil_catch	0.000	0.000	0.000	0.000	0.000
Recruitment	14.891	12.238	10.245	9.448	8.752
Parm_priors	0.017	0.017	0.018	0.019	0.019
Parm_devs	0.000	0.000	0.000	0.000	0.000
penalties	0.000	0.000	0.000	0.000	0.000







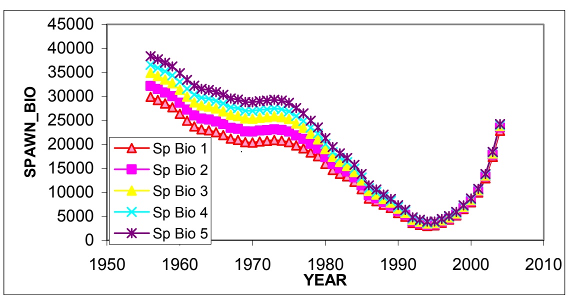
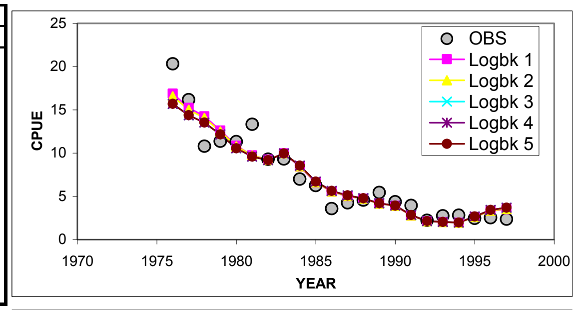
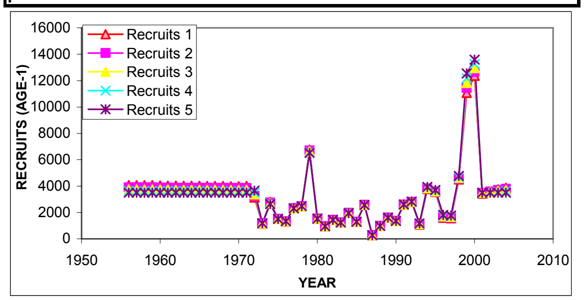
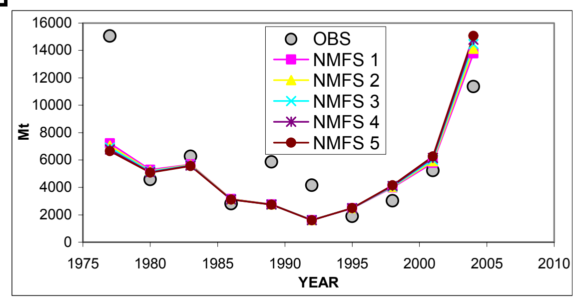


Figure 5. SS2 output for the northern area (LCN) base model: Profile over Beveton-Holt spawner-recruit steepness (*h*). Clockwise from top left: negative log likelihood values, trawl logbook index, NMFS trawl survey, female spawning biomass, recruitment.

H	0.8	0.85	0.9	0.95	1.0
Component	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**
total	646.6	647.6	648.7	649.8	651.0
indices	21.6	21.9	22.3	22.7	23.2
discard	0.000	0.000	0.000	0.000	0.000
mean_body_wt	0.000	0.000	0.000	0.000	0.000
length_comps	251.0	251.6	252.1	252.7	253.2
age_comps	364.8	365.1	365.5	365.8	366.0
size-age	0.000	0.000	0.000	0.000	0.000
Equil_catch	0.000	0.000	0.000	0.000	0.000
Recruitment	9.183	8.937	8.752	8.625	8.554
Parm_priors	0.020	0.019	0.019	0.019	0.018
Parm_devs	0.000	0.000	0.000	0.000	0.000
penalties	0.000	0.000	0.000	0.000	0.000







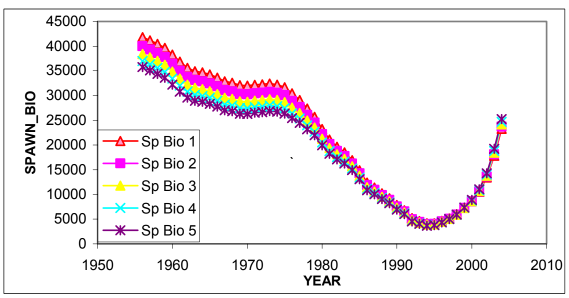
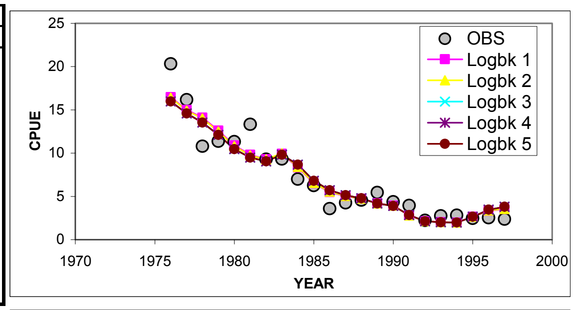
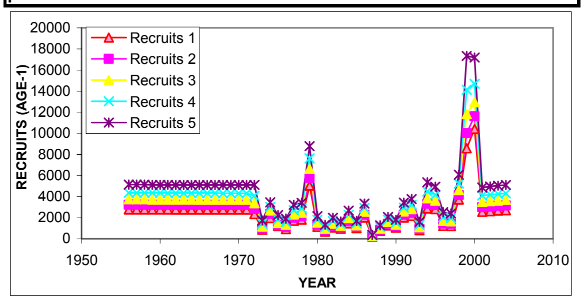
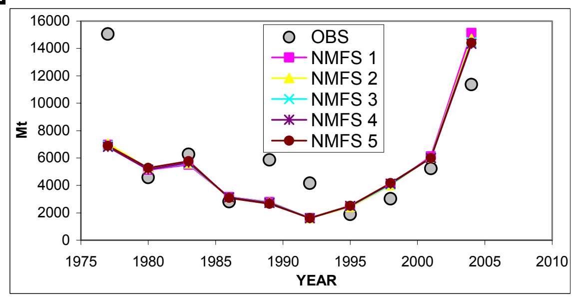


Figure 6. SS2 output for the northern area (LCN) base model: Profile over natural mortality (M). Clockwise from top left: negative log likelihood values, trawl logbook index, NMFS trawl survey, female spawning biomass, recruitment.

M (Fem/Male)	.14/.26	.16/.29	.18/.32	.20/.35	.22/.38
Component	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**
total	647.4	647.4	648.7	651.1	654.9
indices	21.6	21.8	22.3	23.0	23.9
discard	0.000	0.000	0.000	0.000	0.000
mean_body_wt	0.000	0.000	0.000	0.000	0.000
length_comps	250.5	251.3	252.1	253.7	255.9
age_comps	366.2	365.5	365.5	365.8	366.4
size-age	0.000	0.000	0.000	0.000	0.000
Equil_catch	0.000	0.000	0.000	0.000	0.000
Recruitment	9.006	8.901	8.752	8.638	8.639
Parm_priors	0.026	0.023	0.019	0.014	0.016
Parm_devs	0.000	0.000	0.000	0.000	0.000
penalties	0.000	0.000	0.000	0.000	0.000







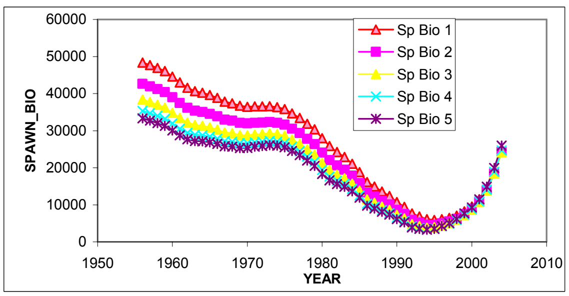
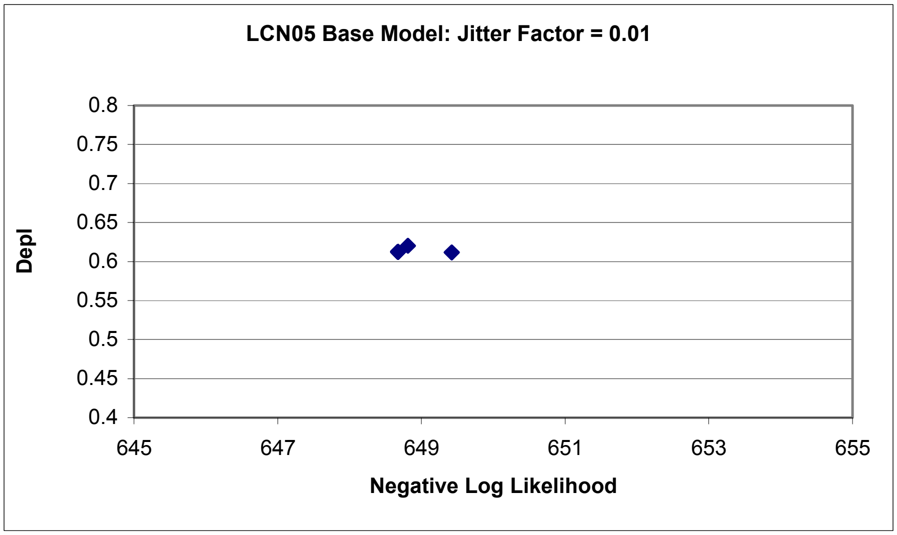
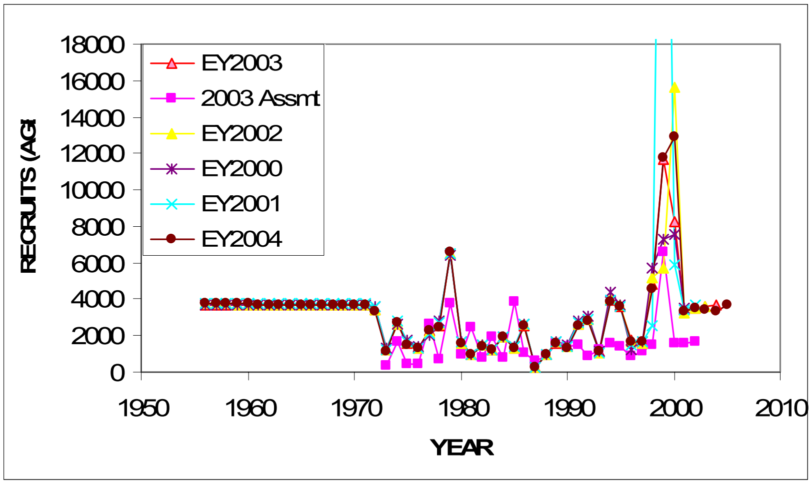


Figure 6a. SS2 output for the northern area (LCN) base model: Model stability test; Results of 30 base-model runs with SS2 jitter factor = 0.01.



Run Number	-Log Likelihood	Depletion
1	648.675	0.612608302
2	648.675	0.612608302
3	648.675	0.612608302
4	648.675	0.612608302
5	648.675	0.612608302
6	648.675	0.612608302
7	648.675	0.612608302
8	648.675	0.612608302
9	648.675	0.612608302
10	648.675	0.612608302
11	648.675	0.612608302
12	648.675	0.612608302
13	648.675	0.612608302
14	648.675	0.612608302
15	648.675	0.612608302
16	648.675	0.612608302
17	648.675	0.612608302
18	648.675	0.612608302
19	648.675	0.612608302
20	648.675	0.612608302
21	648.675	0.612608302
22	648.675	0.612608302
23	648.675	0.612608302
24	648.675	0.612608302
25	648.675	0.612608302
26	648.814	0.620331152
27	648.814	0.620331152
28	649.423	0.611444507
29	649.423	0.611444507
30	649.423	0.611444507

Figure 6b. SS2 output for the northern area (LCN) base model: Retrospective Analysis, obtained by sequentially decrementing end-year from 2004 to 2000; Top: time series of recruitment, Bottom: time series of spawning biomass.



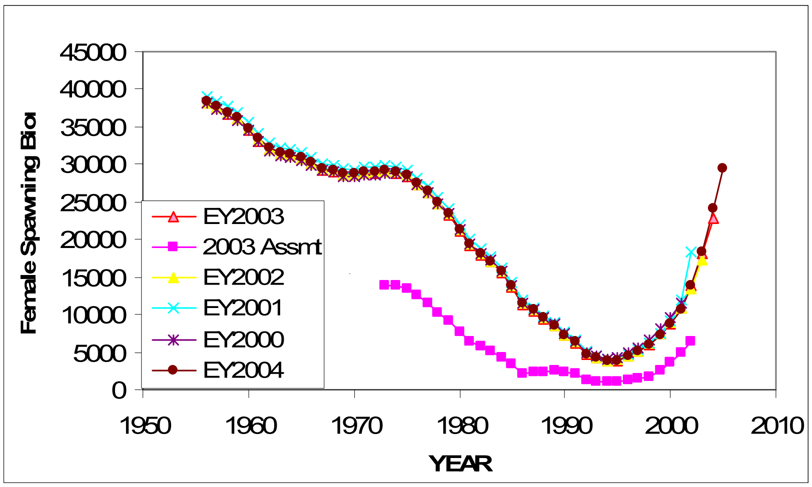


Figure 7. SS2 output for the northern area (LCN) base model: Model fits to commercial fishery catch-at-age.

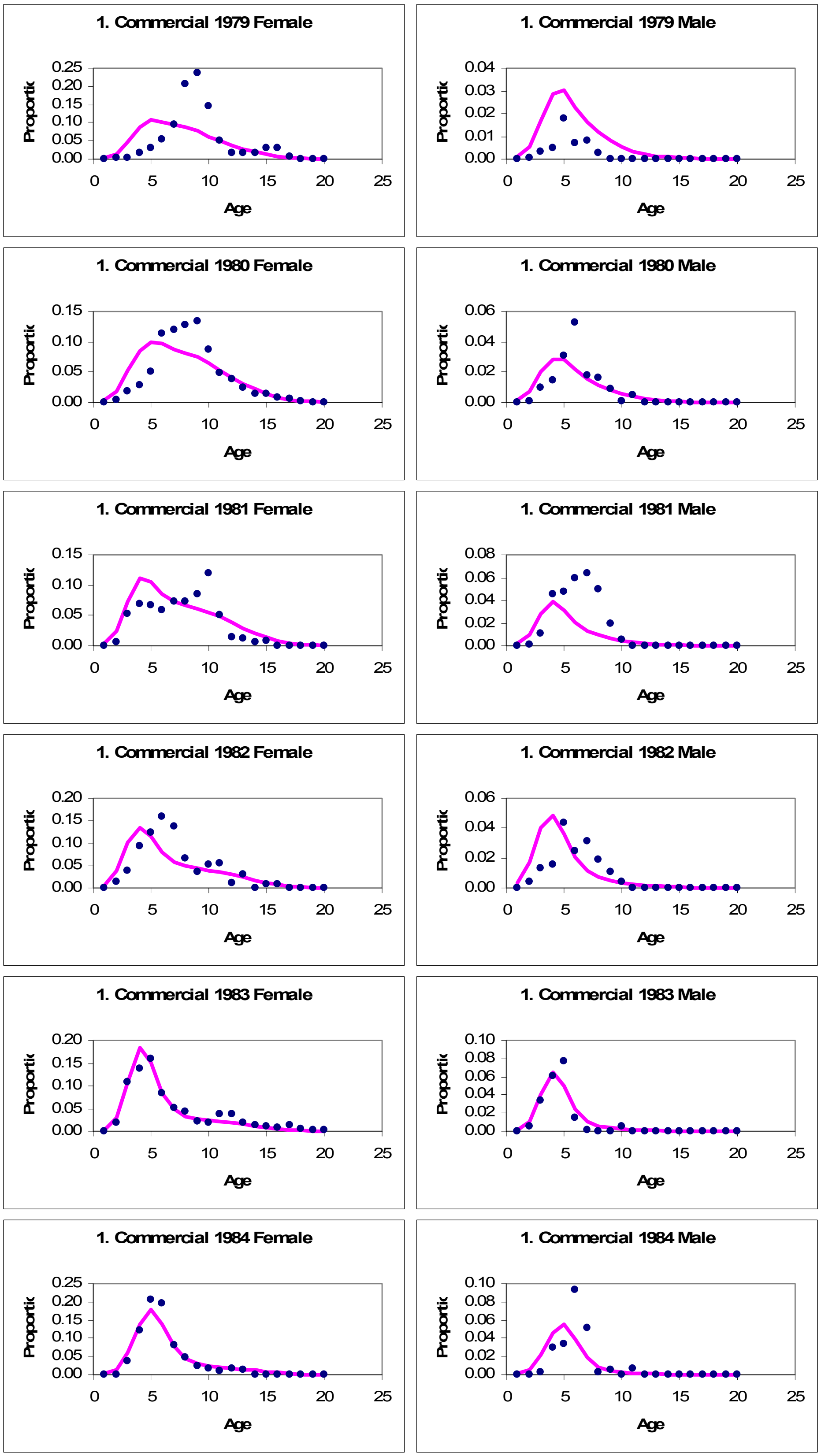


Figure 7, continued. SS2 output for the northern area (LCN) base model: Model fits to commercial fishery catch-at-age.

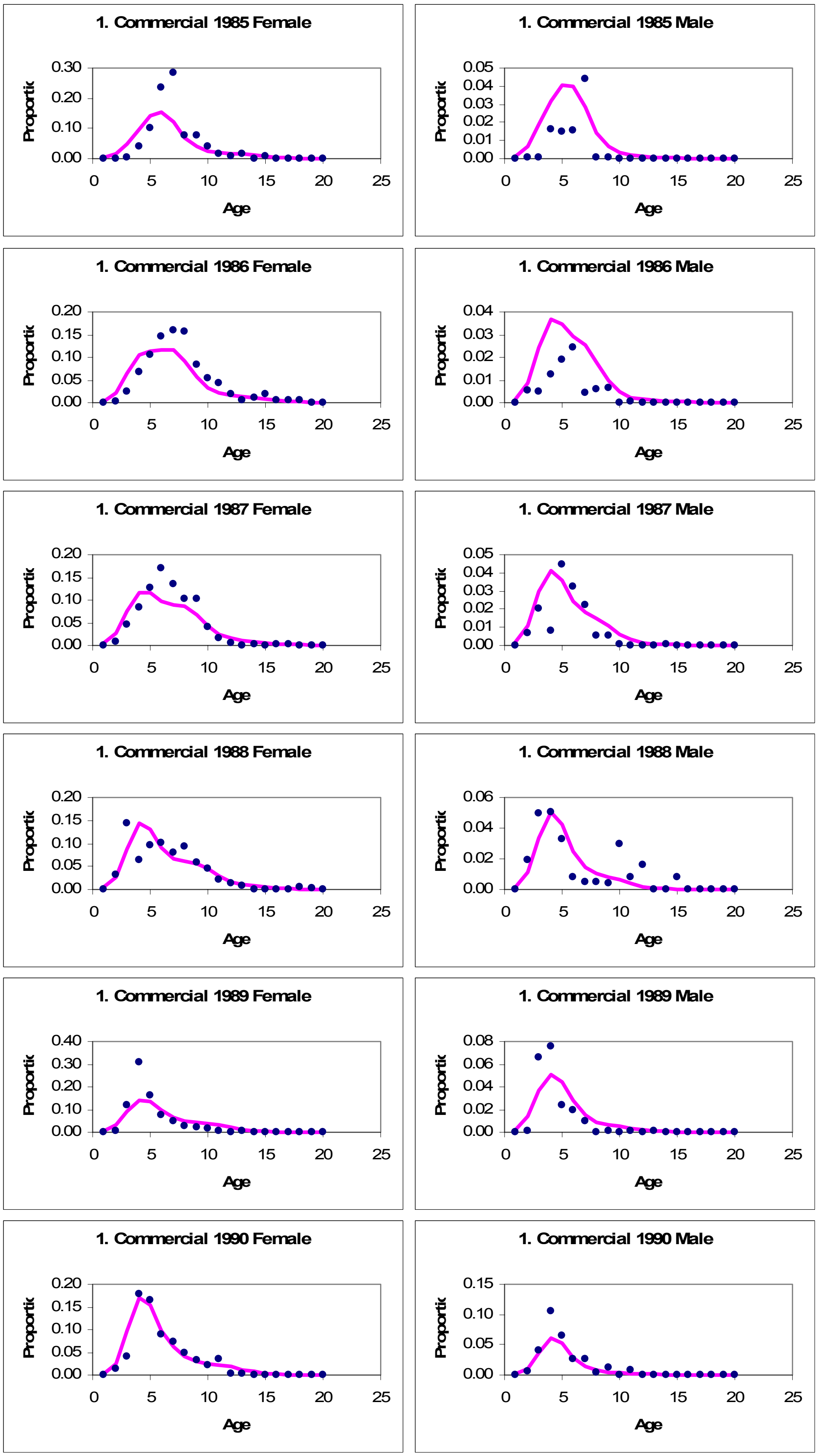


Figure 7, continued. SS2 output for the northern area (LCN) base model: Model fits to commercial fishery catch-at-age.

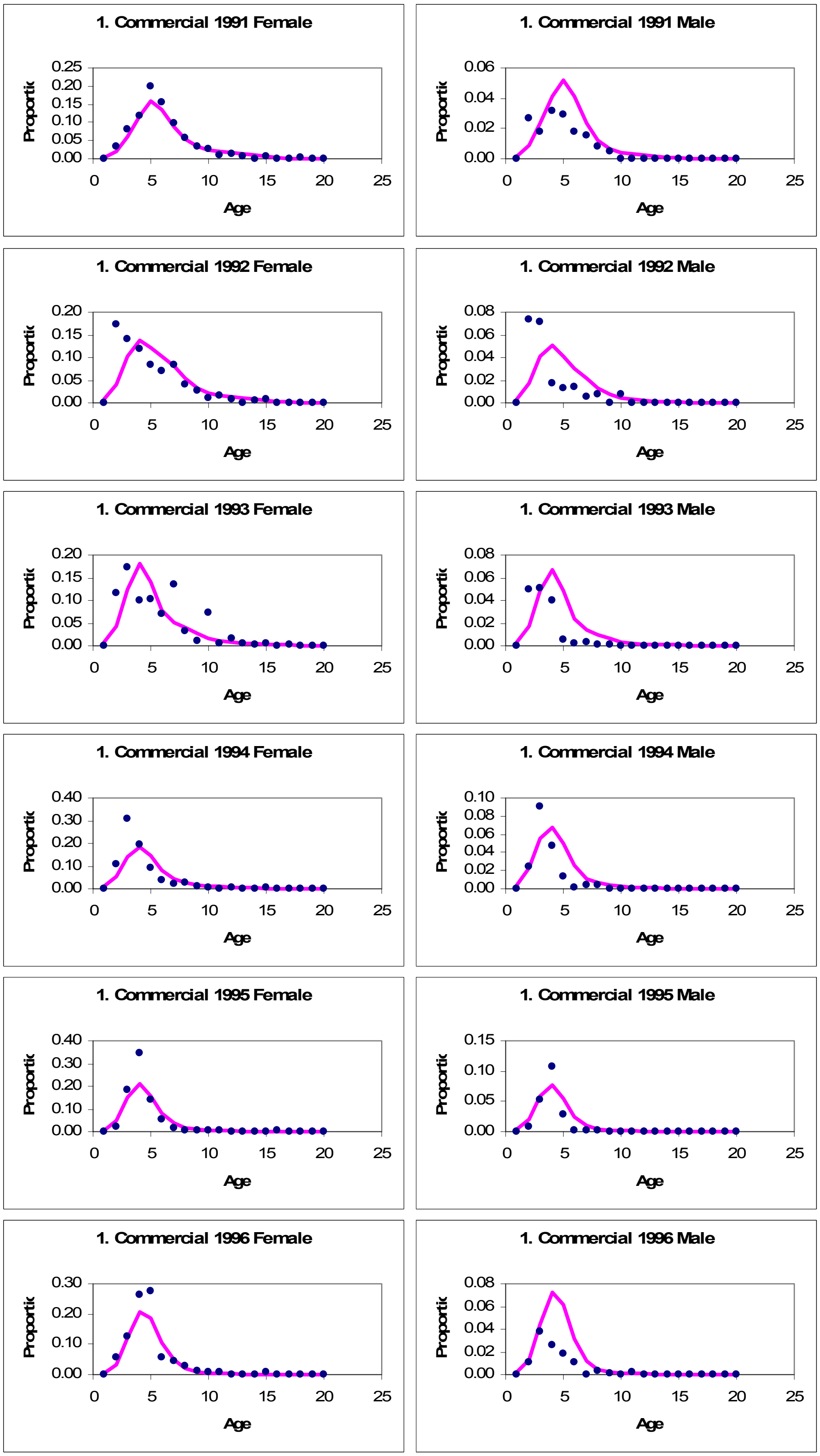


Figure 7, continued. SS2 output for the northern area (LCN) base model: Model fits to commercial fishery catch-at-age.

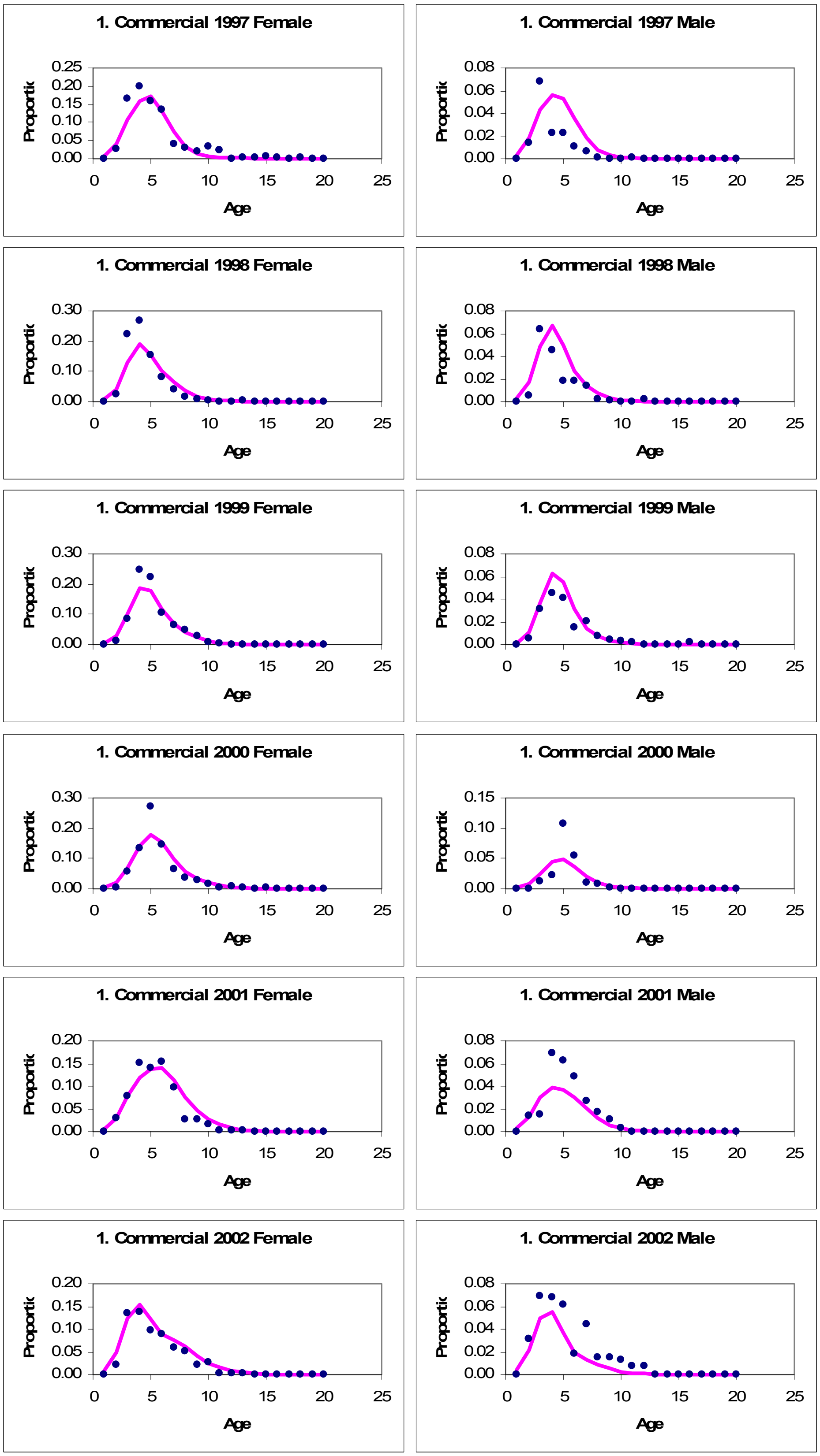


Figure 7, continued. SS2 output for the northern area (LCN) base model: Model fits to commercial fishery catch-at-age.

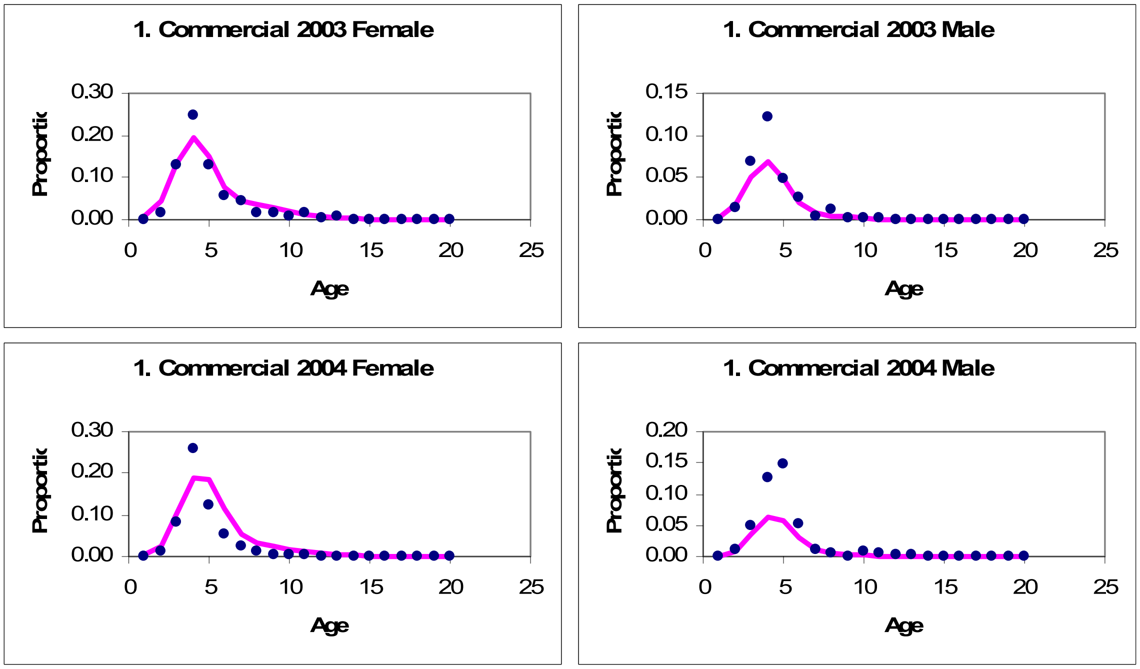


Figure 8. SS2 output for the northern area (LCN) base model: Model fits to recreational fishery catch-at-age.

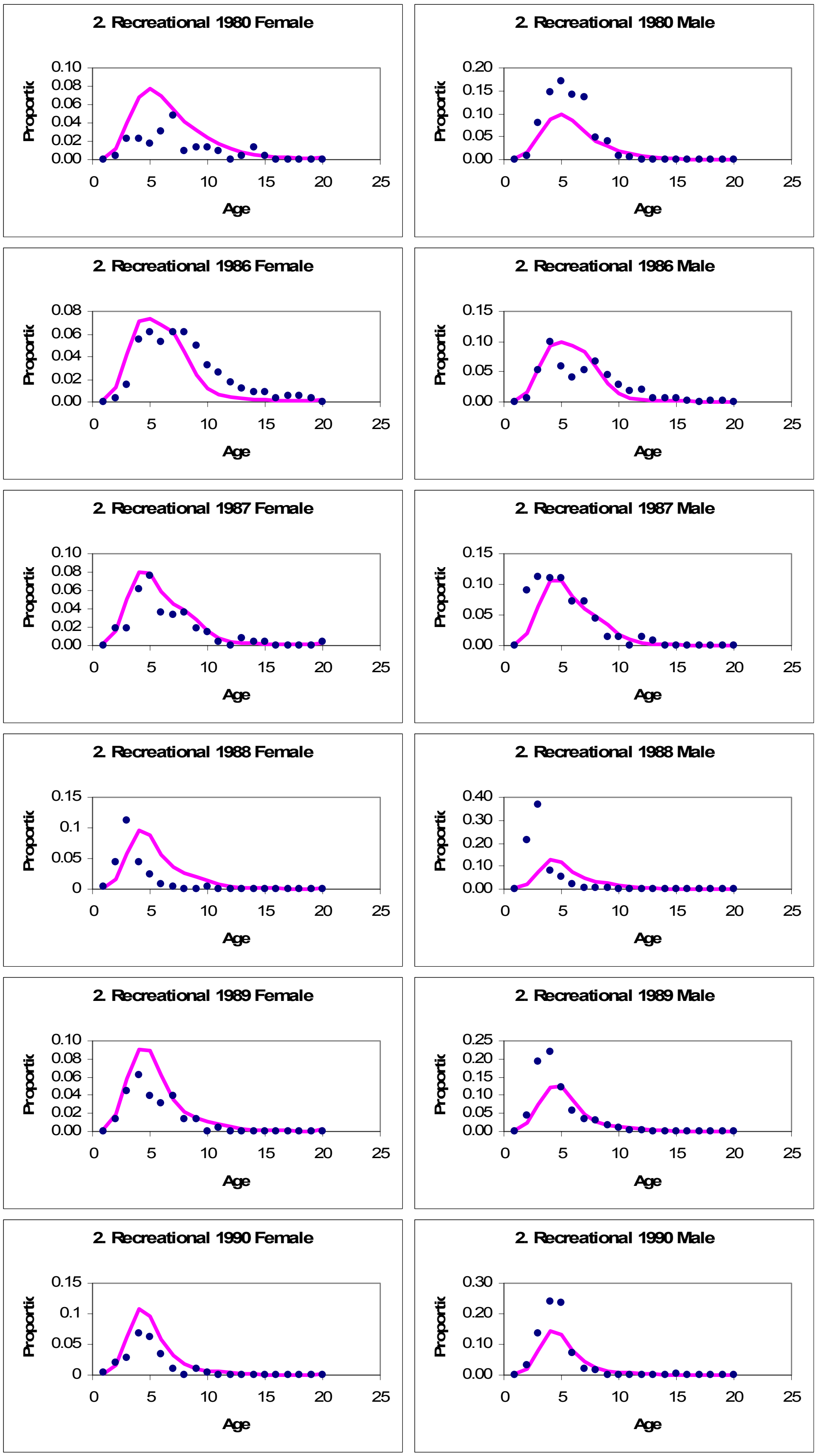


Figure 8, continued. SS2 output for the northern area (LCN) base model: Model fits to recreational fishery catch-at-age.

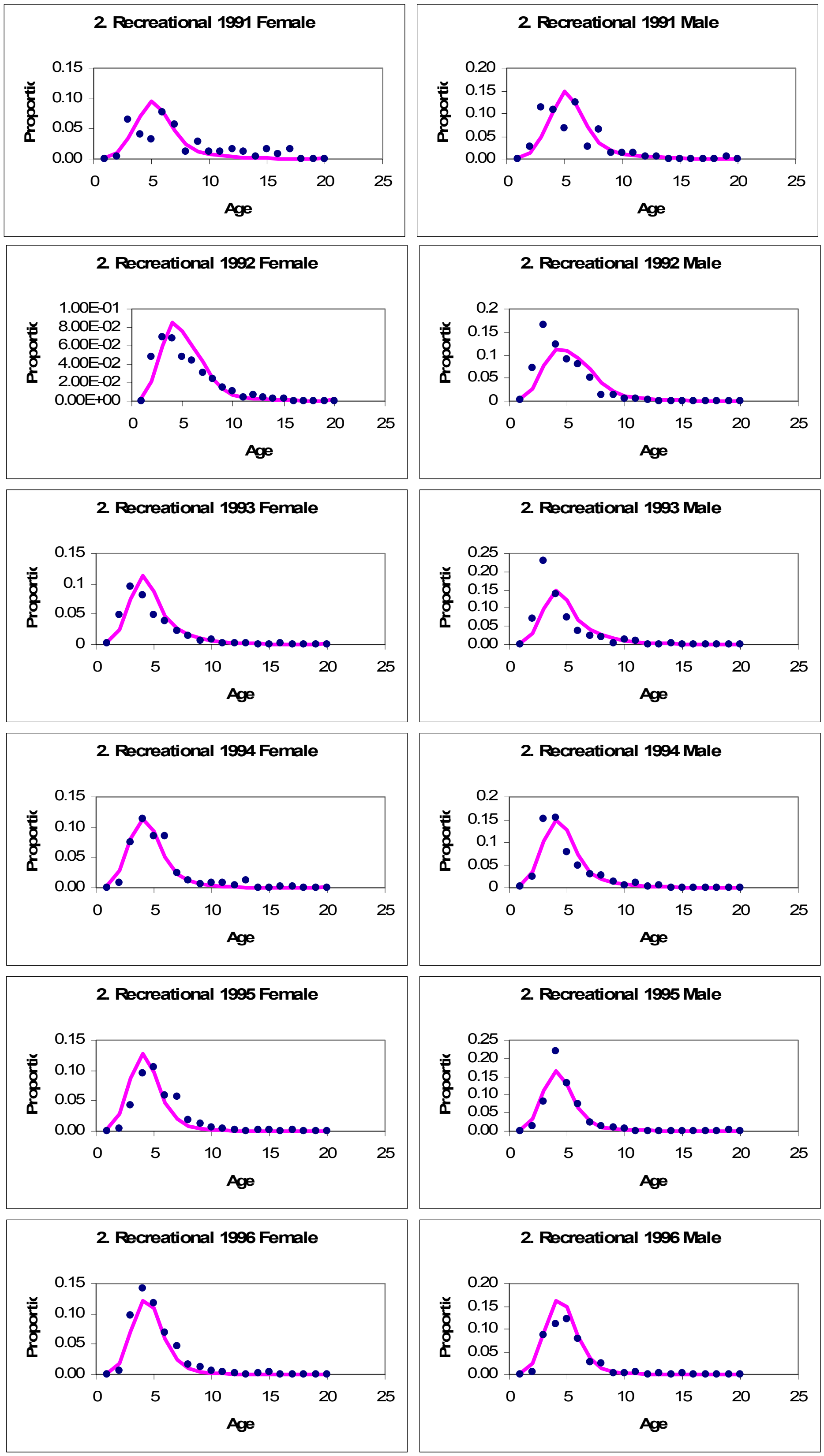


Figure 8, continued. SS2 output for the northern area (LCN) base model: Model fits to recreational fishery catch-at-age.

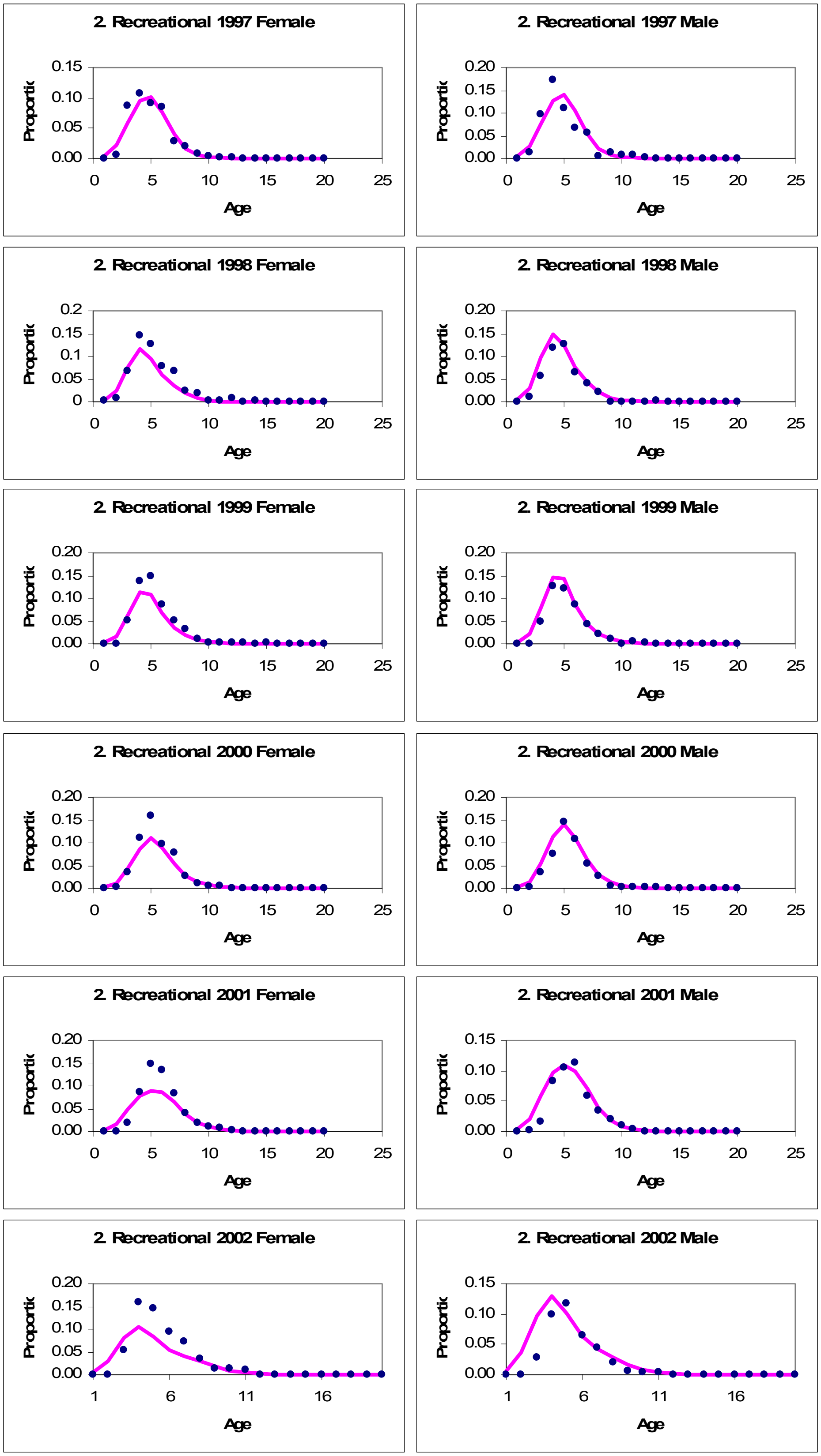


Figure 8, continued. SS2 output for the northern area (LCN) base model: Model fits to recreational fishery catch-at-age.

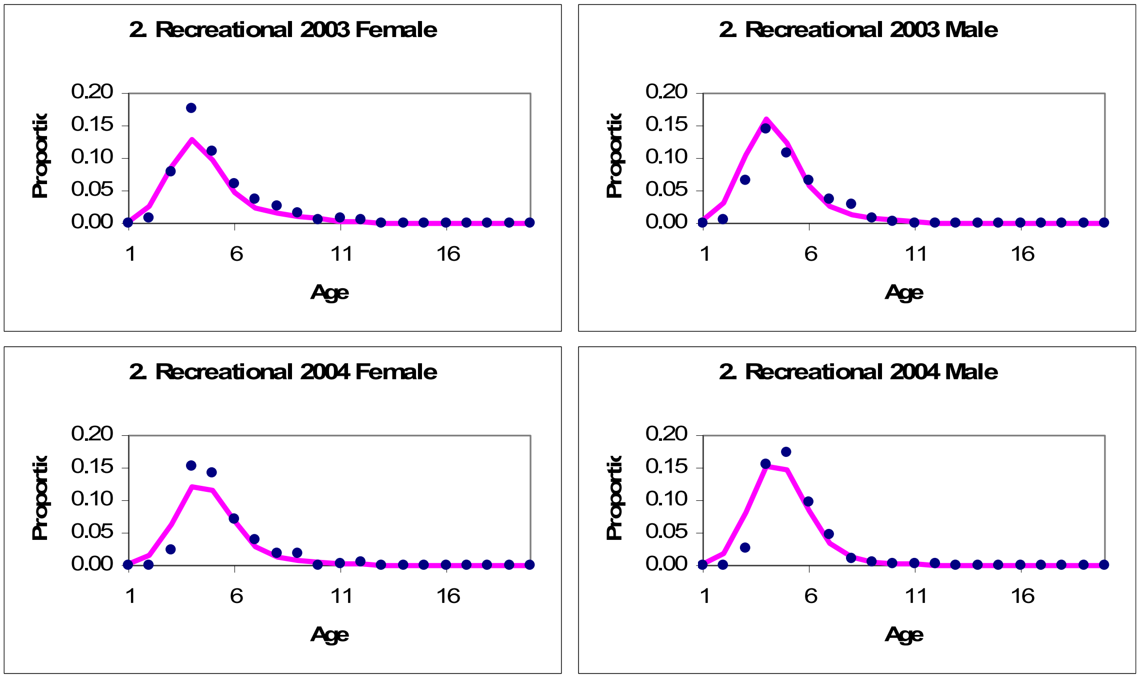


Figure 9. SS2 output for the northern area (LCN) base model: Model fits to commercial fishery catch-at-length.

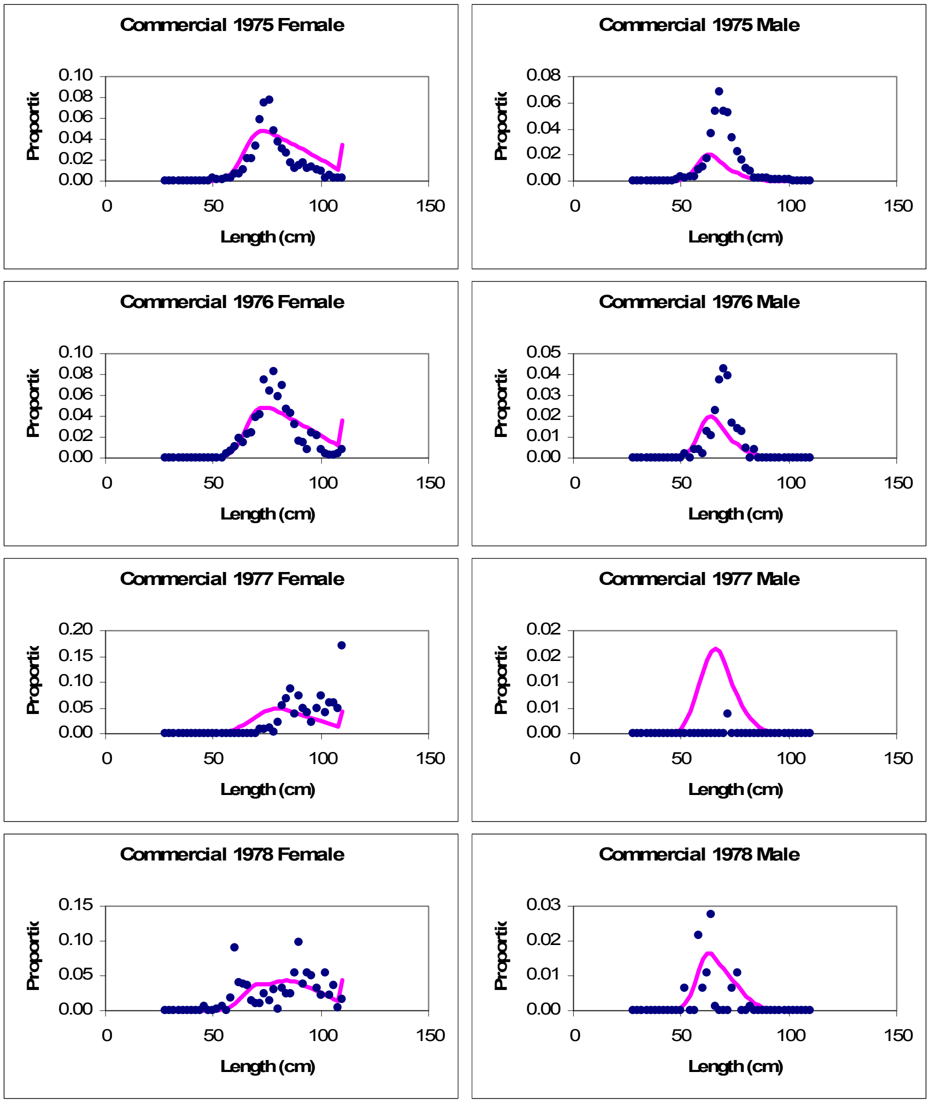


Figure 10. SS2 output for the northern area (LCN) base model: Model fits to recreational fishery catch-at-length.

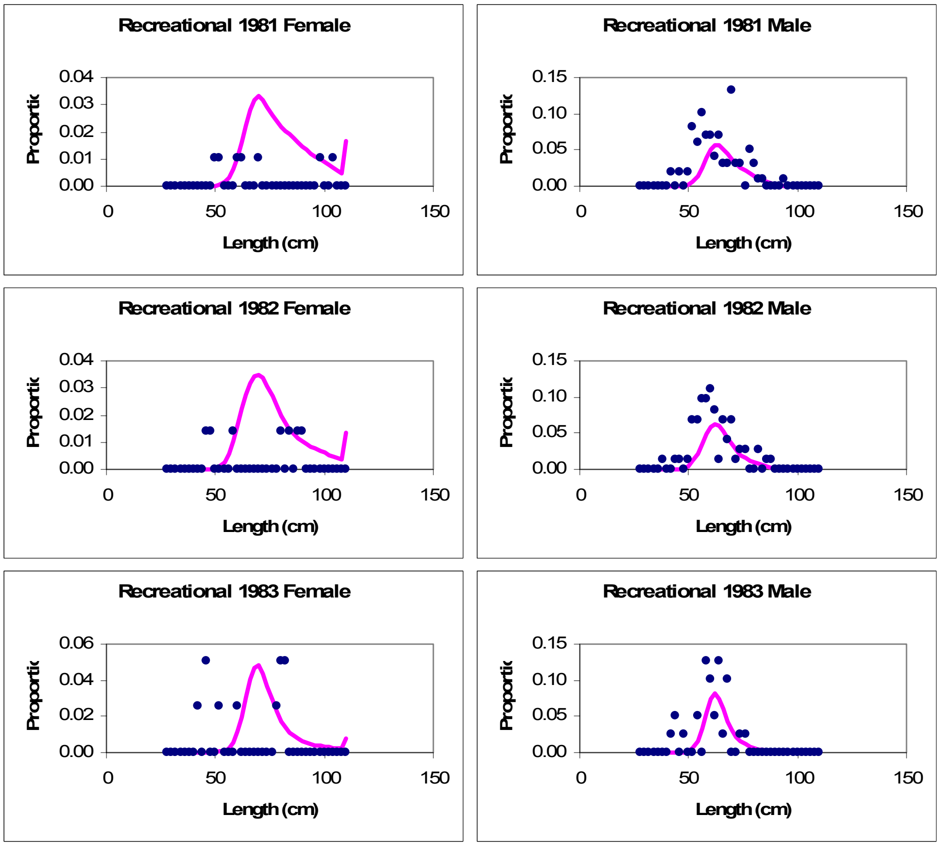


Figure 11. SS2 output for the northern area (LCN) base model: Model fits to NMFS trawl survey catch-at-age.

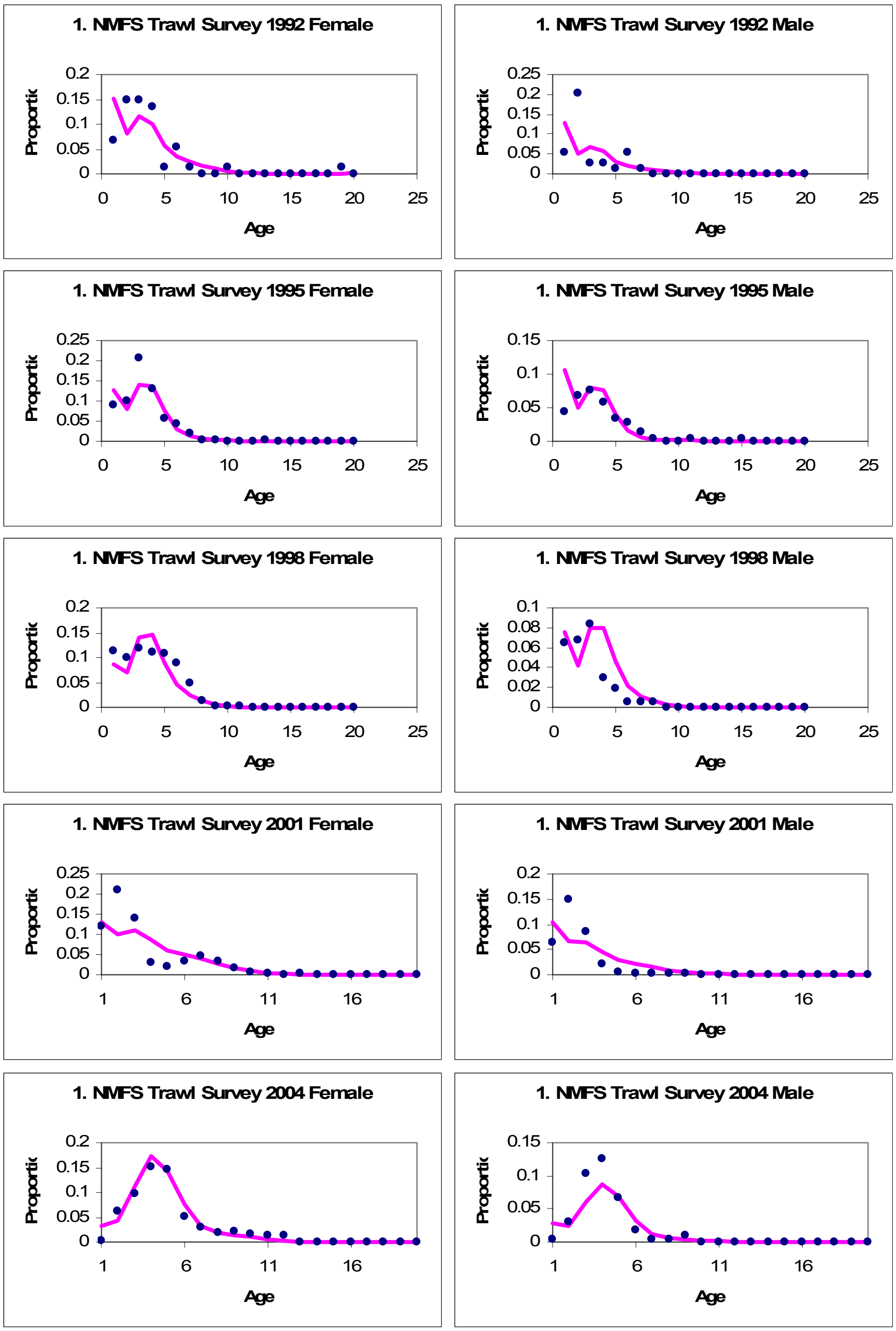


Figure 12. SS2 output for the northern area (LCN) base model: Model fits to WDFW tagging survey catch-at-age.

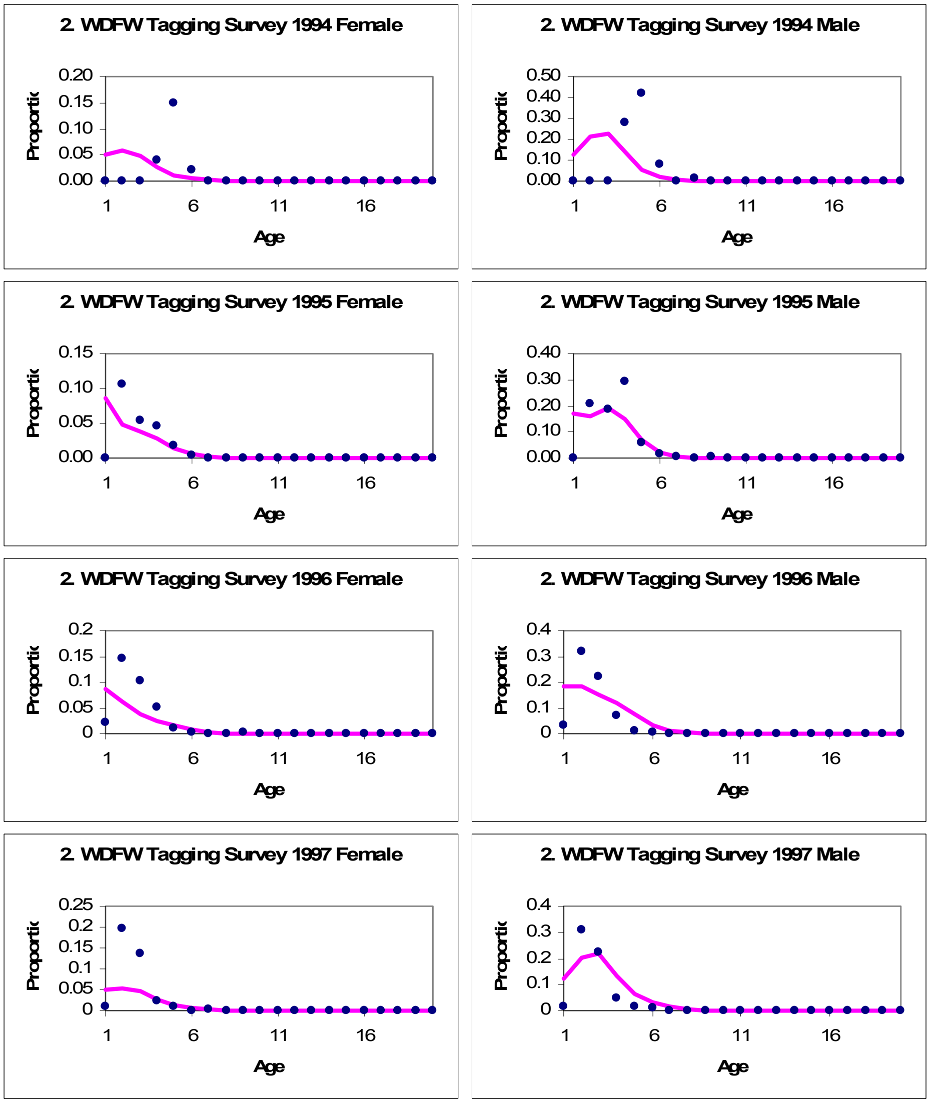


Figure 13. SS2 output for the northern area (LCN) base model: Model fits to NMFS trawl survey catch-at-length.

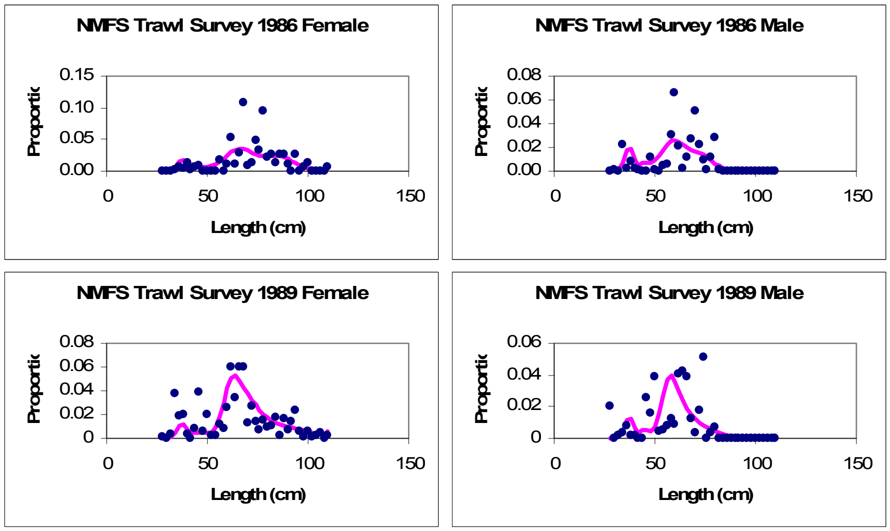


Figure 14. SS2 output for the northern area (LCN) base model: Model fits to WDFW tagging survey catch-at-length.

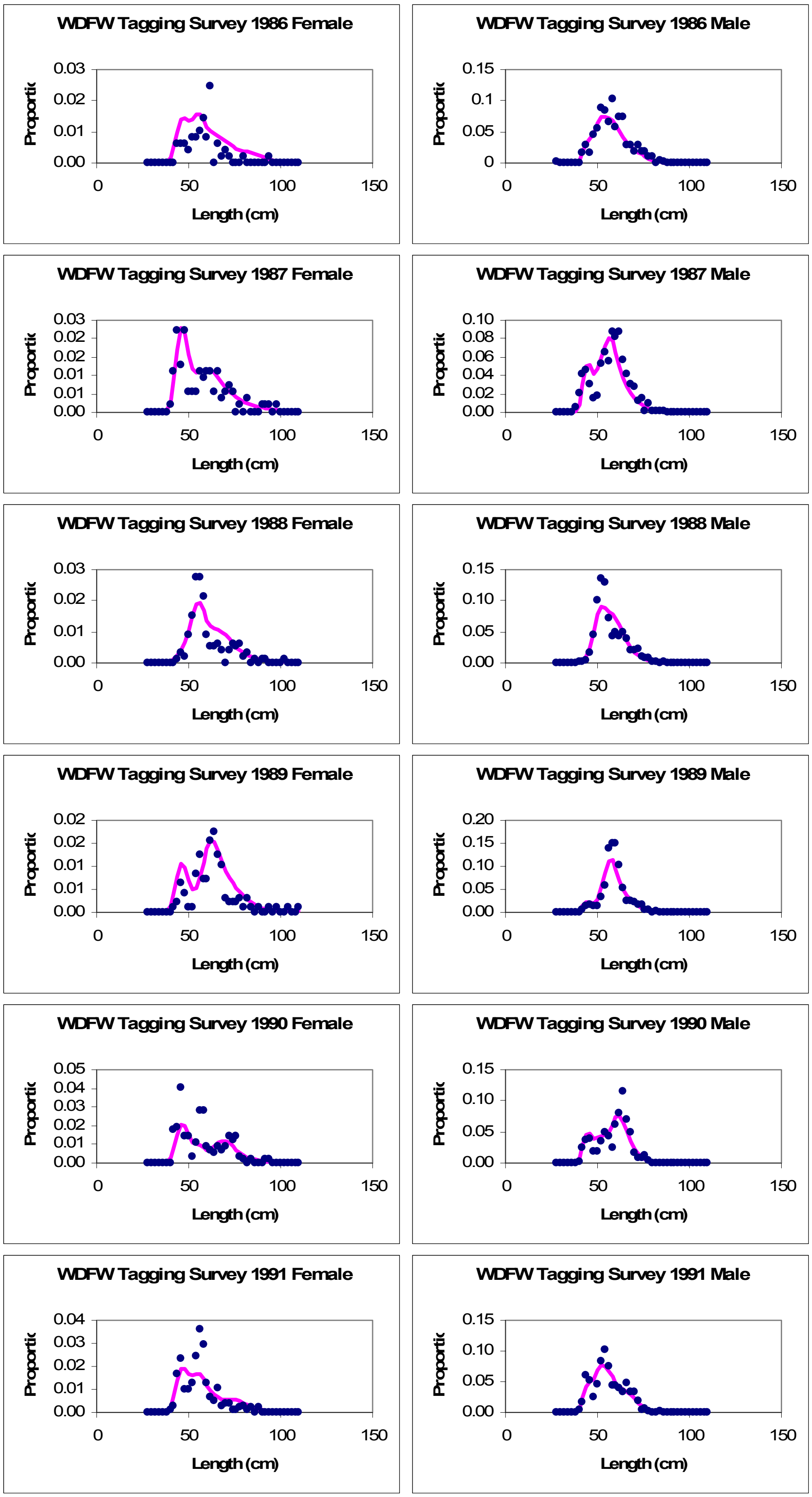
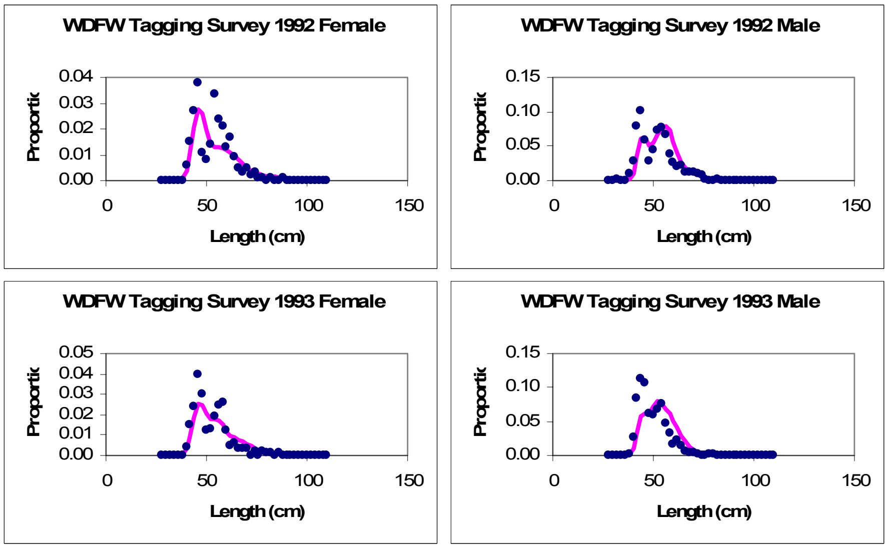


Figure 14, continued. SS2 output for the northern area (LCN) base model: Model fits to WDFW tagging survey catch-at-length.



Filename: LCNCTL05.CTL

```
#  LCNCTL05.ctl: 2005 LCN assessment model ** Tagging Lambda = 0.0 **
#  datafile:LCNData05.dat
2	#_N_growthmorphs

#_assign_sex_to	each_morph_(1=female;_2=male)
1	2

1	#_N_Areas_(populations)

#_each_fleet/survey_operates_in_just_one_area
#_but_different_fleets/surveys_can	be	assigned_to_share_same_selex(FUTURE_coding)

1	1	1	1	1 #area_for_each_fleet and each Survey

0 #do_migration_(0/1)
0 #_N_Block_Designs
#_N_Blocks_per_Design(Block_1_always_starts_in_styr)

#Natural_mortality_and_growth_parameters_for_each_morph
2	#_Last_age_for_natmort_young
3	#_First_age_for_natmort_old
1	#_age_for_growth_Lmin
20	#_age_for_growth_Lmax
-4	#_MGparm_dev_phase

#	LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-variable	use_dev	dev_minyr dev_maxyr
	dev_stddev
# Female natural mortality and growth
	0.05	0.25	0.18	0.0001	0	99	-3	0	0	0	0	0.5	0
	0	#M1_natM_young
	-3	3	0	1	0	99	-3	0	0	0	0	0.5	0
	0	#M1_natM_old_as_exponential_offset(rel_young)
	10	60	43	43	0	99	-2	0	0	0	0	0.5	0
	0	#M1_Lmin
	40	140	118	118	0	99	-2	0	0	0	0	0.5	0
	0	#M1_Lmax
	0.01	0.5	0.1041	0.1041	0	99	-3	0	0	0	0	0.5	0
	0	#M1_VBK
	0.01	0.5	0.0633	0.0633	0	99	-3	0	0	0	0	0.5	0
	0	#M1_CV-young
	0.01	0.5	0.28857	0.28857	0	99	-3	0	0	0	0	0.5	0
	0	#M1_CV-old_as_exponential_offset(rel_young)
# Male natural mortality and growth
	0.01	0.5	0.5754	0.5754	0	99	-3	0	0	0	0	0.5	0
	0	#M2_natM_young_as_exponential_offset(rel_females)
	-3	3	0	1	0	99	-3	0	0	0	0	0.5	0
	0	#M2_natM_old_as_exponential_offset(rel_young_males)
	-1	1	-0.0231	1.0	0	99	-3	0	0	0	0	0.5	0
	0	#M2_Lmin_as_exponential_offset(rel_females_Lmin)
	-1	1	-0.2842	1.0	0	99	-3	0	0	0	0	0.5	0
	0	#M2_Lmax_as_exponential_offset(rel_females_Lmax)
	0.01	1	0.3603	1.0	0	99	-3	0	0	0	0	0.5	0
	0	#M2_VBK_as_exponential_offset(rel_females)
	-1	1	-0.2379	0	0	99	-3	0	0	0	0	0.5	0
	0	#M2_CV-young_as_exponential_offset(rel_CV-young_females)
	0.01	1.0	0.5324	0	0	99	-3	0	0	0	0	0.5	0
	0	#M2_CV-old_as_exponential_offset(rel_CV-young_males)

# Add 2+2*gender lines to read the wt-Len and mat-Len parameters
# Female length-weight
#	LO	HI	INIT		PRIOR	PR_type	SD	PHASE
	-3	3	0.00000176  0.00000176	0	99	-3	0	0	0	0	0.5
	0	0	#Female wt-len-1 a
	-3	5	3.39780	3.39780 0	99	-3	0	0	0	0	0.5	0
	0	#Female wt-len-2 b
# Female maturity
```

```
-3	100	68.059	0.1577	0	99	-3	0	0	0	0	0.5	0
0	#Female mat-len-infl
-5	5	-0.1577	68.059	0	99	-3	0	0	0	0	0.5	0
0	#Female mat-len-slope
# Female fecundity - Same as biomass if intercept = 1 and slope = 0
-3	3	1.	1.	0	99	-3	0	0	0	0	0.5	0
0	#Female eggs/gm intercept
-3	3	0.	0.	0	99	-3	0	0	0	0	0.5	0
0	#Female eggs/gm slope
# Male length-weight
-3	3	0.000003953	0.000003953	0	99	-3	0	0	0	0
0.5	0	0	#Male wt-len-1
-5	5	3.2149	3.2149	0	99	-3	0	0	0	0	0.5
0	0	#Male wt-len-2

#_allocate_recruits
# pop*gmorph lines For the proportion of each morph in each area
0	1	0.5000	0.2	0	9.8	-3	0	0	0	0	0.5	0	0
#frac to morph 1 in area 1
0	1	0.5000	0.2	0	9.8	-3	0	0	0	0	0.5	0	0
#frac to morph 2 in area 1

# pop lines For the proportion assigned to each area
0	1	1	1	0	0.8	-3	0	0	0	0	0.5	0	0
#frac to area 1

0 #_custom-env_read

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


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

# LO	HI	INIT	PRIOR	Pr_type	SD	PHASE
#-10	10	0.0	0	0	4	4

#_Spawner-Recruitment_parameters

1	# SR_fxn:  1=Beverton-Holt

#LO	HI	INIT	PRIOR	Pr_type	SD	PHASE
1	100	8.22947	7.6187	0	99	1	#Ln(R0)
0.2	5	0.9	0.9	0	99	-4	#steepness
0	20	1.0	0.5	0	99	-3	#SD_recruitments
-5	5	0	0	0	99	-3	#Env_link
-5	5	0	0	0	99	-5	#_ln(init_eq_R_multiplier)

0	#env-var_for_link

#	recruitment_residuals
#start_rec_year	end_rec_year	Lower_limit	Upper_limit	phase
1972	2000	-15	15	3

#init_F_setupforeachfleet
#LO	HI	INIT	PRIOR	PR_type	SD	PHASE
0	1	0.0039	0.09	0	99	1
0	1	0.0006	0.09	0	99	1

#_Qsetup
#_add_parm_row_for_each_positive_entry_below(row_then_column)

#-Float(0/1)	#Do-power(0/1)	#Do-env(0/1)	#Do-dev(0/1)  #env-Var	#Num/Bio(0/1)	for	each
fleet	and	survey
0	0	0	0	0	1 #Com_1
0	0	0	0	0	1 #Rec_2
0	0	0	0	0	1 #Logbk_3
0	0	0	0	0	1 #NMFS_4
0	0	0	0	0	0 #WDFTag_5
```

```
#	LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-variable
#_SELEX_&_RETENTION_PARAMETERS

#Selex_type Do_retention(0/1) Do_male Mirrored_selex_number

#Length Selectivity
0	0	0	0	#Com_1
0	0	0	0	#Rec_2
0	0	0	0	#Logbk_3
0	0	0	0	#NMFS_4
0	0	0	0	#WDFTag_5
#_Age	selectivity

18	0	1	0	#Com_1
18	0	1	0	#Rec_2
15	0	0	1	#Logbk_3
18	0	1	0	#NMFS_4
18	0	1	0	#WDFTag_5

#Com_1 1-8 Age Selex for Females: Peak Init Infl1 Slope1 Final Infl2 Slope2 PeakWidth
#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-variable	use_dev	dev_minyr	dev_maxyr	dev_stddev
	Block_Pattern
1	20	5	0.001	0	99	-2	0	0	0	0	0.5	0	0
	# age@peak - fem
0	2	0	1	0	99	-2	0	0	0	0	0.5	0	0
	# sel@minA
-10	10	0.7376	0	0	99	2	0	0	0	0	0.5	0	0
	# asc_infl (logit)
0.1	20	4.193	0.001	0	99	5	0	0	0	0	0.5	0	0
	# asc_slope
-20	30	-10.52	-5	0	99	4	0	0	0	0	0.5	0	0
	# sel@maxA (logit)
-10	10	-1.069	-1.5	0	99	4	0	0	0	0	0.5	0	0
	# desc_infl (logit)
-10	2	1.259	0.5	0	99	4	0	0	0	0	0.5	0	0
	# desc_slope
0	40	1.5	1	0	99	-4	0	0	0	0	0.5	0	0
	# width_of_top <= ( maxA - p1 )
#Com_1 9-12 Age Selex for males relative to females)
# 4 parms: 1=dogleg age, 2=log(rel_sel) at min age, 3= log(rel_sel) at dogleg age, 4+log(relsel) at maxage
1	20	5	3	0	99	-2	0	0	0	0	0	0	0
	# Age_@transition - male
-10	30	0.0	3.21	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ minL
-10	30	-0.499	-0.20	0	99	4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ m1
-10	10	-6.461	0	0	99	4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ maxL

#Rec_2 13-20 Age Selex for Females
1	13	5	0.001	0	99	-2	0	0	0	0	0	0	0
	# age@peak - fem
0	2	0	1	0	99	-2	0	0	0	0	0	0	0
	# sel@minA
-10	10	0.572	0	0	99	2	0	0	0	0	0	0	0
	# asc_infl (logit)
0.0	20	9.427	0.001	0	99	3	0	0	0	0	0	0	0
	# asc_slope
-20	30	-10.22	-5	0	99	4	0	0	0	0	0	0	0
	# sel@maxA (logit)
-10	10	-2.410	-1.5	0	99	4	0	0	0	0	0	0	0
	# desc_infl (logit)
0	2	0.213	0.5	0	99	4	0	0	0	0	0	0	0
	# desc_slope
0	40	1.5	1	0	99	-4	0	0	0	0	0	0	0
	# width_of_top <= ( maxA - p1 )
#Rec_2 21-24 Age Selex for males relative to females
1	10	5	5	0	99	-2	0	0	0	0	0	0	0
	# Age_@transition - male
```

```
-10	30	00.0	20.35	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ minL
-10	30	1.06	-0.09	0	99	4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ m1
-10	10	00.0	0.33	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ maxL

#NMFS_4 25-32 Age Selex for Females: Peak Init Infl1 Slope1 Final Infl2 Slope2 PeakWidth
1	35	3	0.001 0	99	-2	0	0	0	0	0	0	0	#
age@peak - fem
0	2	0.149	1	0	99	-2	0	0	0	0	0	0	0
	# sel@minA
-10	10	4.627	2	0	99	2	0	0	0	0	0	0	0
	# asc_infl (logit)
0	30	0.161	0.001	0	99	3	0	0	0	0	0	0	0
	# asc_slope
-15	30	-3.26	-5	0	99	4	0	0	0	0	0	0	0
	# sel@maxA (logit)
-10	10	-1.32	-1.5	0	99	4	0	0	0	0	0	0	0
	# desc_infl (logit)
0	20	9.894	0.5	0	99	5	0	0	0	0	0	0	0
	# desc_slope
0	40	1.0	1	0	99	-5	0	0	0	0	0	0	0
	# width_of_top <= ( maxA - p1 )
#NMFS_4 33-36 Age Selex for males relative to females
# 4 parms: 1=dogleg age, 2=log(rel_sel) at min age, 3= log(rel_sel) at dogleg age, 4+log(relsel) at maxage
1	10	3	3	0	99	-2	0	0	0	0	0	0	0
	# Age_@transition - male
-10	30	0.0	1	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ minL
-10	0	-0.030	1	0	99	4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ m1
-30	0	0.00	1	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ maxL

#WDFWTag_5 37-44 Age Selex for Females
0	20	3	0.001	0	99	-3	0	0	0	0	0	0	0
	# age@peak - fem
0	2	0	1	0	99	-3	0	0	0	0	0	0	0
	# sel@minA
-10	10	-2.50	-.249	0	99	3	0	0	0	0	0	0	0
	# asc_infl (logit)
-10	10	6.25	.134	0	99	4	0	0	0	0	0	0	0
	# asc_slope
-20	30	-8.28	-5	0	99	4	0	0	0	0	0	0	0
	# sel@maxA (logit)
-10	10	-2.59	-1.5	0	99	4	0	0	0	0	0	0	0
	# desc_infl (logit)
0	10	0.680	0.5	0	99	5	0	0	0	0	0	0	0
	# desc_slope
0	40	1	1	0	99	-5	0	0	0	0	0	0	0
	# width_of_top <= ( maxA - p1 )
#WDFWTag_5 45-48 Age Selex for males relative to females
0	20	3	3	0	99	-2	0	0	0	0	0	0	0
	# Age_@transition - male
-15	10	0.0	6.61	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ minL
-20	20	2.26	5.62	0	99	4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ m1
-20	20	0.00	0	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ maxL

#_custom-env_read
0	#_ 0=read_one_setup_and_apply_to_all_env_fxns;  1=read_a_setup_line_for_each_SELparm_with_Env-var>0
#	except read NO setup lines If no SELparms have Env-var>0
# LO	HI	INIT	PRIOR	PR_type	SD	PHASE
# -10	10	0	0	0	4	4	#Env-parm_setup

#_custom-block_read
```

```
0	#_	0=read_one_setup_and_apply_to_all;_1=Custom_so_see_detailed_instructions_for_N_rows_in_Custom_setup

#LO	HI	INIT	PRIOR	PR_type	SD	PHASE
# -10	10	0	0	0	4	4
-4	#_phase_for_selex_parm_devs

1	#_max_lambda_phases:_read_this_Number_of_values_for_each_componentxtype_below
0	#_sd_offset - 0 = omit +log(s) term; 1 = include Log(s) term in Like
#_CPUE_lambdas for each fleet and survey
1	1	1	1	0
#_discard_lambdas
0	0	0	0	0
#_meanwtlambda(one_for_all_sources)
0
#_lenfreq_lambdas
1	1	0	1	1
#_age_freq_lambdas
1	1	0	1	1
#_size@age_lambdas
1	1	0	1	1
#_initial_equil_catch
1
#_recruitment_lambda
1.0
#_parm_prior_lambda
1
#_parm_dev_timeseries_lambda
1
# crashpen lambda
100
#max F
0.9
999	#_end-of-file
```

Filename: LCNData05d.DAT

#_Number_of_datafiles: 1
#_start_nudata: 1
#_MODEL_DIMENSIONS
1956 #_styr
2004 #_endyr
1 #_nseas

#_vector_with_N_months_in_each_season
12 #_months/season
1 #_spawn_seas
2 #_Nfleet
3 #_Nsurv

Labels
Comm1%Sport2%logbk3%NMFS4%WDFTAG5

Timing within each season, for each fishery and survey
0.5 0.5 0.5 0.5 0.5

2 #_Ngenders
40 #_accumulator_age;_model_always_starts_with_age_0
132 7.6 #_init_equil_catch_for_each_fishery

#_catch_biomass(mtons):_columns_are_fisheries _rows_are_year*season

920	0
1000	5
1133	9
1863	14
2028	18
1875	23
1323	27
938	32
1257	36
1538	40
1813	45
1244	49
1626	54
1148	58
851	63
1009	67
952	72
1326	76
1549	81
2019	85
1662	69
1671	76
1346	70
2211	82
2004	93

1905	128
2241	128
3051	114
3005	156
3127	90
1305	95
1620	111
1646	115
2231	146
1746	125
2320	121
1207	210
1429	252
1214	255
1018	117
1186	129
1106	120
718	73
665	101
223	75
206	86
226	140
147	144
208	168

39 #_N_cpue_and_surveyabundance_observations
#_year seas index obs se(log)
#Logbook GLM
1976 1 3 20.33 0.2
1977 1 3 16.16 0.2
1978 1 3 10.79 0.2
1979 1 3 11.37 0.2
1980 1 3 11.32 0.2
1981 1 3 13.33 0.2
1982 1 3 9.29 0.2
1983 1 3 9.32 0.2
1984 1 3 6.99 0.2
1985 1 3 6.26 0.2
1986 1 3 3.58 0.2
1987 1 3 4.24 0.2
1988 1 3 4.56 0.2
1989 1 3 5.45 0.2
1990 1 3 4.36 0.2
1991 1 3 3.94 0.2
1992 1 3 2.23 0.2
1993 1 3 2.74 0.2
1994 1 3 2.82 0.2
1995 1 3 2.47 0.2
1996 1 3 2.54 0.2
1997 1 3 2.36 0.2
#NMFS Trawl Survey no water hauls
1977 1 4 15043.15776 0.77
1980 1 4 4579.96215 0.31

1983 1 4 6267.97273 0.16
1986 1 4 2811.65104 0.12
1989 1 4 5855.76262 0.3
1992 1 4 4154.87076 0.49
1995 1 4 1884.36548 0.56
1998 1 4 3019.97203 0.26
2001 1 4 5226.82217 0.27
2004 1 4 11365.7 0.35
#WDFW Tag Survey in numbers of fish
1986 1 5 119700 0.16
1987 1 5 208500 0.15
1988 1 5 165400 0.11
1989 1 5 149000 0.09
1990 1 5 123800 0.08
1991 1 5 114400 0.08
1992 1 5 127300 0.09

2 #_discard_type
0 #_N_discard_obs

0 #_N_meanbodywt_obs

-1 #_comp_tail_compression
0.0001 #_add_to_comp

42 #_N_LengthBins
28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110

17 #_N_Length_obs
#Yr Seas Flt/Svy Gender Part Nsamp(Fem-Male)
#Com_1 Length Comps
1975 1 1 3 0 14.6 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0001489417 0.0031108317 0.0017565662 0.0011852852 0.0025418072 0.0029410116
0.0065371858 0.0067358572 0.0107029144 0.0214315447 0.0213849300 0.0334709147 0.0584148774 0.0752367302
0.0779870928 0.0487304609 0.0375367740 0.0303834109 0.0274517735 0.0170846334 0.0116896115 0.0143208604
0.0168067903 0.0117262534 0.0128513433 0.0105013505 0.0094854849 0.0027994129 0.0049533924 0.0023328711
0.0019703447 0.0028396070 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000744708 0.0010472954 0.0034707080 0.0015286394 0.0031044549
0.0032655141 0.0084576705 0.0110242922 0.0168913290 0.0368298376 0.0533668091 0.0686534366 0.0532135656
0.0522671670 0.0328809278 0.0221313752 0.0163318470 0.0091745992 0.0077709247 0.0022468499 0.0022993468
0.0018747793 0.0015849008 0.0004976894 0.0008954757 0.0004976894 0.0009953787 0.0004976894 0.0000000000
0.0000744708 0.0000000000 0.0000000000 0.0000000000
1976 1 1 3 0 40.0 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0042932706 0.0063050163
0.0104633974 0.0186452699 0.0148915575 0.0230734300 0.0234780986 0.0393022855 0.0415838104 0.0755253064
0.0645223509 0.0826280626 0.0595546326 0.0694784718 0.0468097104 0.0427862189 0.0327274901 0.0163637451
0.0144868889 0.0081818725 0.0246805071 0.0207919052 0.0081818725 0.0040234915 0.0021466353 0.0021466353
0.0042932706 0.0084516516 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0021466353 0.0000000000
0.0040234915 0.0041583810 0.0021466353 0.0126100327 0.0103285078 0.0230734300 0.0374254293 0.0431908875
0.0393022855 0.0166335242 0.0143519993 0.0124751431 0.0042932706 0.0000000000 0.0040234915 0.0000000000

	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1977 1 1 3 0 26.2	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0076335878	0.0076335878
	0.0114503817	0.0038167939	0.0229007634	0.0534351145	0.0687022901	0.0877862595	0.0381679389	0.0725190840
	0.0496183206	0.0419847328	0.0229007634	0.0496183206	0.0725190840	0.0419847328	0.0610687023	0.0610687023
	0.0496183206	0.1717557252	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0038167939	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1978 1 1 3 0 22.3	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0064070830	0.0000000000	0.0000000000	0.0009766171	0.0064070830	0.0000000000	0.0181416502
	0.0909142142	0.0407371492	0.0373628991	0.0353066833	0.0137907830	0.0107579501	0.0107579501	0.0245487331
	0.0137907830	0.0299791990	0.0019532341	0.0319324331	0.0234691344	0.0249779695	0.0549571686	0.0986241689
	0.0372447548	0.0550601503	0.0510507004	0.0324646513	0.0221511001	0.0536391343	0.0230247354	0.0368155184
	0.0039064682	0.0167206342	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0064070830	0.0000000000
	0.0000000000	0.0215159003	0.0064070830	0.0107579501	0.0279229832	0.0009766171	0.0000000000	0.0000000000
	0.0000000000	0.0064070830	0.0107579501	0.0000000000	0.0000000000	0.0009766171	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
#Rec Length Comps								
1981 1 2 3 0 9.8	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0102040816	0.0102040816	0.0000000000	0.0000000000	0.0000000000
	0.0102040816	0.0102040816	0.0000000000	0.0000000000	0.0000000000	0.0102040816	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0102040816	0.0000000000	0.0000000000	0.0102040816	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0204081633	0.0000000000	0.0204081633	0.0000000000	0.0204081633	0.0816326531	0.0612244898
	0.1020408163	0.0714285714	0.0714285714	0.0408163265	0.0714285714	0.0306122449	0.0306122449	0.1326530612
	0.0306122449	0.0306122449	0.0000000000	0.0510204082	0.0306122449	0.0102040816	0.0102040816	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0102040816	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1982 1 2 3 0 7.2	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0138888889	0.0138888889	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0138888889
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0138888889	0.0000000000	0.0138888889	0.0000000000	0.0138888889	0.0138888889
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0138888889
	0.0000000000	0.0000000000	0.0138888889	0.0138888889	0.0000000000	0.0138888889	0.0694444444	0.0694444444
	0.0972222222	0.0972222222	0.1111111111	0.0833333333	0.0138888889	0.0694444444	0.0416666667	0.0694444444
	0.0138888889	0.0277777778	0.0277777778	0.0000000000	0.0000000000	0.0277777778	0.0000000000	0.0138888889
	0.0138888889	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1983 1 2 3 0 3.9	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0256410256
	0.0000000000	0.0512820513	0.0000000000	0.0000000000	0.0256410256	0.0000000000	0.0000000000	0.0000000000
	0.0256410256	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0256410256	0.0512820513	0.0512820513	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000

	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0256410256	0.0512820513	0.0000000000	0.0256410256	0.0000000000	0.0000000000	0.0512820513
	0.0000000000	0.1282051282	0.1025641026	0.0512820513	0.1282051282	0.0256410256	0.1025641026	0.0000000000
	0.0000000000	0.0256410256	0.0256410256	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
#NMFS Survey Length Comps								
1986 1 4 3 0 99 0.0000000000	0.0000000000	0.0000000000	0.0010924626	0.0066860944	0.0049146845	0.0140637093	0.0022254385	
	0.0059680308	0.0097036381	0.0000000000	0.0000000000	0.0000000000	0.0008829109	0.0169583160	0.0000000000
	0.0101646517	0.0526240057	0.0107625724	0.0290676069	0.1079526246	0.0097148142	0.0122336249	0.0498816732
	0.0327640979	0.0961101627	0.0230548718	0.0262470418	0.0125954508	0.0256742673	0.0261436630	0.0118103306
	0.0008829109	0.0257315448	0.0000000000	0.0073007793	0.0126904475	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0063955162	0.0000000000	0.0008144574	0.0000000000	0.0224681272	0.0026948341	0.0085776473
	0.0019362572	0.0011217998	0.0000000000	0.0000000000	0.0120589986	0.0009667316	0.0000000000	0.0050152693
	0.0056592914	0.0312427530	0.0657433356	0.0216997712	0.0028582844	0.0123188426	0.0277725778	0.0513639018
	0.0223507783	0.0095108506	0.0011036387	0.0116692325	0.0278717656	0.0008829109	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1989 1 4 3 0 99 0.0013070357	0.0000000000	0.0030014599	0.0375334563	0.0193774252	0.0201898203	0.0029934560	0.0000000000	
	0.0083248492	0.0394535902	0.0063638954	0.0199168876	0.0020537990	0.0017056296	0.0122867763	0.0085113399
	0.0264800799	0.0609296362	0.0338108456	0.0608856148	0.0602901251	0.0125637110	0.0267754236	0.0137058665
	0.0074796381	0.0150137027	0.0096639005	0.0109621320	0.0171435386	0.0028261747	0.0169034218	0.0064935585
	0.0141516834	0.0230576152	0.0052841702	0.0014975284	0.0063606938	0.0016079821	0.0025740520	0.0048783728
	0.0000000000	0.0025740520	0.0200681612	0.0000000000	0.0017368448	0.0032303713	0.0076052992	0.0017368448
	0.0013998809	0.0000000000	0.0000000000	0.0254683878	0.0157756733	0.0390774073	0.0042020439	0.0053802169
	0.0081607694	0.0120522622	0.0090211879	0.0404388695	0.0425006723	0.0393127217	0.0121611152	0.0034128600
	0.0180431762	0.0517587755	0.0000000000	0.0031999565	0.0073235622	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
#WDFW Tagging Length Comps								
1986 1 5 3 0 99 0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	
	0.0061983471	0.0061983471	0.0061983471	0.0041322314	0.0082644628	0.0082644628	0.0103305785	0.0144628099
	0.0082644628	0.0247933884	0.0000000000	0.0061983471	0.0020661157	0.0041322314	0.0020661157	0.0000000000
	0.0000000000	0.0000000000	0.0020661157	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0020661157	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0020661157	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0165289256	0.0289256198	0.0165289256	0.0454545455	0.0557851240	0.0888429752	0.0847107438
	0.0661157025	0.1033057851	0.0578512397	0.0743801653	0.0743801653	0.0289256198	0.0289256198	0.0185950413
	0.0289256198	0.0185950413	0.0185950413	0.0103305785	0.0103305785	0.0000000000	0.0041322314	0.0020661157
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1987 1 5 3 0 99 0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0018450185	0.0110701107	
	0.0221402214	0.0129151292	0.0221402214	0.0055350554	0.0055350554	0.0055350554	0.0110701107	0.0092250923
	0.0110701107	0.0110701107	0.0055350554	0.0110701107	0.0036900369	0.0055350554	0.0073800738	0.0055350554
	0.0000000000	0.0018450185	0.0000000000	0.0036900369	0.0000000000	0.0000000000	0.0000000000	0.0018450185
	0.0018450185	0.0018450185	0.0000000000	0.0018450185	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0055350554
	0.0202952030	0.0424354244	0.0461254613	0.0313653137	0.0147601476	0.0184501845	0.0535055351	0.0664206642
	0.0553505535	0.0885608856	0.0830258303	0.0885608856	0.0571955720	0.0424354244	0.0313653137	0.0276752768
	0.0129151292	0.0147601476	0.0018450185	0.0092250923	0.0018450185	0.0018450185	0.0018450185	0.0018450185
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				

1988 1 5 3 0 99	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0010224949	0.0030674847	0.0020449898	0.0092024540	0.0153374233	0.0276073620	0.0276073620	0.0214723926
	0.0092024540	0.0051124744	0.0051124744	0.0061349693	0.0040899796	0.0000000000	0.0040899796	0.0061349693
	0.0051124744	0.0061349693	0.0020449898	0.0030674847	0.0000000000	0.0010224949	0.0000000000	0.0010224949
	0.0010224949	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0010224949	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0010224949	0.0020449898	0.0040899796	0.0173824131	0.0449897751	0.1022494888	0.1370143149	0.1308793456
	0.0715746421	0.0429447853	0.0490797546	0.0439672802	0.0490797546	0.0398773006	0.0214723926	0.0214723926
	0.0235173824	0.0112474438	0.0071574642	0.0071574642	0.0010224949	0.0020449898	0.0000000000	0.0010224949
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1989 1 5 3 0 99	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0010373444
	0.0020746888	0.0062240664	0.0041493776	0.0010373444	0.0010373444	0.0082987552	0.0124481328	0.0072614108
	0.0072614108	0.0155601660	0.0176348548	0.0124481328	0.0103734440	0.0031120332	0.0020746888	0.0020746888
	0.0020746888	0.0031120332	0.0010373444	0.0031120332	0.0010373444	0.0000000000	0.0010373444	0.0000000000
	0.0000000000	0.0010373444	0.0000000000	0.0010373444	0.0000000000	0.0000000000	0.0010373444	0.0000000000
	0.0000000000	0.0010373444	0.0000000000	0.0000000000	0.0000000000	0.0010373444	0.0000000000	0.0000000000
	0.0010373444	0.0041493776	0.0145228216	0.0165975104	0.0145228216	0.0145228216	0.0321576763	0.0580912863
	0.1410788382	0.1504149378	0.1504149378	0.1026970954	0.0539419087	0.0248962656	0.0248962656	0.0217842324
	0.0155601660	0.0165975104	0.0041493776	0.0041493776	0.0010373444	0.0020746888	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1990 1 5 3 0 99	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0177619893
	0.0195381883	0.0408525755	0.0142095915	0.0142095915	0.0035523979	0.0106571936	0.0284191829	0.0284191829
	0.0088809947	0.0071047957	0.0053285968	0.0088809947	0.0071047957	0.0088809947	0.0142095915	0.0124333925
	0.0142095915	0.0035523979	0.0017761989	0.0000000000	0.0017761989	0.0000000000	0.0000000000	0.0000000000
	0.0017761989	0.0017761989	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0017761989	0.0239786856	0.0373001776	0.0390763766	0.0195381883	0.0186500888	0.0355239787	0.0497335702
	0.0444049734	0.0248667851	0.0621669627	0.0799289520	0.1154529307	0.0710479574	0.0506216696	0.0159857904
	0.0088809947	0.0088809947	0.0115452931	0.0035523979	0.0000000000	0.0008880995	0.0008880995	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1991 1 5 3 0 99	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0009832842	0.0029498525
	0.0167158309	0.0235988201	0.0098328417	0.0098328417	0.0127826942	0.0245821042	0.0363815143	0.0294985251
	0.0127826942	0.0068829892	0.0049164208	0.0108161259	0.0029498525	0.0039331367	0.0039331367	0.0009832842
	0.0009832842	0.0019665683	0.0029498525	0.0009832842	0.0019665683	0.0000000000	0.0019665683	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0039331367	0.0167158309	0.0599803343	0.0521140610	0.0255653884	0.0452310718	0.0845624385	0.1022615536
	0.0757128810	0.0432645034	0.0432645034	0.0403146509	0.0334316618	0.0481809243	0.0344149459	0.0334316618
	0.0196656834	0.0049164208	0.0058997050	0.0009832842	0.0000000000	0.0000000000	0.0009832842	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000				
1992 1 5 3 0 99	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0059820538	0.0149551346
	0.0269192423	0.0378863410	0.0109670987	0.0079760718	0.0139581256	0.0338983051	0.0239282154	0.0209371884
	0.0129611167	0.0169491525	0.0089730808	0.0049850449	0.0029910269	0.0049850449	0.0019940179	0.0029910269
	0.0009970090	0.0009970090	0.0000000000	0.0009970090	0.0000000000	0.0000000000	0.0009970090	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0009970090	0.0000000000	0.0000000000	0.0109670987
	0.0279162512	0.0797607178	0.1026919242	0.0598205384	0.0289132602	0.0438683948	0.0737786640	0.0767696909
	0.0667996012	0.0388833500	0.0269192423	0.0209371884	0.0219341974	0.0129611167	0.0129611167	0.0119641077

0.0109670987 0.0089730808 0.0019940179 0.0000000000 0.0000000000 0.0009970090 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000
1993 1 5 3 0 99 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0040160643 0.0150602410
0.0240963855 0.0401606426 0.0301204819 0.0120481928 0.0130522088 0.0190763052 0.0251004016 0.0261044177
0.0120481928 0.0050200803 0.0060240964 0.0030120482 0.0030120482 0.0030120482 0.0000000000 0.0020080321
0.0000000000 0.0020080321 0.0010040161 0.0010040161 0.0000000000 0.0010040161 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0020080321
0.0271084337 0.0843373494 0.1144578313 0.1074297189 0.0622489960 0.0592369478 0.0692771084 0.0763052209
0.0471887550 0.0321285141 0.0170682731 0.0220883534 0.0140562249 0.0070281124 0.0030120482 0.0030120482
0.0020080321 0.0000000000 0.0000000000 0.0010040161 0.0010040161 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000

20 #_N_age_bins
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

2 #_N_ageerror_definitions

0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5
18.5 19.5 20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5
18.5 19.5 20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5
0.5 0.715501191 0.809263396 0.903025602 0.996787807 1.090550012 1.184312217 1.278074422 1.371836627
1.465598832 1.559361037 1.653123242 1.746885447 1.840647652 1.934409857 2.028172062 2.121934267
2.215696472 2.309458677 2.403220882 2.5 2.6 2.7 2.8 2.9 3 3 3 3 3 3
3 3 3 3 3 3 3 3 3 3

55 #_N_Agecomp_obs
#Yr Seas Flt/Svy Gender Part Ageerr Lbin_lo Lbin_hi Nsamp datavector(female-male)
#Com_1 Age Comps
1979 1 1 3 0 2 -1 -1 40.0 0 0.002553316 0.004046359 0.015273198 0.031165609 0.052476117 0.093628843 0.206630678 0.236086714 0.14492568 0.04957326 0.018095932 0.017173086
0.017335274 0.029611456 0.031145955 0.006287515 0.00038875 0 0 0 0.000549647 0.003424967 0.004659841 0.017581272 0.006998617 0.007906343 0.002481571 0 0 0 0 0 0 0 0 0 0 0 0
1980 1 1 3 0 2 -1 -1 40.0 0 0.003701201 0.018961966 0.029276376 0.051113189 0.112958127 0.12042954 0.127980038 0.134158111 0.086853476 0.048782599 0.038168099 0.025266011
0.01484596 0.014500354 0.007677481 0.006003076 0.001962052 0 0.000806368 0 0.000421964 0.009378278 0.014302048 0.030909132 0.053038019 0.018066328 0.016067437 0.00858445
0.000792878 0.004995442 0 0 0 0 0 0 0 0 0
1981 1 1 3 0 2 -1 -1 40.0 0 0.006869185 0.052506503 0.069993811 0.067419153 0.059190293 0.072991602 0.07334632 0.084607436 0.119046534 0.049943728 0.01337834 0.011897026
0.005864662 0.008774407 0.00023413 0.00023413 0.00023413 0 0 0 0.000557103 0.010329262 0.045310559 0.047693511 0.059863587 0.063999261 0.050057075 0.019800218 0.005858033 0 0 0 0
0 0 0 0 0 0
1982 1 1 3 0 2 -1 -1 40.0 0 0.012509712 0.038969607 0.093193043 0.124398574 0.160189722 0.136380008 0.066956608 0.036793993 0.051707373 0.053790001 0.009619453 0.030483778 0
0.009141072 0.009141072 0 0.000699384 0 0 0 0.003750265 0.012882527 0.015666803 0.043747685 0.02500972 0.031607407 0.018931115 0.01044001 0.003991068 0 0 0 0 0 0 0 0 0 0
1983 1 1 3 0 2 -1 -1 40.0 0 0.01926718 0.109635254 0.136972446 0.161227685 0.085226544 0.052443709 0.044306675 0.021325408 0.017824325 0.036620831 0.038943158 0.019579944
0.014001155 0.010940847 0.008422366 0.013676059 0.005470424 0.002735212 0.002843577 0 0.004908855 0.034006453 0.060702445 0.077084684 0.014604098 0.001643053 0 0 0.005587612 0 0
0 0 0 0 0 0 0 0

1984 1 1 3 0 2 -1 -1 33.9 0 0 0.036025544 0.120691126 0.205723659 0.195994048 0.080291529 0.048373013 0.022136789 0.015551624 0.009605419 0.018134869 0.01333085 0.001251173
0.001251173 0.001251173 0.001251173 0 0.00E+00 0 0 0 0.003277179 0.030123953 0.034160295 0.094055209 0.052029531 0.003157329 0.005700359 0 0.006632983 0 0 0 0 0 0 0 0 0
1985 1 1 3 0 2 -1 -1 31.2 0 0.000298442 0.001987681 0.040266078 0.101435357 0.235397499 0.28549755 0.078193054 0.076501121 0.040042177 0.015636681 0.008692065 0.015636681 0
0.007910621 0.00018456 0 0 0 0 0 0.000298442 0.000298442 0.015860582 0.015149817 0.015263699 0.044298886 0.000596884 0.00055368 0 0 0 0 0 0 0 0 0 0
1986 1 1 3 0 2 -1 -1 40.0 0 0.003131076 0.025630353 0.068767155 0.106038917 0.146744688 0.15963359 0.156209909 0.083834838 0.053998121 0.043001166 0.018085335 0.006186117
0.011920448 0.018312428 0.00430184 0.004539594 0.006395238 0 0 0 0.005372104 0.004577363 0.01264405 0.018918589 0.024507474 0.004485753 0.006036146 0.006427093 0 0.00026961
3.10042E-05 0 0 0 0 0 0 0 0
1987 1 1 3 0 2 -1 -1 40.0 0 0.008008495 0.046026893 0.084541681 0.126700838 0.171608157 0.136863551 0.103892467 0.102368503 0.040526178 0.014946603 0.005422533 0.000826192
0.002510307 0.000778998 0.003096766 0.003567064 0 0.000778998 0 0 0.006975622 0.020496225 0.008001659 0.044379211 0.032795377 0.022623806 0.005563232 0.005472926 0.000843368 0 0
0 0.000384348 0 0 0 0 0 0
1988 1 1 3 0 2 -1 -1 40.0 0 0.031461304 0.143703543 0.063950551 0.097407275 0.101245268 0.07905152 0.094056031 0.058183815 0.044969992 0.022374834 0.012568141 0.007242449
0.000171169 0 0 0 0.005165158 0.002760466 0 0 0.019556469 0.049873815 0.05041191 0.032731189 0.008245977 0.004712567 0.004432702 0.004154582 0.029627873 0.00798535 0.015970701 0 0
0.00798535 0 0 0 0 0
1989 1 1 3 0 2 -1 -1 40.0 0 0.00438203 0.119850817 0.308531241 0.160874677 0.074930028 0.047520555 0.024461295 0.021788907 0.017132945 0.007788129 0.000398926 0.007637376 0
0.001433006 0.000379793 0.000345031 0 0.001433006 0 0 0.001444961 0.06636062 0.076382447 0.024314279 0.019148552 0.01004375 0.000268011 0.00101337 0 0.00134598 0 0.000790268 0 0 0
0 0 0 0
1990 1 1 3 0 2 -1 -1 40.0 0 0.012735386 0.041192816 0.17936064 0.1666164 0.08829784 0.072300378 0.049076648 0.032136199 0.020732015 0.036305249 0.003702667 0.002966772 0.000104005 0
0 0 0 0 0 0.005861697 0.040707867 0.105617182 0.065616985 0.026057341 0.025919138 0.004247243 0.012543125 0 0.007902405 0 0 0 0 0 0 0 0 0
1991 1 1 3 0 2 -1 -1 40.0 0 0.033978925 0.081646227 0.119145743 0.198796205 0.157053846 0.099018027 0.056862363 0.032448742 0.028190025 0.010605135 0.013072406 0.00600988 0
0.007223898 0 0.001177783 0.002355567 0 0 0 0.026909853 0.018198879 0.031780812 0.028880766 0.01803825 0.015154818 0.008202836 0.005042711 0 0.000206305 0 0 0 0 0 0 0 0
1992 1 1 3 0 2 -1 -1 40.0 0 0.174545732 0.141631532 0.118847697 0.08471211 0.071157023 0.083169424 0.041690113 0.026168794 0.010159997 0.01511247 0.009142544 0.00045196 0.003998033
0.008222562 0.000692762 0.000117528 0.000117528 0 0 0 0.073907669 0.071856319 0.017431569 0.012555422 0.013709238 0.005386803 0.007817122 8.52498E-05 0.007312801 0 0 0 0 0 0 0 0 0
1993 1 1 3 0 2 -1 -1 40.0 0 0.115904949 0.173321339 0.099808484 0.102417754 0.070684752 0.134930006 0.032190892 0.009603728 0.073164131 0.004309527 0.015265726 0.006342657
0.001722002 0.004568442 0.000487329 0.001264005 0 0 0 0 0.050118204 0.050526469 0.040459262 0.005636169 0.001660381 0.003626994 0.001337019 0.000649777 0 0 0 0 0 0 0 0 0 0
1994 1 1 3 0 2 -1 -1 40.0 0 0.107436681 0.307512726 0.194312593 0.094545405 0.038646301 0.019124911 0.024868623 0.011072403 0.006379807 0.001531115 0.002731525 0.000551815
0.001267983 0.00394701 0.000275908 0 0.000154992 0 0 0 0.024139059 0.091469083 0.047061823 0.012829561 0.001856329 0.003545312 0.004144914 0 0 0.000297061 0 0 0 0.000297061 0 0 0 0
0
1995 1 1 3 0 2 -1 -1 40.0 0 0.020855938 0.186631402 0.346820219 0.143670099 0.055176057 0.017753033 0.003888755 0.007216244 0.002702272 0.003355004 0.002427255 0 0.000212006
0.000764918 0.005834658 0.000143364 0 0.00E+00 0 0 0.008916665 0.051895815 0.106864094 0.027857337 0.002375977 0.002324269 0.001459598 0 0 0 0.000855021 0 0 0 0 0 0 0 0
1996 1 1 3 0 2 -1 -1 40.0 0 0.057656682 0.124272217 0.266098901 0.276199336 0.05842101 0.043081862 0.026935931 0.011673259 0.00765892 0.008377882 0 0 0.000146652 0.009967668 0 0 0 0 0
0 0.011215279 0.038182338 0.02544157 0.017995599 0.011076331 0 0.002756044 0.001159518 0 0.001683 0 0 0 0 0 0 0 0 0
1997 1 1 3 0 2 -1 -1 40.0 0 0.027943356 0.164570217 0.200047866 0.15880798 0.134765534 0.040889581 0.031650072 0.019976674 0.033161279 0.024193226 0.00134466 0.001993163
0.003397766 0.007539747 0.001993163 0 0.001993163 0 0 0 0.013625481 0.067975335 0.022301909 0.022612928 0.010704626 0.006015221 0.001346798 0.000381302 0 0.000768953 0 0 0 0 0 0 0 0
0
1998 1 1 3 0 2 -1 -1 40.0 0 0.022571578 0.224078633 0.269319671 0.154833462 0.080761094 0.040775873 0.017793558 0.006973829 0.00449362 0.000770763 0.001291276 0.003484523 0
0.000770763 0 0.001478371 0 0 0 0 0.00520524 0.063695051 0.045437909 0.018198033 0.018884286 0.013479797 0.002572789 0.001245003 0 0 0.00188488 0 0 0 0 0 0 0 0
1999 1 1 3 0 2 -1 -1 40.0 0 0.010735673 0.087086226 0.246760247 0.223243455 0.104572668 0.064114745 0.048535482 0.026961615 0.006548026 0.002267982 0 0.000850155 0.001284383 0 0 0 0
0 0 0 0.004877356 0.031622519 0.045780185 0.040668634 0.015301976 0.020681676 0.00743565 0.003741394 0.002867282 0.002031174 0 0 0 0 0.002031497 0 0 0 0
2000 1 1 3 0 2 -1 -1 31.0 0 0.003312198 0.057174317 0.136052656 0.272972728 0.146809557 0.063522878 0.034794558 0.030235539 0.015478467 0.003989225 0.008744508 0.0048401 0
0.002845487 0 0 0 0 0 0 0 0.013087343 0.023209794 0.106994324 0.053986903 0.01045394 0.008649991 0.002845487 0 0 0 0 0 0 0 0 0 0 0
2001 1 1 3 0 2 -1 -1 40.0 0 0.030990492 0.078880433 0.151138149 0.141684561 0.15465605 0.098778973 0.027077623 0.025856518 0.015439547 0.003379184 0.002575701 0.003379184 0 0 0 0 0 0
0 0 0.013815632 0.014871391 0.068850873 0.06235235 0.048272112 0.027560033 0.016944226 0.010813348 0.00268362 0 0 0 0 0 0 0 0 0 0
2002 1 1 3 0 2 -1 -1 40.0 0 0.020643537 0.135452478 0.138246818 0.098044234 0.090768969 0.059515129 0.050170547 0.021561314 0.02609329 0.003934479 0.00196724 0.00196724 0 0 0 0 0 0
0 0.031179337 0.069312086 0.068583265 0.061816348 0.018065704 0.044048329 0.014953709 0.015397012 0.013429772 0.007424582 0.007424582 0 0 0 0 0 0 0 0
2003 1 1 3 0 2 -1 -1 40.0 0.0000000000 0.0166880616 0.1309370988 0.2464698331 0.1283697047 0.0577663671 0.0436456996 0.0166880616
0.0179717587 0.0077021823 0.0154043646 0.0051347882 0.0064184852 0.0012836970 0.0000000000 0.0000000000
0.0012836970 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0141206675 0.0693196406 0.1219512195
0.0487804878 0.0256739409 0.0038510911 0.0128369705 0.0025673941 0.0025673941 0.0025673941 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
2004 1 1 3 0 2 -1 -1 40.0 0.0000000000 0.0132450331 0.0838852097 0.2582781457 0.1236203091 0.0529801325 0.0242825607 0.0110375276
0.0022075055 0.0044150110 0.0022075055 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0110375276 0.0485651214 0.1258278146

0.1479028698 0.0529801325 0.0110375276 0.0066225166 0.0000000000 0.0088300221 0.0066225166 0.0022075055
0.0022075055 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
#Rec_Age Comps
1980 1 2 3 0 2 -1 -1 22.6 0 0.004424779 0.022123894 0.022123894 0.017699115 0.030973451 0.048672566 0.008849558 0.013274336 0.013274336 0.008849558 0 0.004424779 0.013274336 0.004424779 0 0 0 0 0 0 0.008849558 0.079646018 0.146017699 0.172566372 0.14159292 0.137168142 0.048672566 0.039823009 0.008849558 0.004424779 0 0 0 0 0 0 0 0 0
1986 1 2 3 0 2 -1 -1 34.1 0 0.002932551 0.014662757 0.055718475 0.061583578 0.052785924 0.061583578 0.061583578 0.049853372 0.032258065 0.026392962 0.017595308 0.011730205 0.008797654 0.008797654 0.002932551 0.005865103 0.005865103 0.002932551 0 0 0.005865103 0.052785924 0.099706745 0.058651026 0.041055718 0.052785924 0.06744868 0.04398827 0.029325513 0.017595308 0.020527859 0.005865103 0.005865103 0.005865103 0.002932551 0 0.002932551 0.002932551 0
1987 1 2 3 0 2 -1 -1 27.4 0 0.018248175 0.018248175 0.062043796 0.076642336 0.03649635 0.032846715 0.03649635 0.018248175 0.01459854 0.003649635 0 0.00729927 0.003649635 0.003649635 0 0 0 0 0.003649635 0 0.091240876 0.113138686 0.109489051 0.109489051 0.072992701 0.072992701 0.04379562 0.01459854 0.01459854 0 0.01459854 0.00729927 0 0 0 0 0 0 0
1988 1 2 3 0 2 -1 -1 25.0 0.004 0.044 0.112 0.044 0.024 0.008 0.004 0 0 0.004 0 0 0 0 0 0 0 0 0 0 0 0.216 0.372 0.08 0.056 0.02 0.004 0.004 0.004 0 0 0 0 0 0 0 0 0 0 0
1989 1 2 3 0 2 -1 -1 22.7 0 0.013215859 0.044052863 0.061674009 0.039647577 0.030837004 0.039647577 0.013215859 0.013215859 0 0.004405286 0 0 0 0 0 0 0 0 0 0.044052863 0.193832599 0.220264317 0.123348018 0.057268722 0.035242291 0.030837004 0.017621145 0.008810573 0.004405286 0.004405286 0 0 0 0 0 0 0 0
1990 1 2 3 0 2 -1 -1 20.7 0.004830918 0.019323671 0.028985507 0.06763285 0.062801932 0.033816425 0.009661836 0 0.009661836 0.004830918 0 0 0 0 0 0 0 0 0 0 0.033816425 0.1352657 0.241545894 0.236714976 0.072463768 0.019323671 0.014492754 0 0 0 0 0 0 0.004830918 0 0 0 0 0
1991 1 2 3 0 2 -1 -1 24.7 0 0.004048583 0.064777328 0.04048583 0.032388664 0.076923077 0.056680162 0.012145749 0.028340081 0.012145749 0.012145749 0.016194332 0.012145749 0.004048583 0.016194332 0.008097166 0.016194332 0 0 0 0 0.028340081 0.113360324 0.109311741 0.068825911 0.125506073 0.028340081 0.064777328 0.012145749 0.012145749 0.012145749 0.004048583 0.004048583 0 0 0 0 0 0.004048583 0
1992 1 2 3 0 2 -1 -1 40.0 0 0.048096192 0.070140281 0.068136273 0.048096192 0.044088176 0.03006012 0.024048096 0.014028056 0.01002004 0.004008016 0.006012024 0.004008016 0.002004008 0.002004008 0 0 0 0 0 0.002004008 0.072144289 0.166332665 0.124248497 0.092184369 0.080160321 0.052104208 0.014028056 0.012024048 0.004008016 0.004008016 0.002004008 0 0 0 0 0 0 0 0
1993 1 2 3 0 2 -1 -1 40.0 0.001886792 0.049056604 0.096226415 0.081132075 0.049056604 0.037735849 0.022641509 0.01509434 0.005660377 0.00754717 0.001886792 0.001886792 0.001886792 0 0 0.001886792 0 0 0 0 0 0.069811321 0.230188679 0.137735849 0.075471698 0.037735849 0.024528302 0.020754717 0.003773585 0.013207547 0.011320755 0 0 0.001886792 0 0 0 0 0 0
1994 1 2 3 0 2 -1 -1 40.0 0 0.008908686 0.075723831 0.113585746 0.084632517 0.084632517 0.024498886 0.011135857 0.006681514 0.008908686 0.008908686 0.004454343 0.011135857 0 0 0.002227171 0.002227171 0 0 0 0.002227171 0.024498886 0.151447661 0.155902004 0.077951002 0.048997773 0.028953229 0.026726058 0.013363029 0.004454343 0.011135857 0.002227171 0.004454343 0 0 0 0 0 0 0
1995 1 2 3 0 2 -1 -1 40.0 0 0.00466563 0.041990669 0.096423017 0.105754277 0.059097978 0.057542768 0.018662519 0.01244168 0.00622084 0.00466563 0.00155521 0 0.00155521 0.00155521 0 0.00155521 0 0 0 0 0.01399689 0.082426128 0.220839813 0.133748056 0.074650078 0.023328149 0.01244168 0.01088647 0.00622084 0.00155521 0.00155521 0.00155521 0 0 0 0 0 0.00311042 0
1996 1 2 3 0 2 -1 -1 40.0 0 0.006507592 0.097613883 0.143167028 0.117136659 0.069414317 0.047722343 0.015184382 0.013015184 0.006507592 0.004338395 0.002169197 0 0.002169197 0.004338395 0 0 0 0 0 0.006507592 0.086767896 0.110629067 0.121475054 0.078091106 0.028199566 0.023861171 0.002169197 0.002169197 0.006507592 0 0.002169197 0 0.002169197 0 0 0 0 0
1997 1 2 3 0 2 -1 -1 40.0 0 0.006726457 0.087443946 0.107623318 0.091928251 0.085201794 0.029147982 0.020179372 0.00896861 0.004484305 0.002242152 0.002242152 0 0 0 0 0 0 0 0 0.013452915 0.098654709 0.17264574 0.109865471 0.067264574 0.056053812 0.004484305 0.013452915 0.006726457 0.00896861 0.002242152 0 0 0 0 0 0 0 0
1998 1 2 3 0 2 -1 -1 40.0 0.002403846 0.007211538 0.067307692 0.146634615 0.127403846 0.079326923 0.067307692 0.024038462 0.019230769 0.002403846 0.002403846 0.007211538 0 0.002403846 0 0 0 0 0 0 0.009615385 0.057692308 0.120192308 0.127403846 0.064903846 0.040865385 0.021634615 0 0 0 0 0.002403846 0 0 0 0 0 0 0
1999 1 2 3 0 2 -1 -1 40.0 0 0 0.052545156 0.137931034 0.149425287 0.085385878 0.052545156 0.032840722 0.011494253 0.003284072 0.003284072 0.001642036 0.001642036 0 0.001642036 0 0 0 0 0 0 0 0.047619048 0.128078818 0.123152709 0.087027915 0.042692939 0.02134647 0.009852217 0 0.004926108 0.001642036 0 0 0 0 0 0 0 0
2000 1 2 3 0 2 -1 -1 40.0 0 0.001639344 0.036065574 0.109836066 0.159016393 0.098360656 0.078688525 0.027868852 0.01147541 0.004918033 0.006557377 0 0 0 0 0 0 0 0 0 0.001639344 0.03442623 0.07704918 0.147540984 0.108196721 0.054098361 0.026229508 0.006557377 0.003278689 0.003278689 0.001639344 0.001639344 0 0 0 0 0 0 0
2001 1 2 3 0 2 -1 -1 40.0 0 0 0.018730489 0.087408949 0.14880333 0.134235172 0.083246618 0.039542144 0.019771072 0.01144641 0.007284079 0.002081165 0.001040583 0 0 0 0 0 0 0 0.002081165 0.015608741 0.083246618 0.106139438 0.1144641 0.058272633 0.03433923 0.019771072 0.009365245 0.003121748 0 0 0 0 0 0 0 0 0
2002 1 2 3 0 2 -1 -1 40.0 0 0.000910747 0.053734062 0.160291439 0.146630237 0.094717668 0.073770492 0.035519126 0.014571949 0.014571949 0.010928962 0.000910747 0.000910747 0.000910747 0.000910747 0 0 0 0 0 0 0 0.028233151 0.100182149 0.118397086 0.06557377 0.044626594 0.02003643 0.006375228 0.003642987 0.003642987 0 0 0 0 0 0 0 0 0
2003 1 2 3 0 2 -1 -1 40.0 0.0000000000 0.0067632850 0.0801932367 0.1777777778 0.1120772947 0.0599033816 0.0357487923 0.0270531401
0.0154589372 0.0057971014 0.0067632850 0.0038647343 0.0000000000 0.0009661836 0.0009661836 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0048309179 0.0657004831 0.1439613527
0.1091787440 0.0647342995 0.0376811594 0.0299516908 0.0077294686 0.0019323671 0.0000000000 0.0009661836
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
2004 1 2 3 0 2 -1 -1 40.0 0.0000000000 0.0000000000 0.0247349823 0.1537102473 0.1431095406 0.0706713781 0.0388692580 0.0176678445
0.0194346290 0.0000000000 0.0017667845 0.0053003534 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0265017668 0.1554770318
0.1749116608 0.0971731449 0.0477031802 0.0106007067 0.0053003534 0.0017667845 0.0035335689 0.0017667845
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000

```
#NMFS Survey Age Comps
1992 1 4 3 0 2 -1 -1 7.4 0.067567568 0.148648649 0.148648649 0.135135135 0.013513514 0.054054054 0.013513514 0 0 0.013513514 0 0 0 0 0 0 0 0.013513514 0 0.054054054 0.202702703
0.027027027 0.027027027 0.013513514 0.054054054 0.013513514 0 0 0 0 0 0 0 0 0 0 0 0
1995 1 4 3 0 2 -1 -1 20.8 0.091346154 0.100961538 0.206730769 0.129807692 0.057692308 0.043269231 0.019230769 0.004807692 0.004807692 0 0 0 0.004807692 0 0 0 0 0 0 0.043269231
0.067307692 0.076923077 0.057692308 0.033653846 0.028846154 0.014423077 0.004807692 0 0 0.004807692 0 0 0 0.004807692 0 0 0 0 0
1998 1 4 3 0 2 -1 -1 36.7 0.114441417 0.100817439 0.119891008 0.111716621 0.108991826 0.089918256 0.049046322 0.013623978 0.002724796 0.002724796 0.002724796 0 0 0 0 0 0 0 0
0.065395095 0.068119891 0.084468665 0.029972752 0.019073569 0.005449591 0.005449591 0.005449591 0 0 0 0 0 0 0 0 0 0 0
2001 1 4 3 0 2 -1 -1 40.0 0.1195511955	0.2107096602	0.1402315543	0.0309798553	0.0209665630	0.0337843188	0.0454866809	0.0322222722
	0.0162576739	0.0073745878	0.0039712182	0.0000000000	0.0020728571	0.0000000000	0.0014768564	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0649520542	0.1497722942	0.0849266799	0.0214044940
	0.0042836979	0.0025585764	0.0023129119	0.0025889516	0.0012448931	0.0008701533	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
2004 1 4 3 0 2 -1 -1 40.0 0.0035952614	0.0628980471	0.0971440942	0.1524476852	0.1472861247	0.0513114833	0.0291076123	0.0193219005
	0.0218298424	0.0168063783	0.0140589282	0.0141983541	0.0000000000	0.0011644763	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0041222304	0.0314111635	0.1033534247	0.1263304322
	0.0676519629	0.0187346499	0.0029694938	0.0038425081	0.0095699167	0.0008440299	0.0000000000	0.0000000000
	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000	0.0000000000
#WDFW Tagging Survey Age Comps
1994 1 5 3 0 2 -1 -1 10.0 0 0 0 0.04 0.15 0.02 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.28 0.42 0.08 0 0.01 0 0 0 0 0 0 0 0 0 0 0 0
1995 1 5 3 0 2 -1 -1 28.1 0 0.106761566 0.053380783 0.046263345 0.017793594 0.003558719 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.206405694 0.185053381 0.295373665 0.060498221 0.014234875
0.007117438 0 0.003558719 0 0 0 0 0 0 0 0 0 0 0
1996 1 5 3 0 2 -1 -1 40.0 0.021526419 0.146771037 0.1037182 0.050880626 0.011741683 0.001956947 0 0 0.001956947 0 0 0 0 0 0 0 0 0 0 0.031311155 0.318982387 0.225048924 0.070450098
0.011741683 0.003913894 0 0 0 0 0 0 0 0 0 0 0 0 0
1997 1 5 3 0 2 -1 -1 40.0 0.010040161 0.196787149 0.138554217 0.024096386 0.010040161 0 0.002008032 0 0 0 0 0 0 0 0 0 0 0 0 0.014056225 0.309236948 0.226907631 0.046184739 0.014056225
0.008032129 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)

0 #_N_environ_variables
0 #_N_environ_obs

999

ENDDATA
```

Filename: SS2NAMES.NAM

```
LCNDATA05d.dat
LCNCTL05.CTL
1      #run number
0       # 0=no Parameter read; use the init values in the CTL file; 1=use SS2.PAR
1      #Show_run_progress_on_console_(0/1/2)

1      #Produce_detailed_.rep_file_(0/1)

0      #_N_nudata
5       #_last_phase
Code_version_:_
10       # burn in for mcmc chain
2        # thinning interval for mcmc chain
.000  # jitter initial parm values
0.01  # push initial parm values away from bounds
-1    # min year for spbio sd_report (negative value sets to styr-2; the virgin
level)
-1    # max year for spbio sd_report (negative value sets to endyr+1)
```

Filename: FORECAST.SS2

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

 # verify end of input harvest rates
 999

 # specified actual catches into the future
 # (negative values are not used, but there must be a sufficient number of
values)
 # fleet1 fleet2
      -1    -1    #year 1     season      1
      -1    -1    #year 2     season      1
      -1    -1    #year 3     season      1
      -1    -1    #year 4     season      1
      -1    -1    #year 5     season      1
      -1    -1    #year 6     season      1
      -1    -1    #year 7     season      1
      -1    -1    #year 8     season      1
      -1    -1    #year 9     season      1
      -1    -1    #year 10    season      1
      -1    -1    #year 11    season      1
      -1    -1    #year 12    season      1
```

Filename: SS2.STD

index	name	value	std dev
1	SR_parm[1]	8.2295e+000	6.0926e-002
2	rec_dev1	4.0448e-001	3.4968e-001
3	rec_dev1	-6.4972e-001	5.5649e-001
4	rec_dev1	1.8346e-001	3.6967e-001
5	rec_dev1	-3.9555e-001	5.1451e-001
6	rec_dev1	-5.2724e-001	4.6657e-001
7	rec_dev1	3.2428e-002	3.9414e-001
8	rec_dev1	1.0130e-001	4.7424e-001
9	rec_dev1	1.0869e+000	2.1447e-001
10	rec_dev1	-3.6691e-001	5.0167e-001
11	rec_dev1	-8.3942e-001	4.8202e-001
12	rec_dev1	-4.2364e-001	2.6594e-001
13	rec_dev1	-5.6783e-001	2.5719e-001
14	rec_dev1	-1.0160e-001	1.7944e-001
15	rec_dev1	-5.1036e-001	2.0569e-001
16	rec_dev1	1.9043e-001	1.1324e-001
17	rec_dev1	-2.0135e+000	3.8910e-001
18	rec_dev1	-7.5233e-001	1.6636e-001
19	rec_dev1	-2.5090e-001	1.3077e-001
20	rec_dev1	-4.0102e-001	1.7001e-001
21	rec_dev1	2.6525e-001	1.2684e-001
22	rec_dev1	3.9293e-001	1.4381e-001
23	rec_dev1	-5.0232e-001	4.1306e-001
24	rec_dev1	7.5193e-001	2.3349e-001
25	rec_dev1	6.8557e-001	2.7234e-001
26	rec_dev1	-9.6639e-002	4.6511e-001
27	rec_dev1	-1.3762e-001	4.6978e-001
28	rec_dev1	8.5178e-001	3.0361e-001
29	rec_dev1	1.7572e+000	3.1580e-001
30	rec_dev1	1.8330e+000	3.0397e-001
31	init_F[1]	3.9449e-003	2.2767e-004
32	init_F[2]	6.9670e-004	7.7643e-005
33	selparm[3]	7.3762e-001	1.6314e-001
34	selparm[4]	4.1939e+000	1.6927e+000
35	selparm[5]	-1.0529e+001	3.8664e+001
36	selparm[6]	-1.0696e+000	1.3400e-001
37	selparm[7]	1.2599e+000	9.6629e-001
38	selparm[11]	-4.9999e-001	1.1698e-001
39	selparm[12]	-6.4613e+000	2.3977e+000
40	selparm[15]	5.7274e-001	5.5487e-001
41	selparm[16]	9.4277e+000	3.0578e+001
42	selparm[17]	-1.0226e+001	3.9672e+001
43	selparm[18]	-2.4105e+000	4.5483e-001
44	selparm[19]	2.1334e-001	9.3221e-002
45	selparm[23]	1.0632e+000	9.5736e-002
46	selparm[27]	4.6271e+000	3.5876e-002
47	selparm[28]	1.6200e-001	2.6107e-001
48	selparm[29]	-3.2613e+000	2.0208e+000
49	selparm[30]	-1.3255e+000	3.8484e-001
50	selparm[31]	9.8950e+000	4.1573e+001
51	selparm[35]	-3.0891e-002	1.3149e-001
52	selparm[39]	-2.5020e+000	1.0955e+001
53	selparm[40]	6.2544e+000	2.5305e+001
54	selparm[41]	-8.2802e+000	4.3552e+001

55	selparm[42]	-2.5929e+000	2.1912e-001
56	selparm[43]	6.8064e-001	3.3308e-001
57	selparm[47]	2.2667e+000	1.0225e-001
58	fore_recruitments	-4.9803e-002	2.9962e-001
59	fore_recruitments	-3.7198e-003	3.1477e-001
60	fore_recruitments	-5.6715e-002	3.0745e-001
61	fore_recruitments	-1.0465e-001	3.0097e-001
62	fore_recruitments	0.0000e+000	1.0000e+000
63	fore_recruitments	0.0000e+000	1.0000e+000
64	fore_recruitments	0.0000e+000	1.0000e+000
65	fore_recruitments	0.0000e+000	1.0000e+000
66	fore_recruitments	0.0000e+000	1.0000e+000
67	fore_recruitments	0.0000e+000	1.0000e+000
68	fore_recruitments	0.0000e+000	1.0000e+000
69	fore_recruitments	0.0000e+000	1.0000e+000
70	fore_recruitments	0.0000e+000	1.0000e+000
71	fore_recruitments	0.0000e+000	1.0000e+000
72	fore_recruitments	0.0000e+000	1.0000e+000
73	fore_recruitments	0.0000e+000	1.0000e+000
74	R0	3.7498e+003	3.7561e+000
75	S0	3.9466e+004	3.7561e+000
76	spbio_std	3.9466e+004	3.7561e+000
77	spbio_std	3.8357e+004	3.7561e+000
78	spbio_std	3.8357e+004	3.7561e+000
79	spbio_std	3.7696e+004	3.7561e+000
80	spbio_std	3.6979e+004	3.7561e+000
81	spbio_std	3.6181e+004	3.7561e+000
82	spbio_std	3.4816e+004	3.7561e+000
83	spbio_std	3.3381e+004	3.7561e+000
84	spbio_std	3.2166e+004	3.7561e+000
85	spbio_std	3.1513e+004	3.7561e+000
86	spbio_std	3.1280e+004	3.7561e+000
87	spbio_std	3.0866e+004	3.7561e+000
88	spbio_std	3.0281e+004	3.7561e+000
89	spbio_std	2.9521e+004	3.7561e+000
90	spbio_std	2.9283e+004	3.7561e+000
91	spbio_std	2.8785e+004	3.7561e+000
92	spbio_std	2.8723e+004	3.7561e+000
93	spbio_std	2.8946e+004	3.7561e+000
94	spbio_std	2.9065e+004	3.7561e+000
95	spbio_std	2.9236e+004	3.7561e+000
96	spbio_std	2.9073e+004	3.7561e+000
97	spbio_std	2.8628e+004	3.7561e+000
98	spbio_std	2.7545e+004	3.7561e+000
99	spbio_std	2.6402e+004	3.7561e+000
100	spbio_std	2.4918e+004	3.7561e+000
101	spbio_std	2.3504e+004	3.7561e+000
102	spbio_std	2.1260e+004	3.7561e+000
103	spbio_std	1.9384e+004	3.7561e+000
104	spbio_std	1.8112e+004	3.7561e+000
105	spbio_std	1.7140e+004	3.7561e+000
106	spbio_std	1.5700e+004	3.7561e+000
107	spbio_std	1.3790e+004	3.7561e+000
108	spbio_std	1.1454e+004	3.7561e+000
109	spbio_std	1.0562e+004	3.7561e+000
110	spbio_std	9.5239e+003	3.7561e+000
111	spbio_std	8.6149e+003	3.7561e+000

112	spbio_std	7.2956e+003	3.7561e+000
113	spbio_std	6.3284e+003	3.7561e+000
114	spbio_std	4.7957e+003	3.7561e+000
115	spbio_std	4.2661e+003	3.7561e+000
116	spbio_std	3.8638e+003	3.7561e+000
117	spbio_std	3.9241e+003	3.7561e+000
118	spbio_std	4.4488e+003	3.7561e+000
119	spbio_std	5.0338e+003	3.7561e+000
120	spbio_std	5.8857e+003	3.7561e+000
121	spbio_std	7.2455e+003	3.7561e+000
122	spbio_std	8.6752e+003	3.7561e+000
123	spbio_std	1.0702e+004	3.7561e+000
124	spbio_std	1.3758e+004	3.7561e+000
125	spbio_std	1.8370e+004	3.7561e+000
126	spbio_std	2.4077e+004	3.7561e+000
127	spbio_std	2.9416e+004	3.7561e+000
128	recr_std	3.7498e+003	3.7561e+000
129	recr_std	3.7498e+003	3.7561e+000
130	recr_std	3.7468e+003	3.7561e+000
131	recr_std	3.7449e+003	3.7561e+000
132	recr_std	3.7428e+003	3.7561e+000
133	recr_std	3.7404e+003	3.7561e+000
134	recr_std	3.7360e+003	3.7561e+000
135	recr_std	3.7309e+003	3.7561e+000
136	recr_std	3.7263e+003	3.7561e+000
137	recr_std	3.7237e+003	3.7561e+000
138	recr_std	3.7228e+003	3.7561e+000
139	recr_std	3.7210e+003	3.7561e+000
140	recr_std	3.7185e+003	3.7561e+000
141	recr_std	3.7151e+003	3.7561e+000
142	recr_std	3.7140e+003	3.7561e+000
143	recr_std	3.7116e+003	3.7561e+000
144	recr_std	3.7113e+003	3.7561e+000
145	recr_std	3.7124e+003	3.7561e+000
146	recr_std	3.3747e+003	3.7561e+000
147	recr_std	1.1762e+003	3.7561e+000
148	recr_std	2.7055e+003	3.7561e+000
149	recr_std	1.5154e+003	3.7561e+000
150	recr_std	1.3265e+003	3.7561e+000
151	recr_std	2.3175e+003	3.7561e+000
152	recr_std	2.4767e+003	3.7561e+000
153	recr_std	6.6186e+003	3.7561e+000
154	recr_std	1.5392e+003	3.7561e+000
155	recr_std	9.5497e+002	3.7561e+000
156	recr_std	1.4417e+003	3.7561e+000
157	recr_std	1.2440e+003	3.7561e+000
158	recr_std	1.9717e+003	3.7561e+000
159	recr_std	1.2981e+003	3.7561e+000
160	recr_std	2.5765e+003	3.7561e+000
161	recr_std	2.8221e+002	3.7561e+000
162	recr_std	9.8575e+002	3.7561e+000
163	recr_std	1.6096e+003	3.7561e+000
164	recr_std	1.3568e+003	3.7561e+000
165	recr_std	2.5887e+003	3.7561e+000
166	recr_std	2.8057e+003	3.7561e+000
167	recr_std	1.1197e+003	3.7561e+000
168	recr_std	3.8411e+003	3.7561e+000

169	recr_std	3.6070e+003	3.7561e+000
170	recr_std	1.6944e+003	3.7561e+000
171	recr_std	1.6655e+003	3.7561e+000
172	recr_std	4.6015e+003	3.7561e+000
173	recr_std	1.1733e+004	3.7561e+000
174	recr_std	1.2945e+004	3.7561e+000
175	recr_std	3.3198e+003	3.7561e+000
176	recr_std	3.5516e+003	3.7561e+000
177	recr_std	3.4335e+003	3.7561e+000
178	recr_std	3.3183e+003	3.7561e+000
179	recr_std	3.7146e+003	3.7561e+000
180	depletion	6.1008e-001	3.7561e+000
181	depletion	7.4534e-001	3.7561e+000
182	depletion	2.6631e+003	3.7561e+000
183	depletion	1.7140e+004	3.7561e+000
184	depletion	4.5000e-001	3.7561e+000
185	depletion	2.9416e+004	3.7561e+000
186	depletion	3.7146e+003	3.7561e+000
187	depletion	7.4534e-001	3.7561e+000
188	depletion	-1.#INDe+000	3.7561e+000
189	depletion	-1.#INDe+000	3.7561e+000
190	depletion	-1.#INDe+000	3.7561e+000
191	depletion	-1.#INDe+000	3.7561e+000
192	depletion	-1.#INDe+000	3.7561e+000
193	depletion	-1.#INDe+000	3.7561e+000
194	depletion	-1.#INDe+000	3.7561e+000
195	depletion	-1.#INDe+000	3.7561e+000
196	depletion	-1.#INDe+000	3.7561e+000
197	depletion	-1.#INDe+000	3.7561e+000
198	depletion	-1.#INDe+000	3.7561e+000
199	depletion	-1.#INDe+000	3.7561e+000
200	depletion	-1.#INDe+000	3.7561e+000
201	depletion	-1.#INDe+000	3.7561e+000
202	depletion	-1.#INDe+000	3.7561e+000
203	depletion	-1.#INDe+000	3.7561e+000
204	depletion	-1.#INDe+000	3.7561e+000
205	depletion	-1.#INDe+000	3.7561e+000
206	depletion	-1.#INDe+000	3.7561e+000
207	depletion	-1.#INDe+000	3.7561e+000
208	depletion	-1.#INDe+000	3.7561e+000
209	depletion	-1.#INDe+000	3.7561e+000
210	depletion	-1.#INDe+000	3.7561e+000
211	depletion	-1.#INDe+000	3.7561e+000
212	depletion	-1.#INDe+000	3.7561e+000
213	depletion	-1.#INDe+000	3.7561e+000
214	depletion	-1.#INDe+000	3.7561e+000
215	depletion	-1.#INDe+000	3.7561e+000
216	depletion	-1.#INDe+000	3.7561e+000
217	depletion	-1.#INDe+000	3.7561e+000
218	depletion	-1.#INDe+000	3.7561e+000
219	depletion	-1.#INDe+000	3.7561e+000
220	depletion	-1.#INDe+000	3.7561e+000
221	depletion	-1.#INDe+000	3.7561e+000
222	depletion	-1.#INDe+000	3.7561e+000
223	depletion	-1.#INDe+000	3.7561e+000
224	depletion	-1.#INDe+000	3.7561e+000
225	depletion	-1.#INDe+000	3.7561e+000

226	depletion	-1.#INDe+000	3.7561e+000
227	depletion	-1.#INDe+000	3.7561e+000
228	depletion	-1.#INDe+000	3.7561e+000
229	depletion	-1.#INDe+000	3.7561e+000
230	depletion	-1.#INDe+000	3.7561e+000
231	depletion	-1.#INDe+000	3.7561e+000
232	depletion	-1.#INDe+000	3.7561e+000
233	depletion	-1.#INDe+000	3.7561e+000
234	depletion	-1.#INDe+000	3.7561e+000
235	depletion	-1.#INDe+000	3.7561e+000
236	depletion	-1.#INDe+000	3.7561e+000
237	depletion	-1.#INDe+000	3.7561e+000
238	depletion	-1.#INDe+000	3.7561e+000
239	depletion	-1.#INDe+000	3.7561e+000
240	depletion	-1.#INDe+000	3.7561e+000
241	depletion	-1.#INDe+000	3.7561e+000
242	depletion	-1.#INDe+000	3.7561e+000
243	depletion	-1.#INDe+000	3.7561e+000
244	depletion	-1.#INDe+000	3.7561e+000

Appendix II. Southern Area (LCS) Base Model Output.

Assessment of Lingcod for the Pacific Fishery Management Council in 2005

Table 1. Negative log likelihood and lambda (likelihood weighting factor) values for the southern area (LCS) base model.

Component	-Log(L)	Lambda
Total Likelihood	**168.74**	
Indices	**21.72**	
Trawl Logbook	7.50	1
NMFS Trawl Survey	14.22	1
Discard	**0.00**	
Age_comps	**140.07**	
Commercial Fishery	78.74	1
Recreational	47.09	1
NMFS Trawl Survey	14.23	1
Size-at-age	**0.00**	
Equil_catch	**0.00**	1
Recruitment	**6.71**	1
Parm_priors	**0.02**	1
Parm_devs	**0.00**	1
Penalties	**0.00**	0.000
Forecast_Recruitment	**0.22**	0

Table 2. Parameters used in the southern area (LCS) base model; mortality-growth and biology.

Parameter Name	Value	Min	Max	Active_Cnt	Bound
M-G_parms					
Females					
M-Young	0.18				
M-Old	0				
Lmin	35.1				
Lmax	107.9				
VBK	0.1449				
CV-Young	0.0699				
CV-Old	-0.13116				
Males					
M-Young	0.5754				
M-Old	0				
Lmin	-0.02482				
Lmax	-0.28624				
VBK	0.43216				
CV-Young	-0.17699				
CV-Old	0.98074				
biology_parms					
Females					
Wt-Len a	1.76E-06				
Wt-Len b	3.3978				
Mat-Len 1	60.6010				
Mat-Len 2	-0.1550				
Males					
Wt-Len a	3.95E-06				
Wt-Len b	3.2149				

Table 3. Parameters used in the southern area (LCS) base model; spawner-recruit, recruitment deviations, and initial F.

Parameter Name		Value	Min	Max	Active_Cnt	Bound
SR_parms						
LN(R0)		7.82528	1	100	1	0
H		0.9				
SD-r		1				
Init_R_Mult		0				
Recr_Devs						
	1976	0.981304			2	0
	1977	-0.298281			3	0
	1978	-0.187007			4	0
	1979	1.31782			5	0
	1980	-0.050209			6	0
	1981	-0.912532			7	0
	1982	-1.09592			8	0
	1983	-0.435261			9	0
	1984	1.34793			10	0
	1985	-0.226117			11	0
	1986	1.20906			12	0
	1987	-0.97255			13	0
	1988	-0.851553			14	0
	1989	0.15918			15	0
	1990	0.221584			16	0
	1991	0.436269			17	0
	1992	-0.447594			18	0
	1993	0.221315			19	0
	1994	-0.107363			20	0
	1995	-0.19598			21	0
	1996	0.777998			22	0
	1997	-1.3312			23	0
	1998	-0.3149			24	0
	1999	0.509758			25	0
	2000	0.244251			26	0
init_F_parms						
Com		0.0141265	0	1	27	0
Rec		0.0027733	0	1	28	0

Table 4. Parameters used in the southern area (LCS) base model; selectivity.

Parameter Name	Value	Min	Max	Active_Cnt	Bound
sel_parms					
Com-Fem					
age@peak	5				
sel@minA	0				
asc_infl (logit)	0.309357	-20	20	29	0
asc_slope	12.3414	0.1	20	30	0
sel@maxA (logit)	-9.49234	-20	20	31	0
desc_infl (logit)	-2.8446	-20	20	32	0
desc_slope	1.69115	0	2	33	0
width_of_top	1.5				
Com-Male					
Age_@transition	5				
MinL Offset	0	0	0	0	0
M1 Offset	-0.415637	-10	10	34	0
MaxL Offset	4.13413	-10	10	35	0
Rec-Fem					
age@peak	4				
sel@minA	0				
asc_infl (logit)	4.1625	-10	10	36	0
asc_slope	0.1	0	0	0	0
sel@maxA (logit)	-8.14862	-10	30	37	0
desc_infl (logit)	-1.72958	-10	10	38	0
desc_slope	8.90171	0	20	39	0
width_of_top	1.5				
Rec-Male					
Age_@transition	4				
MinL Offset	0	0	0	0	0
M1 Offset	0	0	0	0	0
MaxL Offset	0	0	0	0	0
NMFS-Female					
age@peak	3				
sel@minA	0				
asc_infl (logit)	-4.92714	-20	20	40	0
asc_slope	0.101	0	0	0	0
sel@maxA (logit)	-8.04143	-20	30	41	0
desc_infl (logit)	-1.33629	-20	30	42	0
desc_slope	9.65261	0	20	43	0
width_of_top	1				
NMFS-Male					
Age_@transition	3				
MinL Offset	0	0	0	0	0
M1 Offset	-0.060557	-10	20	44	0
MaxL Offset	0	0	0	0	0

Figure 1. SS2 output for the southern area (LCS) base model; From the top: recruitment, female spawning biomass, total biomass, and spawner-recruit relationship. Triangular symbols are present assessment estimates; square symbols are 2003 assessment estimates.

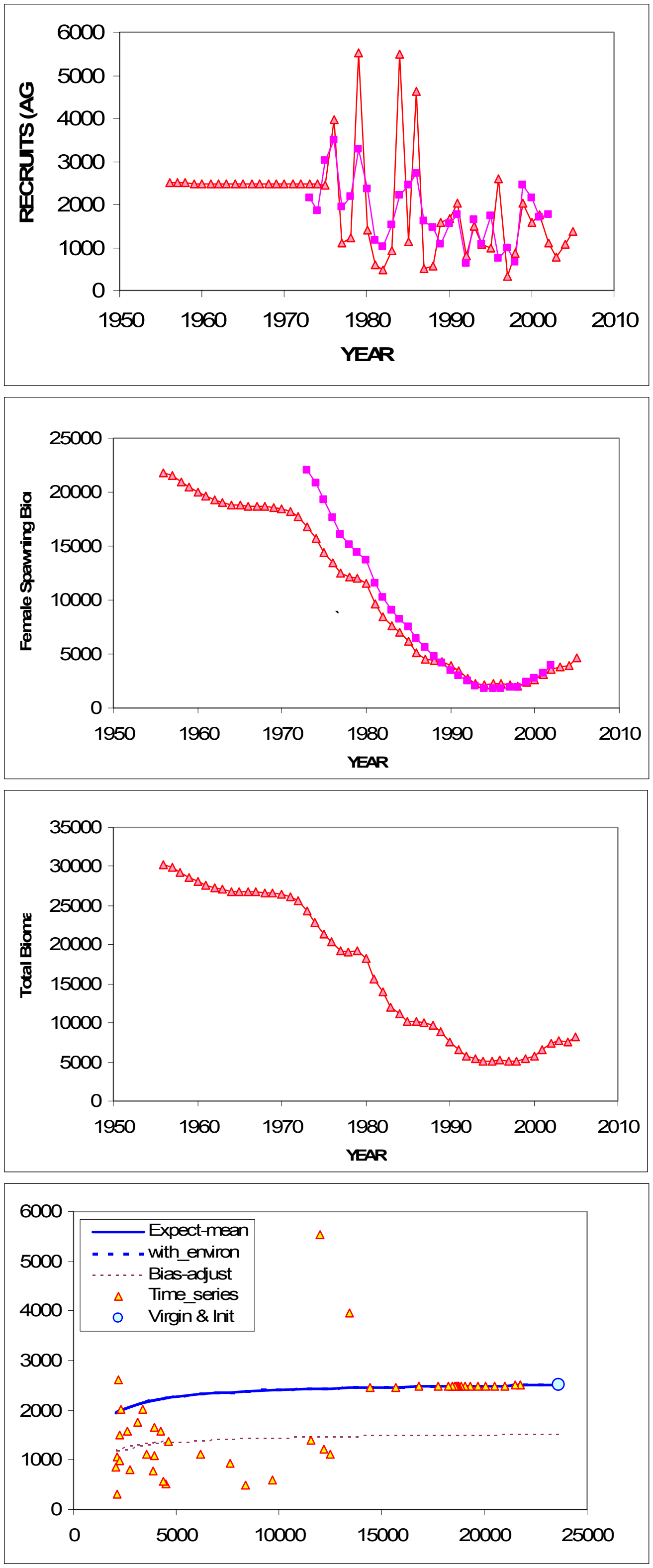
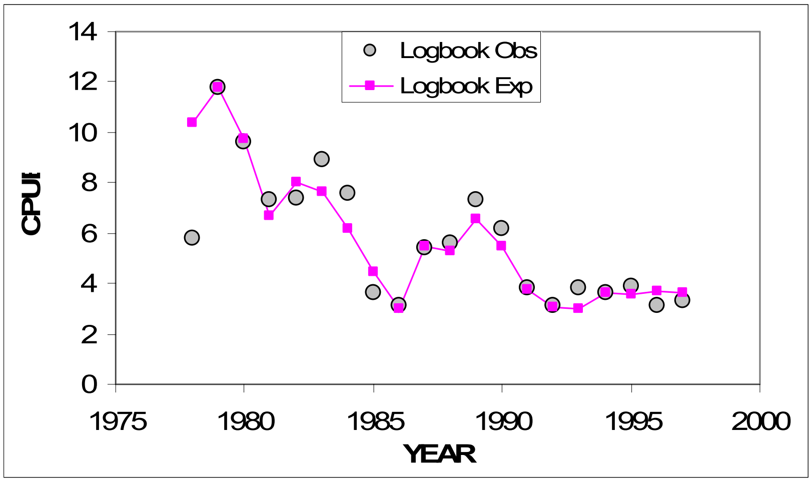


Figure 2. SS2 output for the southern area (LCS) base model: Model fits to indices of abundance; Top; trawl logbook, bottom; NMFS trawl survey.



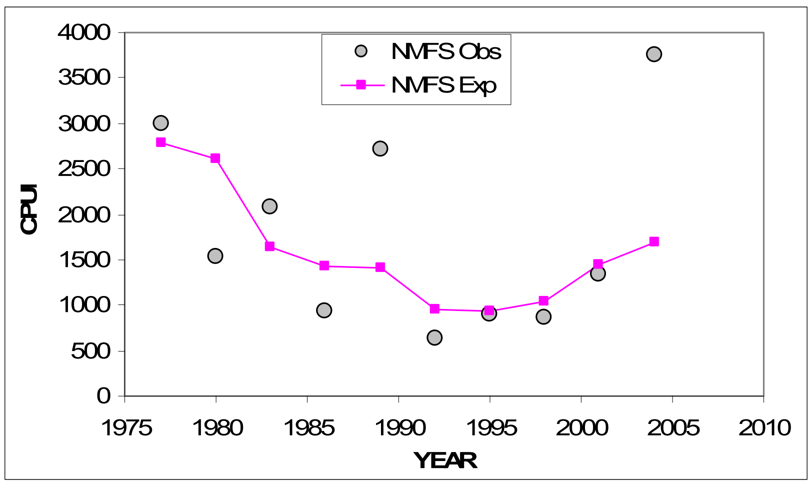


Figure 3. SS2 output for the southern area (LCS) base model: Estimated selectivity for the commercial fishery, recreational fishery, NMFS trawl survey, and WDFW tagging survey.

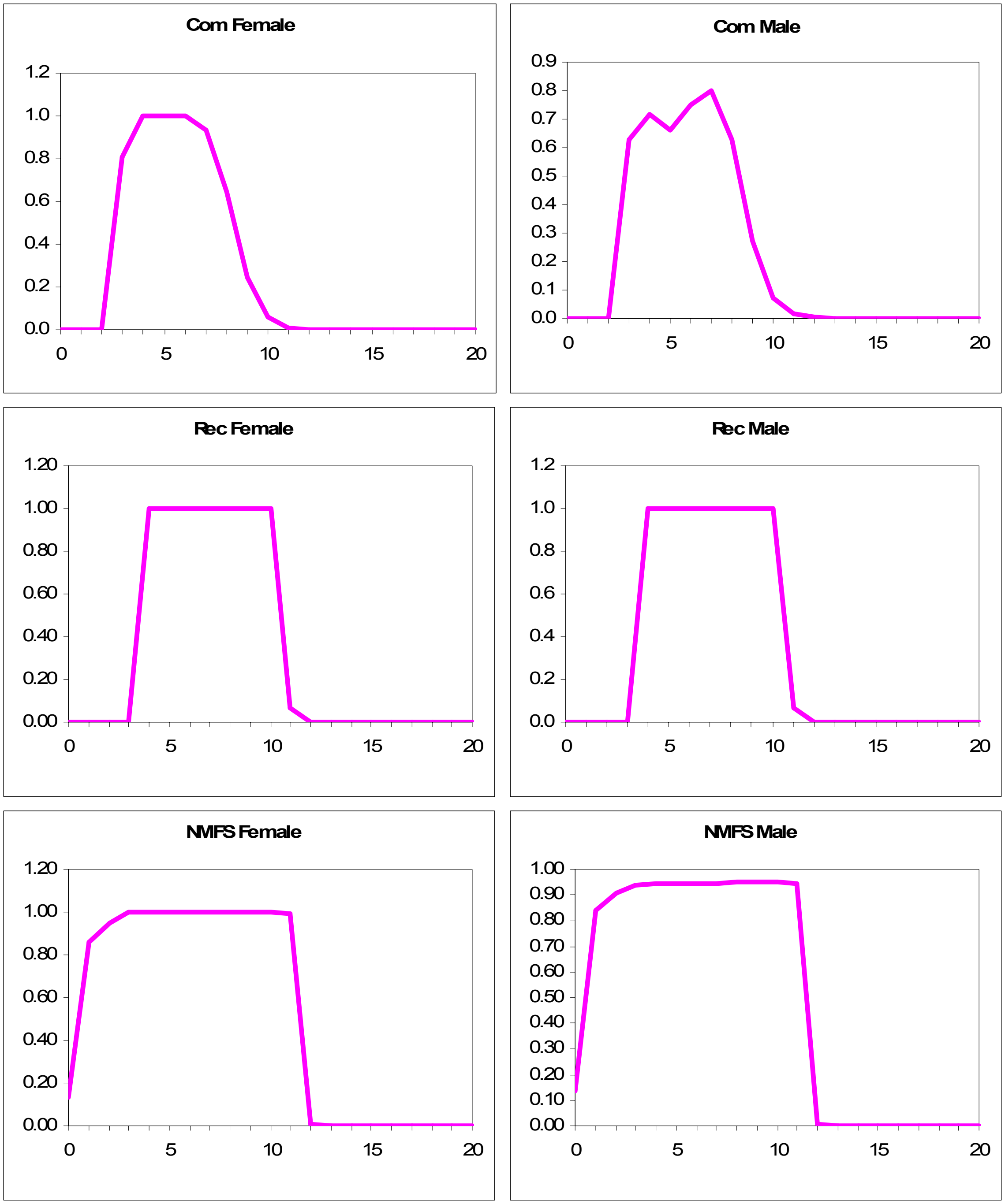
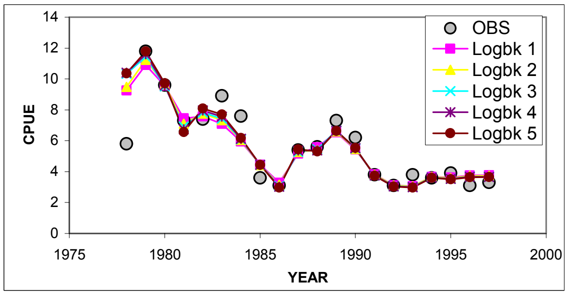
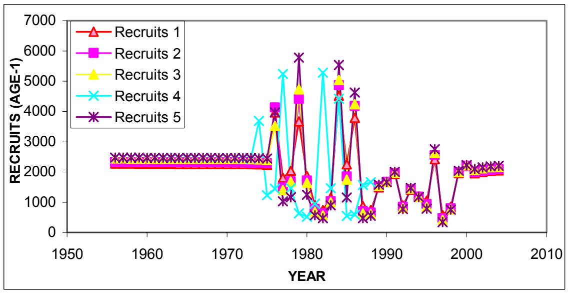
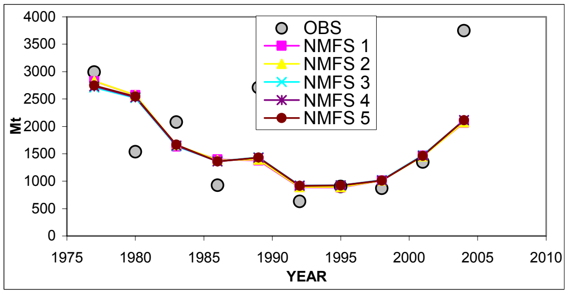


Figure 4. SS2 output for the southern area (LCS) base model: Profile of the base model over the standard deviation of recruitment.; Clockwise from top left: negative log likelihood values, trawl logbook index, NMFS trawl survey, female spawning biomass, recruitment.

SD-r	0.7	0.8	0.9	0.95	1.0
Component	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**
total	169.956	169.554	169.732	169.931	170.243
indices	18.9942	18.5505	19.1881	19.1455	19.069
discard	0	0	0	0	0
mean_body_wt	0	0	0	0	0
length_comps	0	0	0	0	0
age_comps	143.52	143.532	143.889	143.911	143.942
size-age	0	0	0	0	0
Equil_catch	1.45E-10	1.69E-10	4.43E-11	6.66E-11	8.2E-11
Recruitment	7.41976	7.45017	6.63348	6.85212	7.20956
Parm_priors	0.021748	0.020426	0.021509	0.022502	0.022647
Parm_devs	0	0	0	0	0
penalties	0	0	0	0	0







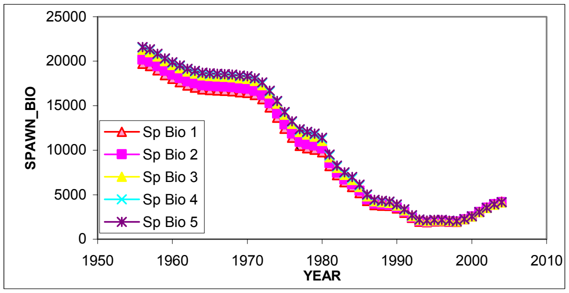
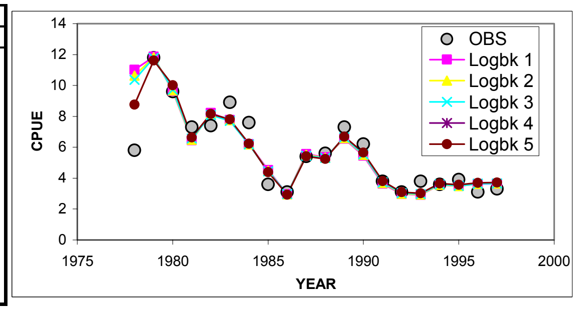
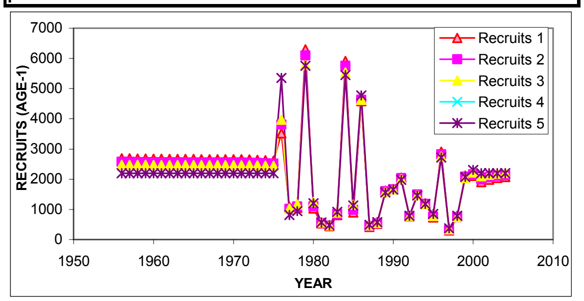
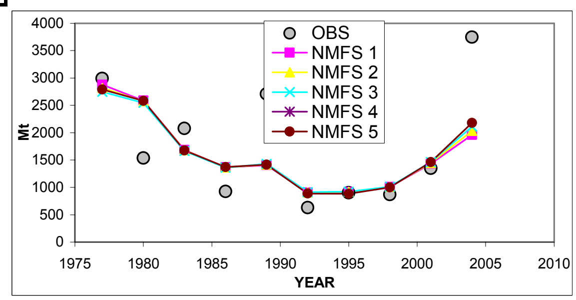


Figure 5. SS2 output for the southern area (LCS) base model: Profile over Beveton-Holt spawner-recruit steepness (*h)*; Clockwise from top left: negative log likelihood values, trawl logbook index, NMFS trawl survey, female spawning biomass, recruitment.

H	0.8	0.85	0.9	0.95	1
Component	Run 1	Run 2	Run 3	Run 4	Run 5
total	172.7	171.4	170.2		168.1
indices	20.9	19.9	19.1		16.7
discard	0.000	0.000	0.000		0.000
mean_body_wt	0.000	0.000	0.000		0.000
length_comps	0.0	0.0	0.0		0.0
age_comps	143.7	143.7	143.9		143.7
size-age	0.000	0.000	0.000		0.000
Equil_catch	0.000	0.000	0.000		0.000
Recruitment	8.103	7.724	7.210		7.691
Parm_priors	0.023	0.024	0.023		0.021
Parm_devs	0.000	0.000	0.000		0.000
penalties	0.000	0.000	0.000		0.000







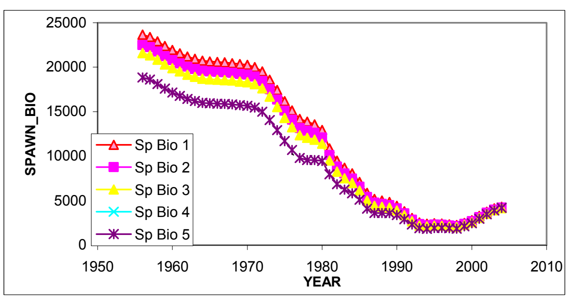
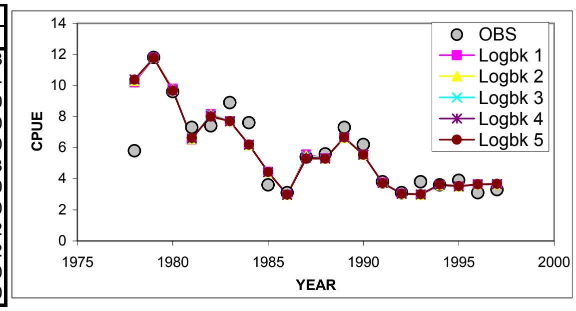
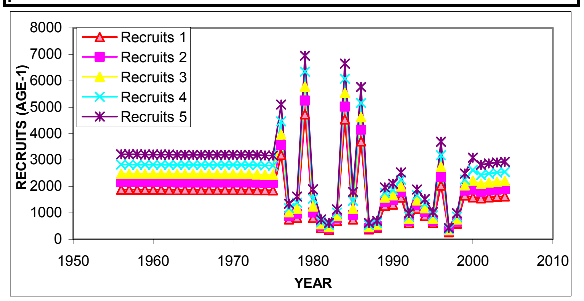
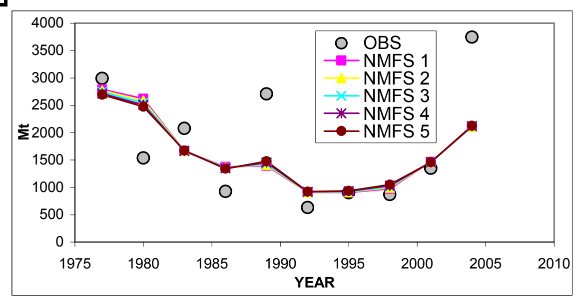


Figure 6. SS2 output for the southern area (LCS) base model: Profile over natural mortality (M); Clockwise from top left: negative log likelihood values, trawl logbook index, NMFS trawl survey, female spawning biomass, recruitment.

M (Fem/Male)	.14/.26	.16/.29	.18/.32	.20/.35	.22/.38
Component	Run 1	Run 2	Run 3	Run 4	Run 5
total	165.988	167.921	170.243	172.943	176.028
indices	19.4506	19.2924	19.069	18.7575	18.4084
discard	0	0	0	0	0
mean_body_wt	0	0	0	0	0
length_comps	0	0	0	0	0
age_comps	138.97	141.218	143.942	147.11	150.658
size-age	0	0	0	0	0
Equil_catch	6.73E-10	9.69E-12	8.2E-11	1.78E-10	1.73E-10
Recruitment	7.54262	7.38731	7.20956	7.05349	6.94112
Parm_priors	0.025065	0.023931	0.022647	0.021433	0.020162
Parm_devs	0	0	0	0	0
penalties	0	0	0	0	0







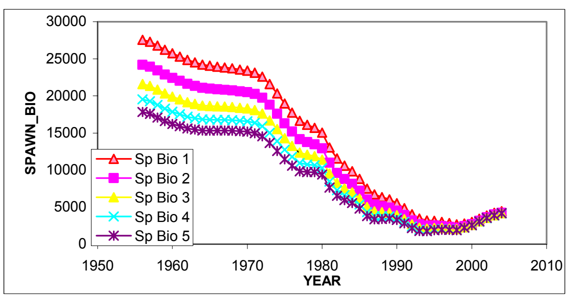
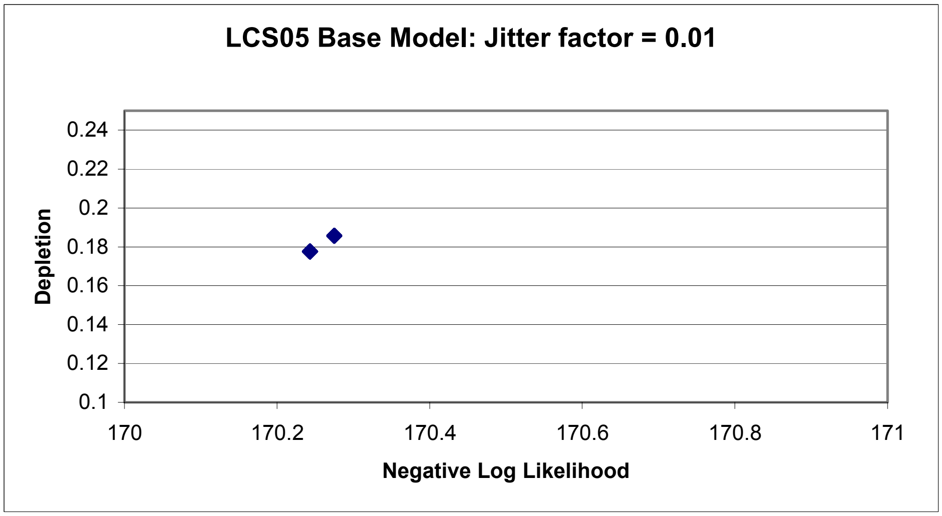
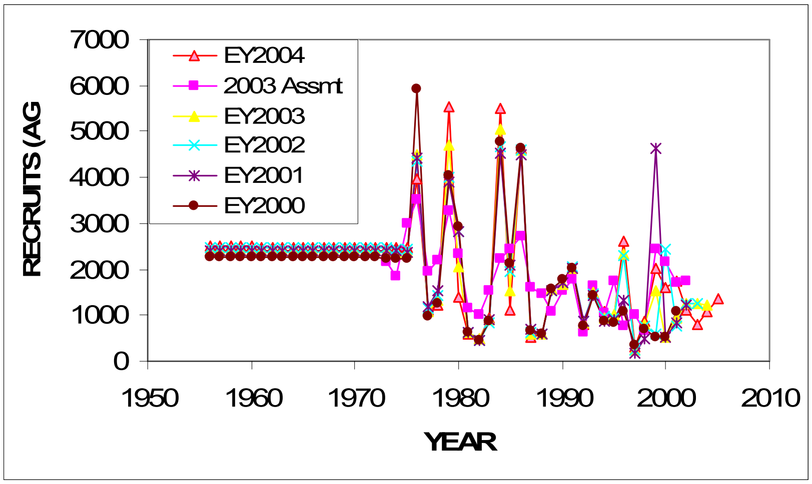


Figure 6a. SS2 output for the southern area (LCS) base model: Model stability test; Results of 30 base-model runs with SS2 jitter factor = 0.01.



Run Number	-Log Likelihood	Depletion
1	170.243	0.17768
2	170.243	0.17768
3	170.243	0.17768
4	170.243	0.17768
5	170.243	0.17768
6	170.243	0.17768
7	170.243	0.17768
8	170.243	0.17768
9	170.243	0.17768
10	170.243	0.17768
11	170.243	0.17768
12	170.243	0.17768
13	170.243	0.17768
14	170.243	0.17768
15	170.243	0.17768
16	170.243	0.17768
17	170.243	0.17768
18	170.275	0.18573
19	170.275	0.18573
20	170.275	0.18573
21	170.275	0.18573
22	170.275	0.18573
23	170.275	0.18573
24	170.275	0.18573
25	170.275	0.18573
26	170.275	0.18573
27	170.275	0.18573
28	170.275	0.18573
29	170.275	0.18573
30	170.275	0.18573

Figure 6b. SS2 output for the southern area (LCS) base model: Retrospective Analysis, obtained by sequentially decrementing end-year from 2004 to 2000; Top: time series of recruitment (number of age 0 fish in thousands), Bottom: time series of spawning biomass (mt).



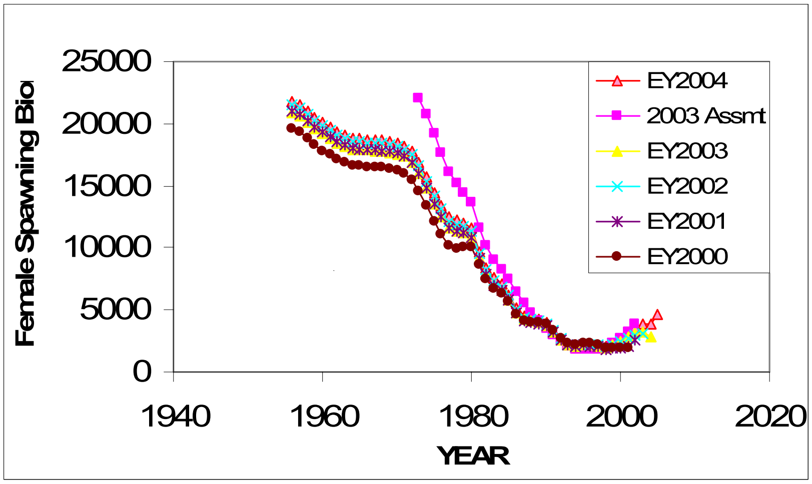


Figure 7. SS2 output for the southern area (LCS) base model: Model fits to commercial fishery catch-at-age.

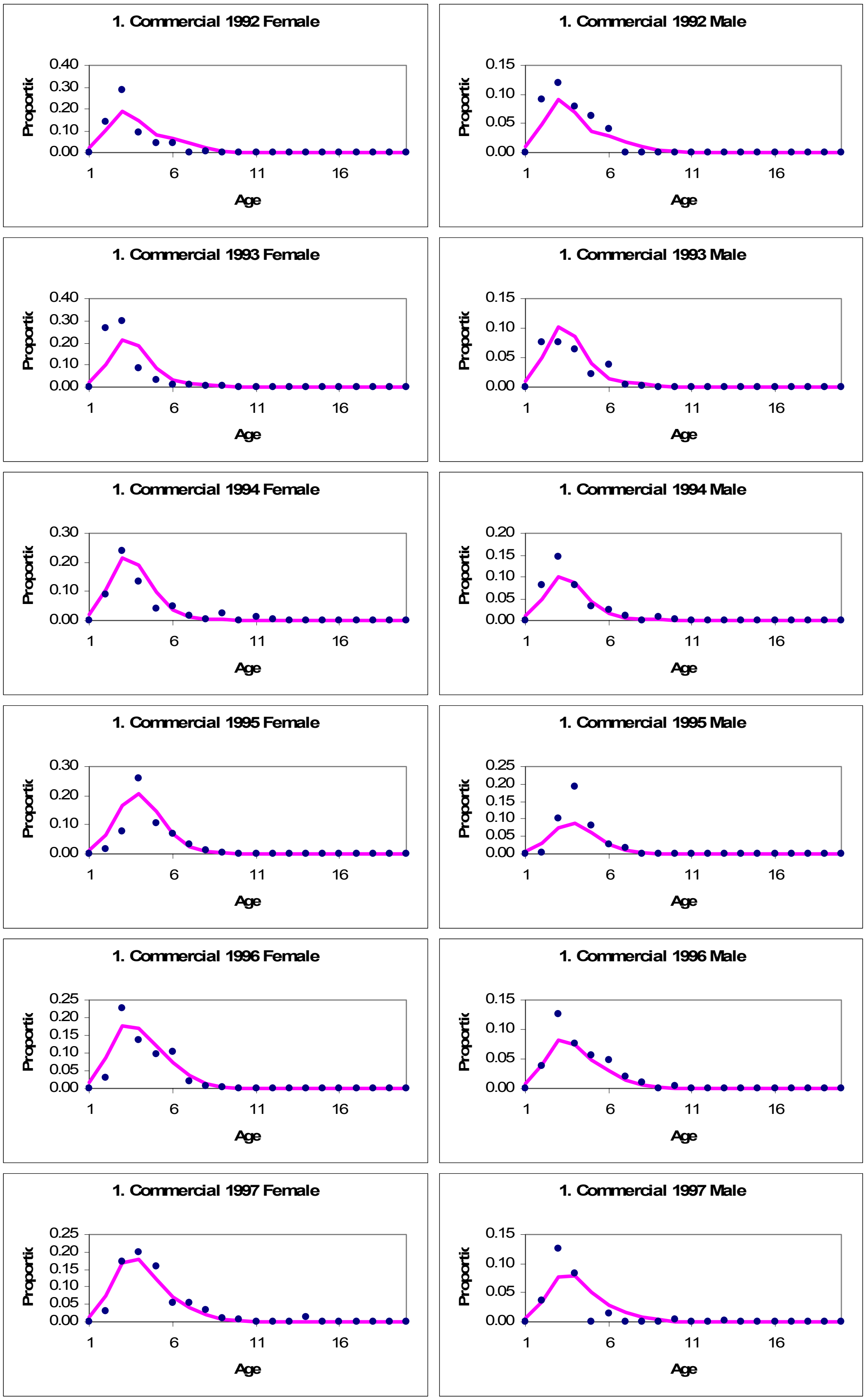


Figure 7, continued. SS2 output for the southern area (LCS) base model: Model fits to commercial fishery catch-at-age.

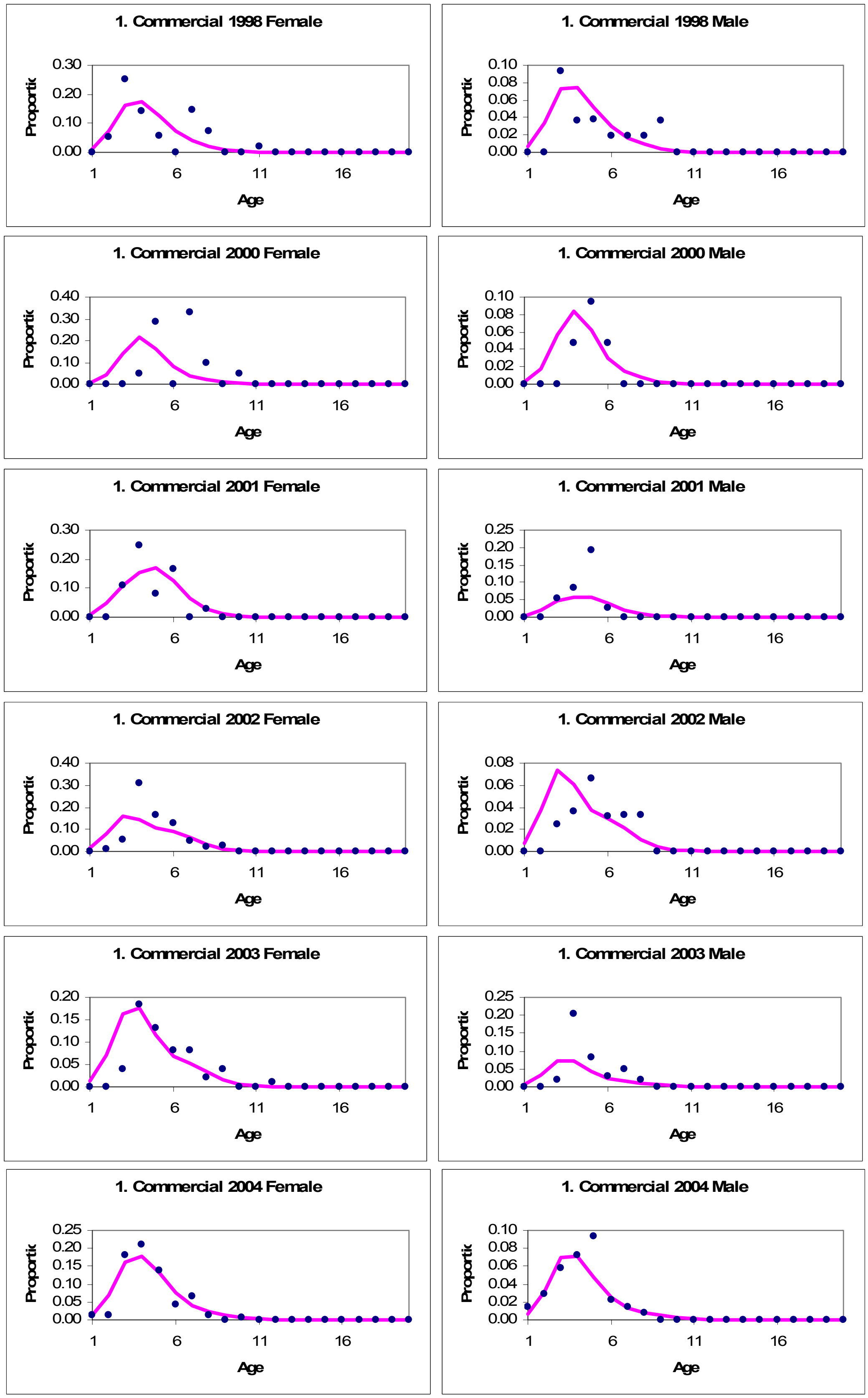


Figure 8. SS2 output for the southern area (LCS) base model: Model fits to recreational fishery catch-at-age.

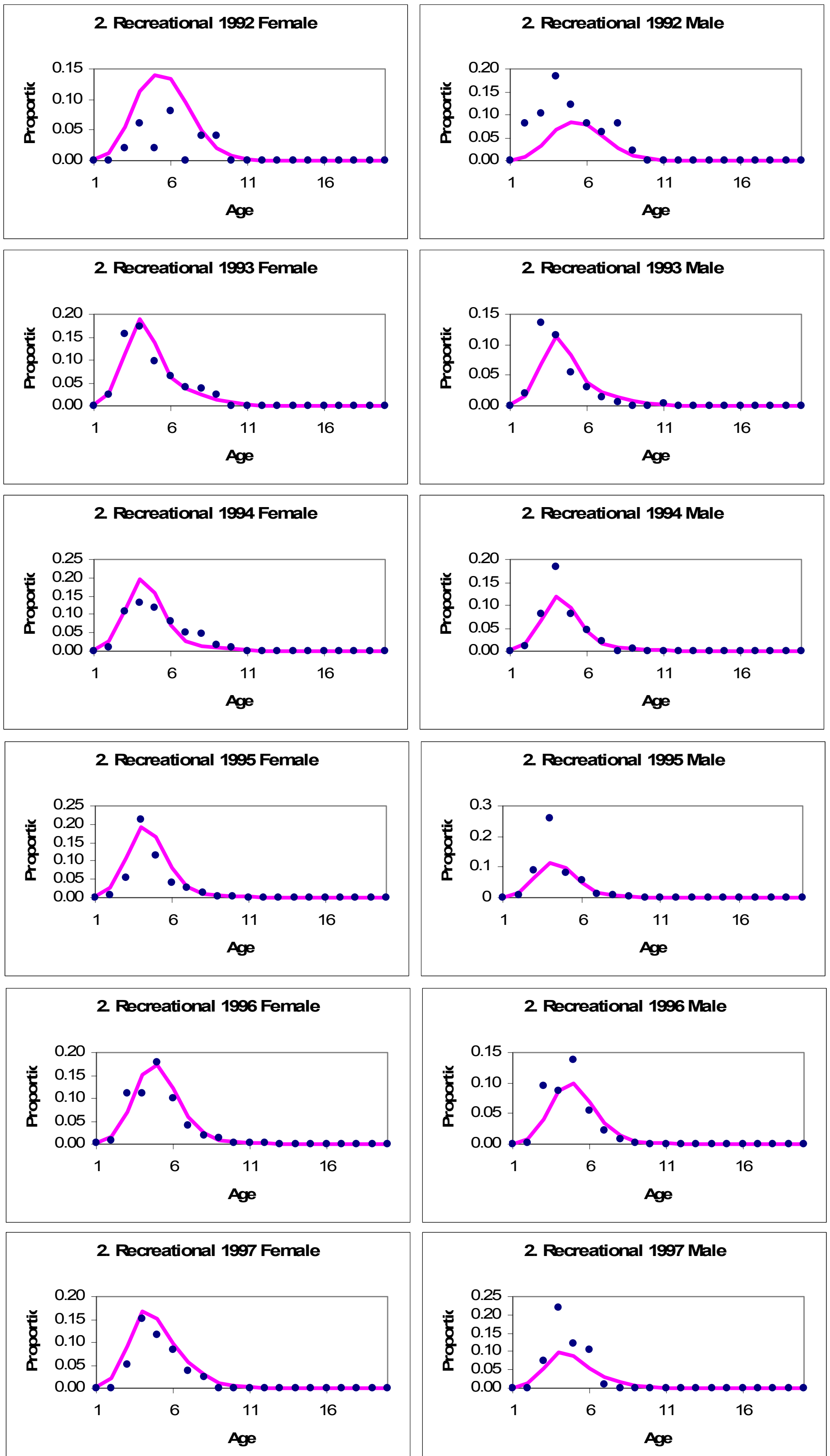


Figure 8, continued. SS2 output for the southern area (LCS) base model: Model fits to recreational fishery catch-at-age.

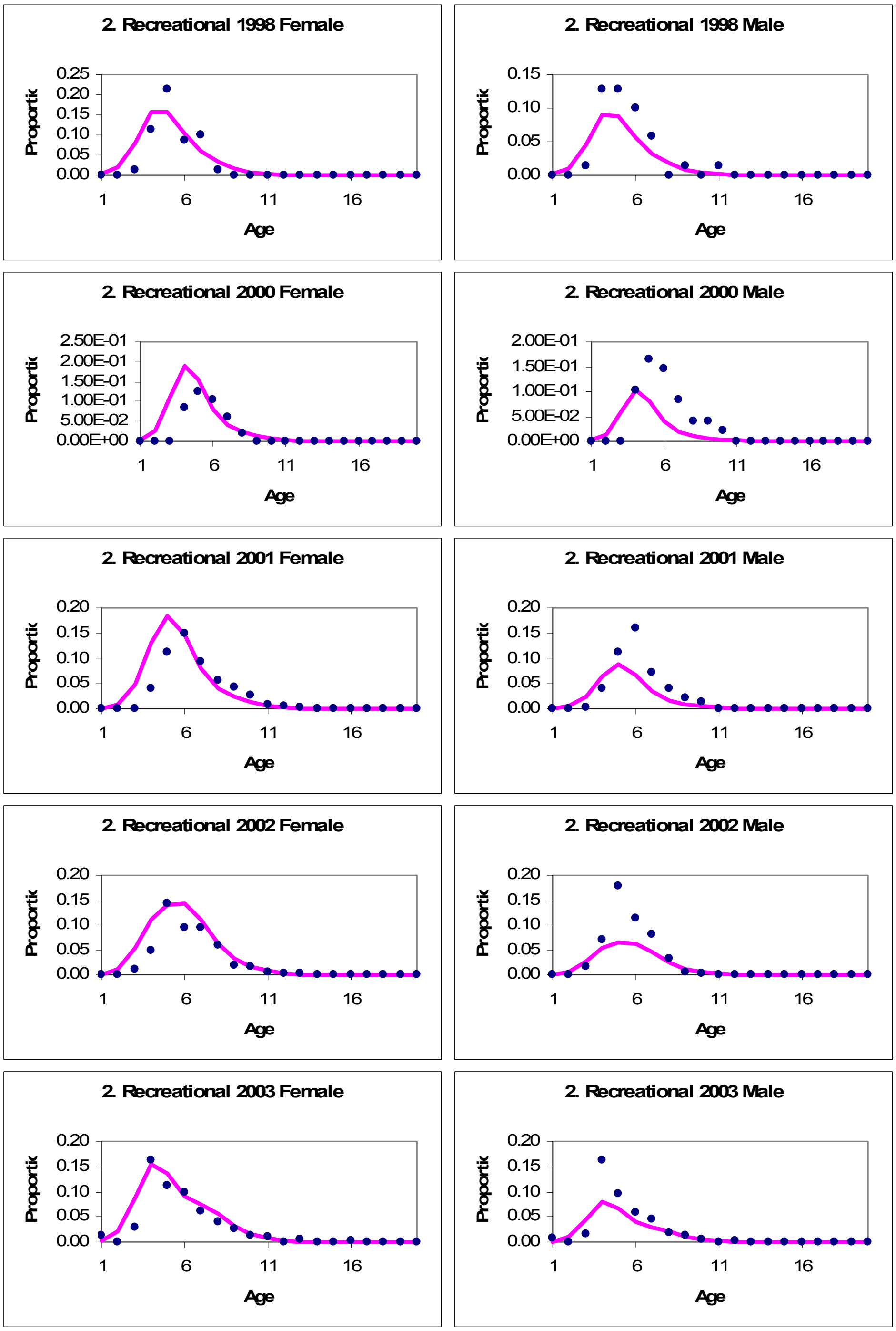
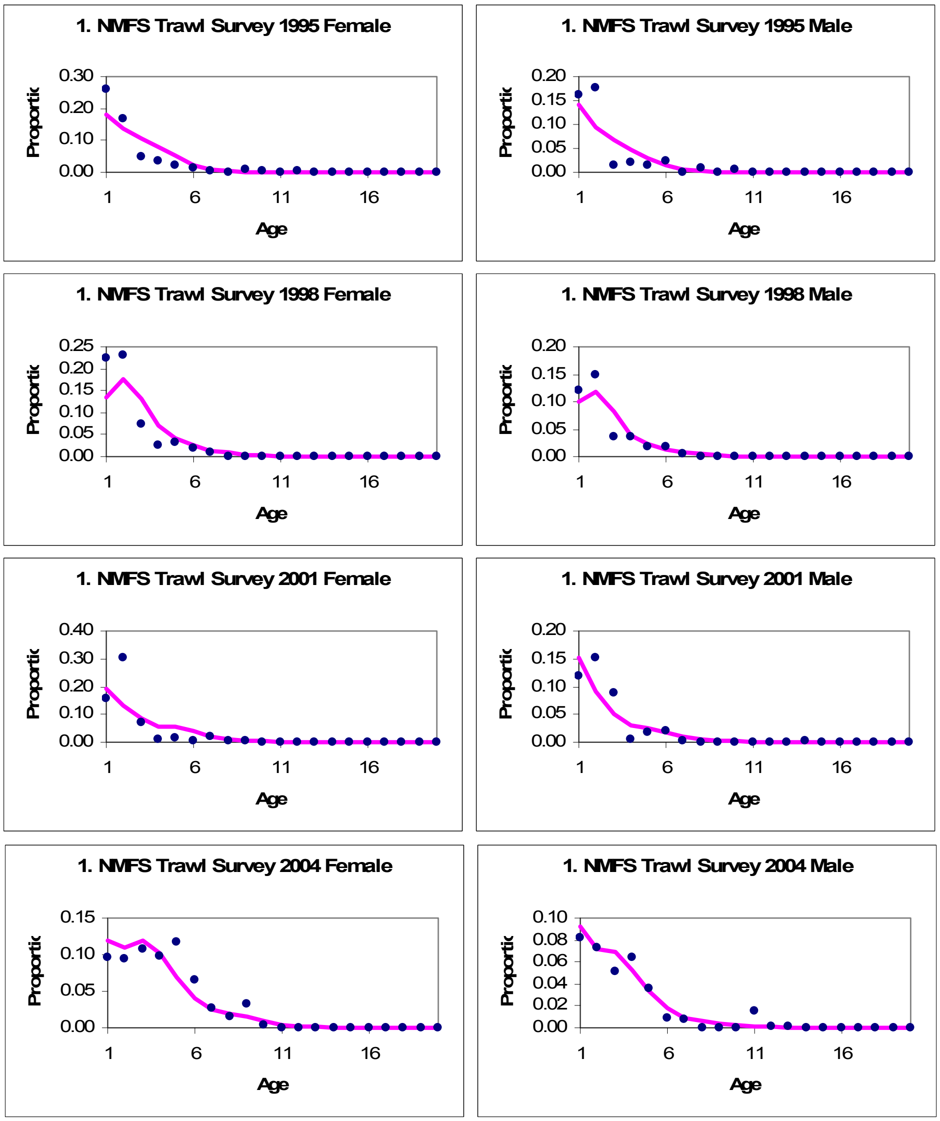


Figure 11. SS2 output for the southern area (LCS) base model: Model fits to NMFS trawl survey catch-at-age.



Filename:LCSCTL05.CTL

```
#  LCSCTL05.ctl: 2005 LCS assessment model
#  datafile:LCSData05.dat
2	#_N_growthmorphs

#_assign_sex_to	each_morph_(1=female;_2=male)
1	2

1	#_N_Areas_(populations)

#_each_fleet/survey_operates_in_just_one_area
#_but_different_fleets/surveys_can	be	assigned_to_share_same_selex(FUTURE_coding)

1	1	1	1	#area_for_each_fleet and each Survey

0 #do_migration_(0/1)
0 #_N_Block_Designs
#_N_Blocks_per_Design(Block_1_always_starts_in_styr)

#Natural_mortality_and_growth_parameters_for_each_morph
2	#_Last_age_for_natmort_young
3	#_First_age_for_natmort_old
1	#_age_for_growth_Lmin
20	#_age_for_growth_Lmax
-4	#_MGparm_dev_phase

#	LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-variable	use_dev	dev_minyr	dev_maxyr
	dev_stddev
# Female natural mortality and growth
	0.05	0.25	0.18	0.0001	0	0.8	-3	0	0	0	0	0.5	0
	0	#M1_natM_young
	-3	3	0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M1_natM_old_as_exponential_offset(rel_young)
	10	60	35.1	35	0	10	-2	0	0	0	0	0.5	0
	0	#M1_Lmin
	40	140	107.9	108	0	10	-2	0	0	0	0	0.5	0
	0	#M1_Lmax
	0.01	0.5	0.1449	0.001	0	0.8	-3	0	0	0	0	0.5	0
	0	#M1_VBK
	0.01	0.5	0.0699	0.001	0	0.8	-3	0	0	0	0	0.5	0
	0	#M1_CV-young
	0.01	0.5	-.13116	0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M1_CV-old_as_exponential_offset(rel_young)
# Male natural mortality and growth
	0.01	0.5	0.5754	0.5754	0	0.8	-3	0	0	0	0	0.5	0
	0	#M2_natM_young_as_exponential_offset(rel_morph_1)
	-3	3	0	1.0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M2_natM_old_as_exponential_offset(rel_young)
	-3	3	-.02482	1.0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M2_Lmin_as_exponential_offset
	0	140	-.28624	1.0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M2_Lmax_as_exponential_offset
	0.01	0.5	0.43216	1.0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M2_VBK_as_exponential_offset
	0.01	0.5	-.17699	0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M2_CV-young_as_exponential_offset(rel_CV-young_for_morph_1)
	0.01	0.5	0.98074	0	0	0.8	-3	0	0	0	0	0.5	0
	0	#M2_CV-old_as_exponential_offset(rel_CV-young)

# Add 2+2*gender lines to read the wt-Len and mat-Len parameters
# Female length-weight
	-3	3	0.00000176 0.00000176	0	0.8	-3	0	0	0	0	0.5
	0	0	#Female wt-len-1 a
	-3	3	3.39780	3.39780	0	0.8	-3	0	0	0	0	0.5	0
	0	#Female wt-len-2 b
# Female maturity
	-3	100	60.601	84.6	0	0.8	-3	0	0	0	0	0.5	0
	0	#Female mat-len-1
```

-3 5 -0.155 3.814 0 0.8 -3 0 0 0 0 0.5 0
0 #Female mat-len-2
Female fecundity - Same as biomass if intercept = 1 and slope = 0
-3 3 1. 1. 0 0.8 -3 0 0 0 0 0.5 0
0 #Female eggs/gm intercept
-3 3 0. 0. 0 0.8 -3 0 0 0 0 0.5 0
0 #Female eggs/gm slope
Male length-weight
-3 3 0.000003953 0.000003953 0 0.8 -3 0 0 0 0
0.5 0 0 #Male wt-len-1
-3 5 3.2149 3.2149 0 0.8 -3 0 0 0 0 0.5 0
0 #Male wt-len-2

#_allocate_recruits
pop*gmorph lines For the proportion of each morph in each area
0 1 0.5000 0.2 0 9.8 -3 0 0 0 0 0.5 0 0
#frac to morph 1 in area 1
0 1 0.5000 0.2 0 9.8 -3 0 0 0 0 0.5 0 0
#frac to morph 2 in area 1

pop lines For the proportion assigned to each area
0 1 1 1 0 0.8 -3 0 0 0 0 0.5 0 0
#frac to area 1

0 #_custom-env_read

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

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

LO HI INIT PRIOR Pr_type SD PHASE
#-10 10 0.0 0 0 4 4

#_Spawner-Recruitment_parameters

1 # SR_fxn: 1=Beverton-Holt

#LO HI INIT PRIOR Pr_type SD PHASE
1 100 7.825 7.6497 0 99 1 #Ln(R0)
0.2 5 0.90 0.9 0 99 -4 #steepness
0 20 1.0 0.5 0 99 -3 #SD_recruitments
-5 5 0 0 0 99 -3 #Env_link
-5 5 0 0 0 99 -5 #_ln(init_eq_R_multiplier)

0 #env-var_for_link

recruitment_residuals
start_rec_year end_rec_year Lower_limit Upper_limit phase
1976 2000 -15 15 1

#init_F_setupforeachfleet
#LO HI INIT PRIOR PR_type SD PHASE
0 1 0.0141 0.09 0 99 1
0 1 0.0027 0.09 0 99 1

#_Qsetup
#_add_parm_row_for_each_positive_entry_below(row_then_column)

#-Float(0/1) #Do-power(0/1) #Do-env(0/1) #Do-dev(0/1) #env-Var #Num/Bio(0/1) for each
fleet and survey
0 0 0 0 0 1 #Com_1
0 0 0 0 0 1 #Rec_2
0 0 0 0 0 1 #Logbk_3
0 0 0 0 0 1 #NMFS_4

LO HI INIT PRIOR PR_type SD PHASE env-variable
#_SELEX_&_RETENTION_PARAMETERS

```
#Selex_type	Do_retention(0/1)	Do_male	Mirrored_selex_number

#Length Selectivity
0	0	0	0	#Com_1
0	0	0	0	#Rec_2
0	0	0	0	#Logbk_3
0	0	0	0	#NMFS_4
#_Age	selectivity

18	0	1	0	#Com_1
18	0	1	0	#Rec_2
15	0	0	1	#Logbk_3
18	0	1	0	#NMFS_4

# 1-8 Com_1 Age Selex for Females
#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-variable		use_dev	dev_minyr
1	20	5	0.001	0	99	-3	0	0	0	0	0.5	0	0
	# age@peak - fem
0	2	0	1	0	99	-3	0	0	0	0	0.5	0	0
	# sel@minA
-20	20	0.309	0	0	99	2	0	0	0	0	0.5	0	0
	# asc_infl (logit)
0.1	20	12.341	0.001	0	99	5	0	0	0	0	0.5	0	0
	# asc_slope
-20	20	-9.49	-5	0	99	4	0	0	0	0	0.5	0	0
	# sel@maxA (logit)
-20	20	-2.84	-1.5	0	99	4	0	0	0	0	0.5	0	0
	# desc_infl (logit)
0	2	1.69	0.5	0	99	4	0	0	0	0	0.5	0	0
	# desc_slope
0	40	1.5	1	0	99	-4	0	0	0	0	0.5	0	0
	# width_of_top <= ( maxA - p1 )
# 9-12 Com_1 Age Selex for males relative to females
1	10	5	3	0	99	-2	0	0	0	0	0	0	0
	# Age_@transition - male
-10	10	0.0	3.21	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ minL
-10	10	-0.415	-0.20	0	99	4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ m1
-10	10	4.134	1	0	99	4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ maxL

# 13-20 Rec_2 Age Selex for Females
1	20	4	0.001	0	99	-3	0	0	0	0	0	0	0
	# age@peak - fem
0	2	0	1	0	99	-3	0	0	0	0	0	0	0
	# sel@minA
-10	10	4.162	0	0	99	2	0	0	0	0	0	0	0
	# asc_infl (logit)
0.1	10	0.1	0.001	0	99	-3	0	0	0	0	0	0	0
	# asc_slope
-10	30	-8.14	-5	0	99	4	0	0	0	0	0	0	0
	# sel@maxA (logit)
-10	10	-1.72	-1.5	0	99	4	0	0	0	0	0	0	0
	# desc_infl (logit)
0	20	8.901	0.5	0	99	4	0	0	0	0	0	0	0
	# desc_slope
0	40	1.5	1	0	99	-4	0	0	0	0	0	0	0
	# width_of_top <= ( maxA - p1 )
# 21-24 Rec_2 Age Selex for males relative to females
1	10	4	3	0	99	-2	0	0	0	0	0	0	0
	# Age_@transition - male
-10	10	0.00	1	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ minL
-10	10	0.00	1	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ m1
-10	10	0.00	1	0	99	-4	0	0	0	0	0	0	0
	# ln(mal_sel/fem_sel) @ maxL

# 25-32 NMFS_4 Age Selex for Females
```

```
1      20     3      0.001   0      99     -2     0      0      0      0      0      0      0
       # age@peak - fem
0      2      0.0    1       0      99     -2     0      0      0      0      0      0      0
       # sel@minA
-20    20     -4.92  0       0      99     2      0      0      0      0      0      0      0
       # asc_infl (logit)
0.1    20     0.101  0.001   0      99     -3     0      0      0      0      0      0      0
       # asc_slope
-20    30     -8.04  -5      0      99     4      0      0      0      0      0      0      0
       # sel@maxA (logit)
-20    30     -1.33  -1.5    0      99     4      0      0      0      0      0      0      0
       # desc_infl (logit)
0      20     9.65   0.5     0      99     5      0      0      0      0      0      0      0
       # desc_slope
0      40     1.0    1       0      99     -5     0      0      0      0      0      0      0
       # width_of_top <= ( maxA - p1 )
# 33-36 NMFS_4 Age Selex for males relative to females
1      10     3      3       0      99     -2     0      0      0      0      0      0      0
       # Age_@transition - male
-10    20     0.00   23.0    0      99     -4     0      0      0      0      0      0      0
       # ln(mal_sel/fem_sel) @ minL
-10    20     -0.06  8.76    0      99     4      0      0      0      0      0      0      0
       # ln(mal_sel/fem_sel) @ m1
-10    20     0.00   -0.22   0      99     -4     0      0      0      0      0      0      0
       # ln(mal_sel/fem_sel) @ maxL

#_custom-env_read
0      #_ 0=read_one_setup_and_apply_to_all_env_fxns;  1=read_a_setup_line_for_each_SELparm_with_Env-var>0
#      except read NO setup lines If no SELparms have Env-var>0
# LO   HI     INIT   PRIOR   PR_type  SD     PHASE
# -10  10     0      0       0        4      4      #Env-parm_setup

#_custom-block_read

0      #_     0=read_one_setup_and_apply_to_all;_1=Custom_so_see_detailed_instructions_for_N_rows_in_Custom_setup


#LO    HI     INIT   PRIOR   PR_type  SD     PHASE

# -10  10     0      0       0        4      4

-4     #_phase_for_selex_parm_devs


1      #_max_lambda_phases:_read_this_Number_of_values_for_each_componentxtype_below

0      #_sd_offset - 0 = omit +log(s) term; 1 = include Log(s) term in Like


#_CPUE_lambdas for each fleet and survey
1      1      1      1
#_discard_lambdas
0      0      0      0
#_meanwtlambda(one_for_all_sources)
0
#_lenfreq_lambdas
0      0      0      0
#_age_freq_lambdas
1      1      0      1
#_size@age_lambdas
1      1      0      1
#_initial_equil_catch
1
#_recruitment_lambda
1.0
#_parm_prior_lambda
1
#_parm_dev_timeseries_lambda
1
# crashpen lambda
```

300
#max F
1.0

999 #_end-of-file

Filename: LCSData05d.DAT

```
# LCSData05d.dat 2005 LCS Assessment
#_Number_of_datafiles: 1
#_start_nudata: 1
#_MODEL_DIMENSIONS
1956 #_styr
2004 #_endyr
1 #_nseas

#_vector_with_N_months_in_each_season
12 #_months/season
1 #_spawn_seas
2 #_Nfleet
2 #_Nsurv

# Labels
Comm1%Sport2%logbk3%NMFS4

# Timing within each season, for each fishery and survey
0.5 0.5 0.5 0.5

2 #_Ngenders
40 #_accumulator_age;_model_always_starts_with_age_0
161.4  40.3 #_init_equil_catch_for_each_fishery

#_catch_biomass(mtons):_columns_are_fisheries _rows_are_year*season
 422    113
 744    114
 726    120
 638     94
 593     85
 653     70
 504     76
 514     83
 379     76
 369    100
 363    134
 426    131
 496    128
 505    98
 695    119
 952    179
1472    269
1614.6      403.1
1734.6      399.1
1447.1      429.1
1415.3      422.1
768.6       284.1
914.2       334.2
1433.9      339.7
```

1275.0	2229
1403.7	1173
1598.9	882
1220.7	589
1046.5	514
752.6	981
601.1	950
981.5	969
1141.2	1054
1357.7	980
1187.7	799
844.4	820
676.1	808
778.0	479
691.1	289
705	300
648	391
736	299
349	279
347	375
120	240
151	226
152	608
100	1125
107	188

30 #_N_cpue_and_surveyabundance_observations
#_year seas index obs se(log)
#Logbook GLM

1978	1	3	5.8	.2
1979	1	3	11.8	.2
1980	1	3	9.6	.2
1981	1	3	7.3	.2
1982	1	3	7.4	.2
1983	1	3	8.9	.2
1984	1	3	7.6	.2
1985	1	3	3.6	.2
1986	1	3	3.1	.2
1987	1	3	5.4	.2
1988	1	3	5.6	.2
1989	1	3	7.3	.2
1990	1	3	6.2	.2
1991	1	3	3.8	.2
1992	1	3	3.1	.2
1993	1	3	3.8	.2
1994	1	3	3.6	.2
1995	1	3	3.9	.2
1996	1	3	3.1	.2
1997	1	3	3.3	.2

#NMFS Trawl Survey no water hauls

1977	1	4	2992.9	.14

1980 1 4 1537.3 .31
1983 1 4 2078.7 .33
1986 1 4 925.9 .21
1989 1 4 2708.1 .20
1992 1 4 629.7 .25
1995 1 4 901.3 .27
1998 1 4 870.5 .27
2001 1 4 1346.9 .12
2004 1 4 3745.8 .32

2 #_discard_type
0 #_N_discard_obs

0 #_N_meanbodywt_obs

-1 #_comp_tail_compression
0.0001 #_add_to_comp

42 #_N_LengthBins
28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110
0 #_N_Length_obs

20 #_N_age_bins
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

2 #_N_ageerror_definitions

0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5
18.5 19.5 20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001 0.001
0.001 0.001 0.001 0.001 0.001 0.001
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5 13.5 14.5 15.5 16.5 17.5
18.5 19.5 20.5 21.5 22.5 23.5 24.5 25.5 26.5 27.5 28.5 29.5 30.5 31.5 32.5 33.5 34.5
35.5 36.5 37.5 38.5 39.5 40.5
0.5 0.715501191 0.809263396 0.903025602 0.996787807 1.090550012 1.184312217 1.278074422 1.371836627
1.465598832 1.559361037 1.653123242 1.746885447 1.840647652 1.934409857 2.028172062 2.121934267
2.215696472 2.309458677 2.403220882 2.5 2.6 2.7 2.8 2.9 3 3 3 3 3 3
3 3 3 3 3 3 3 3 3 3

27 #_N_Agecomp_obs
#Yr Seas Flt/Svy Gender Part Ageerr Lbin_lo Lbin_hi Nsamp datavector(female-male)
#Com_1 Age Comps
1992 1 1 3 0 2 -1 -1 28.9 0 0.138317762 0.28910858 0.090998391 0.041160674
0.040841257 0 0.006096096 0 0 0 0 0 0 0 0 0 0 0 0
0 0.091871557 0.120138604 0.079297347 0.062521058 0.039648674 0 0 0 0 0 0
0 0 0 0 0 0 0 0
1993 1 1 3 0 2 -1 -1 40 0 0.267269601 0.30055667 0.083051851 0.033971697
0.011877766 0.009168764 0.004727982 0.005224045 0 0 0 0 0 0 0 0 0

0 0 0 0.076391509 0.076726831 0.064349688 0.022829594 0.037322709 0.00449579 0.001674108
0.000361396 0 0 0 0 0 0 0 0 0 0 0
1994 1 1 3 0 2 -1 -1 40 0 0.088444854 0.241004546 0.135406074 0.040922956
0.046766227 0.016582109 0.005258632 0.023106223 0.000996545 0.011253719 0.002353445 0 0 0
0 0 0 0 0 0 0.082278053 0.146616837 0.080986678 0.031833427 0.024009571
0.012054763 0.000686715 0.006932412 0.002506215 0 0 0 0 0 0 0 0 0
0
1995 1 1 3 0 2 -1 -1 26.7 0 0.01592892 0.079141173 0.260939008 0.107380111
0.067529984 0.033362611 0.013768495 0.003430881 0 0 0 0 0 0 0 0 0
0 0 0 0.001806499 0.101310109 0.193738276 0.07966953 0.026794072 0.01520033 0 0
0 0 0 0 0 0 0 0 0 0 0
1996 1 1 3 0 2 -1 -1 30.2 0 0.028487848 0.225884259 0.13784627 0.096710465
0.103603503 0.019492079 0.005227274 0.003875154 0 0.001287223 0.001287223 0 0 0 0
0 0 0 0 0 0.037511894 0.125536397 0.075487435 0.056077577 0.047979927 0.020727892
0.009102428 0 0.003875154 0 0 0 0 0 0 0 0 0 0
1997 1 1 3 0 2 -1 -1 40 0 0.030948896 0.173091221 0.198439666 0.160048589
0.053162266 0.055330347 0.033254392 0.009197599 0.007545174 0.001324798 0.000627297 0 0.012159748
0 0 0 0 0 0 0 0.035773462 0.12608761 0.0827361 0 0.013403238 0 0
0 0.004579731 0 0 0.002289865 0 0 0 0 0 0
1998 1 1 3 0 2 -1 -1 28.7 0 0.052758094 0.252758094 0.141998981 0.055379556
0 0.144620444 0.072965587 0 0 0.018896762 0 0 0 0 0 0 0
0 0 0 0.093173081 0.036482794 0.037793525 0.018896762 0.018896762 0.018896762 0.036482794
0 0 0 0 0 0 0 0 0 0 0
2000 1 1 3 0 2 -1 -1 6.1 0 0 0 0.047619048 0.285714286 0
0.333333333 0.095238095 0 0.047619048 0 0 0 0 0 0 0 0 0 0
0 0 0 0.047619048 0.095238095 0.047619048 0 0 0 0 0 0 0 0
0 0 0 0 0 0
2001 1 1 3 0 2 -1 -1 26.2 0 0 0.111111111 0.25 0.083333333 0.166666667
0 0.027777778 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0.055555556 0.083333333 0.194444444 0.027777778 0 0 0 0 0 0 0 0 0
0 0 0 0 0
2002 1 1 3 0 2 -1 -1 24.9 0 0.010993236 0.055145899 0.312995002 0.16780332
0.126693506 0.050341298 0.021860565 0.029239599 0 0 0 0 0 0 0 0 0
0 0 0 0 0.024367271 0.036773629 0.066235952 0.031969028 0.032727894 0.032853801 0
0 0 0 0 0 0 0 0 0 0 0
2003 1 1 3 0 2 -1 -1 9.8 0.0000000000 0.0000000000 0.0408163265 0.1836734694
0.1326530612 0.0816326531 0.0816326531 0.0204081633 0.0408163265 0.0000000000 0.0000000000 0.0102040816
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0204081633 0.2040816327 0.0816326531 0.0306122449 0.0510204082 0.0204081633
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000
2004 1 1 3 0 2 -1 -1 13.8 0.0144927536 0.0144927536 0.1811594203 0.2101449275
0.1376811594 0.0434782609 0.0652173913 0.0144927536 0.0000000000 0.0072463768 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0144927536 0.0289855072 0.0579710145 0.0724637681 0.0942028986 0.0217391304 0.0144927536 0.0072463768
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000

#Rec_Age Comps
1992 1 2 3 0 2 -1 -1 4.9 0 0 0.020408163 0.06122449 0.020408163
0.081632653 0 0.040816327 0.040816327 0 0 0 0 0 0 0 0 0 0

0 0 0.081632653 0.102040816 0.183673469 0.12244898 0.081632653 0.06122449 0.081632653
0.020408163 0 0 0 0 0 0 0 0 0 0 0
1993 1 2 3 0 2 -1 -1 29.4 0 0.023809524 0.156462585 0.173469388 0.098639456
0.06462585 0.040816327 0.037414966 0.023809524 0 0 0 0 0 0 0 0 0
0 0 0 0.020408163 0.136054422 0.115646259 0.054421769 0.030612245 0.013605442 0.006802721
0 0 0.003401361 0 0 0 0 0 0 0 0 0
1994 1 2 3 0 2 -1 -1 19.6 0 0.010204082 0.107142857 0.132653061 0.117346939
0.081632653 0.051020408 0.045918367 0.015306122 0.010204082 0 0 0 0 0 0 0
0 0 0 0 0.010204082 0.081632653 0.183673469 0.081632653 0.045918367 0.020408163 0
0.005102041 0 0 0 0 0 0 0 0 0 0 0
1995 1 2 3 0 2 -1 -1 40 0 0.005714286 0.053333333 0.215238095 0.114285714
0.04 0.028571429 0.013333333 0.001904762 0.001904762 0 0 0 0 0 0 0 0
0 0 0.001904762 0.00952381 0.091428571 0.260952381 0.08 0.055238095 0.013333333 0.007619048
0.003809524 0.001904762 0 0 0 0 0 0 0 0 0 0
1996 1 2 3 0 2 -1 -1 40 0.001834862 0.00733945 0.110091743 0.110091743
0.179816514 0.100917431 0.040366972 0.020183486 0.012844037 0.003669725 0.001834862 0.001834862 0
0 0 0 0 0 0 0 0 0.001834862 0.095412844 0.088073394 0.137614679
0.055045872 0.022018349 0.00733945 0.001834862 0 0 0 0 0 0 0 0 0
0 0
1997 1 2 3 0 2 -1 -1 21.2 0 0 0.051886792 0.150943396 0.117924528
0.08490566 0.037735849 0.023584906 0 0 0 0 0 0 0 0 0 0
0 0 0 0.075471698 0.221698113 0.122641509 0.103773585 0.009433962 0 0 0 0
0 0 0 0 0 0 0 0 0
1998 1 2 3 0 2 -1 -1 7 0 0 0.014285714 0.114285714 0.214285714
0.085714286 0.1 0.014285714 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0.014285714 0.128571429 0.128571429 0.1 0.057142857 0 0.014285714 0 0.014285714
0 0 0 0 0 0 0 0 0
2000 1 2 3 0 2 -1 -1 4.8 0 0 0 0.083333333 0.125 0.104166667 0.0625
0.020833333 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0.104166667 0.166666667 0.145833333 0.083333333 0.041666667 0.041666667 0.020833333 0 0 0
0 0 0 0 0 0 0
2001 1 2 3 0 2 -1 -1 39.6 0 0 0 0.04040404 0.113636364 0.148989899
0.093434343 0.055555556 0.042929293 0.027777778 0.007575758 0.005050505 0.002525253 0 0 0
0 0 0 0 0 0 0.002525253 0.04040404 0.111111111 0.161616162 0.073232323
0.04040404 0.02020202 0.012626263 0 0 0 0 0 0 0 0 0 0 0
2002 1 2 3 0 2 -1 -1 40 0 0 0.009779951 0.048899756 0.144254279
0.095354523 0.095354523 0.058679707 0.019559902 0.017114914 0.004889976 0.002444988 0.002444988 0
0 0 0 0 0 0 0 0 0.017114914 0.070904645 0.178484108 0.114914425
0.080684597 0.031784841 0.004889976 0.002444988 0 0 0 0 0 0 0 0 0
0
2003 1 2 3 0 2 -1 -1 38.3 0.0130548303 0.0000000000 0.0287206266 0.1618798956
0.1122715405 0.0992167102 0.0626631854 0.0391644909 0.0261096606 0.0130548303 0.0104438642 0.0000000000
0.0052219321 0.0000000000 0.0000000000 0.0026109661 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0078328982 0.0000000000 0.0156657963 0.1618798956 0.0966057441 0.0600522193 0.0443864230 0.0182767624
0.0130548303 0.0052219321 0.0000000000 0.0026109661 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000

#NMFS Survey Age Comps
1995 1 4 3 0 2 -1 -1 20.8 0.259615385 0.168269231 0.048076923 0.033653846
0.024038462 0.014423077 0.004807692 0 0.009615385 0.004807692 0 0.004807692 0 0 0
0 0 0 0 0 0.163461538 0.177884615 0.014423077 0.019230769 0.014423077 0.024038462
0 0.009615385 0 0.004807692 0 0 0 0 0 0 0 0 0 0

1998 1 4 3 0 2 -1 -1 22.1 0.226244344 0.230769231 0.07239819 0.027149321
0.031674208 0.018099548 0.009049774 0 0 0 0 0 0 0 0 0 0 0
0 0 0.122171946 0.149321267 0.036199095 0.036199095 0.018099548 0.018099548 0.004524887 0
0 0 0 0 0 0 0 0 0 0 0 0
2001 1 4 3 0 2 -1 -1 19.7 0.1550315536 0.3071227959 0.0695270333 0.0116955992
0.0165350909 0.0074985059 0.0192876990 0.0060990609 0.0024551573 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.1184568491 0.1529891059 0.0881653281 0.0047058503 0.0174812273 0.0193949503 0.0016509308 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0019032620 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000
2004 1 4 3 0 2 -1 -1 40 0.0959900982 0.0939041604 0.1072366420 0.0991207996
0.1185247500 0.0656817055 0.0269378914 0.0150281895 0.0320462346 0.0036304377 0.0000000000 0.0007720993
0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000 0.0000000000
0.0826933184 0.0729663276 0.0511899528 0.0639762723 0.0355712194 0.0091741965 0.0072293031 0.0000000000
0.0000000000 0.0000000000 0.0151742864 0.0013515478 0.0018005674 0.0000000000 0.0000000000 0.0000000000
0.0000000000 0.0000000000 0.0000000000 0.0000000000

0 #_N_MeanSize-at-Age_obs
#Yr Seas Flt/Svy Gender Part Ageerr Ignore datavector(female-male)
samplesize(female-male)

0 #_N_environ_variables
0 #_N_environ_obs

999

ENDDATA

Filename: FORECAST.SS2

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

 # verify end of input harvest rates
 999

 # specified actual catches into the future
 # (negative values are not used, but there must be a sufficient number of
values)
 # fleet1 fleet2
      -1    -1    #year 1     season      1
      -1    -1    #year 2     season      1
      -1    -1    #year 3     season      1
      -1    -1    #year 4     season      1
      -1    -1    #year 5     season      1
      -1    -1    #year 6     season      1
      -1    -1    #year 7     season      1
      -1    -1    #year 8     season      1
      -1    -1    #year 9     season      1
      -1    -1    #year 10    season      1
      -1    -1    #year 11    season      1
      -1    -1    #year 12    season      1
```

Filename: SS2NAMES.NAM

```
LCSData05d.dat
LCSCTL05.CTL
1     #run number
0       # 0=no Parameter read; use the init values in the CTL file; 1=use
SS2.PAR
1     #Show_run_progress_on_console_(0/1/2)

1     #Produce_detailed_.rep_file_(0/1)

0     #_N_nudata
5       #_last_phase
Code_version_:_
10      # burn in for mcmc chain
2       # thinning interval for mcmc chain
.000  # jitter initial parm values
0.01  # push initial parm values away from bounds
-1    # min year for spbio sd_report (negative value sets to styr-2; the virgin
level)
-1    # max year for spbio sd_report (negative value sets to endyr+1)
```

Filename: SS2.STD

index	name	value	std dev
1	SR_parm[1]	7.8253e+000	1.0093e-001
2	rec_dev1	9.8130e-001	8.1864e-001
3	rec_dev1	-2.9828e-001	1.4602e+000
4	rec_dev1	-1.8701e-001	1.4076e+000
5	rec_dev1	1.3178e+000	4.6759e-001
6	rec_dev1	-5.0209e-002	1.4008e+000
7	rec_dev1	-9.1253e-001	8.9844e-001
8	rec_dev1	-1.0959e+000	8.4215e-001
9	rec_dev1	-4.3526e-001	9.0183e-001
10	rec_dev1	1.3479e+000	2.6847e-001
11	rec_dev1	-2.2612e-001	1.1936e+000
12	rec_dev1	1.2091e+000	3.3852e-001
13	rec_dev1	-9.7255e-001	8.6134e-001
14	rec_dev1	-8.5155e-001	6.2008e-001
15	rec_dev1	1.5918e-001	2.2141e-001
16	rec_dev1	2.2158e-001	2.4678e-001
17	rec_dev1	4.3627e-001	2.1651e-001
18	rec_dev1	-4.4759e-001	4.3161e-001
19	rec_dev1	2.2131e-001	2.9013e-001
20	rec_dev1	-1.0736e-001	4.2512e-001
21	rec_dev1	-1.9598e-001	5.8690e-001
22	rec_dev1	7.7800e-001	2.6340e-001
23	rec_dev1	-1.3312e+000	7.8255e-001
24	rec_dev1	-3.1490e-001	5.5140e-001
25	rec_dev1	5.0976e-001	4.2892e-001
26	rec_dev1	2.4425e-001	8.1052e-001
27	init_F[1]	1.4126e-002	2.0234e-003
28	init_F[2]	2.7733e-003	3.6353e-004
29	selparm[3]	3.0936e-001	2.1908e-001
30	selparm[4]	1.2341e+001	2.7124e+001
31	selparm[5]	-9.4923e+000	4.0978e+001
32	selparm[6]	-2.8446e+000	4.3940e-001
33	selparm[7]	1.6912e+000	4.2936e+000
34	selparm[11]	-4.1564e-001	1.8407e-001
35	selparm[12]	4.1341e+000	8.8068e+000
36	selparm[15]	4.1625e+000	6.9810e+000
37	selparm[17]	-8.1486e+000	3.1712e+001
38	selparm[18]	-1.7296e+000	3.7842e-001
39	selparm[19]	8.9017e+000	3.5655e+001
40	selparm[27]	-4.9271e+000	3.8697e+000
41	selparm[29]	-8.0414e+000	4.8745e+001
42	selparm[30]	-1.3363e+000	4.0499e-001
43	selparm[31]	9.6526e+000	4.2159e+001
44	selparm[35]	-6.0557e-002	2.9147e-001
45	fore_recruitments	3.1086e-001	6.9361e-001
46	fore_recruitments	-1.7140e-001	7.3566e-001
47	fore_recruitments	-5.2324e-001	7.0640e-001
48	fore_recruitments	-2.1473e-001	9.6298e-001
49	fore_recruitments	0.0000e+000	1.0000e+000
50	fore_recruitments	0.0000e+000	1.0000e+000
51	fore_recruitments	0.0000e+000	1.0000e+000
52	fore_recruitments	0.0000e+000	1.0000e+000
53	fore_recruitments	0.0000e+000	1.0000e+000
54	fore_recruitments	0.0000e+000	1.0000e+000

55	fore_recruitments	0.0000e+000	1.0000e+000
56	fore_recruitments	0.0000e+000	1.0000e+000
57	fore_recruitments	0.0000e+000	1.0000e+000
58	fore_recruitments	0.0000e+000	1.0000e+000
59	fore_recruitments	0.0000e+000	1.0000e+000
60	fore_recruitments	0.0000e+000	1.0000e+000
61	R0	2.5031e+003	2.5264e+002
62	S0	2.3607e+004	2.3828e+003
63	spbio_std	2.3607e+004	2.3828e+003
64	spbio_std	2.1749e+004	2.3780e+003
65	spbio_std	2.1749e+004	2.3780e+003
66	spbio_std	2.1500e+004	2.3789e+003
67	spbio_std	2.0998e+004	2.3804e+003
68	spbio_std	2.0479e+004	2.3808e+003
69	spbio_std	2.0046e+004	2.3803e+003
70	spbio_std	1.9675e+004	2.3798e+003
71	spbio_std	1.9304e+004	2.3798e+003
72	spbio_std	1.9065e+004	2.3798e+003
73	spbio_std	1.8854e+004	2.3801e+003
74	spbio_std	1.8781e+004	2.3801e+003
75	spbio_std	1.8737e+004	2.3801e+003
76	spbio_std	1.8700e+004	2.3801e+003
77	spbio_std	1.8639e+004	2.3803e+003
78	spbio_std	1.8539e+004	2.3807e+003
79	spbio_std	1.8458e+004	2.3808e+003
80	spbio_std	1.8228e+004	2.3814e+003
81	spbio_std	1.7758e+004	2.3826e+003
82	spbio_std	1.6829e+004	2.3845e+003
83	spbio_std	1.5671e+004	2.3845e+003
84	spbio_std	1.4435e+004	2.3822e+003
85	spbio_std	1.3407e+004	2.3793e+003
86	spbio_std	1.2480e+004	2.3716e+003
87	spbio_std	1.2195e+004	2.3177e+003
88	spbio_std	1.1994e+004	2.0932e+003
89	spbio_std	1.1539e+004	1.7299e+003
90	spbio_std	9.6643e+003	1.5091e+003
91	spbio_std	8.3933e+003	1.4490e+003
92	spbio_std	7.6258e+003	1.2942e+003
93	spbio_std	7.0631e+003	1.1490e+003
94	spbio_std	6.2121e+003	1.0699e+003
95	spbio_std	5.1077e+003	9.9835e+002
96	spbio_std	4.5120e+003	9.2471e+002
97	spbio_std	4.3843e+003	8.6537e+002
98	spbio_std	4.2702e+003	8.0337e+002
99	spbio_std	3.9342e+003	6.6318e+002
100	spbio_std	3.3969e+003	5.3843e+002
101	spbio_std	2.7197e+003	4.7036e+002
102	spbio_std	2.2555e+003	4.2168e+002
103	spbio_std	2.1406e+003	3.8415e+002
104	spbio_std	2.2256e+003	3.6386e+002
105	spbio_std	2.2148e+003	3.5855e+002
106	spbio_std	2.1452e+003	3.6275e+002
107	spbio_std	2.0754e+003	3.7913e+002
108	spbio_std	2.3308e+003	4.1165e+002
109	spbio_std	2.6304e+003	4.6456e+002
110	spbio_std	3.0991e+003	5.3414e+002
111	spbio_std	3.5581e+003	6.1426e+002

112	spbio_std	3.8591e+003	7.0623e+002
113	spbio_std	3.9186e+003	8.2215e+002
114	spbio_std	4.6009e+003	9.8079e+002
115	recr_std	2.5031e+003	2.5264e+002
116	recr_std	2.5031e+003	2.5264e+002
117	recr_std	2.4972e+003	2.5267e+002
118	recr_std	2.4963e+003	2.5269e+002
119	recr_std	2.4945e+003	2.5273e+002
120	recr_std	2.4925e+003	2.5278e+002
121	recr_std	2.4908e+003	2.5283e+002
122	recr_std	2.4893e+003	2.5288e+002
123	recr_std	2.4877e+003	2.5294e+002
124	recr_std	2.4866e+003	2.5299e+002
125	recr_std	2.4857e+003	2.5303e+002
126	recr_std	2.4853e+003	2.5304e+002
127	recr_std	2.4851e+003	2.5305e+002
128	recr_std	2.4850e+003	2.5306e+002
129	recr_std	2.4847e+003	2.5307e+002
130	recr_std	2.4842e+003	2.5310e+002
131	recr_std	2.4838e+003	2.5312e+002
132	recr_std	2.4827e+003	2.5318e+002
133	recr_std	2.4804e+003	2.5332e+002
134	recr_std	2.4754e+003	2.5367e+002
135	recr_std	2.4684e+003	2.5427e+002
136	recr_std	2.4597e+003	2.5517e+002
137	recr_std	3.9666e+003	2.9364e+003
138	recr_std	1.0994e+003	1.6596e+003
139	recr_std	1.2273e+003	1.7866e+003
140	recr_std	5.5223e+003	2.2785e+003
141	recr_std	1.4031e+003	1.9950e+003
142	recr_std	5.8608e+002	5.3101e+002
143	recr_std	4.8311e+002	4.0982e+002
144	recr_std	9.2838e+002	8.4676e+002
145	recr_std	5.4872e+003	1.2302e+003
146	recr_std	1.1236e+003	1.3856e+003
147	recr_std	4.6215e+003	1.2675e+003
148	recr_std	5.1367e+002	4.5317e+002
149	recr_std	5.7755e+002	3.5987e+002
150	recr_std	1.5813e+003	3.1632e+002
151	recr_std	1.6637e+003	3.7261e+002
152	recr_std	2.0154e+003	3.9711e+002
153	recr_std	7.9976e+002	3.4464e+002
154	recr_std	1.4999e+003	4.1374e+002
155	recr_std	1.0665e+003	4.5128e+002
156	recr_std	9.8511e+002	5.7380e+002
157	recr_std	2.6061e+003	6.9057e+002
158	recr_std	3.1383e+002	2.5022e+002
159	recr_std	8.6017e+002	4.7700e+002
160	recr_std	2.0163e+003	8.7257e+002
161	recr_std	1.5867e+003	1.2888e+003
162	recr_std	1.7500e+003	1.2173e+003
163	recr_std	1.1060e+003	8.2270e+002
164	recr_std	7.8771e+002	5.6087e+002
165	recr_std	1.0748e+003	1.0402e+003
166	recr_std	1.3619e+003	1.3693e+003
167	depletion	1.6599e-001	2.9460e-002
168	depletion	1.9489e-001	3.5883e-002

169	depletion	1.4109e+003	1.3708e+002
170	depletion	1.0252e+004	1.0348e+003
171	depletion	4.5000e-001	2.9436e-007
172	depletion	4.6009e+003	9.8079e+002
173	depletion	1.3619e+003	1.3693e+003
174	depletion	1.9489e-001	3.5883e-002
175	depletion	5.8604e+002	2.4711e+002
176	depletion	7.5867e-002	1.7176e-002
177	depletion	4.9829e+003	9.9105e+002
178	depletion	2.2676e+003	2.2796e+003
179	depletion	2.1107e-001	3.6283e-002
180	depletion	6.3964e+002	2.3639e+002
181	depletion	8.0620e-002	1.5337e-002
182	depletion	5.1723e+003	9.8809e+002
183	depletion	2.2776e+003	2.2895e+003
184	depletion	2.1909e-001	3.6116e-002
185	depletion	6.0102e+002	2.1697e+002
186	depletion	7.3807e-002	1.5718e-002
187	depletion	5.3435e+003	1.0212e+003
188	depletion	2.2860e+003	2.2979e+003
189	depletion	2.2635e-001	3.7237e-002
190	depletion	6.1499e+002	2.3611e+002
191	depletion	6.9727e-002	1.6927e-002
192	depletion	5.6094e+003	1.1245e+003
193	depletion	2.2983e+003	2.3102e+003
194	depletion	2.3761e-001	4.1625e-002
195	depletion	6.6824e+002	2.8308e+002
196	depletion	6.9113e-002	1.7651e-002
197	depletion	6.0464e+003	1.3549e+003
198	depletion	2.3162e+003	2.3284e+003
199	depletion	2.5612e-001	5.1627e-002
200	depletion	7.8331e+002	3.9952e+002
201	depletion	7.3900e-002	2.1886e-002
202	depletion	6.5928e+003	1.6316e+003
203	depletion	2.3356e+003	2.3480e+003
204	depletion	2.7927e-001	6.3447e-002
205	depletion	9.1493e+002	4.8999e+002
206	depletion	7.9634e-002	2.3969e-002
207	depletion	7.1445e+003	1.8641e+003
208	depletion	2.3525e+003	2.3649e+003
209	depletion	3.0264e-001	7.3154e-002
210	depletion	1.0376e+003	5.5135e+002
211	depletion	8.4548e-002	2.4542e-002
212	depletion	7.6424e+003	2.0300e+003
213	depletion	2.3658e+003	2.3782e+003
214	depletion	3.2373e-001	7.9887e-002
215	depletion	1.1547e+003	5.9132e+002
216	depletion	8.9316e-002	2.4220e-002
217	depletion	8.0533e+003	2.1389e+003
218	depletion	2.3756e+003	2.3881e+003
219	depletion	3.4113e-001	8.4146e-002
220	depletion	1.2495e+003	6.1380e+002
221	depletion	9.2916e-002	2.3522e-002
222	depletion	8.3790e+003	2.2112e+003
223	depletion	2.3828e+003	2.3953e+003
224	depletion	3.5493e-001	8.6860e-002
225	depletion	1.3109e+003	6.2559e+002

226	depletion	9.4655e-002	2.2887e-002
227	depletion	8.6417e+003	2.2624e+003
228	depletion	2.3882e+003	2.4007e+003
229	depletion	3.6606e-001	8.8736e-002
230	depletion	1.3511e+003	6.3298e+002
231	depletion	9.5378e-002	2.2485e-002