

Working document No. 25

Icelandic cod in division Va

by

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and

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Table 3.3.1 Nominal catch (tonnes) of Cod in Division Va, by countries, 1988-2001 as officially reported to ICES.

Country	1988	1989	1990	1991	1992	1993	1994
Belgium	365	309	260	548	222	145	136
Faroe Islands	1,966	2,012	1,782	1,323	883	664	
Germany	-	-	-	-	-	-	-
Greenland	-	-	-	-	-	-	-
Iceland	375,741	353,985	333,348	306,697	266,662	251,170	177,919
Norway	4	3	-	-	-	-	-
UK	-	-	-	-	-	-	-
Total	378,076	356,309	335,390	308,568	267,767	251,979	178,809
WG estimate	-	-	-	-	-	-	-

Country	1995	1996	1997	1998	1999	2000	2001 ¹
Belgium	-	-	-	-	-	-	-
Faroe Islands	739	599	408	1,078	1,247	1,176	1129
Germany	-	-	-	9	21	15	
Greenland	-	-	-	-	25	-	
Iceland	168,685	181,052	202,745	241,545	258,658	234,362	233,969
Norway	-	7	-	-	85	101	
UK	-	-	-	-	16		
Total	169,424	181,658	203,153	242,632	260,052	235,687	
WG estimate	-	-	-	-	-		235,098

1) Provisional.

Table 3.3.2. Cod at Iceland. Division Va. Landings (tonnes), effort, cpue and percentage changes in effort and cpue in the period 1991-2001 (with 1991 as 100%). Data are based on logbooks which have been mandatory in the fisheries since 1991.

Bottom trawl:

Year	Catch	Effort		Cpue	
		Effort	% changes	Cpue	% changes
1991	175142	234946	100	745	100
1992	131504	228196	97	576	77
1993	114587	182882	78	627	84
1994	66186	83975	36	788	106
1995	60580	71202	30	851	114
1996	66867	66867	28	1000	134
1997	81202	74841	32	1085	146
1998	109947	86098	37	1277	171
1999	124381	120408	51	1033	138
2000	103289	126270	54	818	110
2001	80968	90771	39	892	120

Gillnet:

Year	Catch	Effort		Cpue	
		Effort	% changes	Cpue	% changes
1991	58948	1060	100	56	100
1992	59712	984	93	61	109
1993	56701	1008	95	56	101
1994	39192	718	68	55	98
1995	32309	437	41	74	133
1996	41764	492	46	85	153
1997	46742	483	46	97	174
1998	51554	721	68	71	127
1999	47648	781	74	61	104
2000	47989	842	79	57	102
2001	53943	1124	106	48	86

Longline:

Year	Catch	Effort		Cpue	
		Effort	% changes	Cpue	% changes
1991	44711	2006	100	22	100
1992	42301	2016	100	21	94
1993	47263	2224	111	21	95
1994	36426	1652	82	22	99
1995	44588	1724	86	26	116
1996	39770	1478	74	27	121
1997	31276	824	41	38	170
1998	37243	972	48	38	173
1999	53380	1570	78	34	155
2000	50085	1727	86	29	132
2001	47092	1811	90	26	118

Table 3.3.3 Cod at Iceland. Catch in numbers by year and age (millions).

year/age	3	4	5	6	7	8	9	10	11	12	13	14
1982	3.285	20.812	24.462	28.351	14.012	7.666	11.517	1.912	0.327	0.094	0.043	0.011
1983	3.554	10.91	24.305	18.944	17.382	8.381	2.054	2.733	0.514	0.215	0.064	0.037
1984	6.75	31.552999	19.42	15.326	8.082	7.336	2.68	0.512	0.538	0.195	0.09	0.036
1985	6.457	24.552	35.391998	18.267	8.711	4.201	2.264	1.063	0.217	0.233	0.102	0.038
1986	20.642	20.33	26.643999	30.839001	11.413	4.441	1.771	0.805	0.392	0.103	0.076	0.04
1987	11.002	62.130001	27.191999	15.127	15.695	4.159	1.463	0.592	0.253	0.142	0.046	0.058
1988	6.713	39.323002	55.895	18.663	6.399	5.877	1.345	0.455	0.305	0.157	0.114	0.025
1989	2.605	27.983	50.058998	31.455	6.01	1.915	0.881	0.225	0.107	0.086	0.038	0.005
1990	5.785	12.313	27.179001	44.534	17.037001	2.573	0.609	0.322	0.118	0.05	0.015	0.02
1991	8.554	25.131001	15.491	21.514	25.038	6.364	0.903	0.243	0.125	0.063	0.011	0.012
1992	12.217	21.708	26.524	11.413	10.073	8.304	2.006	0.257	0.046	0.032	0.012	0.008
1993	20.5	33.077999	15.195	13.281	3.583	2.785	2.707	1.181	0.18	0.034	0.011	0.013
1994	6.16	24.142	19.666	6.968	4.393	1.257	0.599	0.508	0.283	0.049	0.018	0.006
1995	10.77	9.103	16.829	13.066	4.115	1.596	0.313	0.184	0.156	0.141	0.029	0.008
1996	5.356	14.886	7.372	12.307	9.43	2.157	0.837	0.208	0.076	0.065	0.055	0.005
1997	1.722	16.441999	17.298	6.711	7.379	5.958	1.147	0.493	0.126	0.028	0.037	0.021
1998	3.548	7.707	25.393999	20.167	5.893	3.856	2.951	0.5	0.196	0.055	0.033	0.013
1999	2.525	19.554001	15.226	24.622	12.966	2.795	1.489	0.748	0.14	0.046	0.01	0.005
2000	10.493	6.581	29.08	11.227	11.39	5.714	1.104	0.567	0.314	0.074	0.022	0.006
2001	11.332	25.027	9.306	19.461	5.617	3.927	2.016	0.444	0.202	0.118	0.013	0.009

Table 3.3.4. Cod at Iceland. Division Va. Proportion of fishing and natural mortality before spawning

F	M
0.085	0.250
0.180	0.250
0.248	0.250
0.296	0.250
0.382	0.250
0.437	0.250
0.477	0.250
0.477	0.250
0.477	0.250
0.477	0.250
0.477	0.250
0.477	0.250

Table 3.3.5 Cod at Iceland. Division Va. Mean weight at age in the landings(g).

Year/age	3	4	5	6	7	8	9	10	11	12	13	14
1982	1006	1550	2246	3104	4258	5386	6682	9141	11963	14226	17287	16590
1983	1095	1599	2275	3021	4096	5481	7049	8128	11009	13972	15882	18498
1984	1288	1725	2596	3581	4371	5798	7456	9851	11052	14338	15273	16660
1985	1407	1971	2576	3650	4976	6372	8207	10320	12197	14683	16175	19050
1986	1459	1961	2844	3593	4635	6155	7503	9084	10356	15283	14540	15017
1987	1316	1956	2686	3894	4716	6257	7368	9243	10697	10622	15894	12592
1988	1438	1805	2576	3519	4930	6001	7144	8822	9977	11732	14156	13042
1989	1186	1813	2590	3915	5210	6892	8035	9831	11986	10003	12611	16045
1990	1290	1704	2383	3034	4624	6521	8888	10592	10993	14570	15732	17290
1991	1309	1899	2475	3159	3792	5680	7242	9804	9754	14344	14172	20200
1992	1289	1768	2469	3292	4394	5582	6830	8127	12679	13410	15715	11267
1993	1392	1887	2772	3762	4930	6054	7450	8641	10901	12517	14742	16874
1994	1443	2063	2562	3659	5117	6262	7719	8896	10847	12874	14742	17470
1995	1348	1959	2920	3625	5176	6416	7916	10273	11022	11407	13098	15182
1996	1457	1930	3132	4141	4922	6009	7406	9772	10539	13503	13689	16194
1997	1484	1877	2878	4028	5402	6386	7344	8537	10797	11533	10428	12788
1998	1230	1788	2477	3588	5013	7293	7843	9283	10976	15352	17718	16068
1999	1241	1716	2426	3443	4720	6352	8730	9946	11088	12535	14995	15151
2000	1308	1782	2330	3252	4690	5894	7809	9203	10240	11172	13172	17442
2001	1499	2050	2649	3413	4766	6508	7520	9055	8796	9526	11210	13874

Table 3.3.6. Cod at Iceland. Division Va. Mean weight at age in the spawning stock(g)

Year/age	3	4	5	6	7	8	9	10	11	12	13	14
1982	996	1626	2095	3006	4339	5571	6801	9259	11550	13445	17138	16554
1983	891	1472	2139	2918	4130	5553	7007	7770	10817	13176	14175	18543
1984	1002	1479	2257	3476	4480	5887	7660	9920	11035	14531	15378	16394
1985	1131	1597	2285	3524	5010	6195	7800	9225	11336	13277	15325	18932
1986	1182	1762	2681	3562	4824	6457	7843	9419	10674	13660	13812	18479
1987	1289	1811	2735	4202	5110	6497	7802	10220	11197	10620	15893	16514
1988	1218	1604	2499	3566	5161	6238	7302	8647	10184	11504	14159	10952
1989	1012	1542	2423	3743	5298	6910	7725	9397	11953	9529	12195	14270
1990	813	1330	2132	3187	4691	6627	8915	10362	12093	15453	15337	17257
1991	1122	1776	2233	3044	3891	5897	7657	10573	11230	14340	14172	20200
1992	876	1389	2174	3185	4481	5587	6775	8225	11702	13474	15436	11267
1993	1037	1570	2518	3611	4872	6150	7538	8840	11088	12002	14402	18383
1994	1193	1748	2382	3684	5175	6210	7676	8814	10842	12595	14402	17470
1995	1066	1826	2735	3497	4741	6126	7582	9887	10829	11307	13098	15182
1996	1264	1627	2600	3829	4605	5792	7550	9433	11293	12984	13821	16194
1997	1221	1613	2595	3807	5434	6440	7629	8606	10486	11774	10943	15225
1998	1260	2018	2335	3529	5321	7731	8173	9397	10995	15274	17387	15069
1999	1068	1459	2231	3181	4743	6577	8561	10081	11200	12567	14995	15151
2000	1025	1498	2159	3236	4655	5957	7881	9458	10231	11736	13172	17442
2001	1121	1621	2417	3234	4854	6546	7935	9196	9086	9899	10351	13874

Table 3.3.8. CPUE from bottom trawl survey 1985-2002 as used in the XSA tuning. Sum of North and South (stratified mean) areas indices.

Year/age	1	2	3	4	5	6	7	8	9
1985	16.54	112.29	35.39	48.19	64.82	22.97	15.3	5.05	3.4
1986	15.1	61.03	95.72	22.49	21.54	27.48	7.18	2.8	0.94
1987	3.65	28.94	104.03	83.46	21.73	13	13.15	2.82	1
1988	3.45	7.48	72.71	104.93	70.98	8.56	6.51	7.04	0.68
1989	4.09	17.25	22.36	80.13	74.62	39.41	4.88	1.73	1.43
1990	5.57	12.09	26.71	14.29	27.92	35.3	16.78	1.77	0.59
1991	3.95	16.31	18.19	30.72	15.8	19.27	22.72	4.93	0.95
1992	0.72	17.46	33.84	19.08	16.63	6.9	6.37	5.78	1.49
1993	3.58	4.77	35.07	39.28	13.92	10.87	2.49	2.1	1.43
1994	13.76	16.02	8.85	27.06	23.21	6.22	4.08	0.81	0.53
1995	1.17	29.3	26.16	9.36	24.68	18.61	3.95	1.82	0.35
1996	3.63	5.36	41.94	28.26	12.55	14.39	13.73	3.69	0.97
1997	1.21	22.39	13.71	56.53	29.77	9.68	8.48	6.32	0.49
1998	7.98	5.47	29.78	15.95	61.45	28.15	6.54	5.46	3.34
1999	7.38	34.29	7.1	42.32	13.18	24.36	11.42	2.38	1.34
2000	18.81	28.53	55.62	7.18	30.82	8.53	8.41	4.26	0.5
2001	12.09	24.05	37	38.32	5.11	15.8	3.42	2.05	0.82
2002	0.91	38.67	41.23	40.27	36.31	7.12	8.34	1.49	0.74

Table 3.3.9 CPUE from bottom trawl survey 1985-2001 as used in the TSA runs. Weighted geometric mean of North and South (stratified mean) areas indices.

Year/age	3	4	5	6	7	8	9
1985	10194	17940	19807	9678	4247	2033	1450
1986	25776	8929	8998	10578	2972	861	402
1987	28528	30647	7163	5354	4111	1191	383
1988	18205	38415	26208	3789	2034	1789	287
1989	5163	29516	28150	16648	2006	650	438
1990	8065	3869	12159	16302	6186	741	266
1991	4833	11444	6426	9030	10353	2077	397
1992	11199	8270	6643	2902	2849	2725	639
1993	14173	17635	6459	4770	946	910	590
1994	4071	12707	9497	2786	1314	296	241
1995	9201	4489	10885	8189	1621	678	153
1996	14537	12390	5417	6939	5907	1458	467
1997	5101	20437	11214	4045	3212	2100	215
1998	8590	5603	17600	10281	2462	2007	1538
1999	2165	14238	5266	11516	5083	1187	529
2000	14457	3115	12745	3985	3545	2144	251
2001	13086	15931	2242	6714	1360	817	407
2002	12296	18074	17092	3608	3093	712	312

Table 3.3.10. XSA Tuning diagnostic. Total stratified mean survey indices.

Lowestoft VPA Version 3.1

16/04/2002 21:02

Extended Survivors Analysis

"ICELANDIC COD (Div. Va); data from 1972-2001"

CPUE data from file codvarnt.dat

Catch data for 31 years. 1971 to 2001. Ages 3 to 14.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
SMB. Tot	1984	2001	3	8	0.99	1
SMB. Tot	1985	2001	3	3	0.17	0.25
a3 on a3						

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability dependent on stock size for ages < 5

Regression type = C

Minimum of 5 points used for regression

Survivor estimates shrunk to the population mean for ages < 5

Catchability independent of age for ages >= 11

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 3 years or the 4 oldest ages.

S.E. of the mean to which the estimates are shrunk = .500

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning converged after 15 iterations

1

Regression weights

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Fishing mortalities

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	0.08	0.167	0.095	0.076	0.036	0.023	0.025	0.053	0.064	0.074
4	0.379	0.323	0.303	0.199	0.144	0.148	0.137	0.188	0.188	0.216
5	0.635	0.501	0.325	0.358	0.245	0.247	0.359	0.437	0.472	0.443
6	0.894	0.781	0.453	0.373	0.486	0.369	0.511	0.716	0.681	0.679
7	1.1	0.808	0.651	0.533	0.508	0.612	0.651	0.741	0.895	0.907
8	1.023	1.13	0.76	0.522	0.6	0.716	0.774	0.759	0.893	0.94
9	0.617	1.237	0.799	0.425	0.579	0.763	1.001	0.801	0.793	0.972
10	0.528	0.951	0.822	0.615	0.562	0.83	0.94	0.762	0.846	0.903
11	0.396	0.904	0.625	0.651	0.559	0.818	0.99	0.762	0.881	0.865
12	0.708	0.576	0.67	0.751	0.629	0.411	1.122	0.664	1.337	1.046
13	0.263	0.567	0.702	1.172	0.761	0.94	1.319	0.616	0.799	0.923
14	0.477	0.759	0.709	0.803	0.634	0.758	1.106	0.707	0.979	0.944
F5-10	0.800	0.901	0.635	0.471	0.497	0.590	0.706	0.703	0.763	0.807

1

XSA population numbers (Thousands)

YEAR	AGE	3	4	5	6	7	8	9	10	11	12
1992		1.75E+05	7.60E+04	6.24E+04	2.13E+04	1.67E+04	1.43E+04	4.82E+03	6.92E+02	1.56E+02	6.97E+01

1993	1.47E+05	1.32E+05	4.26E+04	2.71E+04	7.15E+03	4.55E+03	4.21E+03	2.13E+03	3.34E+02	8.58E+01
1994	7.51E+04	1.02E+05	7.84E+04	2.11E+04	1.01E+04	2.61E+03	1.20E+03	1.00E+03	6.73E+02	1.11E+02
1995	1.62E+05	5.59E+04	6.18E+04	4.64E+04	1.10E+04	4.33E+03	9.99E+02	4.43E+02	3.60E+02	2.95E+02
1996	1.67E+05	1.23E+05	3.75E+04	3.54E+04	2.62E+04	5.29E+03	2.10E+03	5.34E+02	1.96E+02	1.54E+02
1997	8.32E+04	1.32E+05	8.72E+04	2.40E+04	1.78E+04	1.29E+04	2.38E+03	9.66E+02	2.49E+02	9.18E+01
1998	1.58E+05	6.65E+04	9.31E+04	5.57E+04	1.36E+04	7.91E+03	5.16E+03	9.07E+02	3.45E+02	9.01E+01
1999	5.45E+04	1.26E+05	4.75E+04	5.32E+04	2.74E+04	5.81E+03	2.99E+03	1.55E+03	2.90E+02	1.05E+02
2000	1.86E+05	4.24E+04	8.54E+04	2.51E+04	2.13E+04	1.07E+04	2.23E+03	1.10E+03	5.93E+02	1.11E+02
2001	1.76E+05	1.43E+05	2.87E+04	4.36E+04	1.04E+04	7.12E+03	3.58E+03	8.25E+02	3.86E+02	2.01E+02

Estimated population abundance at 1st Jan 2002

0.00E+00	1.34E+05	9.41E+04	1.51E+04	1.81E+04	3.44E+03	2.28E+03	1.11E+03	2.74E+02	1.33E+02
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Taper weighted geometric mean of the VPA populations:

1.63E+05	1.26E+05	8.19E+04	4.64E+04	2.21E+04	9.59E+03	3.72E+03	1.45E+03	5.34E+02	1.99E+02
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Standard error of the weighted Log(VPA populations) :

0.4456	0.4423	0.4481	0.4484	0.5408	0.6477	0.7589	0.8238	0.7381	0.6831
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YEAR	AGE	
	13	14
1992	4.30E+01	2.33E+01
1993	2.81E+01	2.70E+01
1994	3.95E+01	1.31E+01
1995	4.64E+01	1.60E+01
1996	1.14E+02	1.18E+01
1997	6.71E+01	4.37E+01
1998	4.98E+01	2.15E+01
1999	2.40E+01	1.09E+01
2000	4.42E+01	1.06E+01
2001	2.38E+01	1.63E+01

Estimated population abundance at 1st Jan 2002

5.79E+01	7.76E+00
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Taper weighted geometric mean of the VPA populations:

7.23E+01	2.49E+01
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Standard error of the weighted Log(VPA populations) :

0.6977	1.1018
1	

Log catchability residuals.

Fleet : SMB. Tot

Age	1984	1985	1986	1987	1988	1989	1990	1991
3	0.29	-0.26	-0.22	0.1	0.43	-0.02	0.04	0.02
4	0.13	-0.06	-0.14	-0.08	0.05	-0.1	0.18	-0.18
5	0.23	0.03	0.07	-0.51	0.26	-0.15	0.1	-0.2
6	0.58	-0.27	0.07	0.25	-0.15	0.1	0.14	-0.14
7	0.24	-0.25	-0.14	0.61	0.07	-0.25	-0.15	-0.1
8	0.66	-0.37	0	-0.23	0.75	0.22	0.29	-0.22

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	-0.05	-0.07	-0.15	-0.2	0.21	0.05	0.07	-0.03	-0.14	-0.05
4	0.06	-0.18	0.11	0.17	-0.06	0.38	-0.02	-0.03	-0.19	-0.02
5	0.02	-0.29	0.02	0.03	0.02	0.25	0.15	-0.15	-0.08	0.18
6	-0.23	-0.09	-0.2	0.18	0.08	0.09	-0.05	-0.11	-0.29	0.05
7	0.04	-0.36	-0.06	0.45	0.1	0.44	-0.08	-0.11	-0.43	-0.03
8	-0.13	0.13	-0.1	0.18	-0.62	0.52	0.15	-0.54	-0.52	-0.17

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	5	6	7	8
Mean Log q	-7.8443	-7.7344	-7.7237	-7.8657
S.E(Log q)	0.2025	0.2172	0.2825	0.4006

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
3	0.67	3.43	9.39	0.87	18	0.18	-8.15
4	0.7	3.74	9.05	0.91	18	0.16	-7.95

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
5	0.92	0.831	8.12	0.86	18	0.19	-7.84
6	0.87	1.29	8.11	0.86	18	0.19	-7.73
7	0.95	0.338	7.82	0.76	18	0.28	-7.72
8	0.92	0.455	7.95	0.64	18	0.38	-7.87
1							

Fleet : SMB. Tot a3 on a3

Age	1984	1985	1986	1987	1988	1989	1990	1991
3	99.99	0.06	-0.12	0.11	0.38	0.3	-0.04	-0.03
4	No data for this fleet at this age							
5	No data for this fleet at this age							
6	No data for this fleet at this age							
7	No data for this fleet at this age							
8	No data for this fleet at this age							

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	-0.15	0.06	-0.2	-0.25	0.03	-0.02	-0.14	-0.03	0.12	-0.1
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
3	0.67	3.626	9.53	0.89	17	0.17	-8.38
1							

Terminal year survivor and F summaries :

Age 3 Catchability dependent on age and year class strength

Year class = 1998

Fleet	Estimated	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
Survivors							
SMB. Tot	127925	0.3	0	0	1	0.347	0.077
SMB. Tot a3 on a3	121430	0.3	0	0	1	0.347	0.081
P shrinkage mean	125534	0.44				0.172	0.079
F shrinkage mean	211704	0.5				0.134	0.047

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
134001	0.18	0.11	4	0.631	0.074

1

Age 4 Catchability dependent on age and year class strength

Year class = 1997

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
	Survivors	s.e	s.e	Ratio		Weights	F
SMB. Tot	87235	0.212	0.061	0.29	2	0.5	0.231
SMB. Tot a3 on a3	106017	0.3	0	0	1	0.242	0.194
P shrinkage mean	81912	0.45				0.143	0.244
F shrinkage mean	120724	0.5				0.115	0.172

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
94080	0.15	0.07	5	0.436	0.216

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 1996

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
	Survivors	s.e	s.e	Ratio		Weights	F
SMB. Tot	15068	0.174	0.111	0.64	3	0.66	0.444
SMB. Tot a3 on a3	14649	0.3	0	0	1	0.198	0.454
F shrinkage mean	15867	0.5				0.142	0.426

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
15094	0.15	0.07	5	0.441	0.443

1

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 1995

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
	Survivors	s.e	s.e	Ratio		Weights	F
SMB. Tot	18209	0.157	0.033	0.21	4	0.685	0.677
SMB. Tot a3 on a3	15757	0.3	0	0	1	0.131	0.75
F shrinkage mean	19573	0.5				0.184	0.642

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
18107	0.15	0.04	6	0.241	0.679

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1994

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
	Survivors	s.e	s.e	Ratio		Weights	F
SMB. Tot	3150	0.154	0.059	0.38	5	0.672	0.961
SMB. Tot a3 on a3	3380	0.3	0	0	1	0.078	0.918
F shrinkage mean	4383	0.5				0.25	0.77

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
3440	0.16	0.08	7	0.47	0.907

1
Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1993

Fleet	Estimated	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
Survivors							
SMB. Tot	1997	0.175	0.112	0.64	6	0.593	1.022
SMB. Tot	2355	0.3	0	0	1	0.045	0.92
a3 on a3							
F shrinkage mean	2812	0.5				0.361	0.817

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2277	0.21	0.11	8	0.505	0.94

Age 9 Catchability constant w.r.t. time and dependent on age

Year class = 1992

Fleet	Estimated	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
Survivors							
SMB. Tot	929	0.155	0.11	0.71	6	0.43	1.086
SMB. Tot	867	0.3	0	0	1	0.041	1.132
a3 on a3							
F shrinkage mean	1305	0.5				0.529	0.874

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1109	0.27	0.11	8	0.413	0.972

1
Age 10 Catchability constant w.r.t. time and dependent on age

Year class = 1991

Fleet	Estimated	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
Survivors							
SMB. Tot	240	0.148	0.113	0.76	6	0.327	0.984
SMB. Tot	225	0.3	0	0	1	0.032	1.025
a3 on a3							
F shrinkage mean	296	0.5				0.641	0.858

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
274	0.32	0.09	8	0.262	0.903

Age 11 Catchability constant w.r.t. time and dependent on age

Year class = 1990

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
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	Survivors	s.e	s.e	Ratio	Weights	F	
SMB. Tot	160	0.156	0.075	0.48	6	0.167	0.761
SMB. Tot a3 on a3	141	0.3	0	0	1	0.012	0.832
F shrinkage mean	128	0.5				0.82	0.887

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
133	0.41	0.08	8	0.19	0.865

1

Age 12 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1989

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
	Survivors	s.e	s.e	Ratio		Weights	F
SMB. Tot	68	0.148	0.099	0.67	6	0.071	0.943
SMB. Tot a3 on a3	50	0.3	0	0	1	0.006	1.146
F shrinkage mean	57	0.5				0.923	1.053

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
58	0.46	0.06	8	0.128	1.046

Age 13 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1988

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
	Survivors	s.e	s.e	Ratio		Weights	F
SMB. Tot	7	0.157	0.185	1.18	6	0.026	0.983
SMB. Tot a3 on a3	8	0.3	0	0	1	0.002	0.938
F shrinkage mean	8	0.5				0.972	0.921

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
8	0.49	0.04	8	0.09	0.923

1

Age 14 Catchability constant w.r.t. time and age (fixed at the value for age) 11

Year class = 1987

Fleet	Estimated	Int	Ext	Var	N	Scaled	Estimated
	Survivors	s.e	s.e	Ratio		Weights	F
SMB. Tot	5	0.177	0.054	0.3	6	0.021	0.931
SMB. Tot a3 on a3	5	0.3	0	0	1	0.001	0.969
F shrinkage mean	5	0.5				0.978	0.944

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5	0.49	0.01	8	0.02	0.944

Table 3.3.11. Cod at Iceland. Division Va. TSA-results**Input data and estimated parameters:**

Data: Catch at age 1971–2001 and spring trawl survey indices (weighted geometric of North and South) 1985–2002.

Estimated stock in numbers and total biomass:

Year/age	4	5	6	7	8	9	10	11	BIOM(4-11)
1984	184720.	76888.	40368.	18416.	13787.	4983.	987.	983.	881.0
1985	109545.	122883.	44927.	19635.	7855.	4696.	1711.	339.	904.5
1986	108324.	66760.	67388.	20841.	7917.	2928.	1648.	588.	832.8
1987	253886.	69652.	31494.	26644.	7028.	2512.	923.	528.	1008.6
1988	234614.	151967.	33204.	11705.	8312.	2058.	740.	273.	1063.3
1989	133789.	152446.	74948.	12023.	3459.	1844.	472.	176.	1038.9
1990	65268.	83394.	102917.	33051.	4568.	1174.	637.	162.	823.8
1991	102522.	42346.	43269.	43854.	12126.	1585.	404.	219.	688.9
1992	76913.	60815.	20143.	15827.	13972.	3997.	506.	125.	533.0
1993	133636.	42950.	26020.	6694.	4482.	4286.	1422.	177.	575.4
1994	100060.	79838.	20718.	9947.	2235.	1231.	1089.	360.	574.8
1995	56026.	61266.	46731.	10598.	4345.	868.	477.	426.	557.3
1996	121872.	37534.	35298.	25410.	5192.	2064.	409.	221.	676.8
1997	130327.	86410.	23464.	17910.	12313.	2332.	932.	183.	790.3
1998	65621.	91479.	54872.	12988.	8116.	5028.	895.	353.	716.7
1999	127062.	46405.	52830.	26632.	5412.	2889.	1562.	286.	716.5
2000	41422.	85002.	24378.	21153.	10183.	2028.	1085.	597.	542.3
2001	149672.	27855.	43937.	9936.	7199.	3453.	710.	381.	660.5
2002	139556.	99890.	14599.	18045.	3374.	2328.	1085.	222.	729.1

Standard deviation of stock estimate:

2001	11957.	2087.	2749.	677.	659.	353.	90.	68.	35.1
2002	17335.	9625.	1494.	1900.	419.	395.	225.	51.	52.2

Estimated fishing mortality rates:

Year/age	4	5	6	7	8	9	10	11	FGBAR	FBAR
1984	0.207	0.337	0.519	0.652	0.877	0.868	0.864	0.874	0.649	0.686
1985	0.294	0.401	0.568	0.706	0.787	0.845	0.868	0.868	0.673	0.696
1986	0.241	0.543	0.728	0.887	0.947	0.948	0.935	0.943	0.816	0.831
1987	0.310	0.538	0.784	0.964	1.028	1.022	1.017	1.022	0.870	0.892
1988	0.231	0.505	0.813	1.018	1.266	1.237	1.206	1.212	0.961	1.007
1989	0.261	0.447	0.615	0.757	0.878	0.860	0.865	0.885	0.717	0.737
1990	0.231	0.451	0.651	0.802	0.858	0.865	0.866	0.874	0.730	0.749
1991	0.322	0.542	0.777	0.920	0.903	0.936	0.960	0.943	0.824	0.840
1992	0.380	0.649	0.897	1.026	0.962	0.834	0.851	0.872	0.861	0.870
1993	0.315	0.528	0.761	0.897	1.059	1.122	1.143	1.131	0.888	0.918
1994	0.270	0.336	0.470	0.628	0.746	0.747	0.739	0.749	0.587	0.611
1995	0.200	0.337	0.410	0.513	0.537	0.536	0.556	0.560	0.474	0.481
1996	0.142	0.270	0.446	0.522	0.595	0.594	0.607	0.606	0.488	0.506
1997	0.152	0.255	0.391	0.572	0.695	0.757	0.770	0.769	0.534	0.573
1998	0.147	0.343	0.522	0.672	0.785	0.910	0.883	0.860	0.651	0.686
1999	0.201	0.444	0.695	0.758	0.775	0.758	0.743	0.753	0.684	0.695
2000	0.197	0.460	0.697	0.862	0.876	0.846	0.840	0.844	0.746	0.763
2001	0.204	0.444	0.689	0.879	0.929	0.957	0.964	0.948	0.783	0.810

Standard deviations of log(F):

2001	0.11	0.09	0.08	0.08	0.10	0.12	0.13	0.13	0.074
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Table 3.3.11 (Continued)**Standardized catch prediction errors:**

Year/age	4	5	6	7	8	9	10	11
1985	1.54	1.00	1.03	-0.78	0.45	-1.24	1.02	0.79
1986	-0.30	1.12	1.55	1.02	0.06	1.15	-0.75	0.62
1987	1.29	1.26	-1.03	0.47	0.16	0.35	1.09	-0.27
1988	-1.59	0.72	1.93	-0.98	0.71	0.33	0.31	2.11
1989	-0.62	-1.01	-0.77	-0.17	-0.60	-2.39	-1.97	-0.83
1990	0.01	-1.73	-0.55	0.67	1.37	0.11	-0.04	0.92
1991	1.08	1.68	0.08	0.32	-0.56	0.45	0.63	0.32
1992	0.93	1.01	1.12	-0.64	-1.08	-1.10	-0.81	-1.46
1993	0.29	-1.23	-0.10	-0.78	-1.07	-0.43	2.22	1.89
1994	0.04	-0.35	-0.37	0.49	1.90	-0.71	-1.00	0.86
1995	-0.54	-1.71	-0.95	-0.57	-1.29	-1.31	-0.80	-0.62
1996	-0.30	-0.91	-1.24	0.16	0.04	0.46	1.86	0.00
1997	-0.70	0.77	0.17	-1.43	0.66	0.22	1.27	1.80
1998	-0.48	1.16	1.84	0.89	-1.46	1.04	0.61	0.47
1999	1.79	1.90	0.62	0.77	0.22	-1.61	-2.00	-1.44
2000	-0.50	1.09	0.89	-0.81	0.51	0.12	-0.67	-0.44
2001	0.36	0.04	-0.29	0.50	-0.95	0.09	0.60	-0.33
2002	-0.03	0.01	-0.01	0.01	0.05	0.03	0.03	0.01

Skewness and kurtosis:

1.013 -1.667

Correlation within cohorts aages and years: 0.23 0.36 -0.09**Standardized prediction errors of cpue:**

Year/age	4	5	6	7	8	9
1985	1.72	0.16	1.25	0.30	1.16	0.82
1986	-0.55	-0.57	0.10	-1.08	-1.77	-0.49
1987	0.22	-0.75	-0.23	-0.47	0.08	0.00
1988	0.72	1.10	-0.28	-0.48	0.61	-0.37
1989	1.54	0.45	2.21	0.54	0.20	-0.08
1990	-0.95	-1.71	-0.05	1.00	0.56	0.73
1991	0.60	1.31	0.53	0.90	-0.16	1.02
1992	0.65	-1.08	-0.34	-1.27	-0.66	-0.53
1993	1.03	0.16	1.08	-1.12	-0.60	-1.03
1994	-1.10	-0.92	-0.47	-1.31	-0.95	-0.58
1995	-0.59	-1.29	0.62	-0.68	-0.40	0.03
1996	0.25	0.01	-0.60	1.27	1.95	1.09
1997	0.63	0.02	0.36	-2.06	-0.81	-2.14
1998	-0.51	-0.06	0.63	-0.24	-0.07	1.40
1999	0.95	-0.51	0.29	-0.18	0.15	-1.20
2000	-0.42	0.38	0.62	-1.48	0.06	-1.37
2001	0.02	-1.18	-0.11	-1.10	-1.84	-1.22
2002	0.50	0.74	2.51	0.31	0.95	-0.36

Skewness and kurtosis:

0.011 -0.473

Correlation within cohorts ages and years: -0.11 0.32 -0.13

Skewness and kurtosis are transformed to variables which follow $N(0;1)$ distribution if the residuals are normally distributed.

Table 3.3.12. AD Model Builder -Statistical Catch at Age - ADMB-SCA - diagnostic and results.**Input data and estimated parameters:**

Data: Catch at age 1971–2001 and spring trawl survey indices 1985–2002.

age	M	Survey Sigma	Survey lnQ	Survey Power	Meansel	Progsel	Sigma
1	0.2	0.331	-23.474	2.089	-1.000	-1.000	-1.000
2	0.2	0.264	-17.933	1.763	-1.000	-1.000	-1.000
3	0.2	0.221	-16.729	1.709	0.080	0.060	0.223
4	0.2	0.195	-14.625	1.572	0.306	0.219	0.188
5	0.2	0.181	-12.180	1.397	0.469	0.458	0.165
6	0.2	0.177	-7.650	1.000	0.593	0.741	0.151
7	0.2	0.182	-7.495	1.000	0.741	0.929	0.143
8	0.2	0.197	-7.457	1.000	0.868	0.962	0.141
9	0.2	0.224	-7.599	1.000	0.930	0.994	0.145
10	0.2	0.268	-7.564	1.000	1.016	1.000	0.154
11	0.2	-1.000	-1.000	-1.000	1.056	0.932	0.171
12	0.2	-1.000	-1.000	-1.000	1.132	0.906	0.197
13	0.2	-1.000	-1.000	-1.000	1.000	1.000	0.237
14	0.2	-1.000	-1.000	-1.000	1.000	1.000	0.295

Estimated fishing mortality rates:

Year/age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	0.072	0.077	0.083	0.079	0.075	0.044	0.042	0.044	0.051	0.056	0.059
4	0.310	0.400	0.327	0.304	0.178	0.145	0.144	0.149	0.183	0.211	0.231
5	0.545	0.574	0.542	0.313	0.381	0.275	0.258	0.366	0.419	0.445	0.434
6	0.808	0.865	0.746	0.563	0.384	0.458	0.447	0.518	0.725	0.712	0.708
7	0.907	1.029	0.854	0.723	0.509	0.512	0.604	0.661	0.730	0.954	0.951
8	0.852	1.001	1.063	0.847	0.566	0.619	0.673	0.755	0.772	0.886	0.954
9	0.784	0.779	1.043	0.953	0.508	0.596	0.718	0.831	0.821	0.855	0.953
10	0.840	0.769	0.826	0.842	0.685	0.693	0.767	0.820	0.838	0.866	0.911
11	0.797	0.766	0.775	0.746	0.725	0.739	0.771	0.792	0.782	0.787	0.787
12	1.073	1.129	1.101	1.065	0.618	0.608	0.636	0.720	0.780	0.831	0.837
13	0.842	0.846	0.879	0.890	0.885	0.881	0.860	0.838	0.834	0.835	0.837
14	0.842	0.846	0.879	0.890	0.885	0.881	0.860	0.838	0.834	0.835	0.837
F(5-10)	0.789	0.836	0.846	0.707	0.506	0.526	0.578	0.659	0.717	0.786	0.818

Table 3.3.12 (Continued)**Estimated stock in numbers:**

Year/age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	109.739	165.733	143.102	72.332	144.357	183.501	79.320	148.775	56.990	182.550	167.284	186.451
4	99.192	83.627	125.688	107.788	54.714	109.618	143.815	62.260	116.566	44.342	141.388	129.090
5	44.112	59.538	45.890	74.215	65.136	37.495	77.660	101.962	43.902	79.503	29.397	91.865
6	46.058	20.941	27.456	21.852	44.450	36.422	23.312	49.131	57.904	23.638	41.725	15.602
7	39.423	16.807	7.216	10.657	10.188	24.779	18.858	12.210	23.959	22.961	9.494	16.835
8	12.430	13.034	4.918	2.515	4.234	5.013	12.153	8.443	5.160	9.451	7.240	3.004
9	1.614	4.340	3.920	1.391	0.883	1.968	2.210	5.079	3.248	1.953	3.191	2.282
10	0.415	0.603	1.630	1.131	0.439	0.435	0.888	0.882	1.812	1.170	0.680	1.007
11	0.252	0.147	0.229	0.584	0.399	0.181	0.178	0.337	0.318	0.642	0.403	0.224
12	0.075	0.093	0.056	0.086	0.227	0.158	0.071	0.067	0.125	0.119	0.239	0.150
13	0.030	0.021	0.025	0.015	0.024	0.100	0.071	0.031	0.027	0.047	0.042	0.085
14	0.036	0.023	0.016	0.014	0.010	0.012	0.038	0.038	0.024	0.018	0.023	0.023

Residuals:**Log(Cay-observed/Cay-predicted)**

Year/age	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
3	0.09	0.31	-0.16	-0.26	-0.53	-0.21	0.22	0.10	0.68	0.21	0.13
4	-0.01	-0.04	0.07	-0.14	-0.07	-0.11	0.04	-0.15	0.04	-0.06	0.12
5	0.04	-0.07	0.05	0.10	-0.33	-0.06	-0.09	0.11	-0.14	0.08	-0.11
6	0.05	0.03	-0.05	0.25	0.02	0.10	-0.09	0.02	0.00	-0.21	0.01
7	-0.09	0.12	0.02	-0.08	0.02	-0.08	0.15	0.01	-0.06	-0.13	0.10
8	-0.04	0.00	0.03	-0.03	-0.15	0.11	-0.03	0.09	-0.06	-0.05	-0.05
9	-0.12	0.09	0.03	0.19	-0.33	-0.04	0.11	-0.07	0.14	-0.27	-0.03
10	0.02	-0.10	0.07	0.13	-0.17	-0.12	0.10	-0.13	0.33	-0.15	-0.07
11	0.01	0.06	-0.20	0.37	-0.19	0.13	-0.01	-0.33	0.41	0.00	-0.17
12	-0.10	0.13	-0.04	0.18	0.05	-0.10	0.24	-0.41	-0.01	-0.05	0.33
13	0.05	-0.31	0.15	0.51	-0.14	-0.26	-0.14	-0.07	-0.07	0.30	0.39
14	-0.08	-0.10	0.02	-0.15	-0.72	-0.17	-0.20	-0.14	0.15	-0.05	0.10

Year/age	1996	1997	1998	1999	2000	2001	2002
3	-0.28	-0.54	-0.49	0.06	0.18	0.26	-5.91
4	0.10	-0.06	-0.02	0.18	-0.14	-0.06	-6.78
5	-0.11	0.07	-0.11	0.09	0.13	-0.01	-7.10
6	0.01	-0.13	0.10	-0.06	0.03	0.00	-5.72
7	0.04	-0.06	0.08	0.07	-0.11	0.05	-5.97
8	0.02	0.09	-0.06	-0.01	0.13	-0.04	-4.28
9	0.03	0.10	0.11	-0.18	0.08	0.11	-4.03
10	0.04	0.12	0.09	-0.08	-0.07	0.18	-3.24
11	-0.11	0.30	0.13	-0.10	-0.01	0.00	-1.83
12	-0.01	-0.05	0.37	-0.16	0.15	-0.05	-1.50
13	0.02	-0.01	0.39	-0.12	-0.03	-0.24	-1.14
14	-0.05	0.02	-0.18	-0.26	-0.12	-0.10	-0.48

Log(U_{ay}-observed/U_{ay}-predicted)

Y/a	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	-0.18	0.55	0.56	-0.19	0.28	-0.24	-0.27	-0.43	-0.38	0.43	-0.22
2	0.39	0.06	0.02	-0.08	0.10	0.03	-0.39	-0.07	-0.16	-0.17	0.01
3	0.22	-0.27	0.08	0.41	0.44	-0.01	-0.11	-0.19	0.09	-0.12	-0.22
4	0.34	-0.26	-0.30	0.16	0.52	-0.09	0.12	-0.05	0.00	-0.13	-0.17
5	0.19	-0.13	-0.01	-0.01	0.15	-0.21	0.20	-0.15	0.03	-0.20	0.06
6	0.29	0.03	0.02	-0.33	0.23	-0.14	0.07	-0.15	0.00	-0.35	-0.01
7	0.50	-0.17	0.05	0.18	-0.10	0.05	0.25	-0.13	-0.24	-0.18	-0.20
8	0.21	-0.23	-0.05	0.53	-0.02	-0.15	-0.16	-0.02	-0.04	-0.29	-0.12
9	0.47	-0.23	0.02	-0.05	0.38	0.13	0.26	-0.15	-0.06	-0.03	-0.05
10	0.47	0.07	-0.03	-0.06	0.07	0.26	0.30	-0.05	-0.36	-0.01	-0.02

Y/a	1996	1997	1998	1999	2000	2001	2002
1	-0.42	0.35	-0.09	0.01	0.70	-0.15	-0.31
2	-0.20	0.11	0.37	0.17	0.14	-0.21	-0.10
3	-0.17	0.14	-0.15	0.06	0.13	-0.13	-0.21
4	-0.17	0.10	0.15	0.15	-0.09	-0.24	-0.07
5	0.13	-0.03	0.34	0.00	0.03	-0.37	-0.05
6	-0.05	-0.01	0.32	0.06	-0.09	-0.05	0.10
7	0.14	-0.05	0.13	0.03	-0.18	-0.19	0.05
8	0.37	0.07	0.29	-0.03	-0.03	-0.43	0.02
9	0.11	-0.44	0.43	0.01	-0.31	-0.34	-0.19
10	-0.08	-0.31	0.44	-0.11	-0.28	-0.08	-0.22

Table 3.3.12 (Continued)**Summary:**

year	F5.10	SSB	Cbio	Cbio4.	N3
1955	0.33	984	1531	2235	150920
1956	0.32	932	1387	1998	187269
1957	0.33	969	1342	1886	169072
1958	0.33	1132	1399	1952	213303
1959	0.35	908	1205	1735	300934
1960	0.37	802	1171	1758	150388
1961	0.36	666	899	1407	195572
1962	0.40	684	984	1481	135632
1963	0.47	586	864	1277	170562
1964	0.56	519	816	1194	280031
1965	0.60	405	704	1132	244505
1966	0.58	374	714	1214	272098
1967	0.59	452	785	1393	307274
1968	0.61	533	853	1515	170511
1969	0.56	601	905	1483	251041
1970	0.58	599	887	1412	187171
1971	0.63	446	732	1154	187775
1972	0.68	369	643	997	144585
1973	0.73	368	530	831	278941
1974	0.78	279	504	921	178792
1975	0.80	285	494	891	256607
1976	0.74	248	524	954	379858
1977	0.65	289	636	1309	136309
1978	0.52	352	724	1304	222249
1979	0.48	449	806	1391	243367
1980	0.52	488	869	1467	146743
1981	0.62	390	851	1304	143086
1982	0.73	230	596	951	131010
1983	0.73	191	497	787	223711
1984	0.67	197	502	894	145652
1985	0.69	229	518	919	132323
1986	0.78	224	497	835	316706
1987	0.85	213	507	996	270033
1988	0.88	164	502	1013	180930
1989	0.71	234	521	1012	89082
1990	0.73	294	497	846	129050
1991	0.79	189	399	684	109739
1992	0.84	204	327	549	165733
1993	0.85	190	307	580	143102
1994	0.71	225	296	591	72332
1995	0.51	292	315	557	144357
1996	0.53	245	371	656	183501
1997	0.58	318	422	795	79320
1998	0.66	261	424	717	148775
1999	0.72	276	402	714	56990
2000	0.79	201	338	539	182550
2001	0.82	289	340	639	167284
2002	0.60	254	354	685	186451
Mean	0.62	417	681	1116	186734

Table 3.3.13. Excel Statistical Catch at Age - STAM - diagnostic and results.**Input data and estimated parameters:**

The fitting procedure was based on minimizing

$$SSR_C = \sum_{ay} \frac{[\ln(C_{ay}) - \ln(\hat{C}_{ay})]^2}{2\sigma_a^2}$$

$$SSR_I = \sum_{ay} \frac{[\ln(I_{ay}) - \ln(\hat{I}_{ay})]^2}{2\rho_a^2}$$

$$SSR_T = a_C SSR_C + a_I SSR_I$$

The weighting factor (a_C and a_I) in each case was set to one. To reflect different accuracy by age in the estimation of catch-at-age and survey-index-at-age the residuals by age in the SSRC and SSRI were weighted according:

Age ->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Catch (sigma)			0,32	0,22	0,16	0,13	0,12	0,11	0,12	0,14	0,17	0,24	0,36	0,60	0,60
Survey (rho)	0,39	0,30	0,24	0,22	0,20	0,21	0,22	0,26	0,32	0,43					

In order to force the model to fit the observed yield within each year an additional minimization factor (penalty factor) was set in:

$$SSR_Y = \sum_y \frac{[\ln(Y_y) - \ln(\hat{Y}_y)]^2}{2\sigma_a^2}$$

$$SSR_T = a_C SSR_C + a_I SSR_I + a_Y SSR_Y$$

where the a_Y factor was set to 1000.

The input data were into the model where:

- 1) catch-in-number matrix was based on ages 3 to 14 for years 1985 to 2001, C_a for ages 1 and 2 were assumed 0 (thus 204 input values).
- 2) aged survey indices for ages 1 to 9 for years 1985-2002 (162 input values).
- 3) auxiliary data on the CV by age groups for Cay and Uay - data obtained from hoski@hafro.is (see intext table above).
- 4) auxiliary data such as corresponding weight at age in the catch and in the survey and maturity at age in the catch.

The number of estimated parameters were:

- 1) 13 estimates of N_{a85} for $a = 2, 3, \dots, 14$
 - 2) 18 estimates of N_{1y} for $y = 1985, 1986, \dots, 2002$
 - 3) 9 estimates of α_a for $a = 1, 2, \dots, 9$
 - 4) 7 estimates of β_a for $a = 1, 2, \dots, 7$. I.e. power model was used for age groups 1-7, simple linear model for age groups 8 and 9 was used ($\beta=1$). The judgement on where to use power model was based on residual plots.
 - 5) 17 estimates of F_y for $y = 1985, 1986, \dots, 2001$
 - 6) estimates of a_{50} and a_{95}
- or a total of 66 parameter estimates.

See WD-22

Estimated fishing mortality rates:

Y/a	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	0.077	0.082	0.086	0.060	0.048	0.046	0.047	0.057	0.066	0.073	0.076
4	0.236	0.251	0.262	0.183	0.148	0.141	0.145	0.173	0.202	0.222	0.231
5	0.525	0.560	0.582	0.406	0.329	0.313	0.322	0.385	0.450	0.495	0.515
6	0.782	0.834	0.868	0.606	0.490	0.467	0.480	0.574	0.672	0.738	0.768
7	0.901	0.961	1.000	0.698	0.564	0.537	0.552	0.662	0.774	0.850	0.884
8	0.939	1.002	1.043	0.727	0.588	0.560	0.576	0.690	0.806	0.886	0.922
9	0.950	1.013	1.055	0.736	0.595	0.567	0.583	0.698	0.816	0.896	0.933
10	0.953	1.017	1.058	0.738	0.597	0.569	0.584	0.700	0.818	0.899	0.936
11	0.954	1.017	1.059	0.739	0.598	0.569	0.585	0.700	0.819	0.900	0.936
12	0.954	1.018	1.059	0.739	0.598	0.569	0.585	0.701	0.819	0.900	0.936
13	0.954	1.018	1.059	0.739	0.598	0.569	0.585	0.701	0.819	0.900	0.937
14	0.954	1.018	1.059	0.739	0.598	0.569	0.585	0.701	0.819	0.900	0.937
F5-10	0.842	0.898	0.934	0.652	0.527	0.502	0.516	0.618	0.723	0.794	0.826

Estimated stock in numbers:

Y/a	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	103.313	171.637	121.503	72.425	150.407	172.190	81.950	153.101	56.488	181.073	166.289	188.134
4	100.234	78.295	129.407	91.302	55.852	117.322	134.627	63.991	118.434	43.280	137.831	126.201
5	46.612	64.829	49.851	81.557	62.278	39.449	83.455	95.390	44.064	79.199	28.371	89.535
6	44.868	22.581	30.328	22.797	44.476	36.703	23.618	49.532	53.127	22.992	39.534	13.878
7	43.187	16.801	8.027	10.421	10.184	22.306	18.845	11.971	22.834	22.223	9.003	15.020
8	13.102	14.361	5.262	2.418	4.247	4.742	10.670	8.881	5.058	8.626	7.780	3.044
9	1.764	4.193	4.317	1.519	0.956	1.930	2.217	4.911	3.648	1.849	2.912	2.533
10	0.517	0.558	1.246	1.231	0.596	0.432	0.897	1.014	2.002	1.321	0.618	0.938
11	0.317	0.163	0.165	0.354	0.482	0.268	0.200	0.409	0.412	0.723	0.440	0.198
12	0.084	0.100	0.048	0.047	0.139	0.217	0.124	0.091	0.166	0.149	0.241	0.141
13	0.032	0.027	0.030	0.014	0.018	0.062	0.101	0.057	0.037	0.060	0.050	0.077
14	0.014	0.010	0.008	0.008	0.005	0.008	0.029	0.046	0.023	0.013	0.020	0.016

Table 3.3.13. (Continued)

Residuals:**Log(Uay-observed/Uay-predicted)**

Y/a	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
4	0.53	-0.40	-0.42	0.14	0.67	-0.14	0.06	-0.04	-0.08	0.08	-0.23
5	0.20	-0.05	-0.16	-0.25	0.11	-0.15	0.18	-0.27	-0.05	-0.28	0.19
6	0.21	0.03	0.01	-0.44	0.13	-0.24	0.05	-0.21	-0.08	-0.32	0.03
7	0.47	-0.29	0.08	0.27	-0.09	-0.09	-0.09	-0.20	-0.24	-0.06	-0.07
8	0.16	-0.26	-0.11	0.70	-0.01	-0.21	-0.21	-0.14	-0.15	-0.32	-0.08
9	0.65	-0.37	0.01	-0.14	0.47	0.10	0.34	-0.08	-0.15	-0.10	-0.05

Y/a	1996	1997	1998	1999	2000	2001	2002
4	-0.26	0.22	0.09	0.13	-0.11	-0.20	-0.02
5	0.20	-0.07	0.46	0.08	0.05	-0.20	0.03
6	-0.01	0.08	0.32	0.10	-0.02	0.00	0.36
7	0.22	-0.06	0.24	0.01	-0.27	-0.06	0.21
8	0.52	0.25	0.28	0.02	0.06	-0.56	0.06
9	0.27	-0.55	0.57	-0.04	-0.35	-0.31	-0.27

Log(CNay-observed/CNay-predicted)

Y/a	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
4	0.45	-0.02	0.15	-0.06	0.30	0.09	0.27	0.31	0.20	0.56	0.27
5	-0.05	0.09	-0.04	-0.14	0.11	-0.01	-0.12	0.04	-0.28	-0.23	0.06
6	-0.07	0.00	-0.12	0.09	-0.12	0.00	-0.04	-0.03	-0.20	-0.31	-0.19
7	-0.08	0.07	0.14	-0.01	0.00	0.04	0.06	0.05	-0.27	-0.09	0.02
8	-0.08	0.03	0.05	0.31	0.01	0.09	-0.14	-0.01	-0.12	0.09	-0.08
9	-0.01	-0.11	-0.03	0.14	-0.29	-0.14	-0.10	-0.20	0.04	-0.19	-0.23

Y/a	1996	1997	1998	1999	2000	2001
4	0.06	0.00	-0.18	-0.01	-0.18	-0.03
5	-0.27	-0.19	-0.09	0.04	0.03	-0.11
6	-0.02	-0.20	0.02	0.03	0.02	0.00
7	0.11	0.01	0.10	0.14	-0.03	0.14
8	0.15	0.33	-0.05	0.08	0.19	-0.09
9	0.09	0.25	0.27	-0.23	0.09	0.22

Table 3.3.13. (Continued)**Summary:**

Year	F5-10	SSB	Cbio	Bio4+	N3
1985	0.68	266	597	900	144
1986	0.82	255	576	831	348
1987	0.90	241	558	1034	283
1988	0.87	196	576	1067	167
1989	0.71	272	633	1017	90
1990	0.70	342	610	841	131
1991	0.84	230	488	709	103
1992	0.90	249	387	564	172
1993	0.93	230	358	614	122
1994	0.65	259	331	577	72
1995	0.53	326	373	553	150
1996	0.50	270	426	666	172
1997	0.52	356	474	787	82
1998	0.62	341	495	709	153
1999	0.72	312	457	692	56
2000	0.79	227	386	528	181
2001	0.83	297	367	621	166
2002	0.644	275	374	659	188
Mean	0.73	275	470	743	155

Table 3.3.14. COLERAINE - diagnostic and results**Input data and estimated parameters:**

Data: Catch at age 1971–2001 and spring trawl survey indices 1985–2002.

StartYear	1971
EndYear	2002
Nsexes	1
Nages	14
Nmethods	1
NCPUEindex	1
Nsurveyindex	2
First_length	1
Length_class_increment	1
Number_of_length_classes	1

****Likelihoods****

CPUE	0	
Survey_Index	5.9201	798034
C@A_Commercial	-718.978	
C@A_survey	-425.017	0
C@L_Commercial	0	
C@L_no_sex_data_survey	0	0
C@L_data_survey	0	0
Prior_penalties	5.24864	

****Parameters****

R0	487109
h	0.9

Sex_specific

M	0.2
Rinit	0.678161
uinit	0.296081
plusscale	1

Method_specific

Sfullest	5.05383
log_varLest	0.656066
log_varRest	15

Method_specific_and_annual

errSfull	0	0	0	0	0	0	0	0	0	0	0	0	0
errvarL	0	0	0	0	0	0	0	0	0	0	0	0	0
errvarR	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0							
	0	0	0	0	0	0							
	0	0	0	0	0	0							

CPUE_index_specific													
log_qCPUE	0												
CPUE_index_specific_and_annual													
qCPUEerr	0												
q	1	1	1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1			
Survey_index_specific													
log_qsurvey	-7.85753	-8.63											
surveySfull	4.43308	4.7											
log_surveyvarL	1.57308	1.9											
log_surveyvarR	15	15											
Recruitment_residuals													
log_InitialDev	-0.31	-0.17	-0.11	0.08	-0.16	0.21	0.39	0.13	0.05	-0.14	-0.07	-0.04	
log_RecDev	0.84	0.05	0.55	1.00	-0.11	0.43	0.49	-0.14	-0.12	-0.37	0.19	-0.22	
	-0.31	0.80	0.75	0.13	-0.70	-0.24	-0.51	0.06	-0.02	-0.79	0.14	0.33	
	-0.68	0.01	-1.33	0.07	0.14	0.26	0.73	-0.65					
Priors													
Priortype_0(or_non_defined_value)=uniform,1=normal,2=lognormal													
	Phase	LB	UB	PriorType	mean	cv	initial_value						
R0_prior			1	100000	1.00E+06	0	0	0	480000				
h_prior			-1	0.2	1	0	0	0	0.9				
Sex_specific													
M_prior			-1	0.01	0.5	0	0	0	0.2				
Rinit_prior			3	0	2	0	0	0	0.68				
uinit_prior			3	0	1	0	0	0	0.3				
p_plusscale			-3	0	2	0	0	0	1				
Method_specific													
p_Sfullest			3	2	10	0	0	0	5.1				
p_Sfulldelta			-1	-5	5	0	0	0	0				
log_varLest_prior			3	-5	5	0	0	0	0.68				
log_varRest_prior			-1	-15	15	0	0	0	15				
Method_specific_and_annual													
errSfull_prior			-1	-15	15	0	0	0	0				
errvarL_prior			-1	-15	15	0	0	0	0				
errvarR_prior			-1	-15	15	0	0	0	0				
CPUE_index_specific													
log_qCPUE_prior			-1	-20	20	0	0	0	0				
CPUE_index_specific_and_annual													
qCPUEerr_prior			-1	-5	5	0	0	0	0				
Survey_index_specific													
log_qsurvey_prior			1	-15	0	0	0	0	-7.84				
	-1		-15	0	0	0	0	-8.6					
surveySfull_prior			3	2	10	0	0	0	4.5				
	-3		2	10	0	0	0	4.7					
p_surveySfulldelta			-1	-5	5	0	0	0	0				
	-1		-5	5	0	0	0	0					

log_surveyvarL_prior		3	-5	5	0	0	0	1.6
	-3	-5	5	0	0	0	1.9	
log_surveyvarR_prior		-1	-15	15	0	0	0	15
	-1	-15	15	0	0	0	15	
Recruitment_residuals								
p_log_InitialDev		3	-15	15	1	0	0.5	0
p_log_RecDev		2	-15	5	1	0	1	0

Estimated fishing mortality rates:

Y/a	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	0.055	0.058	0.057	0.040	0.035	0.034	0.033	0.039	0.047	0.052	0.056
4	0.308	0.330	0.322	0.219	0.190	0.182	0.174	0.210	0.258	0.291	0.316
5	0.648	0.703	0.684	0.436	0.372	0.356	0.339	0.416	0.527	0.604	0.668
6	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
7	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
8	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
9	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
10	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
11	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
12	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
13	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
14	0.651	0.706	0.686	0.437	0.374	0.357	0.340	0.417	0.529	0.607	0.671
F5-10	0.650	0.706	0.686	0.437	0.373	0.357	0.340	0.417	0.528	0.606	0.671

Estimated stock in numbers:

Y/a	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	98.294	173.609	152.522	67.484	158.722	196.783	71.811	140.291	38.905	165.770	172.962	193.270
4	99.779	76.197	134.160	118.039	53.105	125.511	155.805	56.939	110.591	30.438	129.093	134.267
5	38.286	59.906	44.821	79.685	77.811	36.027	85.780	107.370	37.927	70.374	18.817	78.208
6	45.461	16.494	24.513	18.796	42.655	44.309	20.837	50.479	58.790	18.761	32.545	8.288
7	43.000	19.559	6.739	10.265	10.054	24.274	25.611	12.255	27.619	29.053	8.666	14.316
8	20.980	18.499	7.991	2.822	5.490	5.721	14.030	15.063	6.705	13.649	13.420	3.812
9	3.258	9.026	7.558	3.346	1.509	3.124	3.307	8.252	8.241	3.314	6.305	5.903
10	1.824	1.402	3.688	3.165	1.790	0.859	1.806	1.945	4.515	4.073	1.531	2.773
11	1.514	0.785	0.573	1.544	1.693	1.019	0.496	1.062	1.064	2.231	1.881	0.673
12	0.460	0.651	0.321	0.240	0.826	0.963	0.589	0.292	0.581	0.526	1.031	0.828
13	0.305	0.198	0.266	0.134	0.128	0.470	0.557	0.346	0.160	0.287	0.243	0.453
14	0.501	0.347	0.223	0.205	0.181	0.176	0.374	0.547	0.489	0.321	0.281	0.230

Residuals**Log(Uay-oserved/Uay-predicted)**

Y/a	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	-0.44	0.47	-0.07	-0.75	-0.38	-0.26	-0.52	-1.26	-0.57	0.65	-0.90
2	0.42	0.24	0.12	-0.49	-0.22	0.06	-0.25	0.10	-0.45	0.00	0.30
3	-0.26	0.05	0.19	0.33	-0.06	0.00	-0.17	0.04	0.13	-0.34	-0.20
4	-0.24	-0.47	-0.20	-0.06	0.22	-0.27	-0.05	-0.10	-0.01	-0.16	-0.52
5	-0.01	-0.27	-0.04	-0.02	-0.05	-0.07	0.21	-0.04	0.01	0.04	0.03
6	0.14	0.16	0.02	-0.28	0.03	0.22	0.23	0.37	0.36	0.16	0.35
7	0.15	0.01	0.22	0.03	-0.20	0.19	0.45	0.12	0.18	0.35	0.24
8	-0.28	-0.52	-0.13	0.29	-0.65	-0.20	-0.36	0.08	-0.16	0.02	0.07
9	-0.65	-0.93	-0.75	-0.85	-0.66	-0.71	-0.14	-0.56	-0.49	-0.57	-0.28
10	-0.80	-1.04	-0.89	-1.33	-1.13	-0.73	-0.59	-0.56	-1.07	-0.64	-1.12

Y/a	1996	1997	1998	1999	2000	2001	2002
1	-0.42	-0.43	-0.16	-0.20	0.52	0.01	-1.33
2	-0.38	0.19	-0.10	0.36	0.03	0.06	0.04
3	0.07	-0.23	-0.29	-0.36	0.15	0.01	-0.11
4	-0.26	0.03	-0.40	-0.01	-0.59	-0.05	-0.15
5	0.13	-0.06	0.27	-0.15	-0.01	-0.18	0.24
6	0.06	0.23	0.25	0.03	0.02	0.40	0.86
7	0.62	-0.10	0.20	0.03	-0.43	0.19	0.47
8	0.75	0.20	-0.18	-0.12	-0.35	-0.75	0.07
9	0.02	-0.91	-0.07	-0.91	-1.08	-0.92	-1.06
10	-0.56	-1.20	-0.12	-1.03	-1.80	-0.73	-1.25

Summary

Year	F5-10	Bio4+	N3
1971	0.48	1410	165
1972	0.49	1220	143
1973	0.63	944	311
1974	0.63	1050	177
1975	0.57	1010	285
1976	0.48	1120	421
1977	0.34	1550	143
1978	0.27	1580	243
1979	0.30	1720	265
1980	0.34	1830	149
1981	0.46	1480	152
1982	0.48	1190	120
1983	0.44	973	212
1984	0.40	1060	137
1985	0.44	1080	119
1986	0.59	944	349
1987	0.62	1120	337
1988	0.52	1220	182
1989	0.44	1220	77
1990	0.52	936	128
1991	0.65	783	98
1992	0.71	620	174
1993	0.69	650	153
1994	0.44	655	67
1995	0.37	624	159
1996	0.36	745	197
1997	0.34	896	72
1998	0.42	811	140
1999	0.53	780	39
2000	0.61	573	166
2001	0.67	619	173
2002	0.48	690	193

Table 3.3.15. ADAPTive framework - ADAPT - diagnostic and results.**Input parameters:****Estimated fishing mortality rates:**

Y/a	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
3	0.10	0.08	0.17	0.10	0.08	0.04	0.02	0.03	0.05	0.07	0.08
4	0.31	0.38	0.32	0.30	0.20	0.15	0.15	0.14	0.20	0.18	0.22
5	0.51	0.64	0.50	0.33	0.36	0.25	0.26	0.37	0.46	0.52	0.40
6	0.78	0.89	0.78	0.45	0.38	0.49	0.37	0.53	0.75	0.74	0.80
7	0.95	1.11	0.80	0.65	0.53	0.51	0.62	0.65	0.80	0.98	1.11
8	0.77	1.02	1.16	0.74	0.53	0.59	0.72	0.79	0.76	1.03	1.20
9	0.78	0.59	1.21	0.85	0.40	0.59	0.75	1.01	0.83	0.80	1.51
10	1.02	0.53	0.86	0.78	0.71	0.52	0.86	0.89	0.78	0.91	0.96
11	1.10	0.53	0.92	0.51	0.59	0.74	0.70	1.07	0.68	0.93	1.03
12	0.90	0.99	0.99	0.69	0.53	0.53	0.67	0.77	0.79	0.98	1.19
F(5-10)	0.80	0.80	0.88	0.63	0.48	0.49	0.59	0.71	0.73	0.83	1.00

Estimated stock in numbers:

Y/a	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3	101.514	173.451	145.919	74.319	157.677	162.510	79.584	147.646	57.469	178.554	165.845	201.990
4	102.741	75.398	130.989	101.002	55.292	119.379	128.217	63.603	117.760	44.773	136.720	125.559
5	42.718	61.533	42.244	77.525	60.995	37.073	84.325	90.160	45.129	78.809	30.730	89.413
6	43.333	21.098	26.669	20.974	45.803	34.827	23.721	53.480	51.018	23.299	38.478	16.809
7	44.435	16.291	7.112	9.991	10.924	25.770	17.486	13.396	25.728	19.799	9.057	14.153
8	12.930	14.110	4.401	2.628	4.254	5.259	12.653	7.718	5.702	9.504	6.085	2.432
9	1.814	4.909	4.174	1.134	1.030	2.054	2.377	5.041	2.881	2.175	2.791	1.502
10	0.413	0.680	2.225	1.020	0.395	0.562	0.933	0.922	1.505	1.033	0.796	0.507
11	0.203	0.122	0.326	0.770	0.382	0.159	0.274	0.324	0.310	0.565	0.341	0.250
12	0.115	0.055	0.059	0.107	0.377	0.173	0.062	0.112	0.092	0.129	0.183	0.100

Residuals:

Summary:

Year	F5-10	Cbio4	N3
		+	
1985	0.67	912	144
1986	0.78	846	336
1987	0.82	1030	280
1988	0.97	1056	168
1989	0.63	1025	83
1990	0.73	834	132
1991	0.80	700	102
1992	0.80	546	173
1993	0.88	581	146
1994	0.63	579	74
1995	0.48	557	158
1996	0.49	674	163
1997	0.59	783	80
1998	0.71	706	148
1999	0.73	690	57
2000	0.83	522	179
2001	1.00	609	166
2002		647	202
Mean	0.74	739	155

Table 3.3.16 Comparison of the results from the variuos methods.**Estimated fishing mortality rate in 2001:**

Age	XSA	TSA	STAM	ADMB-SCA	Coleraine	ADAPT
3	0.07		0.08	0.06	0.06	0.08
4	0.22	0.20	0.23	0.23	0.32	0.22
5	0.44	0.44	0.52	0.43	0.67	0.40
6	0.68	0.69	0.77	0.71	0.67	0.80
7	0.91	0.88	0.88	0.95	0.67	1.11
8	0.94	0.93	0.92	0.95	0.67	1.20
9	0.97	0.96	0.93	0.95	0.67	1.51
10	0.90	0.96	0.94	0.91	0.67	0.96
11	0.86	0.95	0.94	0.79	0.67	1.03
12	1.05	0.95	0.94	0.84	0.67	1.19
13	0.92	0.95	0.94	0.84	0.67	1.19
14	0.94	0.95	0.94	0.84	0.67	1.19
F(5-10)	0.81	0.81	0.83	0.82	0.67	1.00
Bio4+,2001	654	661	603	640	619	609
Bio4-11,2002	708	729	659	685	690	647

Estimated stock in numbers in 2002:

Age	XSA	TSA	STAM	ADMB-SCA	Coleraine	ADAPT
3			188.134	186.451	193.270	201.990
4	134.001	139.556	126.201	129.090	134.267	125.559
5	94.08	99.890	89.535	91.865	78.208	89.413
6	15.094	14.599	13.878	15.602	8.288	16.809
7	18.107	18.045	15.020	16.835	14.316	14.153
8	3.44	3.374	3.044	3.004	3.812	2.432
9	2.277	2.328	2.533	2.282	5.903	1.502
10	1.109	1.085	0.938	1.007	2.773	0.507
11	0.274	0.222	0.198	0.224	0.673	0.250
12	0.133		0.141	0.150	0.828	0.100
13	0.058		0.077	0.085	0.453	
14	0.008		0.016	0.023	0.230	

Table 3.3.17 Cod at Iceland. Division Va. Resulting fishing mortality using final F from TSA using catch at age and spring trawl survey indices.

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Virtual Population Analysis : Fishing mortality.

Age	1982	1983	1984	1985	1986	1987	1988
3	0.027	0.017	0.055	0.051	0.070	0.045	0.045
4	0.221	0.120	0.211	0.288	0.222	0.309	0.222
5	0.400	0.433	0.323	0.388	0.580	0.519	0.506
6	0.541	0.622	0.539	0.572	0.697	0.785	0.838
7	0.581	0.767	0.598	0.683	0.883	0.976	0.953
8	1.046	0.852	0.900	0.731	0.936	0.994	1.393
9	1.187	0.930	0.746	0.802	0.806	0.975	1.112
10	0.910	1.082	0.634	0.770	0.764	0.707	0.986
11	0.479	0.671	0.639	0.613	0.740	0.582	1.032
12	0.404	0.678	0.587	0.641	0.672	0.665	0.905
13	0.417	0.533	0.685	0.711	0.445	0.739	2.334
14	0.679	0.779	0.658	0.707	0.685	0.734	1.274
W.Av 5-10	0.582	0.609	0.479	0.486	0.689	0.697	0.629
Ave 5-10	0.777	0.781	0.623	0.658	0.778	0.826	0.965
Age	1989	1990	1991	1992	1993	1994	1995
3	0.035	0.050	0.098	0.081	0.168	0.096	0.077
4	0.265	0.231	0.312	0.380	0.324	0.304	0.200
5	0.485	0.445	0.507	0.635	0.502	0.326	0.360
6	0.601	0.640	0.776	0.893	0.780	0.454	0.374
7	0.727	0.785	0.949	1.099	0.807	0.651	0.535
8	0.875	0.816	0.786	1.024	1.126	0.759	0.524
9	0.819	0.786	0.779	0.618	1.232	0.799	0.427
10	0.546	0.836	0.870	0.530	0.948	0.821	0.616
11	0.665	0.624	0.963	0.390	0.902	0.625	0.651
12	0.975	0.771	0.829	0.710	0.561	0.670	0.749
13	0.575	0.438	0.378	0.360	0.571	0.666	1.155
14	0.716	0.691	0.763	0.522	0.843	0.716	0.719
W.Av 5-10	0.544	0.596	0.751	0.790	0.690	0.397	0.388
Ave 5-10	0.676	0.718	0.778	0.800	0.899	0.635	0.473
Age	1996	1997	1998	1999	2000	2001	1998- 2001
3	0.036	0.023	0.026	0.053	0.066	0.079	0.056
4	0.145	0.149	0.137	0.190	0.189	0.221	0.185
5	0.247	0.249	0.361	0.436	0.477	0.444	0.429
6	0.488	0.372	0.512	0.716	0.673	0.689	0.648
7	0.509	0.616	0.656	0.740	0.891	0.879	0.792
8	0.602	0.715	0.780	0.769	0.888	0.929	0.842
9	0.581	0.765	0.993	0.815	0.816	0.957	0.895
10	0.564	0.831	0.941	0.750	0.879	0.964	0.884
11	0.563	0.817	0.989	0.768	0.849	0.948	0.888
12	0.629	0.417	1.110	0.666	1.345	0.948	1.017
13	0.758	0.930	1.322	0.607	0.803	0.948	0.920
14	0.619	0.752	1.071	0.721	0.938	0.953	0.921
W.Av 5-10	0.417	0.368	0.471	0.629	0.610	0.666	0.526
Ave 5-10	0.499	0.591	0.707	0.704	0.771	0.810	0.748

Table 3.3.18. Cod at Iceland. Division Va. Resulting Stock in numbers using final F from TSA using catch at age and spring trawl survey indices.

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Virtual Population Analysis : Stock in numbers, millions

Age	1982	1983	1984	1985	1986	1987	1988
3	133.575	226.325	139.007	144.031	335.805	277.524	168.492
4	115.390	106.396	182.089	107.718	112.095	256.309	217.286
5	81.350	75.742	77.274	120.679	66.119	73.478	154.011
6	74.178	44.653	40.214	45.818	67.038	30.295	35.806
7	34.736	35.350	19.620	19.203	21.166	27.346	11.314
8	12.818	15.903	13.437	8.835	7.941	7.168	8.435
9	17.940	3.687	5.554	4.471	3.484	2.551	2.172
10	3.480	4.482	1.191	2.156	1.642	1.274	0.788
11	0.940	1.147	1.244	0.517	0.817	0.627	0.514
12	0.310	0.476	0.480	0.537	0.230	0.319	0.287
13	0.138	0.170	0.198	0.219	0.232	0.096	0.134
14	0.024	0.075	0.081	0.082	0.088	0.122	0.038
Juvenile	383.310	444.545	405.969	361.273	531.447	607.930	516.069
Adult	91.570	69.860	74.423	92.994	85.210	69.178	83.208
Sum 3- 3	133.575	226.325	139.007	144.031	335.805	277.524	168.492
Sum 4-14	341.305	288.080	341.384	310.235	280.852	399.584	430.785
Total	474.880	514.405	480.391	454.266	616.657	677.108	599.276

Age	1989	1990	1991	1992	1993	1994	1995
3	82.982	131.940	101.382	173.621	146.014	74.249	160.583
4	131.890	65.588	102.802	75.290	131.127	101.080	55.234
5	142.508	82.815	42.619	61.583	42.156	77.638	61.059
6	76.023	102.818	43.432	21.017	26.710	20.902	45.895
7	12.686	34.109	44.373	16.371	7.047	10.024	10.866
8	3.572	5.022	12.733	14.060	4.465	2.576	4.281
9	1.715	1.219	1.818	4.750	4.134	1.186	0.987
10	0.585	0.619	0.455	0.683	2.095	0.988	0.437
11	0.241	0.278	0.220	0.156	0.329	0.665	0.356
12	0.150	0.101	0.122	0.069	0.087	0.109	0.291
13	0.095	0.046	0.038	0.044	0.028	0.040	0.046
14	0.011	0.044	0.024	0.022	0.025	0.013	0.017
Juvenile	345.201	311.670	246.946	259.553	212.883	140.240	196.109
Adult	107.256	112.930	103.074	108.113	151.336	149.229	143.944
Sum 3- 3	82.982	131.940	101.382	173.621	146.014	74.249	160.583
Sum 4-14	369.475	292.659	248.638	194.045	218.204	215.220	179.469
Total	452.457	424.599	350.020	367.666	364.218	289.469	340.052

Age	1996	1997	1998	1999	2000	2001	2002
3	165.212	82.713	155.358	54.034	181.034	165.390	175.000
4	121.758	130.429	66.165	123.993	41.960	138.750	125.187
5	37.026	86.272	91.971	47.225	83.909	28.428	91.074
6	34.879	23.682	55.072	52.497	25.009	42.636	14.930
7	25.846	17.529	13.365	27.025	21.000	10.446	17.526
8	5.212	12.714	7.753	5.676	10.556	7.053	3.551
9	2.076	2.338	5.090	2.909	2.154	3.555	2.281
10	0.528	0.950	0.891	1.545	1.054	0.780	1.118
11	0.193	0.246	0.339	0.285	0.597	0.358	0.243
12	0.152	0.090	0.089	0.103	0.108	0.209	0.114
13	0.113	0.066	0.049	0.024	0.043	0.023	0.066
14	0.012	0.043	0.021	0.011	0.011	0.016	0.007
Juvenile	311.870	193.151	300.392	222.652	286.864	327.890	354.921
Adult	81.136	163.922	95.770	92.674	80.571	69.755	76.177
Sum 3- 3	165.212	82.713	155.358	54.034	181.034	165.390	175.000
Sum 4-14	227.794	274.360	240.804	261.292	186.401	232.255	256.098
Total	393.006	357.073	396.162	315.325	367.435	397.645	431.098

Table 3.3.19 Cod at Iceland. Division Va. Resulting SSB using final F from TSA using catch at age and spring trawl survey indices.

Marine Research Institute Thu Apr 25 06:41:12 2002
Virtual Population Analysis : SSB in 1000 x tons

Age	1982	1983	1984	1985	1986	1987	1988
3	2.917	0.000	0.000	4.166	1.877	6.780	7.584
4	8.747	12.670	10.555	9.011	9.747	19.211	6.371
5	18.924	23.102	28.990	48.126	35.627	40.003	66.523
6	40.895	34.834	47.189	71.051	100.356	56.151	45.213
7	62.440	53.319	43.624	54.566	52.824	73.973	26.630
8	36.502	41.484	39.718	34.163	28.874	27.026	22.627
9	62.993	13.516	24.330	21.231	17.356	11.320	8.247
10	19.197	19.366	7.881	13.102	9.834	8.836	3.829
11	8.215	8.439	9.326	4.166	5.759	4.950	2.965
12	3.271	4.322	4.755	5.000	2.165	2.348	1.672
13	1.845	1.773	2.089	2.271	2.463	1.020	0.595
14	0.277	0.906	0.928	1.051	1.115	1.347	0.213
Total	266.223	213.731	219.384	267.905	267.997	252.964	192.470

Age	1989	1990	1991	1992	1993	1994	1995
3	0.000	0.000	0.000	10.345	11.075	8.023	6.956
4	8.853	5.970	10.343	20.903	45.444	44.712	36.464
5	65.814	45.567	17.084	61.138	41.906	92.491	105.913
6	124.593	163.239	54.279	34.515	52.000	50.970	116.026
7	39.718	92.345	89.255	41.545	22.535	34.441	34.076
8	13.743	20.213	44.936	45.903	15.715	10.035	18.928
9	7.561	6.773	8.633	22.267	16.030	5.915	5.809
10	3.994	4.036	2.545	4.153	10.853	4.771	3.061
11	1.992	2.370	1.482	1.443	2.260	5.014	2.689
12	0.771	1.031	1.118	0.627	0.756	0.953	2.193
13	0.719	0.549	0.432	0.538	0.289	0.403	0.329
14	0.103	0.516	0.327	0.180	0.291	0.151	0.174
Total	267.861	342.610	230.434	243.557	219.154	257.880	332.619

Age	1996	1997	1998	1999	2000	2001
3	15.446	6.999	4.831	2.623	7.021	22.774
4	17.809	59.418	31.969	49.386	10.228	84.913
5	44.101	100.506	89.663	49.836	67.363	35.946
6	81.583	56.845	102.636	92.007	40.117	84.715
7	80.334	63.020	43.694	75.819	52.994	31.752
8	20.110	52.532	38.189	23.574	37.326	26.279
9	9.501	11.437	24.280	15.545	10.720	16.439
10	3.617	4.877	4.701	10.233	6.111	4.249
11	1.586	1.661	2.207	2.101	3.878	1.970
12	1.372	0.755	0.761	0.898	0.635	1.254
13	1.003	0.444	0.428	0.215	0.371	0.144
14	0.136	0.438	0.184	0.108	0.114	0.133
Total	276.599	358.932	343.542	322.345	236.878	310.569

Table 3.3.20 Cod at Iceland. Division Va. Resulting stock weight using final F from TSA using catch at age and spring trawl survey indices.

Marine Research Institute Thu Apr 25 06:41:12 2002
Virtual Population Analysis : Stock weight 1. Jan. in 1000 x tons
FINAL - TSA_Vegið_N+S

Age	1982	1983	1984	1985	1986	1987	1988
3	134.377	247.825	179.041	202.652	489.939	365.221	242.291
4	178.855	170.127	314.104	212.311	219.818	501.340	392.202
5	182.712	172.314	200.603	310.870	188.042	197.363	396.734
6	230.249	134.895	144.007	167.234	240.868	117.968	126.000
7	147.906	144.793	85.761	95.554	98.106	128.965	55.777
8	69.040	87.164	77.908	56.296	48.878	44.849	50.621
9	119.873	25.988	41.413	36.696	26.139	18.795	15.516
10	31.809	36.430	11.733	22.251	14.920	11.771	6.950
11	11.244	12.631	13.747	6.311	8.462	6.702	5.129
12	4.411	6.657	6.884	7.892	3.509	3.390	3.363
13	2.388	2.692	3.024	3.537	3.370	1.525	1.903
14	0.404	1.378	1.358	1.557	1.321	1.532	0.489
Juvenile	715.807	746.864	768.932	756.213	1002.751	1123.689	1028.443
Adult	397.460	296.031	310.652	366.949	340.622	275.734	268.531
Sum 3- 3	134.376	247.826	179.041	202.652	489.939	365.221	242.291
Sum 4-14	978.891	795.070	900.543	920.510	853.434	1034.201	1054.683
Total	1113.267	1042.896	1079.584	1123.162	1343.373	1399.422	1296.974

Age	1989	1990	1991	1992	1993	1994	1995
3	98.417	170.203	132.709	223.797	203.252	107.141	216.466
4	239.116	111.762	195.221	133.113	247.437	208.528	108.204
5	369.096	197.349	105.482	152.049	116.857	198.908	178.292
6	297.631	311.948	137.203	69.188	100.482	76.480	166.371
7	66.095	157.720	168.264	71.935	34.742	51.292	56.241
8	24.617	32.749	72.325	78.485	27.034	16.128	27.465
9	13.778	10.835	13.169	32.443	30.802	9.153	7.815
10	5.751	6.553	4.461	5.554	18.105	8.788	4.487
11	2.883	3.051	2.142	1.979	3.591	7.214	3.924
12	1.500	1.476	1.746	0.921	1.083	1.409	3.325
13	1.197	0.729	0.544	0.684	0.408	0.596	0.601
14	0.171	0.756	0.495	0.243	0.419	0.224	0.258
Juvenile	755.005	621.809	498.646	432.177	382.749	281.376	333.988
Adult	365.246	383.324	335.115	338.212	401.463	404.484	439.461
Sum 3- 3	98.417	170.203	132.709	223.797	203.252	107.141	216.466
Sum 4-14	1021.835	834.929	701.051	546.593	580.960	578.719	556.983
Total	1120.252	1005.132	833.761	770.390	784.212	685.860	773.449

Age	1996	1997	1998	1999	2000	2001	2002
3	240.715	122.746	191.090	67.056	236.793	247.920	236.075
4	234.992	244.816	118.302	212.772	74.773	284.437	240.108
5	115.966	248.291	227.811	114.568	195.508	75.305	249.088
6	144.434	95.393	197.599	180.747	81.330	145.518	53.912
7	127.215	94.690	66.997	127.560	98.488	49.786	81.235
8	31.317	81.192	56.542	36.054	62.215	45.901	21.902
9	15.371	17.168	39.924	25.393	16.820	26.735	18.291
10	5.155	8.114	8.269	15.364	9.702	7.058	10.509
11	2.035	2.654	3.719	3.155	6.116	3.152	2.444
12	2.054	1.038	1.365	1.294	1.207	1.994	1.259
13	1.544	0.692	0.861	0.360	0.572	0.258	0.872
14	0.192	0.554	0.345	0.161	0.187	0.221	0.113
Juvenile	619.767	408.163	547.203	431.318	486.501	627.970	651.691
Adult	301.223	509.184	365.623	353.164	297.210	260.316	264.118
Sum 3- 3	240.715	122.746	191.090	67.056	236.793	247.920	236.075
Sum 4-14	680.275	794.602	721.735	717.426	546.919	640.366	679.733
Total	920.989	917.348	912.825	784.482	783.711	888.286	915.808

Table 3.3.21. Cod at Iceland. Division Va. Capelin biomass ('000 tonnes) used for prediction of cod mean weights at age.

	Total
Year	Biomass
1979	3177
1980	2110
1981	1500
1982	1209
1983	2385
1984	3373
1985	3724
1986	4195
1987	3994
1988	3094
1989	2780
1990	2197
1991	2519
1992	3164
1993	3405
1994	3350
1995	3921
1996	4705
1997	4229
1998	3303
1999	3485
2000	3718
2001	3161
2002	3160
Average	3161

Table 3.3.22. Cod at Iceland. Division Va. Landings ('000 tonnes), average fishing mortality of age groups, recruitment (at age 3 in millions), spawning stock at spawning time ('000 tonnes) and total biomass ('000 tonnes).

Year	Landings	F5-10	SSB	Recruitment	Tot. Bio
1955	538	0.31	1261	260	
1956	481	0.26	1199	307	
1957	452	0.32	1145	153	
1958	509	0.32	1034	191	
1959	453	0.33	928	143	
1960	465	0.38	825	163	
1961	374	0.33	760	292	
1962	387	0.40	729	255	
1963	410	0.45	683	273	
1964	434	0.54	569	328	
1965	394	0.61	454	174	
1966	357	0.54	412	255	
1967	345	0.49	476	186	
1968	381	0.67	594	178	
1969	406	0.53	693	136	
1970	471	0.56	684	303	
1971	453	0.62	615	170	
1972	399	0.71	477	265	
1973	383	0.71	436	432	
1974	375	0.76	329	143	
1975	371	0.81	339	222	
1976	348	0.76	283	246	
1977	340	0.63	319	144	
1978	330	0.48	375	143	
1979	368	0.43	447	134	
1980	434	0.45	602	226	
1981	469	0.68	389	139	1432
1982	388	0.78	266	144	1113
1983	300	0.78	214	336	1043
1984	284	0.62	219	278	1080
1985	325	0.66	268	168	1123
1986	369	0.78	268	83	1343
1987	392	0.83	253	132	1399
1988	378	0.96	192	101	1297
1989	356	0.68	268	174	1120
1990	335	0.72	343	146	1005
1991	309	0.78	230	74	834
1992	268	0.80	244	161	770
1993	252	0.90	219	165	784
1994	179	0.64	258	83	686
1995	169	0.47	333	155	773
1996	182	0.50	277	54	921
1997	203	0.59	359	181	917
1998	243	0.71	344	165	913
1999	260	0.70	322	175	784
2000	236	0.77	237	210	784
2001	235	0.81	311	80	888
Average	357	0.61	478	190	1001

Table 3.3.23. Cod at Iceland. Division Va. Input file used for RCTR3

Iceland Cod: VPA and groundfish survey data,N+S

4 21 2

'Yearcl'	'VPAage3'	'Surv4'	'Surv3'	'Surv2'	'Surv1'
1981	-11	4819	-11	-11	-11
1982	-11	2249	3539	-11	-11
1983	-11	8346	9572	11229	-11
1984	-11	10493	10403	6103	1654
1985	168	8013	7271	2894	1510
1986	83	1429	2236	748	365
1987	132	3072	2671	1725	345
1988	101	1908	1819	1209	409
1989	174	3928	3384	1631	557
1990	146	2706	3507	1746	395
1991	74	936	885	477	72
1992	161	2826	2616	1602	358
1993	165	5653	4194	2930	1376
1994	83	1595	1371	536	117
1995	155	4232	2978	2239	363
1996	54	718	710	547	121
1997	-11	3832	5562	3429	798
1998	-11	4027	3700	2853	738
1999	-11	-11	4123	2405	1881
2000	-11	-11	-11	3867	1209
2001	-11	-11	-11	-11	91

Table 3.3.24. Cod at Iceland. Division Va. Output from RCT3

Analysis by RCT3 ver3.1 of data from file :

in_2002.dat

Iceland Cod: VPA and groundfish survey data,N+S

Data for 4 surveys over 21 years : 1981 - 2001

Regression type = C

Tapered time weighting not applied

Survey weighting not applied

Final estimates shrunk towards mean

Minimum S.E. for any survey taken as .20

Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1997

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Surv4	.58	.21	.16	.870	12	8.25	5.03	.183	.326
Surv3	.66	-.36	.20	.813	12	8.62	5.34	.240	.226
Surv2	.65	.11	.18	.844	12	8.14	5.41	.219	.272
Surv1	.55	1.56	.32	.620	12	6.68	5.22	.379	.091
VPA Mean =						4.77		.391	.085

Yearclass = 1998

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Surv4	.58	.21	.16	.870	12	8.30	5.05	.184	.314
Surv3	.66	-.36	.20	.813	12	8.22	5.07	.229	.239
Surv2	.65	.11	.18	.844	12	7.96	5.29	.213	.277
Surv1	.55	1.56	.32	.620	12	6.61	5.18	.377	.088
VPA Mean =						4.77		.391	.082

Yearclass = 1999

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Surv4									
Surv3	.66	-.36	.20	.813	12	8.32	5.15	.231	.346
Surv2	.65	.11	.18	.844	12	7.79	5.18	.208	.426
Surv1	.55	1.56	.32	.620	12	7.54	5.69	.416	.107
VPA Mean =							4.77	.391	.121

Yearclass = 2000

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Surv4									
Surv3									
Surv2	.65	.11	.18	.844	12	8.26	5.49	.224	.607
Surv1	.55	1.56	.32	.620	12	7.10	5.45	.394	.195
VPA Mean =							4.77	.391	.198

Yearclass = 2001

	I-----Regression-----I					I-----Prediction-----I			
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Surv4									
Surv3									
Surv2									
Surv1	.55	1.56	.32	.620	12	4.52	4.04	.398	.491
VPA Mean =							4.77	.391	.509

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1997	181	5.20	.11	.10	.82		
1998	166	5.11	.11	.07	.41		
1999	176	5.17	.14	.13	.88		
2000	208	5.34	.17	.20	1.33		
2001	82	4.41	.28	.37	1.72		

Table 3.3.25. Short term prediction (Management option table)

Calculation were done with a spreadsheet: codpr2002.xls

Input data:

Sexual maturity at spawning time:

age\year	2001	2002	2003	2004	2005	AV99-01	Av75-01	Av85-01
3	0.13	0.073	0.073	0.073	0.073	0.073	0.036	0.046
4	0.413	0.296	0.296	0.296	0.296	0.296	0.132	0.180
5	0.614	0.536	0.536	0.536	0.536	0.536	0.334	0.416
6	0.792	0.715	0.715	0.715	0.715	0.715	0.577	0.660
7	0.921	0.849	0.849	0.849	0.849	0.849	0.792	0.833
8	0.898	0.916	0.916	0.916	0.916	0.916	0.906	0.916
9	0.967	0.972	0.972	0.972	0.972	0.972	0.955	0.956
10	0.987	0.985	0.985	0.985	0.985	0.985	0.967	0.962
11	1	1.000	1.000	1.000	1.000	1.000	0.995	0.996
12	1	1.000	1.000	1.000	1.000	1.000	0.983	0.978
13	1	0.946	0.946	0.946	0.946	0.946	0.988	0.981
14	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Mean weights in the spawning stock (1/1 - 31/5 in catches each year)

age\year	2001	2002	2003	2004	2005	99-01
3	1.121	1.071	1.071	1.071	1.071	1.071
4	1.621	1.526	1.526	1.526	1.526	1.526
5	2.417	2.384	2.370	2.370	2.370	2.269
6	3.234	3.484	3.457	3.445	3.445	3.217
7	4.854	4.594	4.798	4.776	4.767	4.751
8	6.546	6.276	6.057	6.229	6.210	6.360
9	7.935	8.126	8.126	8.126	8.126	8.126
10	9.196	9.578	9.578	9.578	9.578	9.578
11	9.086	10.172	10.172	10.172	10.172	10.172
12	9.899	11.401	11.401	11.401	11.401	11.401
13	10.351	12.839	12.839	12.839	12.839	12.839
14	13.874	15.489	15.489	15.489	15.489	15.489

Table 3.3.25 (Continued)

Mean weights in the catch

agelyear	2001	2002	2003	2004	2005	98-00
3	1.499	1.349	1.349	1.349	1.349	1.349
4	2.050	1.918	1.852	1.852	1.852	1.849
5	2.649	2.735	2.646	2.602	2.602	2.468
6	3.413	3.611	3.678	3.609	3.575	3.369
7	4.766	4.635	4.814	4.875	4.812	4.725
8	6.508	6.168	6.074	6.203	6.247	6.251
9	7.520	8.020	8.020	8.020	8.020	8.020
10	9.055	9.401	9.401	9.401	9.401	9.401
11	8.796	10.041	10.041	10.041	10.041	10.041
12	9.526	11.078	11.078	11.078	11.078	11.078
13	11.210	13.126	13.126	13.126	13.126	13.126
14	13.874	15.489	15.489	15.489	15.489	15.489

Selection pattern**Fishing mortality from a VPA:**

agelyear	1996	1997	1998	1999	2000	2001	99-01
3	0.036	0.023	0.026	0.053	0.066	0.079	0.066
4	0.145	0.149	0.137	0.19	0.189	0.221	0.200
5	0.247	0.249	0.361	0.436	0.477	0.444	0.452
6	0.488	0.372	0.512	0.716	0.673	0.689	0.693
7	0.509	0.616	0.656	0.74	0.891	0.879	0.837
8	0.602	0.715	0.78	0.769	0.888	0.929	0.862
9	0.581	0.765	0.993	0.815	0.816	0.957	0.863
10	0.564	0.831	0.941	0.75	0.879	0.964	0.864
11	0.563	0.817	0.989	0.768	0.849	0.948	0.855
12	0.629	0.417	1.11	0.666	1.345	0.948	0.986
13	0.758	0.93	1.322	0.607	0.803	0.948	0.786
14	0.619	0.752	1.071	0.721	0.938	0.948	0.869
Ave(5-10)	0.499	0.591	0.707	0.704	0.771	0.810	0.762

Natural Mortality

agelyear	2001	2002	2003	2004	2005
3	0.20	0.20	0.20	0.20	0.20
4	0.20	0.20	0.20	0.20	0.20
5	0.20	0.20	0.20	0.20	0.20
6	0.20	0.20	0.20	0.20	0.20
7	0.20	0.20	0.20	0.20	0.20
8	0.20	0.20	0.20	0.20	0.20
9	0.20	0.20	0.20	0.20	0.20
10	0.20	0.20	0.20	0.20	0.20
11	0.20	0.20	0.20	0.20	0.20
12	0.20	0.20	0.20	0.20	0.20
13	0.20	0.20	0.20	0.20	0.20
14	0.20	0.20	0.20	0.20	0.20

Table 3.3.25 (Continued)

<u>Given stock numbers</u>					<u>Mortality proportions before spawning</u>	
age\year	2002	2003	2004	2005	F	M
3	175.000	210.00	80.00	180.00	0.085	0.250
4	125.187				0.180	0.250
5	91.074				0.248	0.250
6	14.930				0.296	0.250
7	17.526				0.382	0.250
8	3.551				0.437	0.250
9	2.281				0.477	0.250
10	1.118				0.477	0.250
11	0.243				0.477	0.250
12	0.114				0.477	0.250
13	0.066				0.477	0.250
14	0.007				0.477	0.250

Table 3.3.25 (Continued)

Icelandic COD. **Division Va.**

Prognosis - Summery **and plots**

Catch, '000 **tonnes**

	1998	1999	2000	2001	2002	2003	2004	2005
<i>Opt1</i>	203	243	260	235	190	160	160	160
<i>Opt2</i>	203	243	260	235	190	183	219	237
<i>Opt3</i>	203	243	260	235	190	190	190	190
<i>Opt4</i>	203	243	260	235	190	220	220	220
<i>Opt5</i>	203	243	260	235	190	250	250	250

Average fishing mortality of 5-10 **years old**

	1998	1999	2000	2001	2002	2003	2004	2005
<i>Opt1</i>	0.707	0.704	0.771	0.810	0.591	0.385	0.292	0.229
<i>Opt2</i>	0.707	0.704	0.771	0.810	0.591	0.450	0.437	0.413
<i>Opt3</i>	0.707	0.704	0.771	0.810	0.591	0.470	0.375	0.307
<i>Opt4</i>	0.707	0.704	0.771	0.810	0.591	0.560	0.472	0.407
<i>Opt5</i>	0.707	0.704	0.771	0.810	0.591	0.657	0.588	0.539

Fishable stock, 4+ in '000 tonnes at the beginnig of **the year**

	1998	1999	2000	2001	2002	2003	2004	2005
<i>Opt1</i>	722	717	546	640	680	785	996	1030
<i>Opt2</i>	722	717	546	640	680	785	969	930
<i>Opt3</i>	722	717	546	640	680	785	960	956
<i>Opt4</i>	722	717	546	640	680	785	925	882
<i>Opt5</i>	722	717	546	640	680	785	889	808

Spawning stock in '000 at the time of **spawning**

	1998	1999	2000	2001	2002	2003	2004	2005
<i>Opt1</i>	343	322	237	311	285	362	477	595
<i>Opt2</i>	343	322	237	311	285	356	443	500
<i>Opt3</i>	343	322	237	311	285	355	445	532
<i>Opt4</i>	343	322	237	311	285	347	413	470
<i>Opt5</i>	343	322	237	311	285	340	382	409

Table 3.3.25 (Continued)

Icelandic COD.
Division Va.

Prognosis - Summary table (
nwwg2002)

2002				2003				2004				2005			
TAC	4+ stofn	Hr. stofn	F (5-10)	TAC	4+ stofn	Hr. stofn	F (5-10)	TAC	4+ stofn	Hr. stofn	F (5-10)	TAC	4+ stofn	Hr. stofn	F (5-10)
	4+ stock	Sp. stock			4+ stock	Sp. stock			4+ stock	Sp. stock			4+ stock	Sp. stock	
190	680	285	0.591	160	785	362	0.385	160	996	477	0.292	160	1030	595	0.229
				183	785	356	0.450	219	969	443	0.437	237	930	500	0.413
				190	785	355	0.470	190	960	445	0.375	190	956	532	0.307
				220	785	347	0.560	220	925	413	0.472	220	882	470	0.407
				250	785	340	0.657	250	889	382	0.588	250	808	409	0.539

The shaded option corresponds to the harvest control rule.

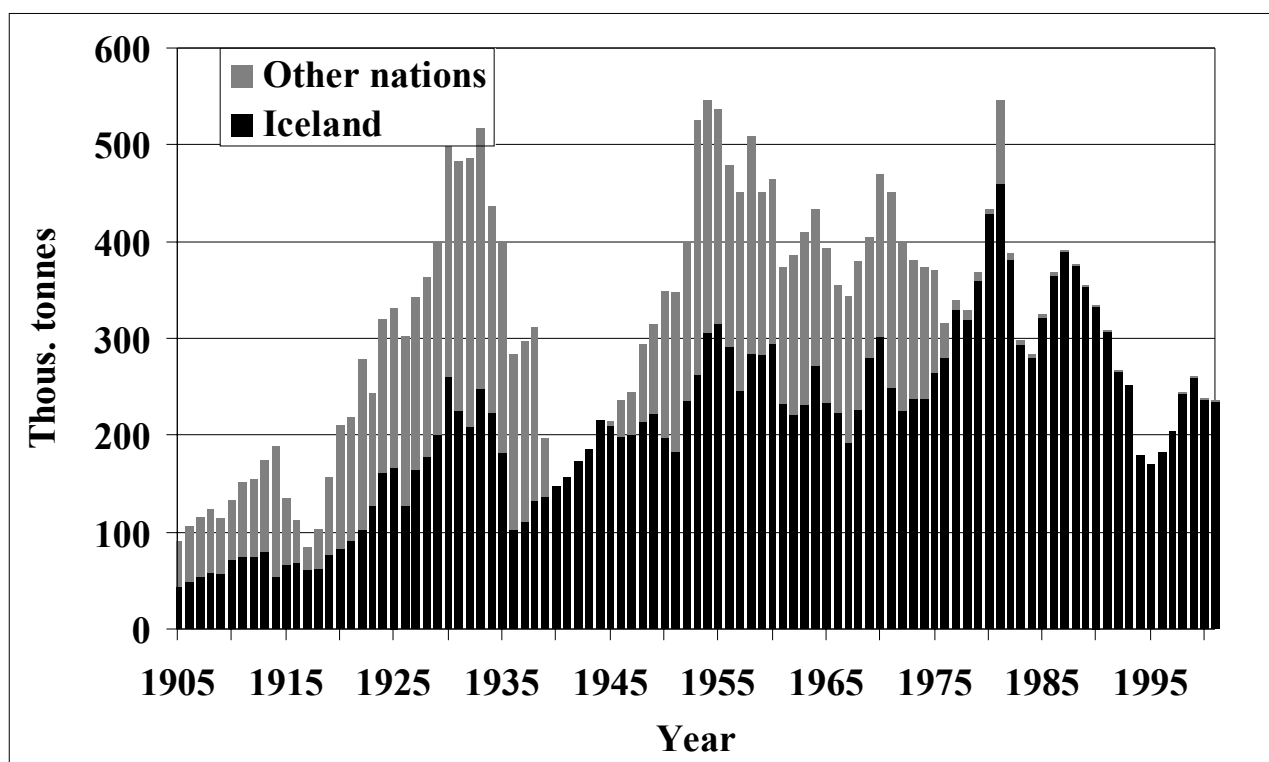


Figure 3.3.1 Cod at Iceland Division Va. Landings since 1905.

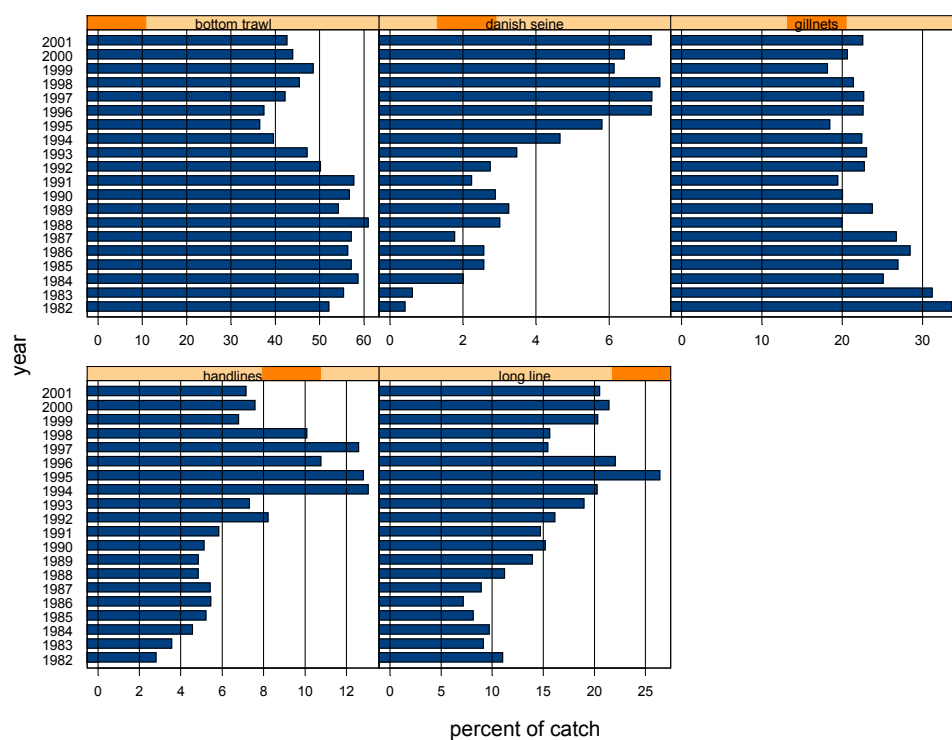
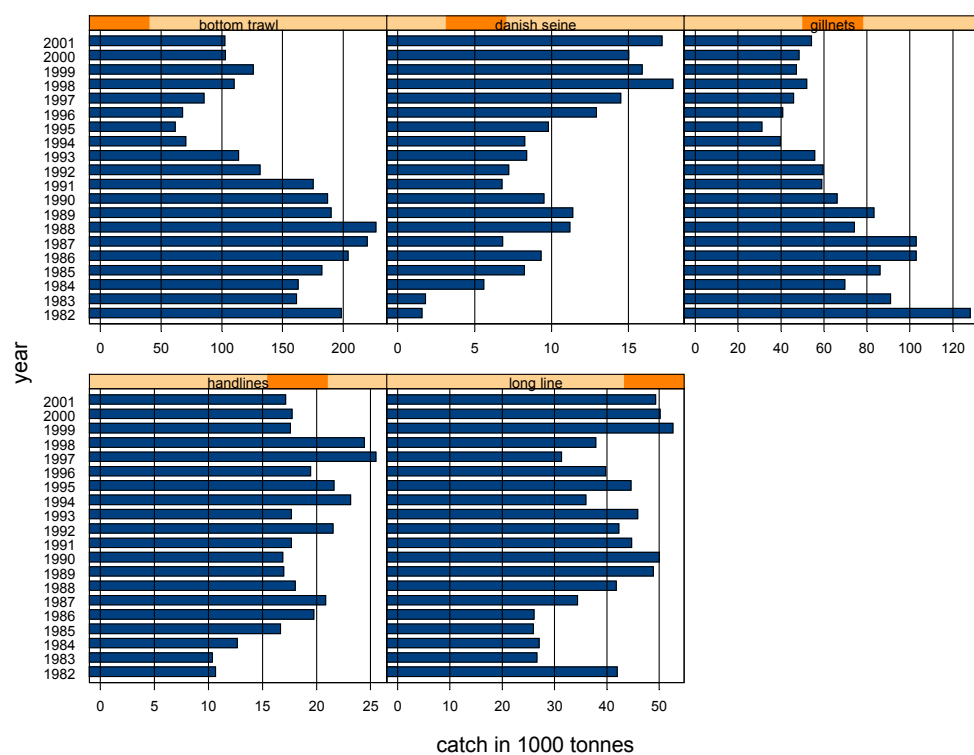


Figure 3.3.2 Landings by geera and year. Upper pictures in tonnes sand lower in percentages.

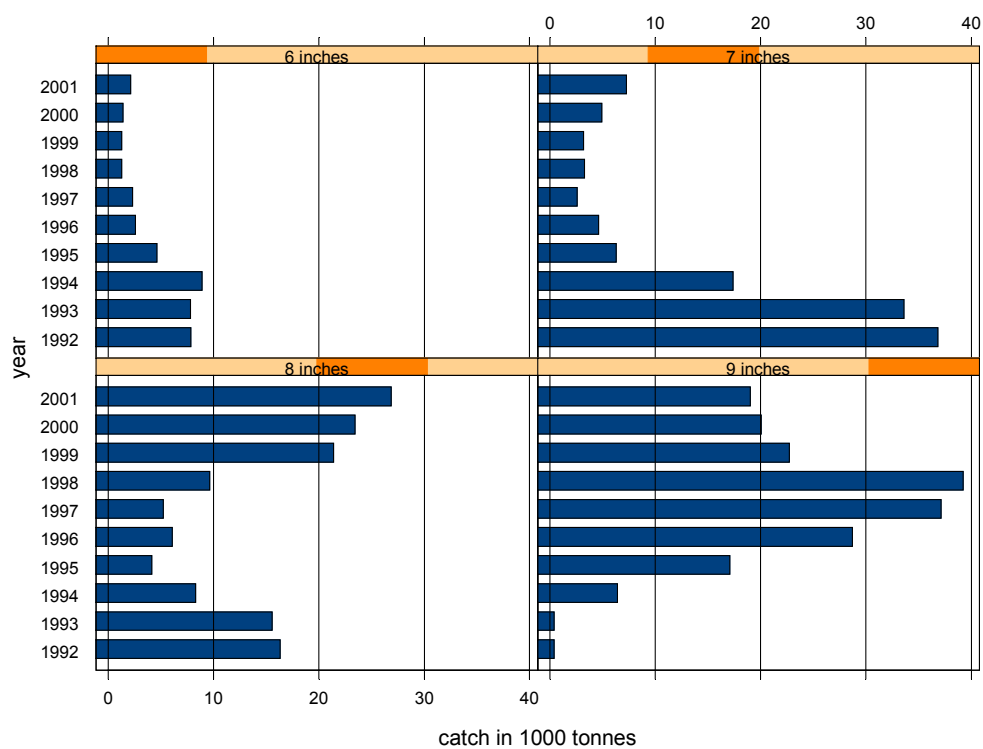


Figure 3.3.3. Cod in division Va. Gillnet landings by mesh size and year.

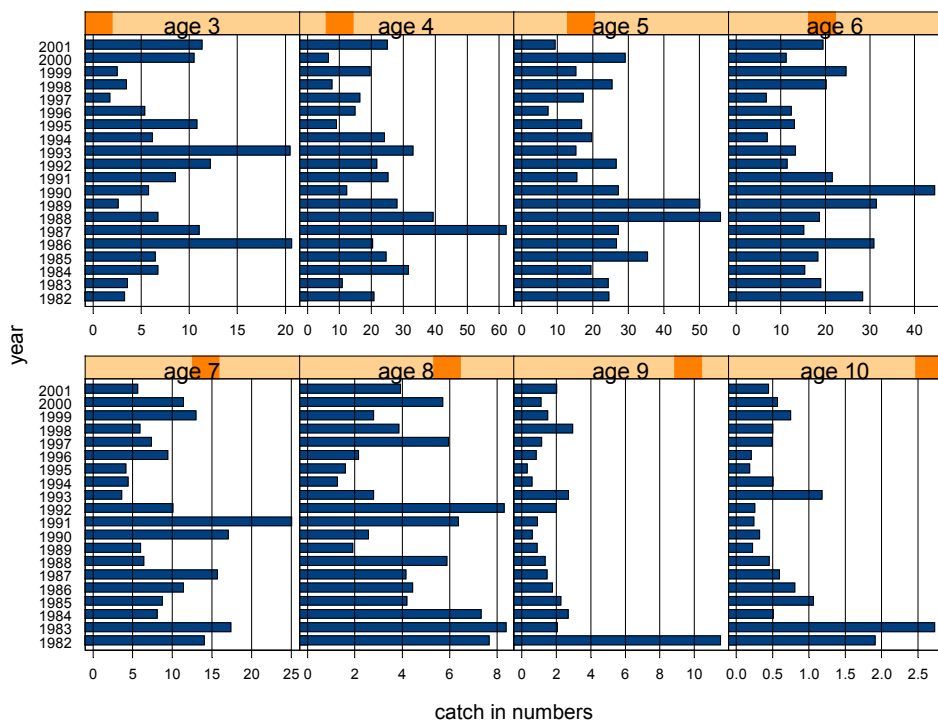


Figure 3.3.4 . Cod in division Va. Catch in numbers by year and age.

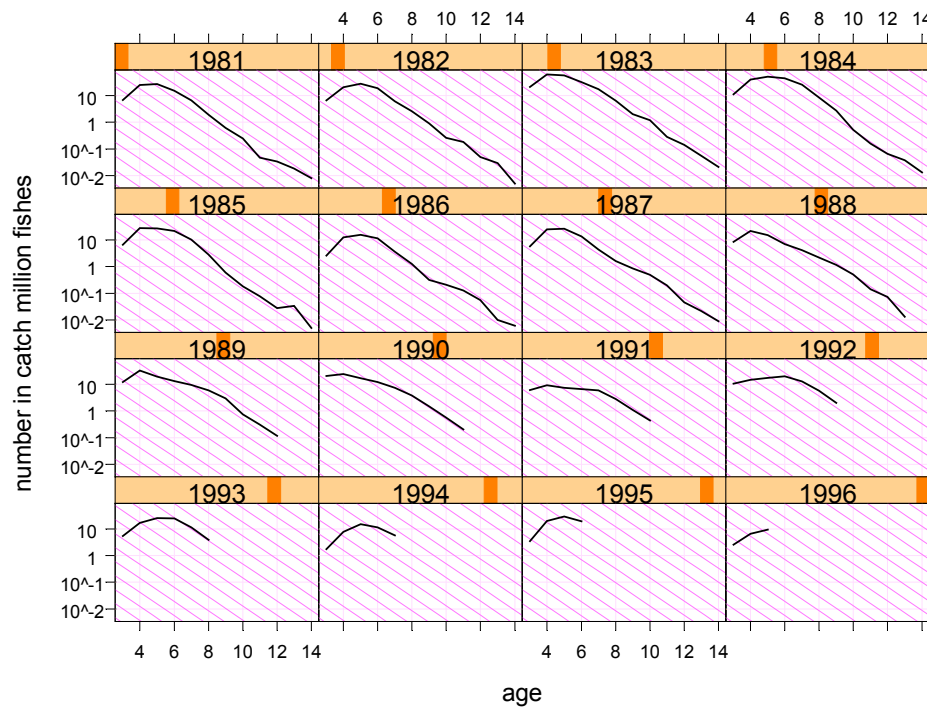


Figure 3.3.5. Icelandic cod. Catch curves. Grey lines show $Z = 1$.

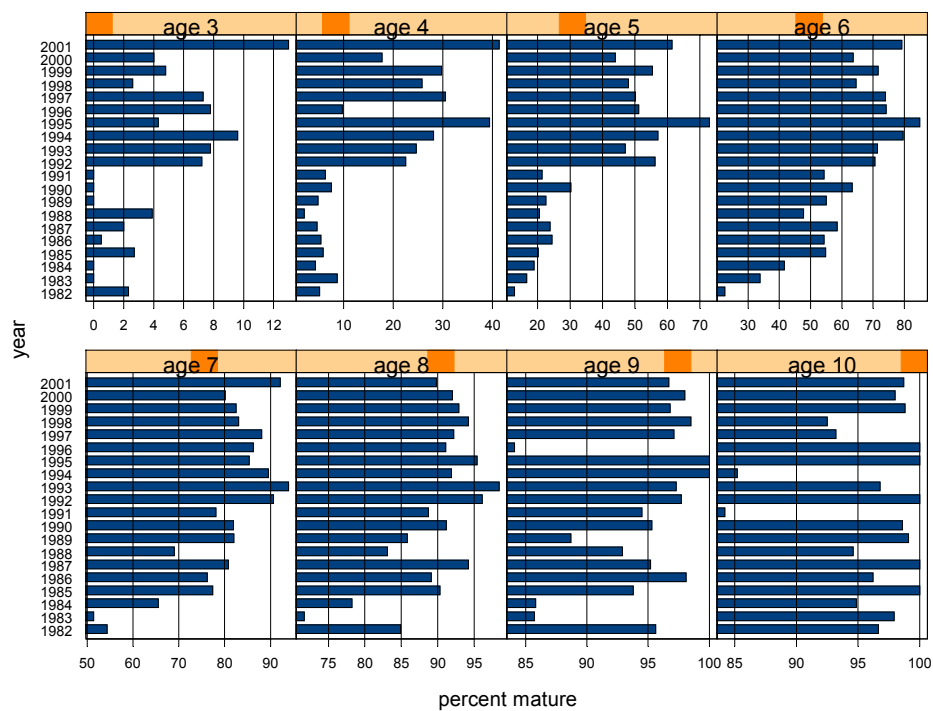


Figure 3.3.6. Cod in division Va. Maturity at age in the catches.

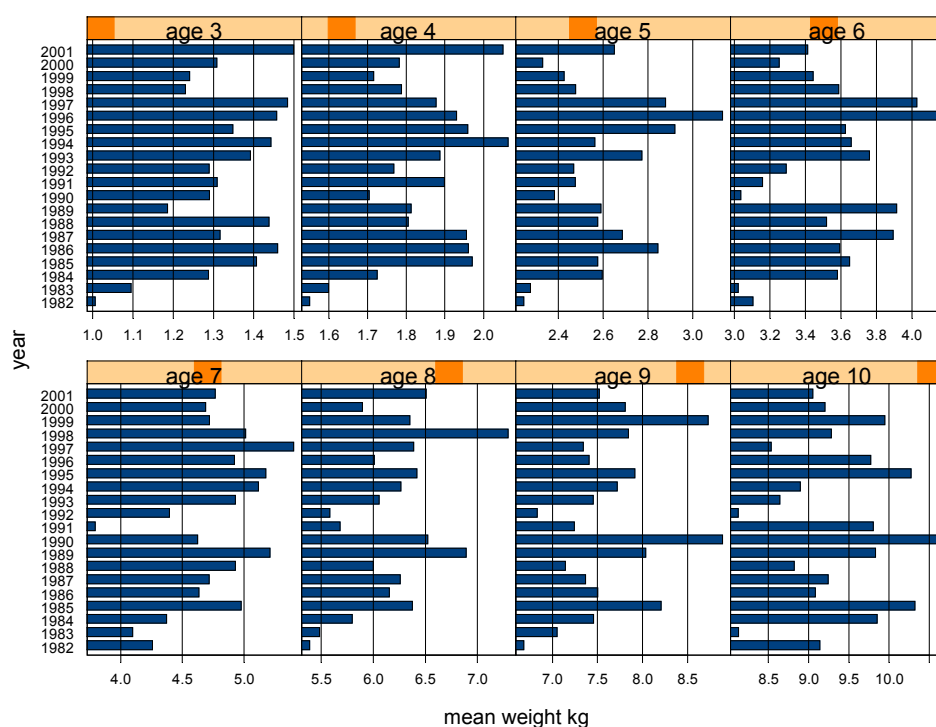


Figure 3.3.7 Cod in division Va. Mean weight at age in the catches.

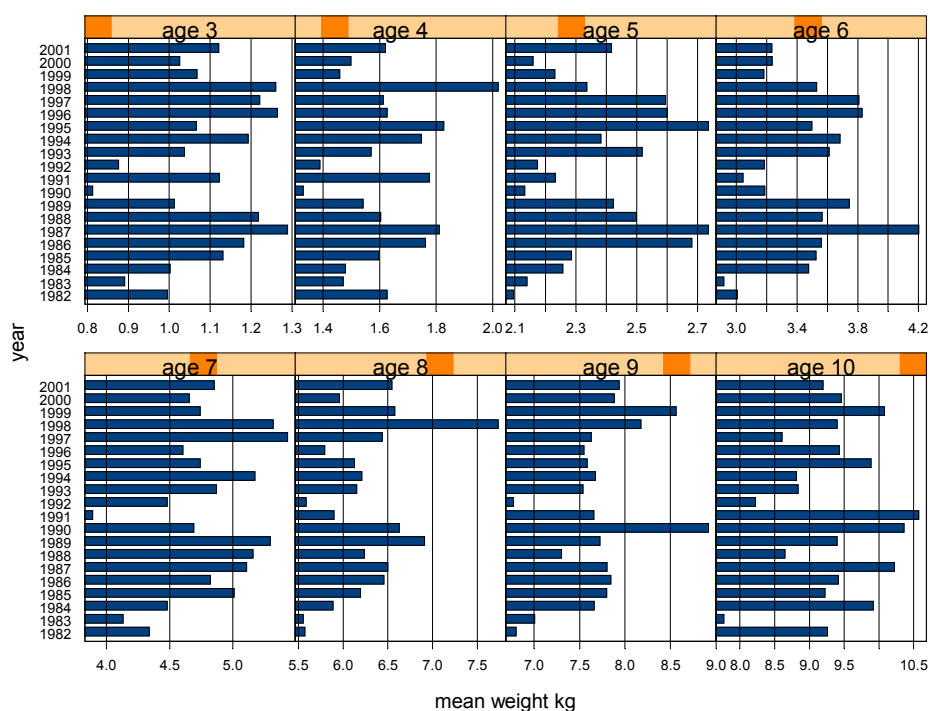


Figure 3.3.8 Cod in division Va. Mean weight at age in the SSB.

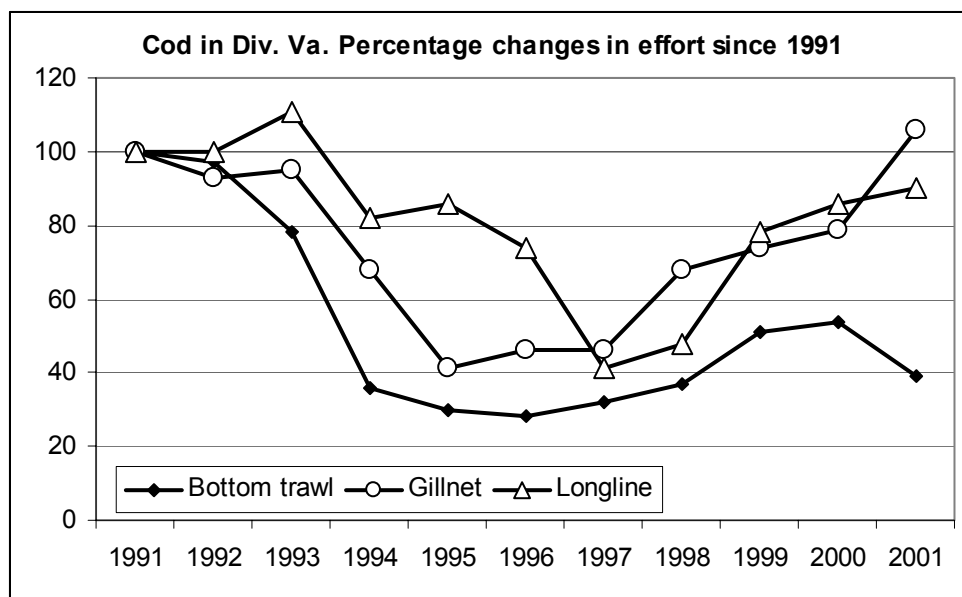


Figure 3.3.9. Cod at Iceland Division Va. Percentages changes in effort for the main gears since 1991.

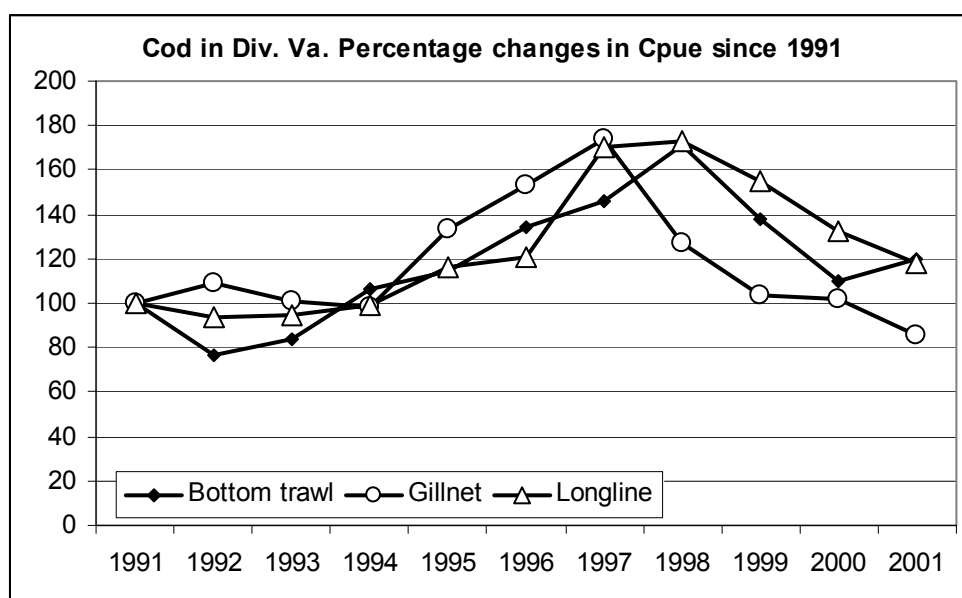


Figure 3.3.9. Cod at Iceland Division Va. Percentages changes in cpue for the main gears since 1991.

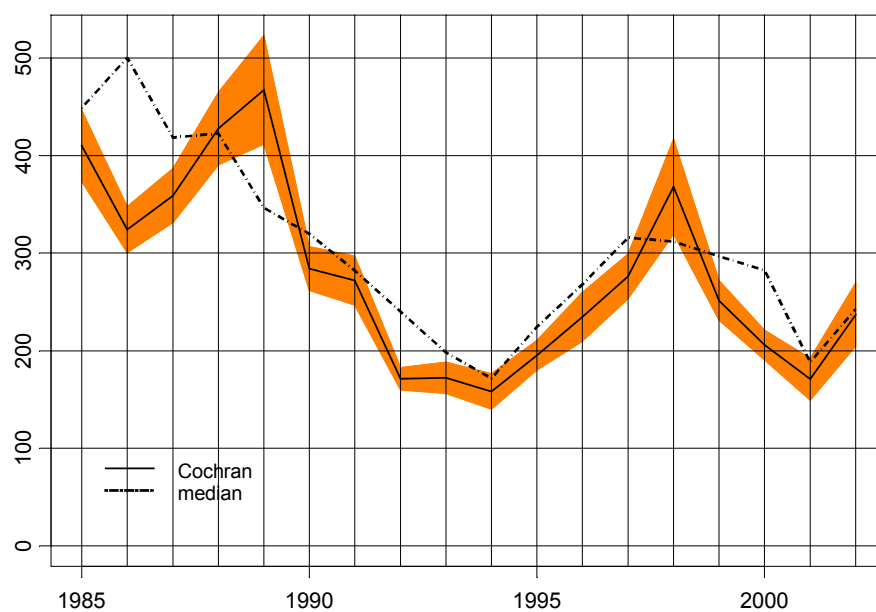


Figure 3.3.10. Cod in division Va. Total biomass index from the groundfish survey. Index base on the median of all stations where cod was caught is shown for comparison. The scale is 100 thousand tonnes.

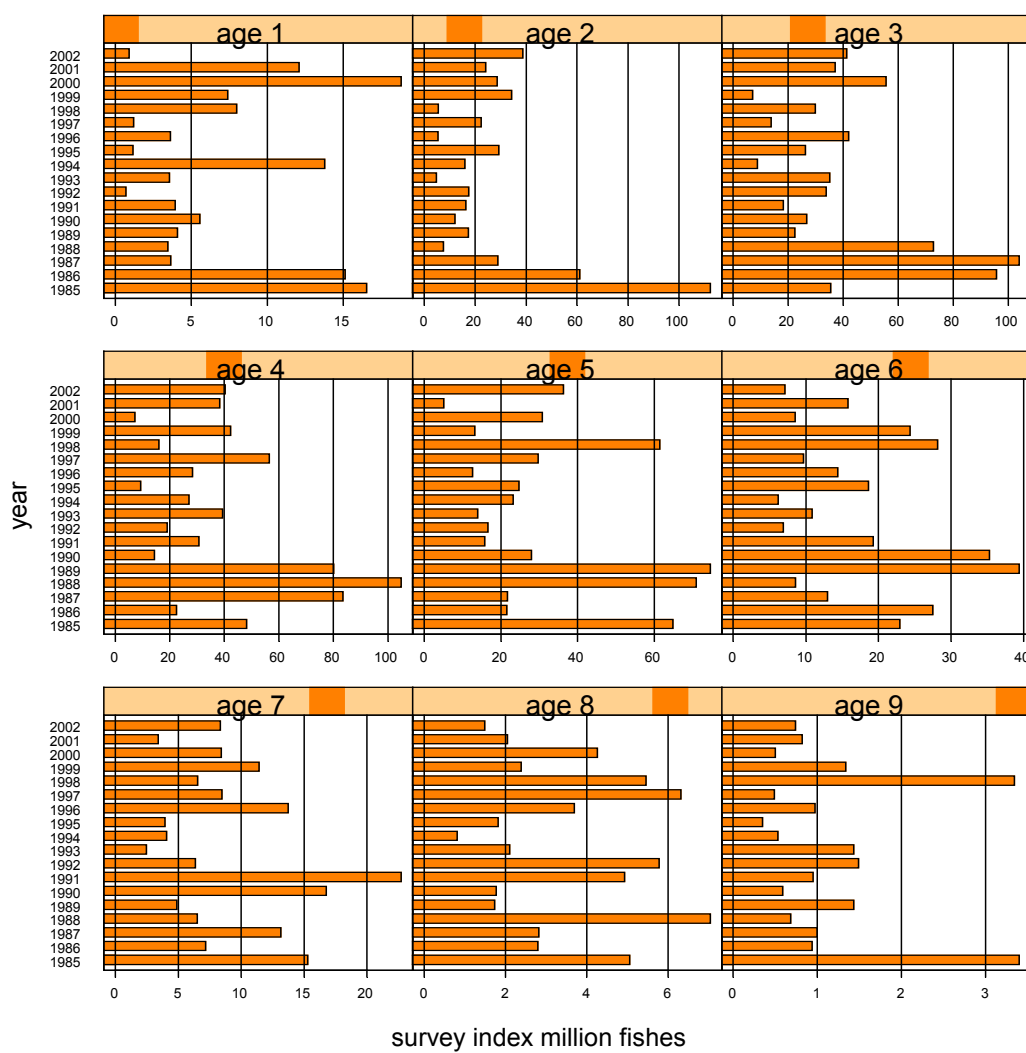


Fig 3.3.11. Cod in division Va. Survey indices from the March survey. Numbers by year and age.

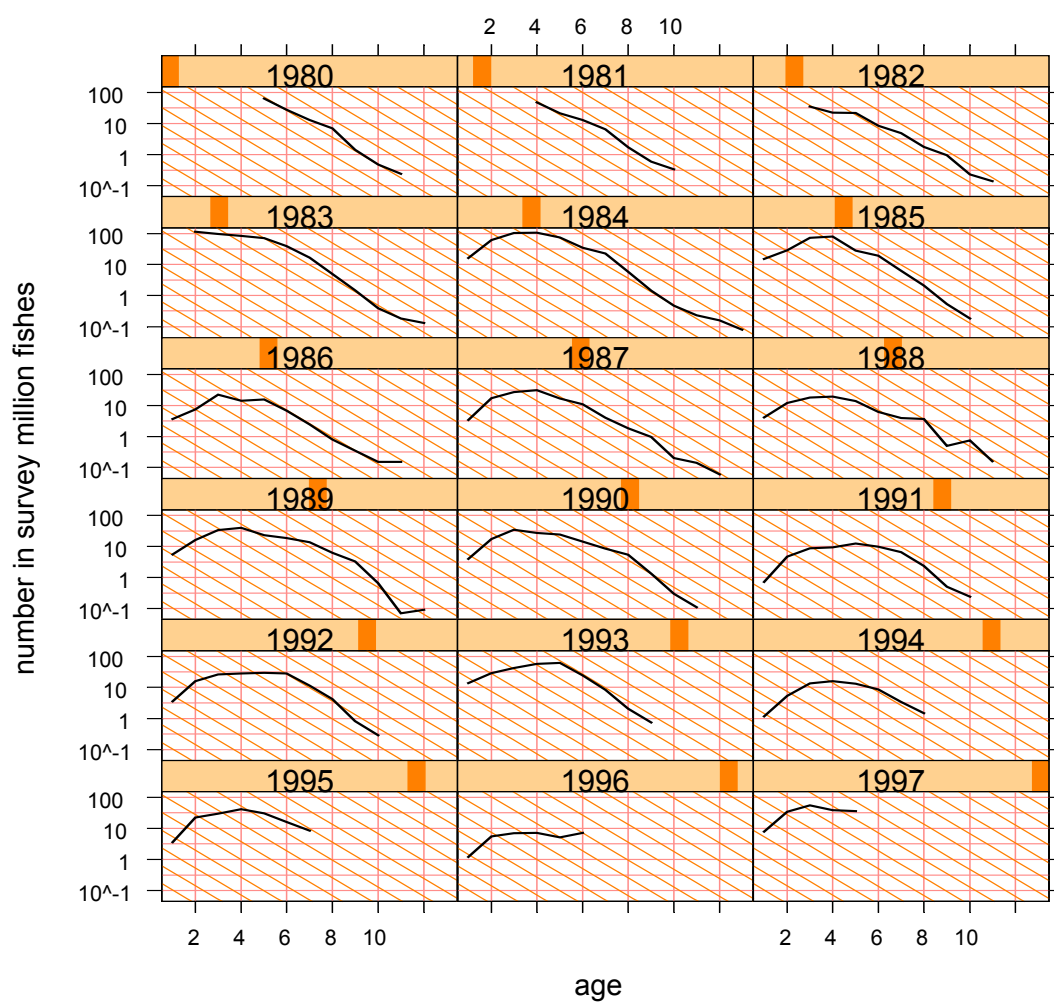


Figure 3.3.12. Cod in division Va. Catchcurves from the survey. The grey lines show $Z=1$

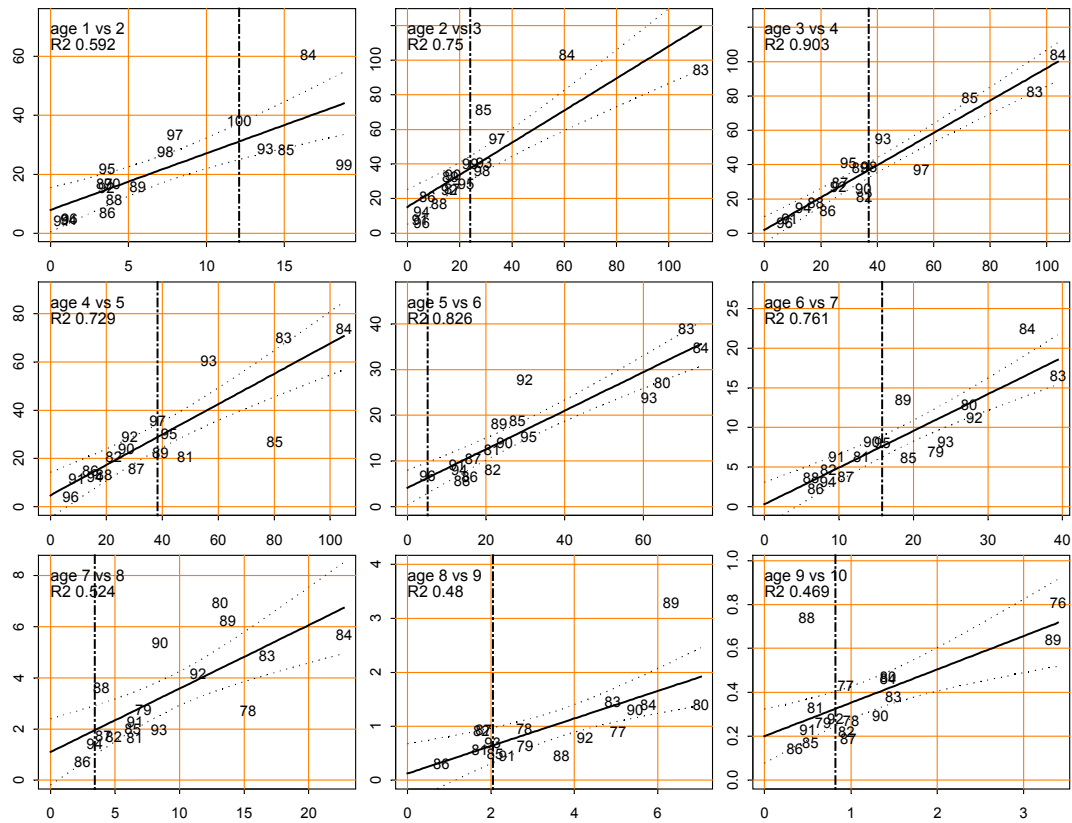


Figure 3.3.13. Cod in division Va. Indices from the groundfish suevey vs. index of the same yearclass in survey a year later (Steinarsson/Stefánsson- plot).

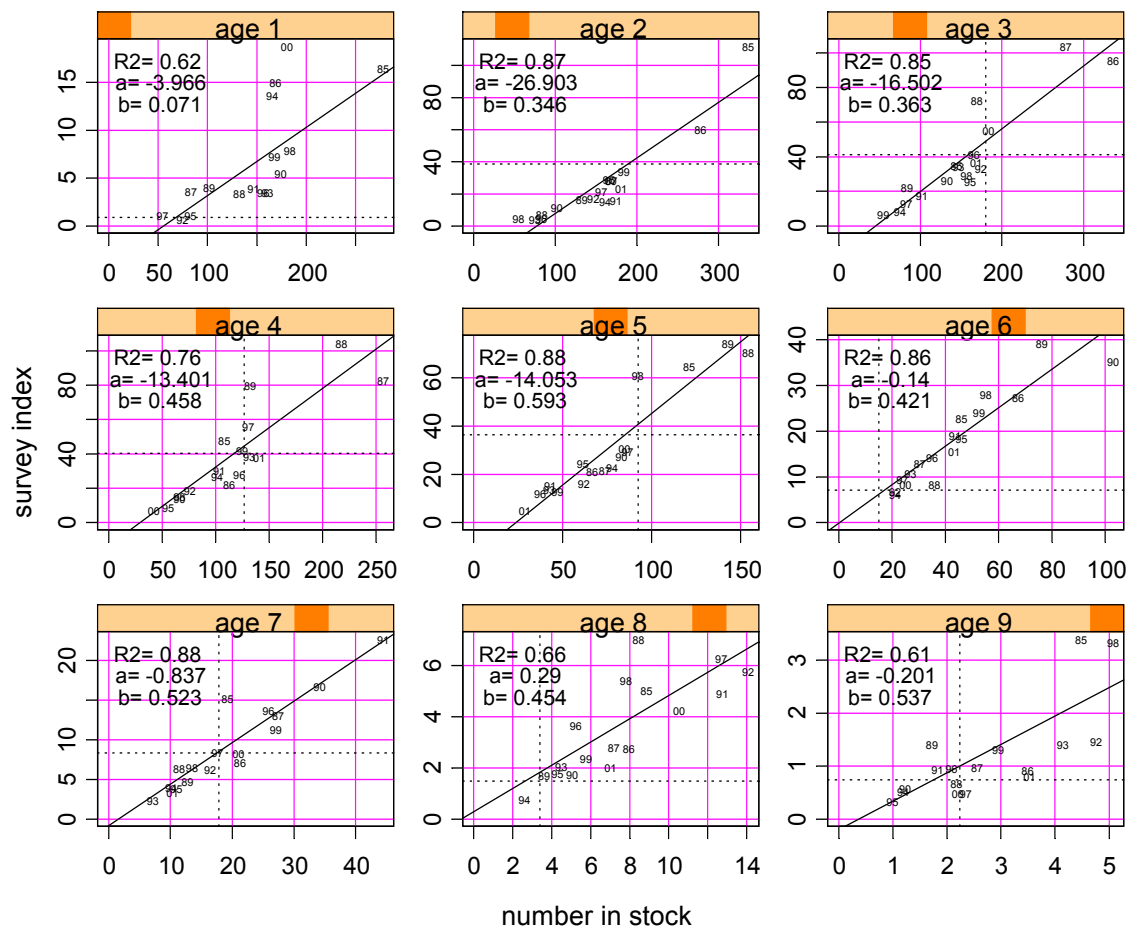


Figure 3.3.14. Cod in division Va. Survey indices vs. number in stock. Line fitted on original scale

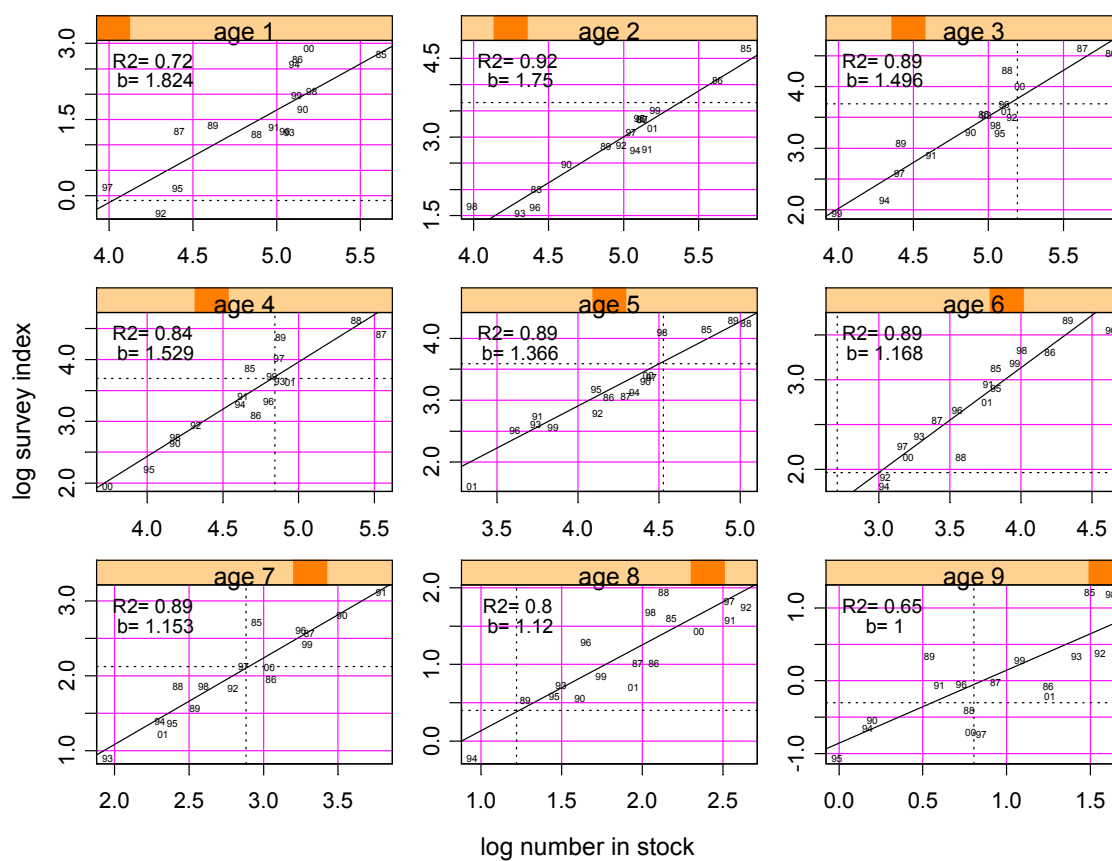


Figure 3.3.15. Cod in division Va. Survey indices vs. number in stock. Line fitted on logscale (power curve)

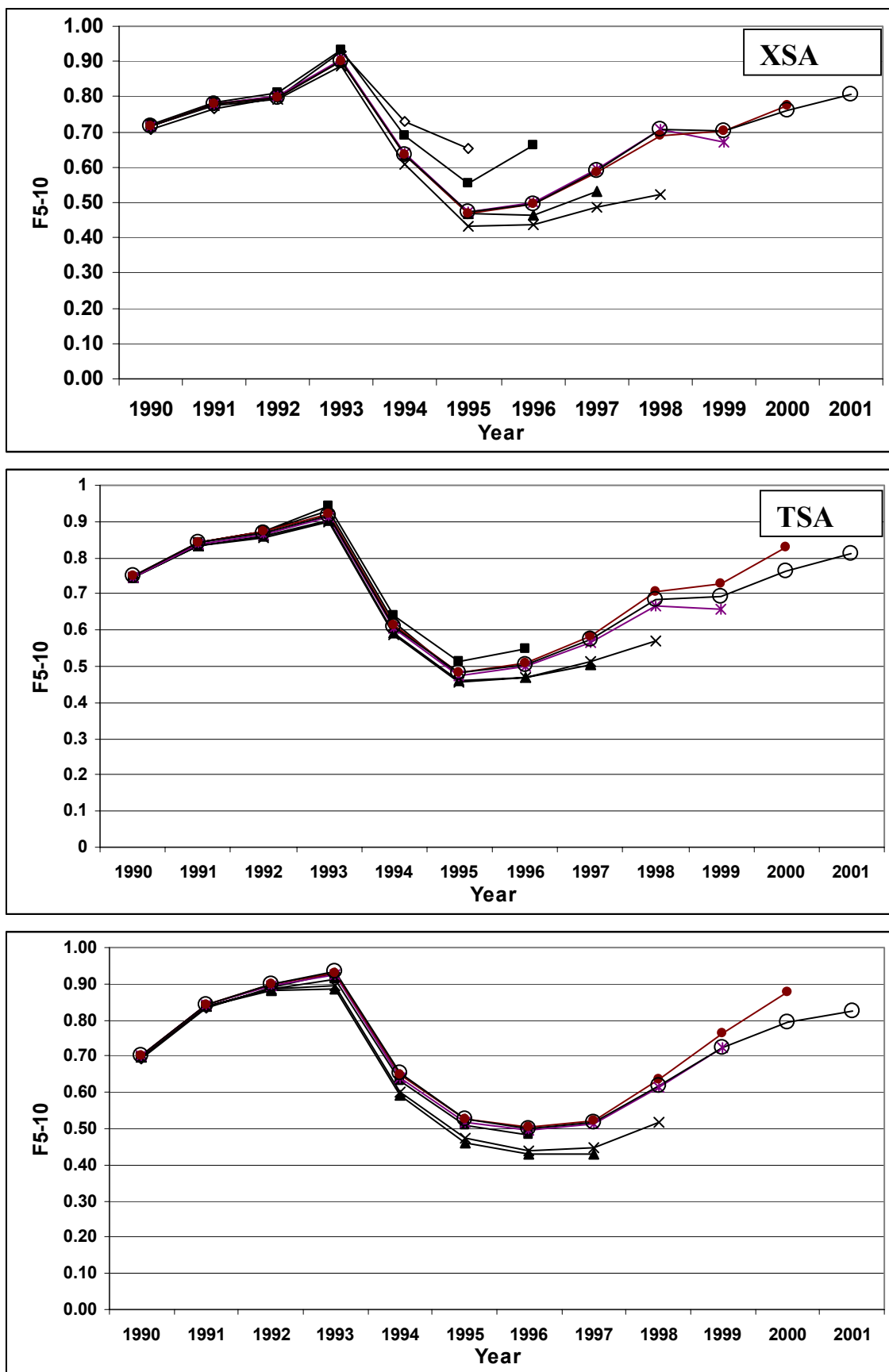


Figure 3.3.16. Retrospective pattern from assessment runs. The figures show mean fishing mortality of ages 5 to 10.

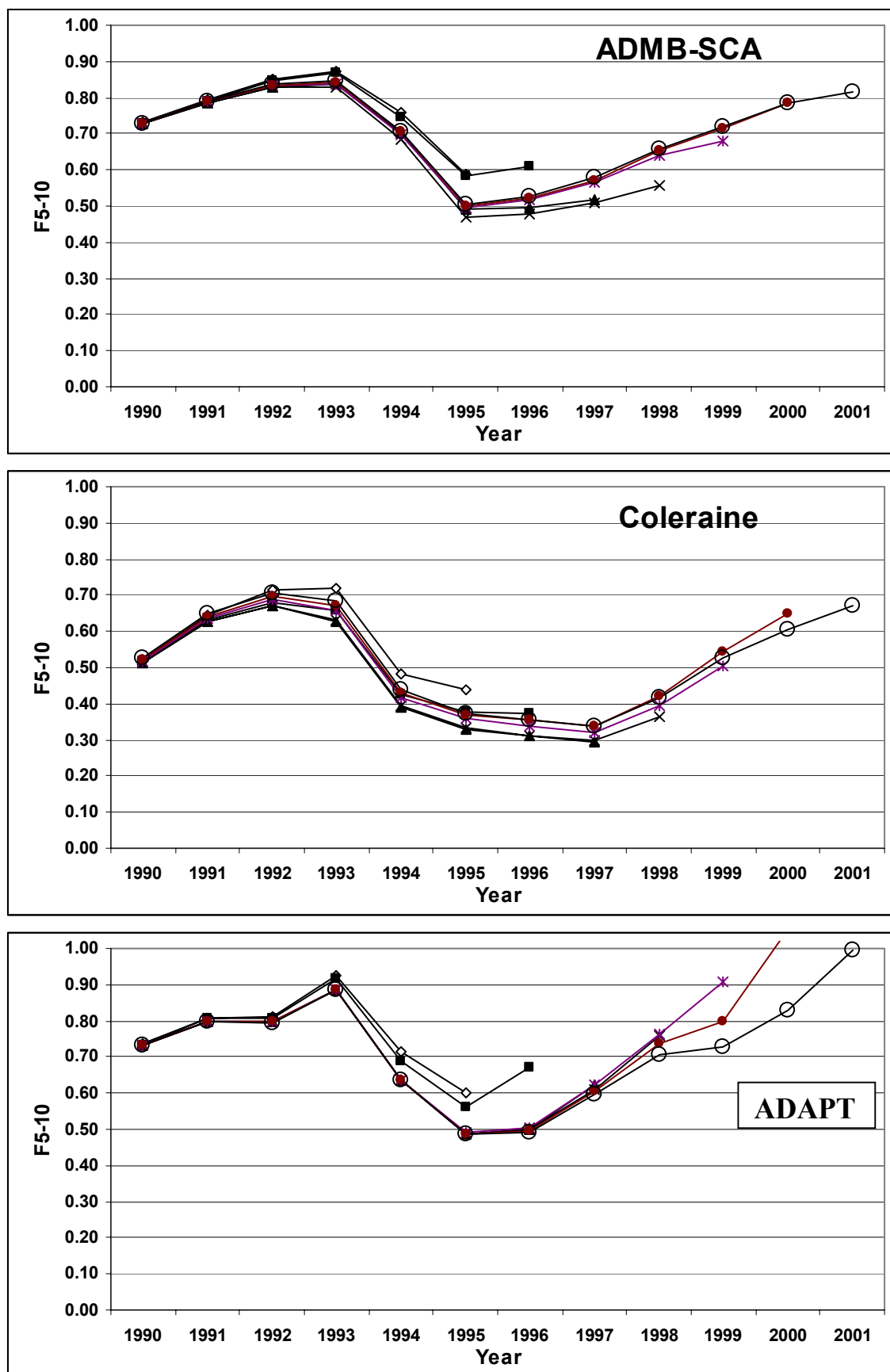


Figure 3.3.16. (Continued)

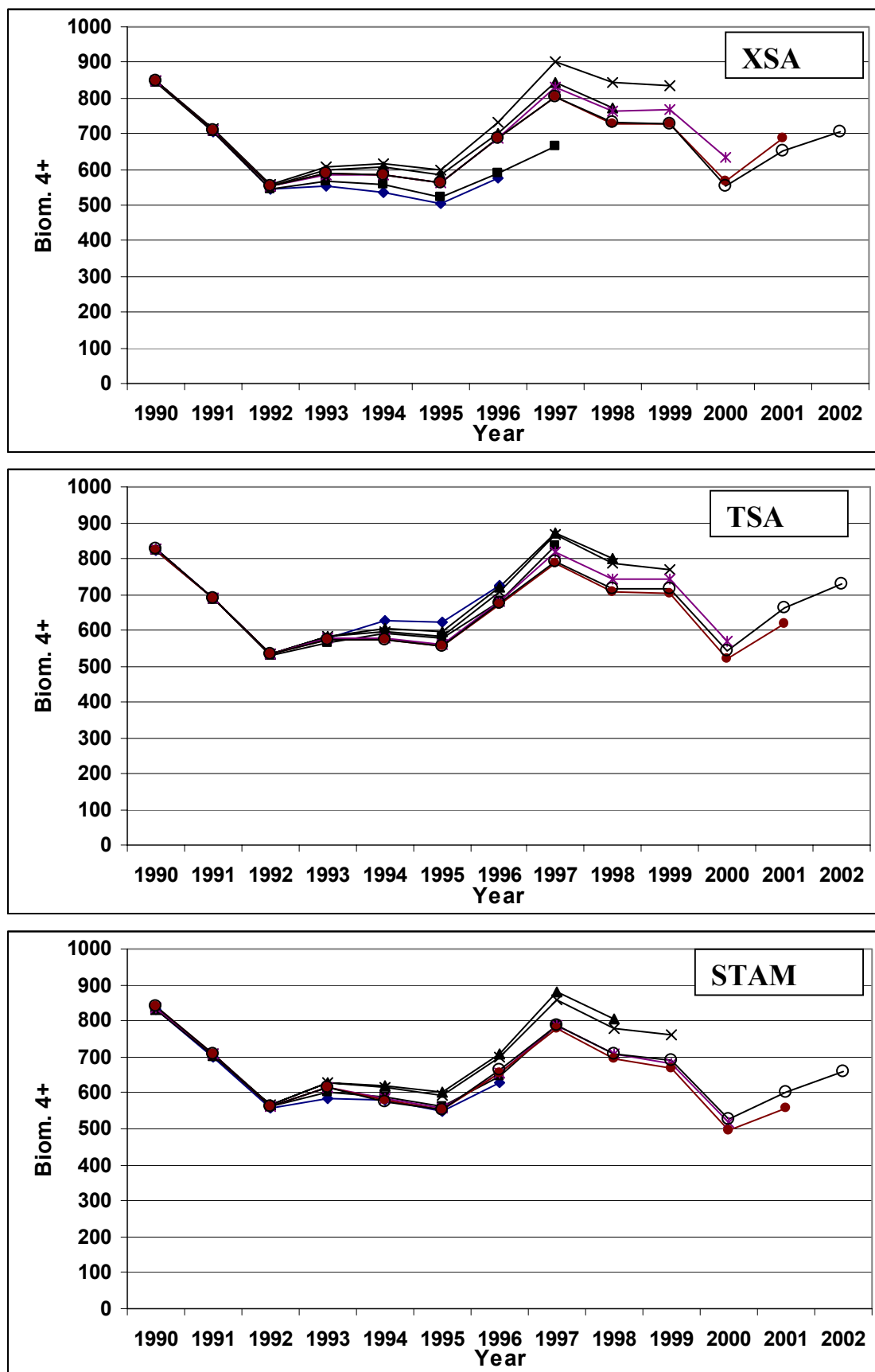


Figure 3.3.17. Retrospective patterns from assessment runs. The figures show number of age and older multiplied by the weight in the catches.

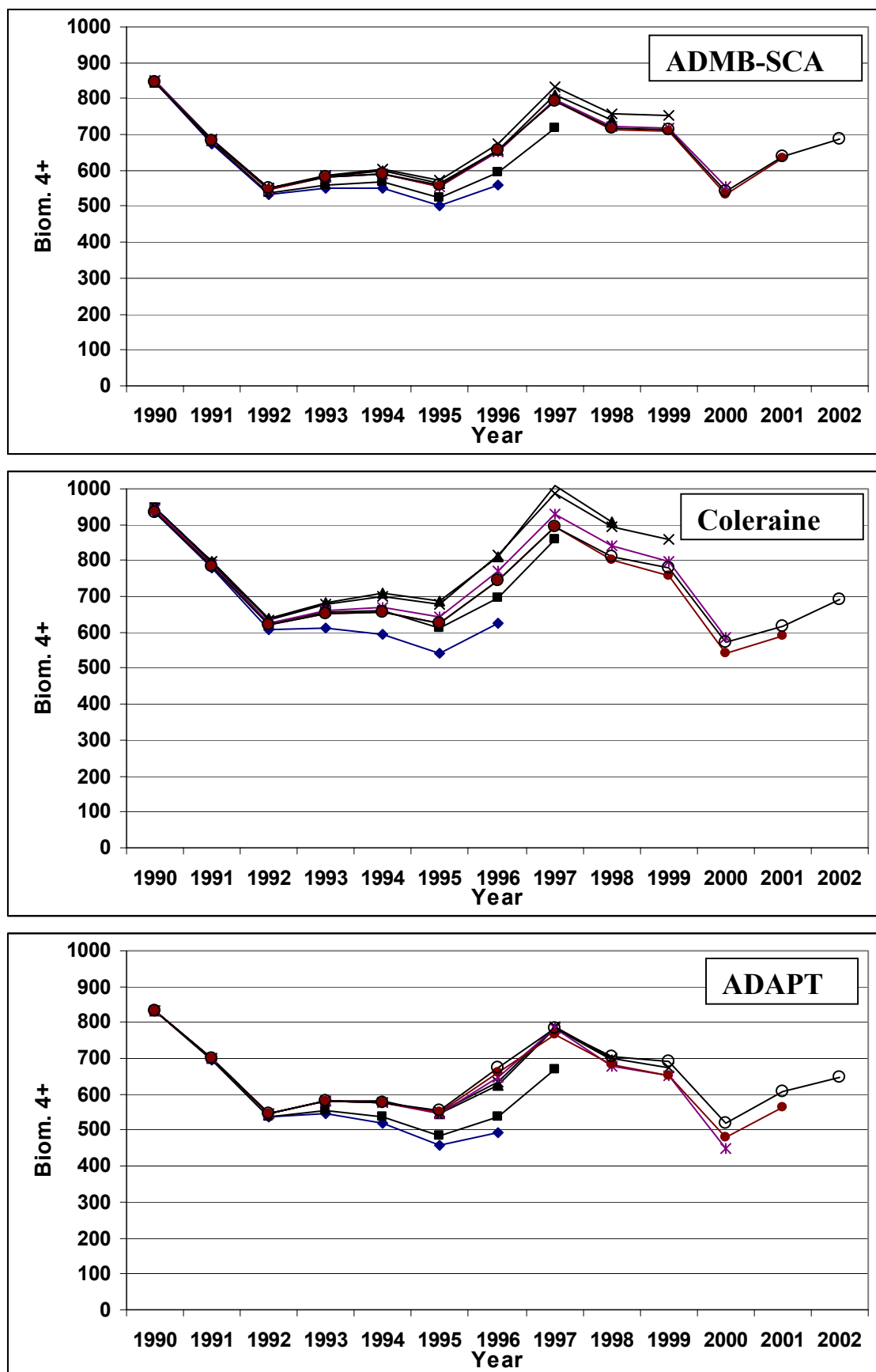


Figure 3.3.17. (Continued)

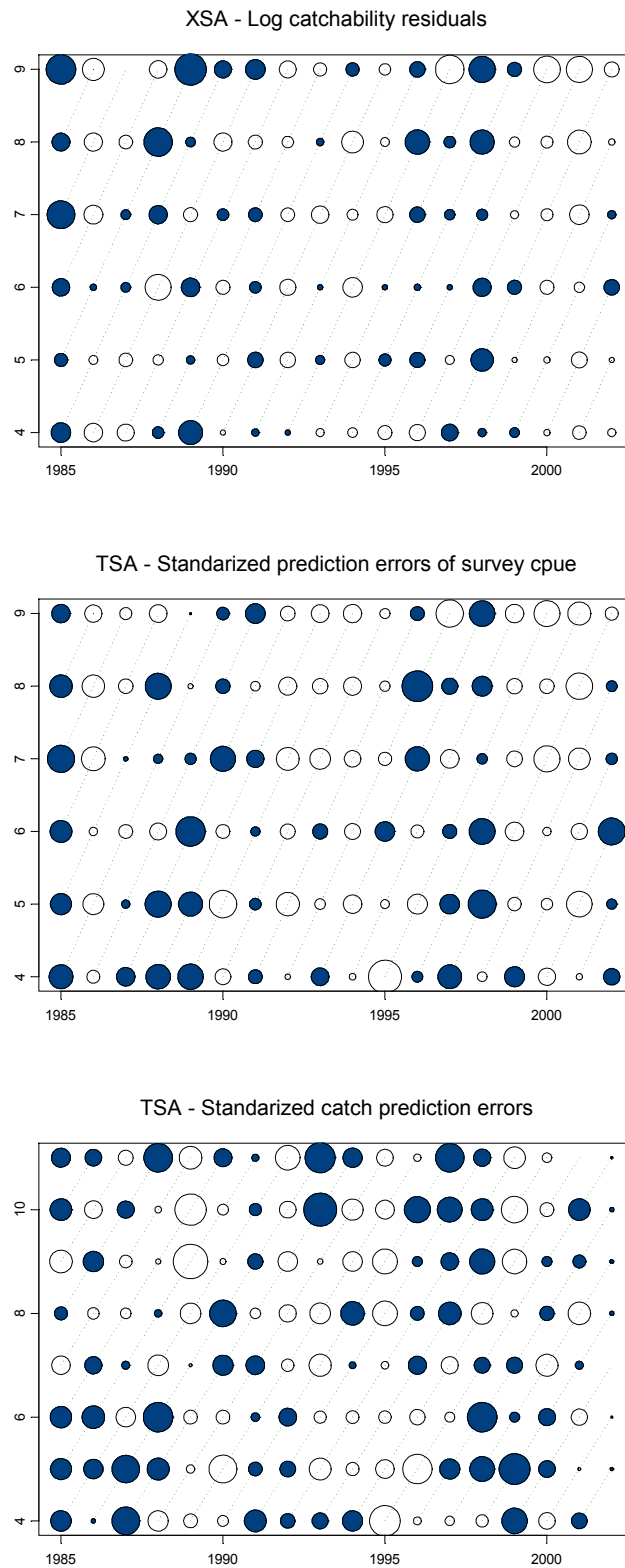


Figure 3.3.18. Residuals by year and age group from the various models. Solid symbols indicate positive values, open symbols indicate negative values. Bubble area is proportional to magnitude.

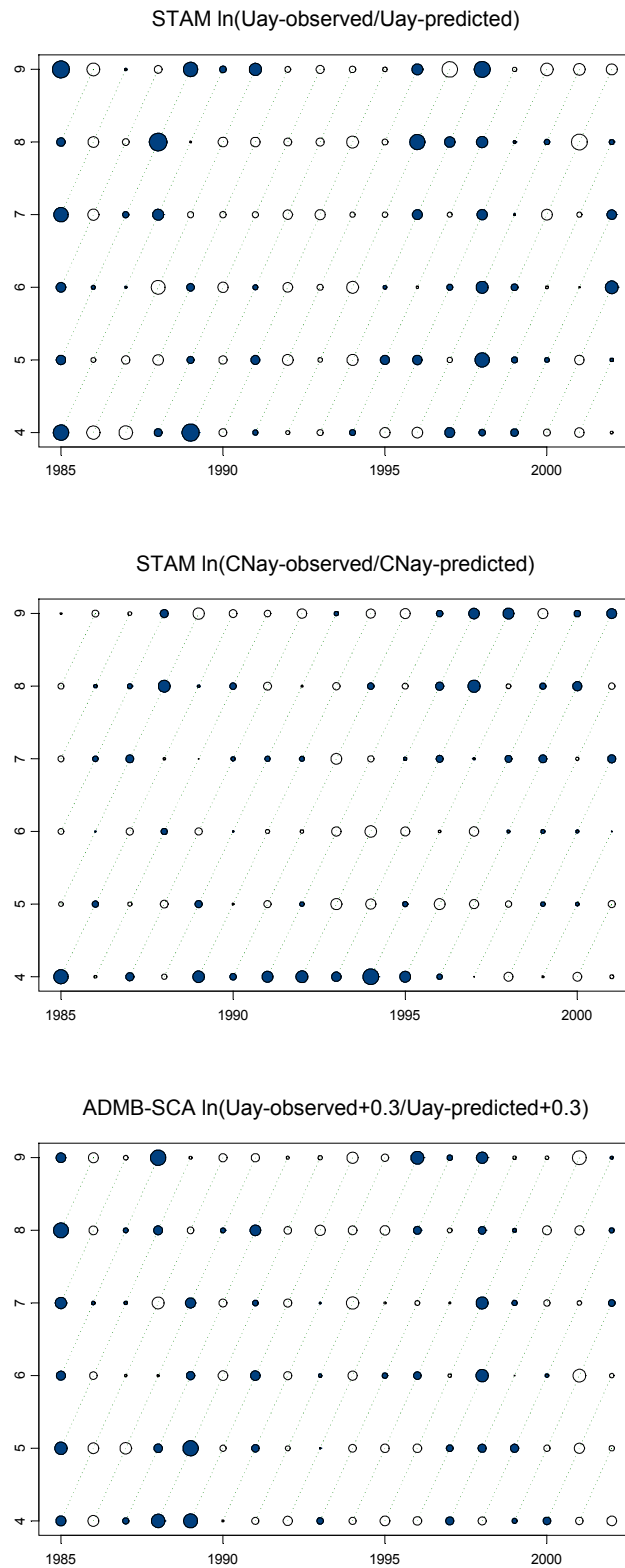


Figure 3.3.18. (Continued)

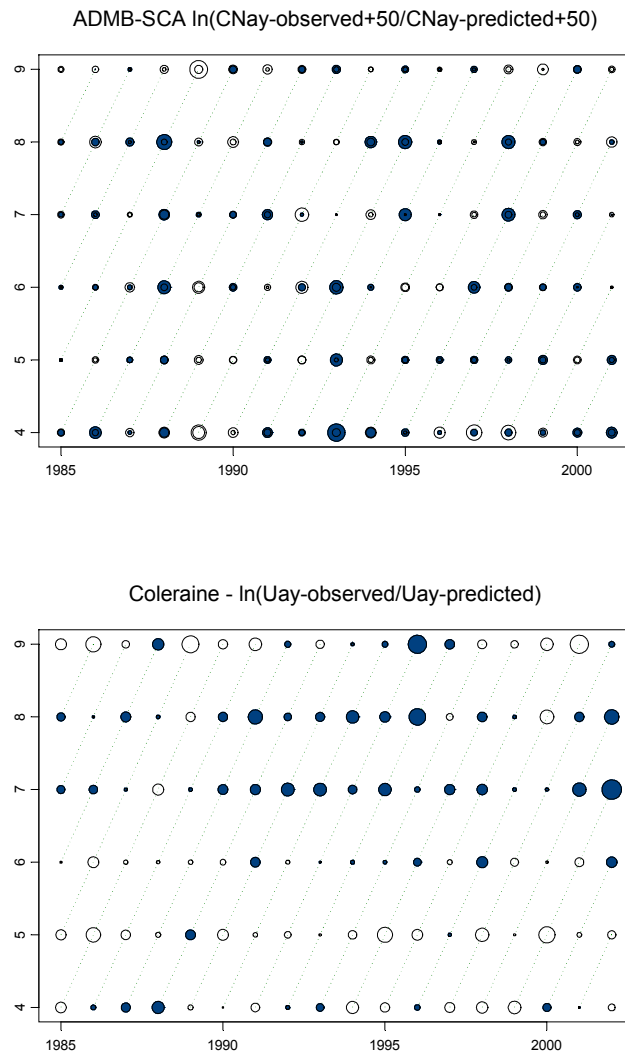


Figure 3.3.18. (Continued)

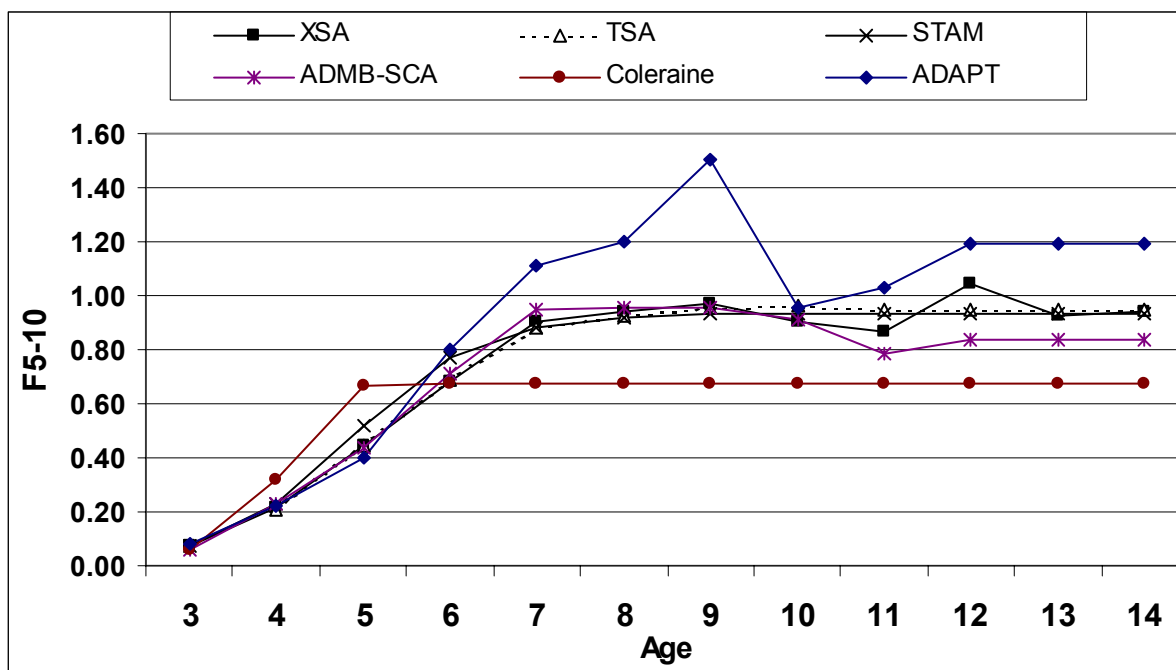


Figure 3.3.19. Comparison of estimated fishing mortalities in 2001 from different assessment runs.

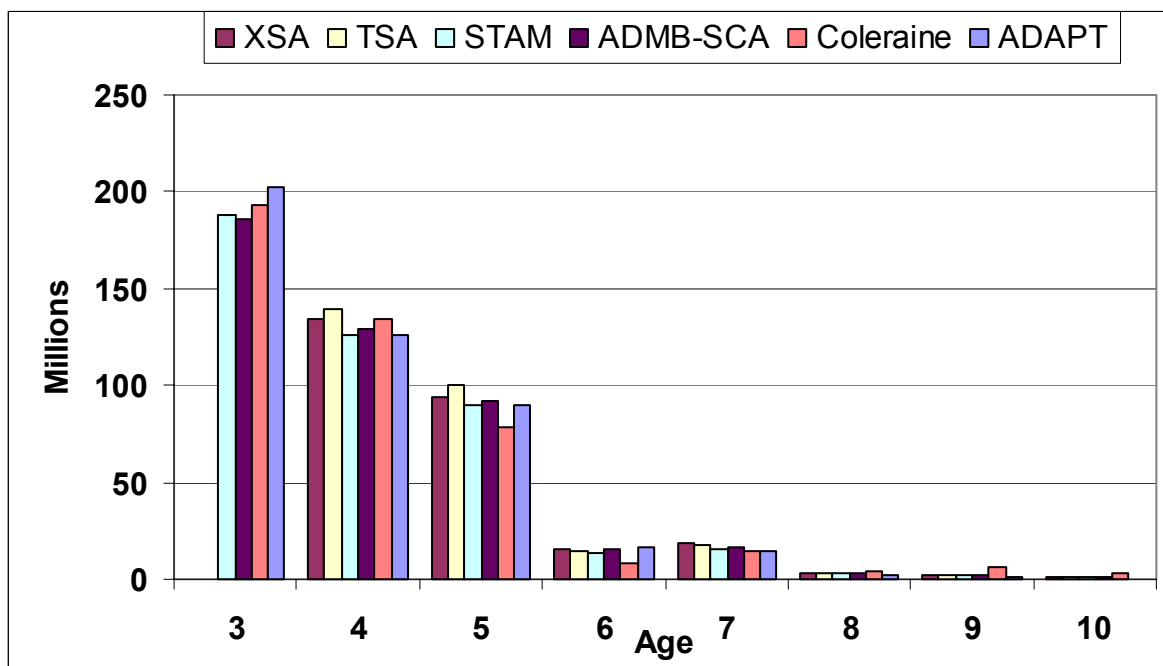


Figure 3.3.20. Comparison of estimated stock in numbers in 2001 from different assessment runs.

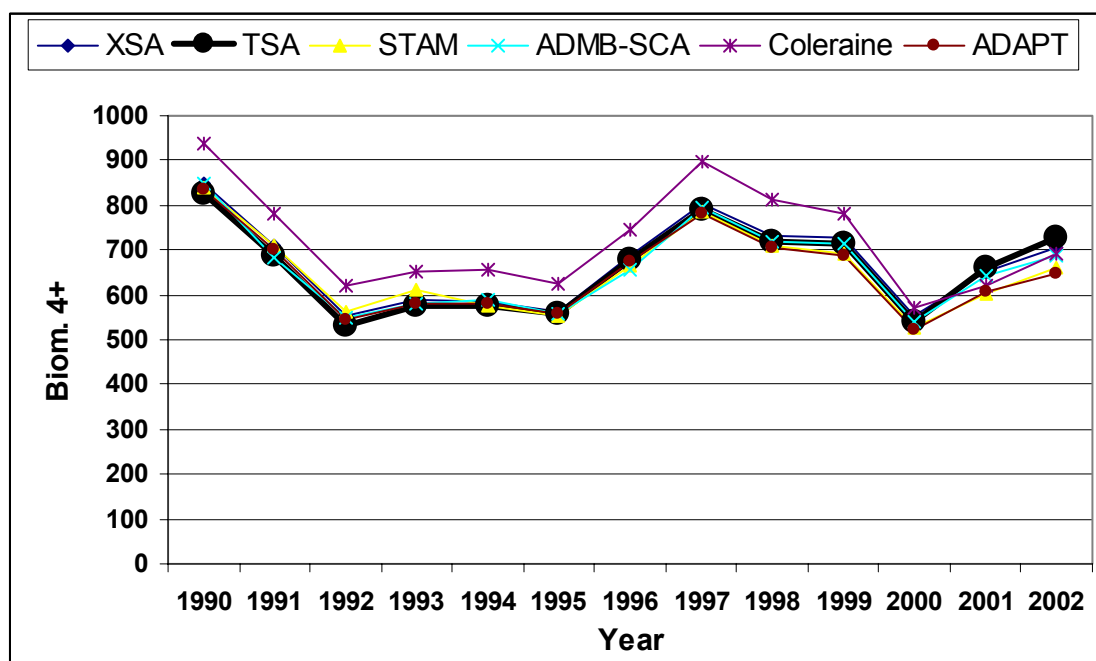


Figure 3.3.21. Estimated 4+ biomass from the various assessment models.

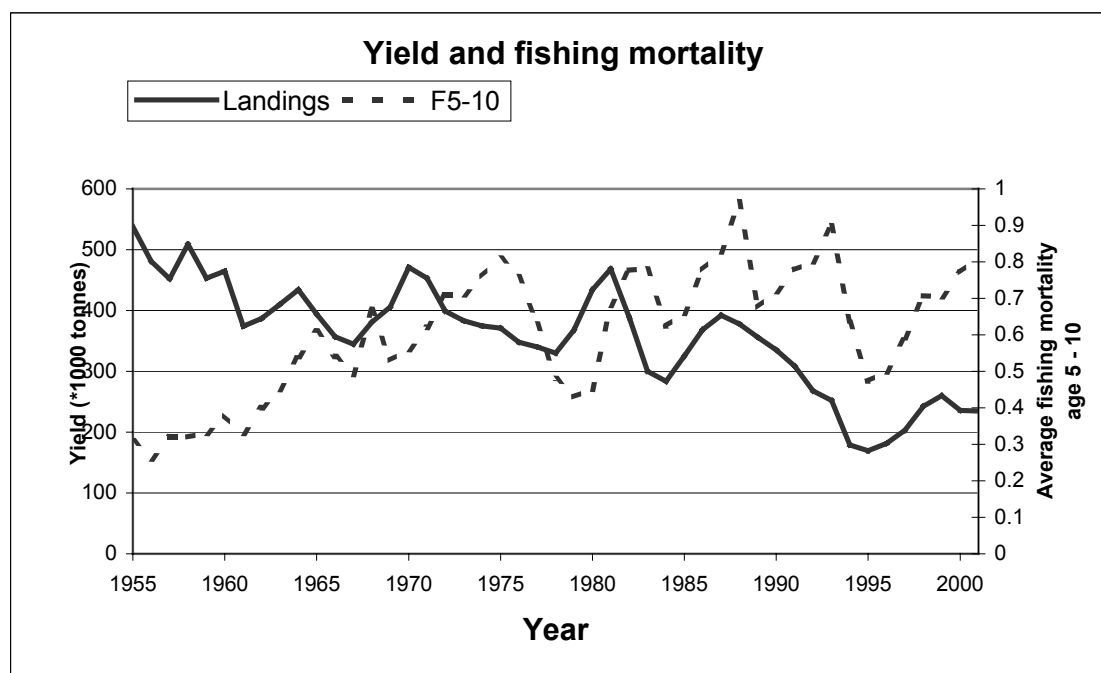


Figure 3.3.21. Yield and fishing mortality

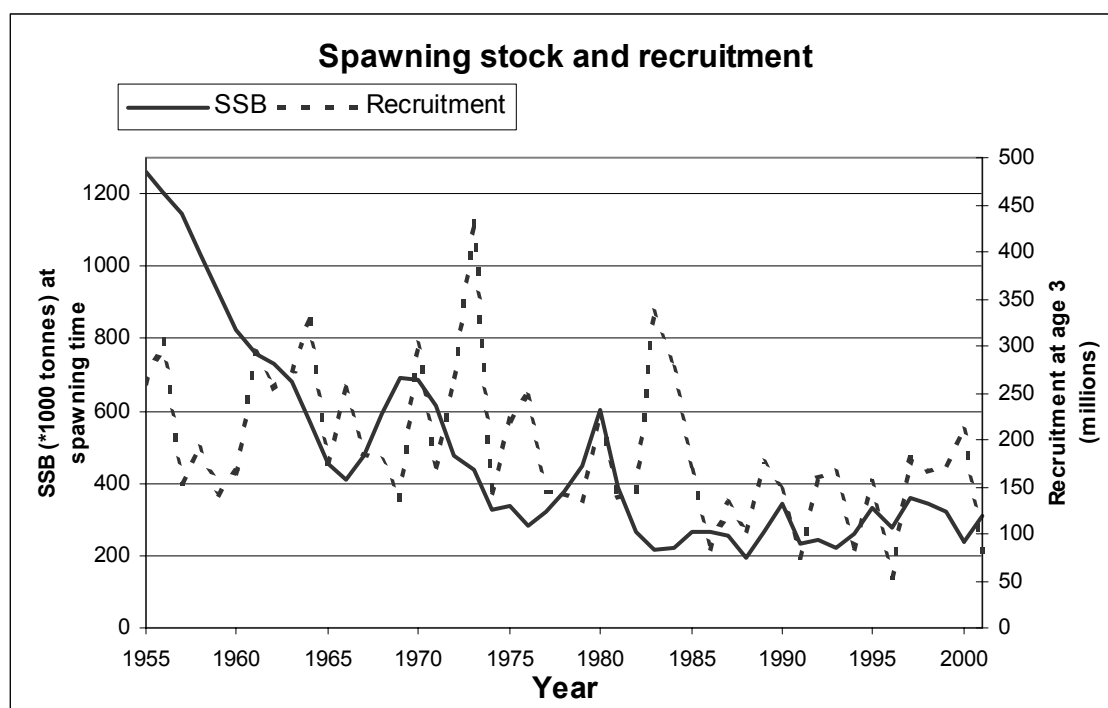


Figure 3.3.22. Spawning stock and recruitment.

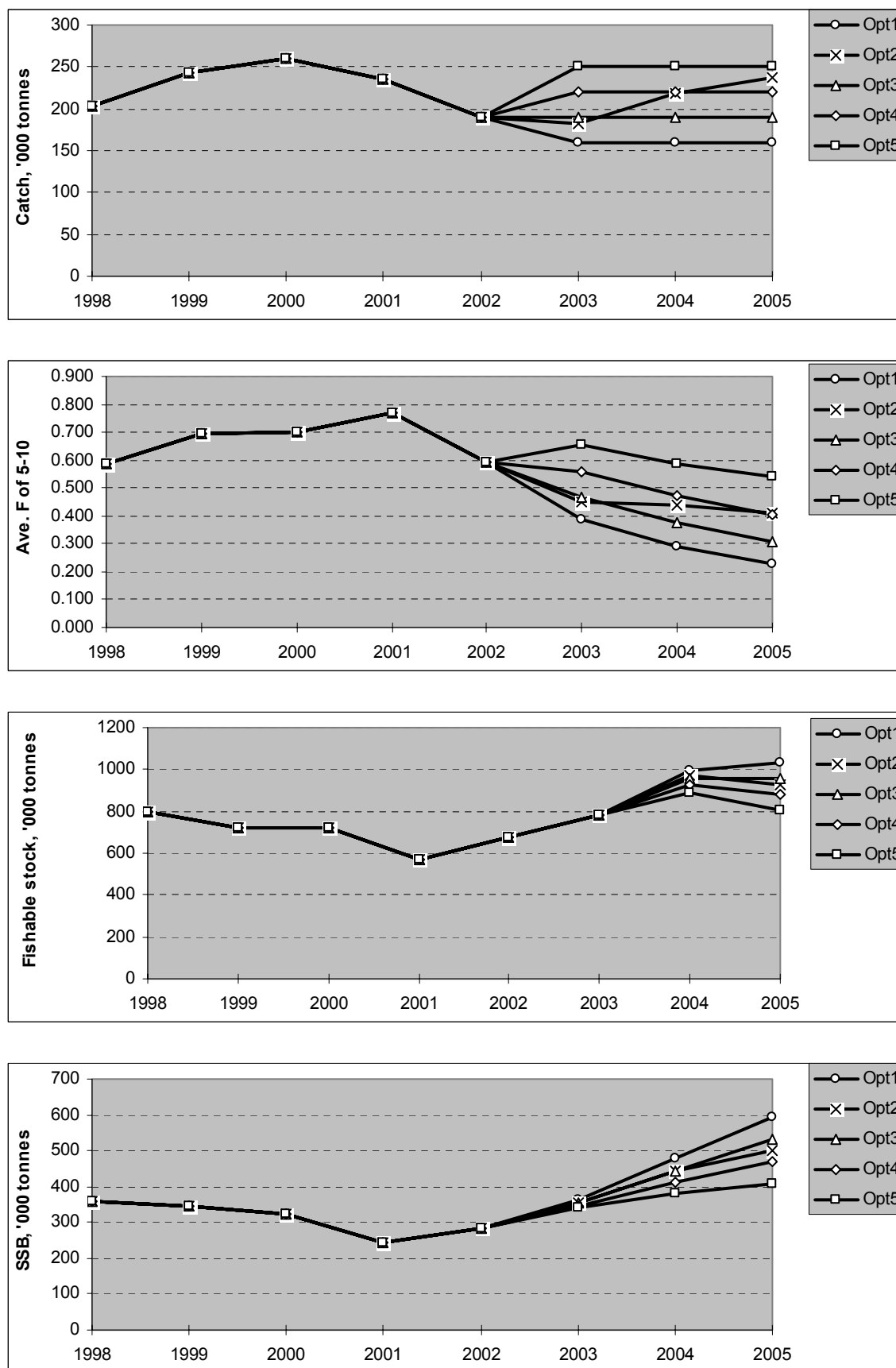


Figure 3.3.23. Results of different management options.

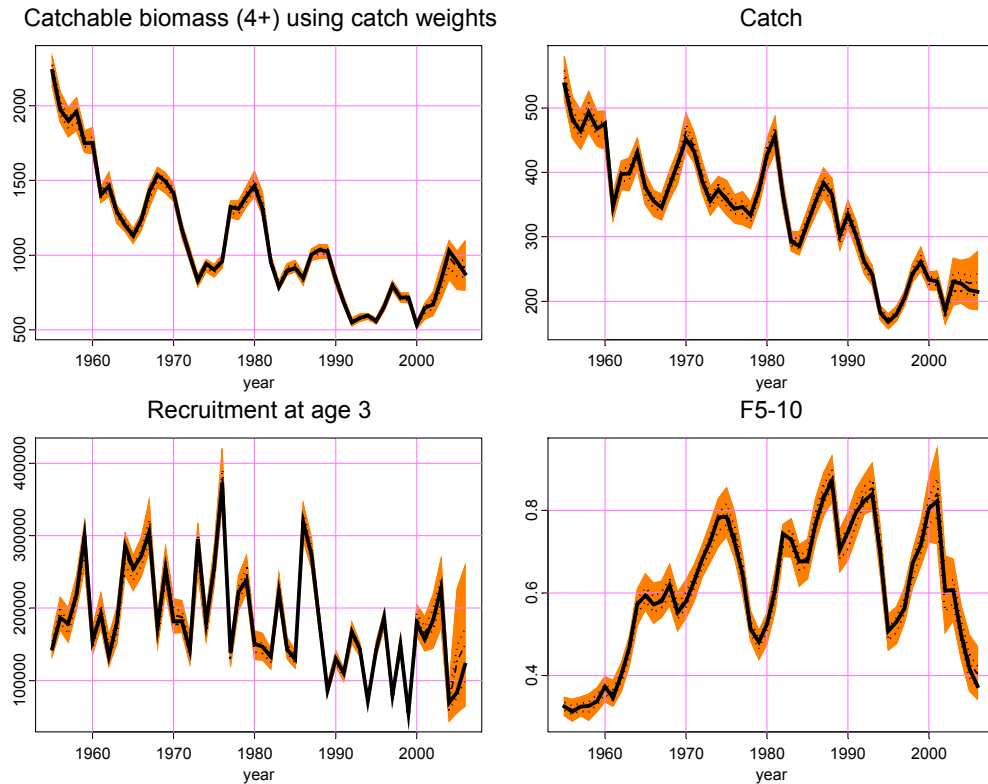


Figure 3.2.4. Cod in division Va. Stock estimate and short term prognosis using the ammended catchrule.

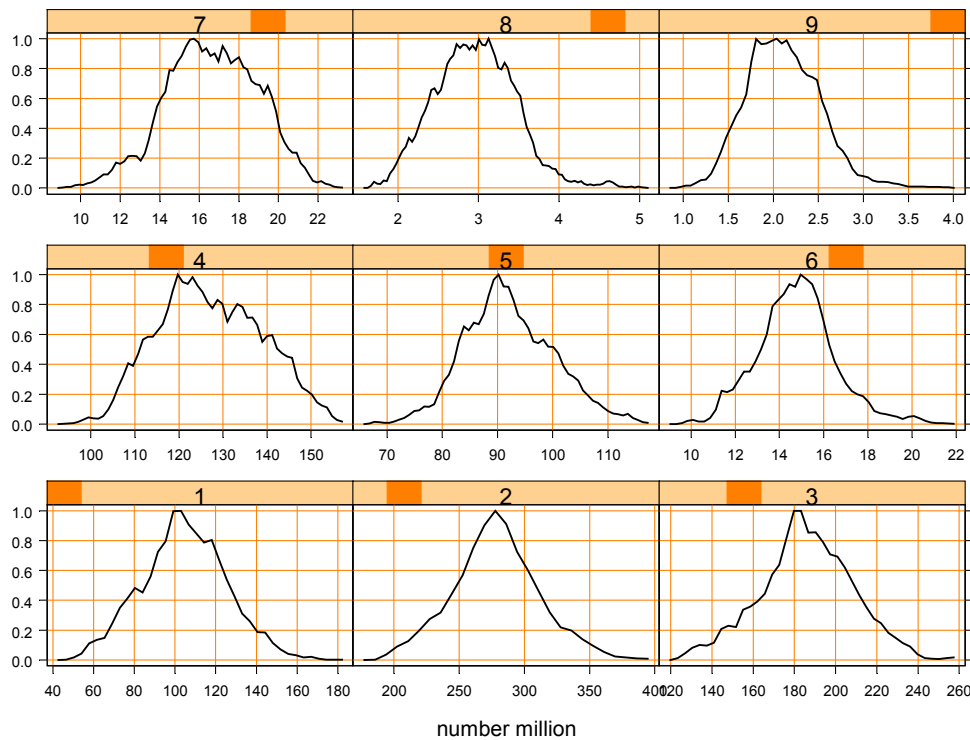


Figure 3.3.24. Cod in division Va. Posterior distribution of number in stock at the start of 2002.

