

APPENDIX

In this appendix are given as an example all calculations for sprat stock assessments by different methods. Similar estimations were also made for the other fish species.

SPRAT STOCK ASSESSMENTS

SEP31.CSV

Separable analysis from 1974 to 1993 on ages 0 to 4
with Terminal F of 150 on age 2 and Terminal S of 1.000

Initial sum of squared residuals was 639.529 and
final sum of squared residuals is 54.386 after 113 iterations

Matrix of Residuals

Years Ages	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83
0/ 1	2.194	-1.607	-1.285	1.491	2.102	1.209	-0.33	-0.301	-0.698
1 / 2	0.08 1	-0.616	-0.3	-0.539	-0.532	-0.799	0.004	-0.457	1.043
2/ 3	-0.044	0.745	0.361	-0.366	-0.483	0.151	0.234	0.367	0.163
3/ 4	-1.278	-0.171	0.218	0.626	0.542	-0.179	-0.383	-0.201	-1.173
TOT	0.001	0	0	0	0	0	0	-0.001	-0.001
WTS	1	1	1	1	1	1	1	1	1

Years	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
0/ 1	-1.454	-1.319	-0.382	-0.408	-0.987	-1.567	0.839	0.541	2.398
1 / 2	0.817	0.388	0.802	-0.159	0.335	1.197	0.386	-1.052	0.515
2/ 3	0.002	-0.007	-0.066	-0.31	0.201	-0.206	-0.514	0.212	-0.294
3/ 4	-0.074	0.353	-0.526	1.179	-0.29	0.071	0.322	0.356	-1.286
TOT	-0.001	-0.001	-0.001	0	0	0	0	0	0

Fishing Mortalities (F)

	1974	1975	1976	1977	1978	1979	1980	1981	1982
F -value:	0.0109	0.0135	0.0296	0.0825	0.2087	0.5306	0.5763	0.8187	0.4631

F-values

Selection-at-age (S)

	0	1	2	3	4
S-value:	0.0041	0.6458	1	1.0705	1

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Run title 1993

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SPRAT STOCK ASSESSMENTS

SEP31.CSV

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Matrix of Residuals

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Ages									
0/1	2.194	-1.607	-1.285	1.491	2.102	1.209	-0.33	-0.301	-0.698
1/2	0.081	-0.616	-0.3	-0.539	-0.532	-0.799	0.004	-0.457	1.043
2/3	-0.044	0.745	0.361	-0.366	-0.483	0.151	0.234	0.367	0.163
3/4	-1.278	-0.171	0.218	0.626	0.542	-0.179	-0.383	-0.201	-1.173
TOT	0.001	0	0	0	0	0	0	-0.001	-0.001
WTS	1	1	1	1	1	1	1	1	1
Years	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
0/1	-1.454	-1.319	-0.382	-0.408	-0.987	-1.567	0.839	0.541	2.398
1/2	0.817	0.388	0.802	-0.159	0.335	1.197	0.386	-1.052	0.515
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TOT	-0.001	-0.001	-0.001	0	0	0	0	0	0
WTS	1	1	1	1	1	1	1	1	1

Fishing Mortalities (F)

	1974	1975	1976	1977	1978	1979	1980	1981	1982
F-value:	0.0109	0.0135	0.0296	0.0825	0.2087	0.5306	0.5763	0.8187	0.4631

F-values

Selection-at-age (S)

	0	1	2	3	4
S-value:	00041	0.6458	1	10705	1

Run title 1993

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SEP31. CSV

Traditional vpa Terminal populations from weighted Separable populations

Fishing mortality residuals									
YEAR	1974	1975	1976	1977	1978	1979	1980	1981	1982
AGE									
0	0 0003	0	-0 0001	0 0006	0.0032	0 0048	-0 001	0.0013	-0.0004
1	0 0047	-0 0024	-0 0047	-0.0313	-0.0559	-0 1596	-0.0214	-0 1273	0 3464
2	-0 0007	0.0075	0.0105	0.001	-0.0675	-0.0234	0.0597	-0 0825	0 0632
3	-0 0045	-0 0004	-0.0083	-0 0046	D 1188	0.0396	-0 1439	-0 1142	-0 2277
4	0	0.0165	0.0047	-0.0345	-0.1077	-0.0282	0.2532	0 0343	-0.0065

Fishing mortality residuals									
YEAR	1984	1985	1986	1967	1988	1989	1990	1991	1992
AGE									
0	-0.0005	-0.0002	-0.0002	-0.0002	-0.0006	0.0019	0.0086	0.0028	-0.0004
1	0.1029	0.0746	-0.005	0.0409	0.1705	0.1308	-0.4825	0.0462	-0.1397
2	-0.0501	0.0439	-0.0705	0.0486	-0.0236	-0.252	-0.2958	0.0336	-0.0672
3	-0.0212	-0.0482	0.1328	-0.007	-0.0054	0.0977	0.1378	-0.1061	0.2867
4	0.021	-0 0685	0.0754	-0.1688	0.064	-0.1256	-0.4262	-0.0371	0.3501

TUN521 CSV

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SPRAT 1993

CPUE data from file E:\LOWE\SP74TUN.DAT

Catch data for 20 years 1974 to 1993. Ages 0 to 5.

Fleet	First year	Last year	First age	Last age
BG BOUR	1977	1993	0	4
USSR SM	1977	1993	0	4
USSR LAP	1977	1993	0	4
USSR RS	1978	1993	1	4

Disaggregated Qs

Log transformation

The final F is the (reciprocal variance-weighted) mean of the raised fleet Fs.

No Vend in Q (mean used)

Terminal Fs derived using L/S (without F shrinkage)

Tuning converged after 8 iterations

Regression weights

0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1
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Oldest age F= 1.000*average of 2 younger ages.

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Fishing mortalities

Age	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
0	0	0.001	0.001	0.001	0	0.007	0.014	0.004	0.001	0
1	0.336	0.168	0.189	0.251	0.301	0.737	0.737	0.167	0.081	0.069
2	0.215	0.327	0.183	0.385	0.178	0.699	1.396	0.352	0.254	0.153
3	0.428	0.179	0.775	0.266	0.222	1.219	2.156	0.122	1.281	0.128
4	0.322	0.253	0.479	0.326	0.2	0.959	1.776	0.237	0.767	0.14

Log catchability residuals

Fleet BG BOURGAS

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
0	0.74	-1.07	0.94	-0.22	0.89	0.13	-0.45										
1	-2.51	-1.23	-1	-0.33	-0.76	0.82	0.48										
2	-0.54	-0.56	0.16	0.13	0.7	0.37	0.43										
3	0.23	0.39	0.31	-0.04	1.03	0.1	0.16										
Age	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993							
0	-0.7	-1.29	-1.85	0.19	-2.03	1.95	2.02	1.56	0.58	-1.34							
1	0.57	-0.14	-0.64	-0.3	-0.22	0.96	0.94	0.09	0	-0.73							
2	-0.61	0.34	-0.70	0.15	-0.51	0.33	0.66	-0.2	-0.06	-0.24							
3	-0.01	-0.4	0.5	-0.91	-0.56	0.17	0.27	-0.2	0.68	0.16							

TUN521.CSV

Fleet : USSR SMALL

Age	1977	1978	1979	1980	1981	1982	1983				
0	0.59	-0.96	0.93	-0.12	1.07	-0.36	-1.31				
1	-1.14	-0.36	-0.16	0.09	0.26	0.61	-0.18				
2	-0.62	-0.38	-0.1	0.39	0.11	-0.1	-0.34				
3	-1.1	-0.62	-1.25	-0.22	0.05	1.42	-0.33				
Age	1984	1985	1986	1987	1988	1989	1995	1991	1992	1993	
0	-1.89	-1.25	-0.69	-0.56	-2.28	1.13	2.07	1.92	0.38	0.77	
1	-0.37	-0.69	-0.63	-0.21	-0.18	0.47	0.66	0.46	-0.14	0.18	
2	-0.86	-0.52	-1.18	-0.29	-1.22	0.29	1.22	1.15	0.9	0.26	
3	-0.05	-1.9	0.46	-0.92	-0.82	0.91	1.63	-0.18	2.51	-0.31	

Fleet. USSR LARGE

Age	1977	1978	1979	1980	1981	1982	1983				
0	0.75	-0.93	1.16	0.02	0.98	-0.07	-1.35				
1	-0.98	-0.31	0.06	0.24	0.16	0.9	-0.22				
2	-0.46	-0.33	0.13	0.54	0.01	0.19	-0.38				
3	-0.94	-0.57	-1.03	-0.08	-0.04	-1.13	-0.36				
Age	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	
0	-1.89	1.02	-0.48	-0.51	-2.14	0.88	1.82	1.91	0.38	0.47	
1	-0.37	-0.45	-0.43	-0.17	-0.03	0.22	0.41	0.45	-0.14	-0.12	
2	-0.86	-0.28	-0.98	-0.24	-1.07	0.04	0.97	1.14	0.9	-0.04	
3	-0.05	-1.66	0.66	-0.88	-0.68	0.66	1.38	-0.18	2.51	-0.61	

Fleet. USSR RS

Age	1977	1978	1979	1980	1981	1982	1983				
0	No data for this fleet at this age										
1	99.99	0.06	0.39	0.9	0.35	0.57	-0.14				
2	99.99	0.05	0.47	1.22	0.21	-0.13	-0.3				
3	99.99	-0.2	-0.69	0.59	0.14	-1.48	-0.28				
Age	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	
0	No data for this fleet at this age										
1	0.11	-0.82	0.7	0.46	-0.87	-0.1	0	-0.28	-0.57	0.46	
2	-0.38	-0.65	0.15	0.39	-1.92	-0.28	0.56	0.41	0.49	0.55	
3	0.43	-2.04	1.79	-0.25	-1.52	0.34	0.97	-0.89	2.09	-0.03	

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SUMMARY STATISTICS FOR AGE 0

Fleet	Pred log q	se (log q)	Partial F	Raised F	Slope	se Slope	Intrcpt	se Intrcpt
1	-11.25	1.223	0.0001	0.0019	5.77E-02	8.28E-02	-11.249	0.3391
2	-10.82	1.215	0.0002	0.0002	1.34E-01	7.60E-02	-10.825	0.3371
3	-10.31	1.124	0	0.0003	1.09E-01	7.19E-02	-10.306	0.3121
4	No data for this fleet at this age							

Fbar	Sigma(in)	Sigma(ex)	Sigma(overall)	Variance ratio
0	0.684	0.645	0.684	0.889

SUMMARY STATISTICS FOR AGE 1

Fleet	Pred. log q	se (log q)	Partial F	Raised F	Slope	se Slope	intrcpt	se Intrcpt
1	-5.99	0.595	0.0105	0.143	3.23E -02	4.00E-02	-5.987	0.165
2	5.54	0.392	0.0412	0.0577	3.59E -02	2.53E-02	-5.541	0.109
3	-5.02	0.326	0.0026	0.0783	1.11E -02	2.23E-02	-5.022	0.091
4	-12.82	0.477	0	0.0436	-3.78E-02	3.23E-02	-12.82	0.133

Fbar	Sigma(in)	Sigma(ex)	Sigma(overall)	Variance ratio
0.069	0.208	0.201	0.208	0.93

SUMMARY STATISTICS FOR AGE 2

Fleet	Fred log q	se (log q)	Partial F	Raised F	Slope	se Slope	Intrcpt	se Intrcpt
1	-5.47	0.378	0.0177	0.1941	-1.27E-02	2.58E -02	-5.467	0.105
2	-5.39	0.712	0.0478	0.1175	9.11E -172	4.29E -02	-5.392	0.197
3	-4.87	0.634	0.0031	0.1595	6.63E-02	4.01E -02	-4.873	0.176
4	-12.68	0.654	0	0.0881	2.35E -02	4.60E -02	-12.677	0.182

Fbar	Sigma(in)	Sigma(ex)	Sigma(overall)	Variance ratio
0.153	0.269	0.174	0.269	0.416

SUMMARY STATISTICS FOR AGE 3

Fleet	Fred log q	se (log q)	Partial F	Raised F	Slope	se Slope	intrcpt	se Intrcpt
1	-5.75	0.408	0.0134	0.1095	-5.68E-03	2.80E-02	-5.749	0.113
2	-5.3	1.052	0.0525	0.174	1.41 E-01	6.26E-02	-5.298	0.292
3	-4.78	0.977	0.0034	0.2362	1.16E-01	6.02E-02	-4.779	0.271
4	-12.58	1.09	0	0.132	2.739E-02	7.47E-02	-12.578	0.304

Fbar	Sigma(in)	Sigma(ex)	Sigma(overall)	Variance ratio
0.128	0.337	0.154	0.337	0.209

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Extended Survivors Analysis

SPRAT 1993

CPUE data from file e:\lowe\sp74\sp74tun1.dat

Catch data for 16 years 1978 to 1993. Ages 0 to 5

Fleet	First year	Last year	First age	Last age	Alpha	Beta
BG BOUR	1978	1993	1	4	0	1
USSR SM	1978	1993	1	4	0.25	0.83
USSR LAf	1978	1993	1	4	0	1
USSR R5	1978	1993	1	4	0.25	0.5
YSO	1980	1993	0	0	0	1

Time series weights

Tapered time weighting applied

Power= 3 over 20 years

Catchability analysis

Catchability dependent on stock size for ages < 1

Regression type = C

Minimum of 5 points used for regression

Survivor estimates shrunk to the population mean for ages < 1

Catchability independent, of age for ages >= 1

Terminal population estimation:

Survivor estimates shrunk towards the mean F
of the final 5 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 had not converged after 30 iterations

Toal absolute residual between iterations

29 and 30 = .00012