

# Appendix B. southern New England-Mid Atlantic yellowtail flounder ASPIC.

SNE-MA Yellowtail (yield and biomass in k mt)

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ASPIC -- A Surplus-Production Model Including Covariates (Ver. 3.74)

FIT Mode

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ASPIC User's Manual  
is available gratis  
from the author

## CONTROL PARAMETERS USED (FROM INPUT FILE)

Number of years analyzed:	67	Number of bootstrap trials:	0
Number of data series:	2	Lower bound on MSY:	3.333E-01
Objective function computed:	in effort	Upper bound on MSY:	3.000E+02
Relative conv. criterion (simplex):	1.000E-08	Lower bound on r:	2.000E-02
Relative conv. criterion (restart):	3.000E-08	Upper bound on r:	1.000E+01
Relative conv. criterion (effort):	1.000E-04	Random number seed:	4952335
Maximum F allowed in fitting:	5.000	Monte Carlo search trials:	50000

## PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS)

code 0

Normal convergence.

## CORRELATION AMONG INPUT SERIES EXPRESSED AS CPUE (NUMBER OF PAIRWISE OBSERVATIONS BELOW)

1	Fall Survey	1.000	
		39	
2	Spring Survey (lagged)	0.805	1.000
		35	35
		1	2

## GOODNESS-OF-FIT AND WEIGHTING FOR NON-BOOTSTRAPPED ANALYSIS

Loss component number and title	Weighted SSE	N	Weighted MSE	Current weight	Suggested weight	R-squared in CPUE
Loss (-1) SSE in yield	0.000E+00					
Loss (0) Penalty for B1R > 2	0.000E+00	1	N/A	1.000E+00	N/A	
Loss (1) Fall Survey	1.993E+01	39	5.387E-01	1.000E+00	9.222E-01	0.350
Loss (2) Spring Survey (lagged)	1.509E+01	35	4.571E-01	1.000E+00	1.087E+00	0.752
TOTAL OBJECTIVE FUNCTION:	3.50166831E+01					

Number of restarts required for convergence: 53

Est. B-ratio coverage index (0 worst, 2 best): 1.8119

Est. B-ratio nearness index (0 worst, 1 best): 1.0000

< These two measures are defined in Prager et al. (1996), Trans. A.F.S. 125:729

## MODEL PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter	Estimate	Starting guess	Estimated	User guess
B1R Starting biomass ratio, year 1935	1.054E+00	2.000E+00	1	1
MSY Maximum sustainable yield	2.030E+01	1.000E+01	1	1
r Intrinsic rate of increase	3.878E-01	5.000E-01	1	1
..... Catchability coefficients by fishery:				
q(1) Fall Survey	8.312E-02	1.000E-01	1	1
q(2) Spring Survey (lagged)	1.103E-01	1.000E-01	1	1

## MANAGEMENT PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter	Estimate	Formula	Related quantity
MSY Maximum sustainable yield	2.030E+01	Kr/4	
K Maximum stock biomass	2.093E+02		
Bmsy Stock biomass at MSY	1.047E+02	K/2	
Fmsy Fishing mortality at MSY	1.939E-01	r/2	
F(0.1) Management benchmark	1.745E-01	0.9*Fmsy	
Y(0.1) Equilibrium yield at F(0.1)	2.009E+01	0.99*MSY	
B-ratio Ratio of B(2002) to Bmsy	1.350E-01		
F-ratio Ratio of F(2001) to Fmsy	4.672E-01		
F01-mult Ratio of F(0.1) to F(2001)	1.926E+00		
Y-ratio Proportion of MSY avail in 2002	2.517E-01	2*Br-Br^2	Ye(2002) = 5.109E+00
..... Fishing effort at MSY in units of each fishery:			
fmsy(1) Fall Survey	2.333E+00	r/2q(1)	f(0.1) = 2.100E+00

## ESTIMATED POPULATION TRAJECTORY (NON-BOOTSTRAPPED)

Obs	Year or ID	Estimated total F mort	Estimated starting biomass	Estimated average biomass	Observed total yield	Model total yield	Estimated surplus production	Ratio of F mort to Fmsy	Ratio of biomass to Bmsy
1	1935	0.072	1.103E+02	1.162E+02	8.400E+00	8.400E+00	2.003E+01	3.726E-01	1.054E+00
2	1936	0.075	1.219E+02	1.270E+02	9.500E+00	9.500E+00	1.936E+01	3.857E-01	1.165E+00
3	1937	0.078	1.318E+02	1.359E+02	1.060E+01	1.060E+01	1.848E+01	4.023E-01	1.259E+00
4	1938	0.075	1.397E+02	1.432E+02	1.080E+01	1.080E+01	1.754E+01	3.890E-01	1.335E+00
5	1939	0.090	1.464E+02	1.482E+02	1.330E+01	1.330E+01	1.678E+01	4.627E-01	1.399E+00
6	1940	0.134	1.499E+02	1.483E+02	1.990E+01	1.990E+01	1.677E+01	6.922E-01	1.432E+00
7	1941	0.190	1.468E+02	1.419E+02	2.700E+01	2.700E+01	1.772E+01	9.814E-01	1.402E+00
8	1942	0.301	1.375E+02	1.274E+02	3.830E+01	3.830E+01	1.928E+01	1.551E+00	1.314E+00
9	1943	0.219	1.185E+02	1.157E+02	2.530E+01	2.530E+01	2.006E+01	1.127E+00	1.132E+00
10	1944	0.133	1.132E+02	1.156E+02	1.540E+01	1.540E+01	2.007E+01	6.867E-01	1.082E+00
11	1945	0.121	1.179E+02	1.206E+02	1.460E+01	1.460E+01	1.982E+01	6.243E-01	1.127E+00
12	1946	0.121	1.231E+02	1.254E+02	1.520E+01	1.520E+01	1.950E+01	6.253E-01	1.176E+00
13	1947	0.132	1.274E+02	1.286E+02	1.700E+01	1.700E+01	1.923E+01	6.818E-01	1.218E+00
14	1948	0.105	1.297E+02	1.322E+02	1.390E+01	1.390E+01	1.888E+01	5.420E-01	1.239E+00
15	1949	0.048	1.346E+02	1.404E+02	6.800E+00	6.800E+00	1.791E+01	2.498E-01	1.286E+00
16	1950	0.045	1.458E+02	1.507E+02	6.800E+00	6.800E+00	1.635E+01	2.327E-01	1.393E+00
17	1951	0.025	1.553E+02	1.607E+02	4.000E+00	4.000E+00	1.445E+01	1.283E-01	1.484E+00
18	1952	0.026	1.658E+02	1.699E+02	4.400E+00	4.400E+00	1.239E+01	1.335E-01	1.584E+00
19	1953	0.017	1.738E+02	1.776E+02	3.100E+00	3.100E+00	1.043E+01	9.001E-02	1.660E+00
20	1954	0.012	1.811E+02	1.844E+02	2.300E+00	2.300E+00	8.522E+00	6.434E-02	1.730E+00
21	1955	0.018	1.873E+02	1.892E+02	3.400E+00	3.400E+00	7.043E+00	9.266E-02	1.790E+00
22	1956	0.029	1.910E+02	1.914E+02	5.500E+00	5.500E+00	6.355E+00	1.482E-01	1.824E+00
23	1957	0.044	1.918E+02	1.908E+02	8.400E+00	8.400E+00	6.541E+00	2.270E-01	1.833E+00
24	1958	0.070	1.900E+02	1.871E+02	1.310E+01	1.310E+01	7.705E+00	3.611E-01	1.815E+00
25	1959	0.062	1.846E+02	1.833E+02	1.130E+01	1.130E+01	8.850E+00	3.180E-01	1.763E+00
26	1960	0.066	1.821E+02	1.808E+02	1.200E+01	1.200E+01	9.552E+00	3.423E-01	1.740E+00
27	1961	0.101	1.797E+02	1.760E+02	1.770E+01	1.770E+01	1.085E+01	5.185E-01	1.717E+00
28	1962	0.111	1.728E+02	1.695E+02	1.880E+01	1.880E+01	1.251E+01	5.720E-01	1.651E+00
29	1963	0.177	1.665E+02	1.594E+02	2.820E+01	2.820E+01	1.473E+01	9.126E-01	1.591E+00
30	1964	0.215	1.530E+02	1.455E+02	3.131E+01	3.131E+01	1.717E+01	1.109E+00	1.462E+00
31	1965	0.233	1.389E+02	1.325E+02	3.092E+01	3.092E+01	1.883E+01	1.203E+00	1.327E+00
32	1966	0.234	1.268E+02	1.222E+02	2.854E+01	2.854E+01	1.971E+01	1.205E+00	1.212E+00
33	1967	0.324	1.180E+02	1.098E+02	3.564E+01	3.564E+01	2.021E+01	1.673E+00	1.127E+00
34	1968	0.372	1.026E+02	9.460E+01	3.517E+01	3.517E+01	2.007E+01	1.917E+00	9.800E-01
35	1969	0.604	8.747E+01	7.342E+01	4.437E+01	4.437E+01	1.838E+01	3.116E+00	8.357E-01
36	1970	0.520	6.148E+01	5.472E+01	2.847E+01	2.847E+01	1.565E+01	2.683E+00	5.874E-01
37	1971	0.422	4.866E+01	4.585E+01	1.933E+01	1.933E+01	1.388E+01	2.174E+00	4.649E-01
38	1972	0.597	4.322E+01	3.765E+01	2.249E+01	2.249E+01	1.196E+01	3.081E+00	4.129E-01
39	1973	0.479	3.268E+01	3.037E+01	1.455E+01	1.455E+01	1.007E+01	2.471E+00	3.123E-01
40	1974	0.732	2.820E+01	2.335E+01	1.709E+01	1.709E+01	8.032E+00	3.774E+00	2.694E-01
41	1975	0.290	1.915E+01	1.974E+01	5.732E+00	5.732E+00	6.935E+00	1.497E+00	1.829E-01
42	1976	0.153	2.035E+01	2.246E+01	3.436E+00	3.436E+00	7.774E+00	7.889E-01	1.944E-01
43	1977	0.197	2.469E+01	2.654E+01	5.223E+00	5.223E+00	8.985E+00	1.015E+00	2.359E-01
44	1978	0.276	2.845E+01	2.929E+01	8.085E+00	8.085E+00	9.769E+00	1.424E+00	2.718E-01
45	1979	0.327	3.013E+01	3.020E+01	9.883E+00	9.883E+00	1.002E+01	1.688E+00	2.879E-01
46	1980	0.255	3.027E+01	3.144E+01	8.021E+00	8.021E+00	1.036E+01	1.316E+00	2.892E-01
47	1981	0.189	3.261E+01	3.492E+01	6.607E+00	6.607E+00	1.128E+01	9.757E-01	3.116E-01
48	1982	0.451	3.728E+01	3.498E+01	1.576E+01	1.576E+01	1.130E+01	2.324E+00	3.562E-01
49	1983	0.876	3.282E+01	2.536E+01	2.221E+01	2.221E+01	8.617E+00	4.516E+00	3.135E-01
50	1984	0.686	1.922E+01	1.637E+01	1.122E+01	1.122E+01	5.849E+00	3.535E+00	1.837E-01
51	1985	0.345	1.385E+01	1.396E+01	4.817E+00	4.817E+00	5.054E+00	1.779E+00	1.323E-01
52	1986	0.322	1.408E+01	1.437E+01	4.620E+00	4.620E+00	5.189E+00	1.658E+00	1.346E-01
53	1987	0.164	1.465E+01	1.618E+01	2.652E+00	2.652E+00	5.788E+00	8.454E-01	1.400E-01
54	1988	0.140	1.779E+01	1.981E+01	2.782E+00	2.782E+00	6.954E+00	7.241E-01	1.700E-01
55	1989	0.388	2.196E+01	2.152E+01	8.349E+00	8.349E+00	7.489E+00	2.000E+00	2.098E-01
56	1990	1.324	2.110E+01	1.353E+01	1.792E+01	1.792E+01	4.882E+00	6.830E+00	2.016E-01
57	1991	1.140	8.066E+00	5.639E+00	6.430E+00	6.430E+00	2.125E+00	5.880E+00	7.707E-02
58	1992	0.931	3.762E+00	2.894E+00	2.695E+00	2.695E+00	1.106E+00	4.802E+00	3.594E-02
59	1993	0.349	2.173E+00	2.212E+00	7.710E-01	7.710E-01	8.486E-01	1.798E+00	2.076E-02
60	1994	0.272	2.251E+00	2.381E+00	6.480E-01	6.480E-01	9.127E-01	1.404E+00	2.150E-02
61	1995	0.095	2.515E+00	2.915E+00	2.760E-01	2.760E-01	1.115E+00	4.883E+00	2.403E-02
62	1996	0.144	3.354E+00	3.785E+00	5.450E-01	5.450E-01	1.441E+00	7.426E-01	3.204E-02
63	1997	0.174	4.250E+00	4.719E+00	8.200E-01	8.200E-01	1.789E+00	8.962E-01	4.061E-02
64	1998	0.118	5.219E+00	5.958E+00	7.030E-01	7.030E-01	2.244E+00	6.085E-01	4.986E-02
65	1999	0.174	6.760E+00	7.483E+00	1.305E+00	1.305E+00	2.798E+00	8.993E-01	6.459E-02
66	2000	0.107	8.253E+00	9.445E+00	1.012E+00	1.012E+00	3.497E+00	5.526E-01	7.885E-02
67	2001	0.091	1.074E+01	1.236E+01	1.120E+00	1.120E+00	4.509E+00	4.672E-01	1.026E-01
68	2002		1.413E+01						1.350E-01

## RESULTS FOR DATA SERIES # 1 (NON-BOOTSTRAPPED)

Fall Survey

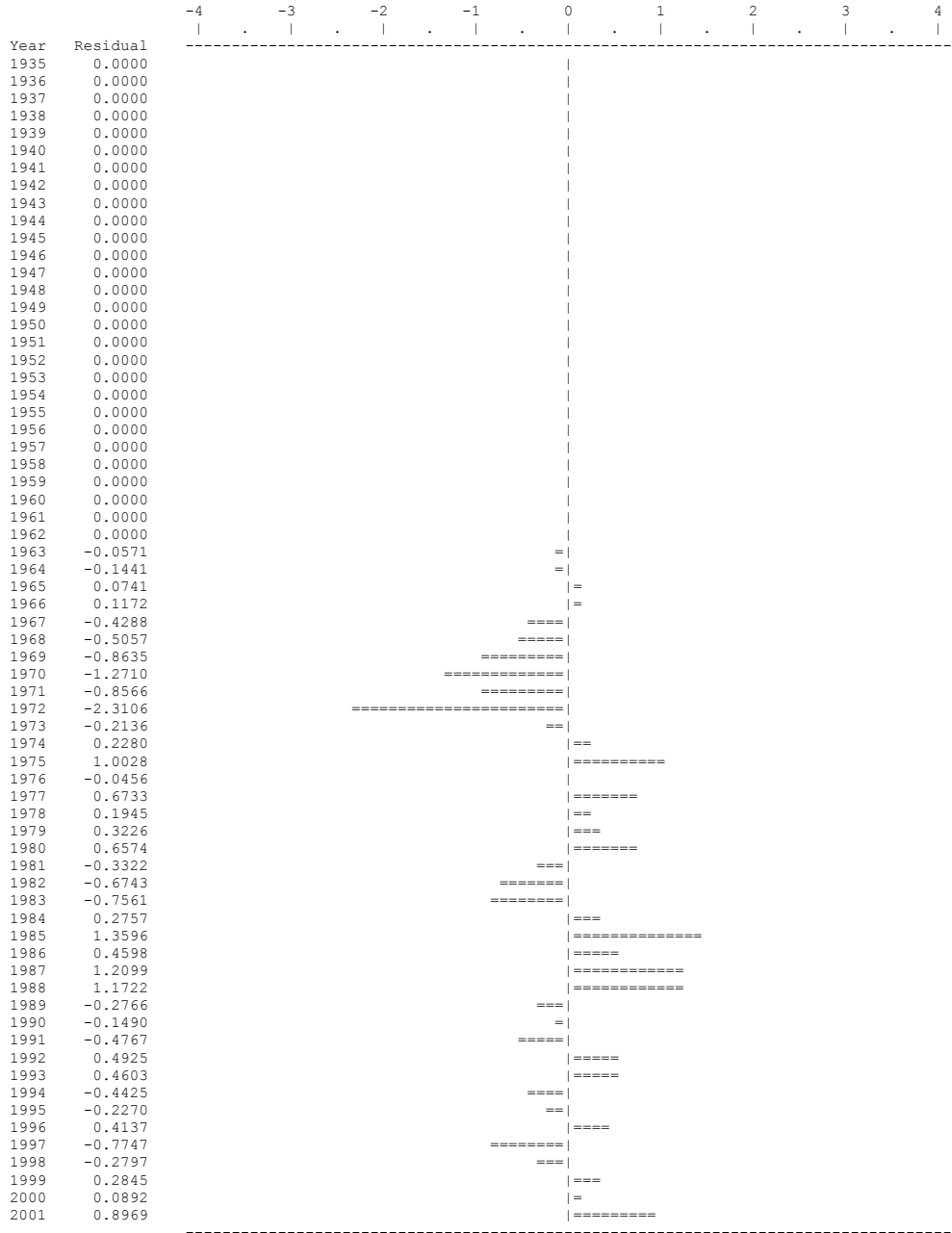
Data type CC: CPUE-catch series

Series weight: 1.000

Obs	Year	Observed CPUE	Estimated CPUE	Estim F	Observed yield	Model yield	Resid in log scale	Resid in yield
1	1935	*	9.662E+00	0.0723	8.400E+00	8.400E+00	0.00000	0.000E+00
2	1936	*	1.056E+01	0.0748	9.500E+00	9.500E+00	0.00000	0.000E+00
3	1937	*	1.129E+01	0.0780	1.060E+01	1.060E+01	0.00000	0.000E+00
4	1938	*	1.190E+01	0.0754	1.080E+01	1.080E+01	0.00000	0.000E+00
5	1939	*	1.232E+01	0.0897	1.330E+01	1.330E+01	0.00000	0.000E+00
6	1940	*	1.232E+01	0.1342	1.990E+01	1.990E+01	0.00000	0.000E+00
7	1941	*	1.179E+01	0.1903	2.700E+01	2.700E+01	0.00000	0.000E+00
8	1942	*	1.059E+01	0.3007	3.830E+01	3.830E+01	0.00000	0.000E+00
9	1943	*	9.620E+00	0.2186	2.530E+01	2.530E+01	0.00000	0.000E+00
10	1944	*	9.612E+00	0.1332	1.540E+01	1.540E+01	0.00000	0.000E+00
11	1945	*	1.002E+01	0.1211	1.460E+01	1.460E+01	0.00000	0.000E+00
12	1946	*	1.042E+01	0.1213	1.520E+01	1.520E+01	0.00000	0.000E+00
13	1947	*	1.069E+01	0.1322	1.700E+01	1.700E+01	0.00000	0.000E+00
14	1948	*	1.099E+01	0.1051	1.390E+01	1.390E+01	0.00000	0.000E+00
15	1949	*	1.167E+01	0.0484	6.800E+00	6.800E+00	0.00000	0.000E+00
16	1950	*	1.253E+01	0.0451	6.800E+00	6.800E+00	0.00000	0.000E+00
17	1951	*	1.336E+01	0.0249	4.000E+00	4.000E+00	0.00000	0.000E+00
18	1952	*	1.412E+01	0.0259	4.400E+00	4.400E+00	0.00000	0.000E+00
19	1953	*	1.476E+01	0.0175	3.100E+00	3.100E+00	0.00000	0.000E+00
20	1954	*	1.532E+01	0.0125	2.300E+00	2.300E+00	0.00000	0.000E+00
21	1955	*	1.573E+01	0.0180	3.400E+00	3.400E+00	0.00000	0.000E+00
22	1956	*	1.591E+01	0.0287	5.500E+00	5.500E+00	0.00000	0.000E+00
23	1957	*	1.586E+01	0.0440	8.400E+00	8.400E+00	0.00000	0.000E+00
24	1958	*	1.555E+01	0.0700	1.310E+01	1.310E+01	0.00000	0.000E+00
25	1959	*	1.523E+01	0.0617	1.130E+01	1.130E+01	0.00000	0.000E+00
26	1960	*	1.503E+01	0.0664	1.200E+01	1.200E+01	0.00000	0.000E+00
27	1961	*	1.463E+01	0.1006	1.770E+01	1.770E+01	0.00000	0.000E+00
28	1962	*	1.409E+01	0.1109	1.880E+01	1.880E+01	0.00000	0.000E+00
29	1963	1.402E+01	1.325E+01	0.1770	2.820E+01	2.820E+01	-0.05707	0.000E+00
30	1964	1.397E+01	1.210E+01	0.2151	3.131E+01	3.131E+01	-0.14409	0.000E+00
31	1965	1.023E+01	1.101E+01	0.2333	3.092E+01	3.092E+01	0.07412	0.000E+00
32	1966	9.033E+00	1.016E+01	0.2336	2.854E+01	2.854E+01	0.11717	0.000E+00
33	1967	1.402E+01	9.130E+00	0.3245	3.564E+01	3.564E+01	-0.42882	0.000E+00
34	1968	1.304E+01	7.863E+00	0.3718	3.517E+01	3.517E+01	-0.50575	0.000E+00
35	1969	1.447E+01	6.102E+00	0.6043	4.437E+01	4.437E+01	-0.86352	0.000E+00
36	1970	1.621E+01	4.548E+00	0.5203	2.847E+01	2.847E+01	-1.27104	0.000E+00
37	1971	8.975E+00	3.811E+00	0.4216	1.933E+01	1.933E+01	-0.85660	0.000E+00
38	1972	3.154E+01	3.129E+00	0.5974	2.249E+01	2.249E+01	-2.31064	0.000E+00
39	1973	3.125E+00	2.524E+00	0.4791	1.455E+01	1.455E+01	-0.21362	0.000E+00
40	1974	1.545E+00	1.941E+00	0.7319	1.709E+01	1.709E+01	0.22799	0.000E+00
41	1975	6.020E-01	1.641E+00	0.2903	5.732E+00	5.732E+00	1.00283	0.000E+00
42	1976	1.954E+00	1.867E+00	0.1530	3.436E+00	3.436E+00	-0.04557	0.000E+00
43	1977	1.125E+00	2.206E+00	0.1968	5.223E+00	5.223E+00	0.67325	0.000E+00
44	1978	2.004E+00	2.434E+00	0.2760	8.085E+00	8.085E+00	0.19455	0.000E+00
45	1979	1.818E+00	2.510E+00	0.3272	9.883E+00	9.883E+00	0.32265	0.000E+00
46	1980	1.354E+00	2.613E+00	0.2551	8.021E+00	8.021E+00	0.65743	0.000E+00
47	1981	4.046E+00	2.902E+00	0.1892	6.607E+00	6.607E+00	-0.33217	0.000E+00
48	1982	5.706E+00	2.907E+00	0.4507	1.576E+01	1.576E+01	-0.67428	0.000E+00
49	1983	4.490E+00	2.108E+00	0.8757	2.221E+01	2.221E+01	-0.75606	0.000E+00
50	1984	1.033E+00	1.361E+00	0.6856	1.122E+01	1.122E+01	0.27566	0.000E+00
51	1985	2.980E-01	1.161E+00	0.3450	4.817E+00	4.817E+00	1.35965	0.000E+00
52	1986	7.540E-01	1.194E+00	0.3216	4.620E+00	4.620E+00	0.45977	0.000E+00
53	1987	4.010E-01	1.345E+00	0.1639	2.652E+00	2.652E+00	1.20988	0.000E+00
54	1988	5.100E-01	1.647E+00	0.1404	2.782E+00	2.782E+00	1.17218	0.000E+00
55	1989	2.359E+00	1.789E+00	0.3879	8.349E+00	8.349E+00	-0.27659	0.000E+00
56	1990	1.305E+00	1.124E+00	1.3244	1.792E+01	1.792E+01	-0.14896	0.000E+00
57	1991	7.550E-01	4.687E-01	1.1402	6.430E+00	6.430E+00	-0.47673	0.000E+00
58	1992	1.470E-01	2.405E-01	0.9312	2.695E+00	2.695E+00	0.49249	0.000E+00
59	1993	1.160E-01	1.838E-01	0.3486	7.710E-01	7.710E-01	0.46034	0.000E+00
60	1994	3.080E-01	1.979E-01	0.2722	6.480E-01	6.480E-01	-0.44252	0.000E+00
61	1995	3.040E-01	2.423E-01	0.0947	2.760E-01	2.760E-01	-0.22695	0.000E+00
62	1996	2.080E-01	3.146E-01	0.1440	5.450E-01	5.450E-01	0.41371	0.000E+00
63	1997	8.510E-01	3.922E-01	0.1738	8.200E-01	8.200E-01	-0.77468	0.000E+00
64	1998	6.550E-01	4.952E-01	0.1180	7.030E-01	7.030E-01	-0.27974	0.000E+00
65	1999	4.680E-01	6.220E-01	0.1744	1.305E+00	1.305E+00	0.28446	0.000E+00
66	2000	7.180E-01	7.850E-01	0.1072	1.012E+00	1.012E+00	0.08921	0.000E+00
67	2001	4.190E-01	1.027E+00	0.0906	1.120E+00	1.120E+00	0.89695	0.000E+00

\* Asterisk indicates missing value(s).

UNWEIGHTED LOG RESIDUAL PLOT FOR DATA SERIES # 1



RESULTS FOR DATA SERIES # 2 (NON-BOOTSTRAPPED)

Spring Survey (lagged)

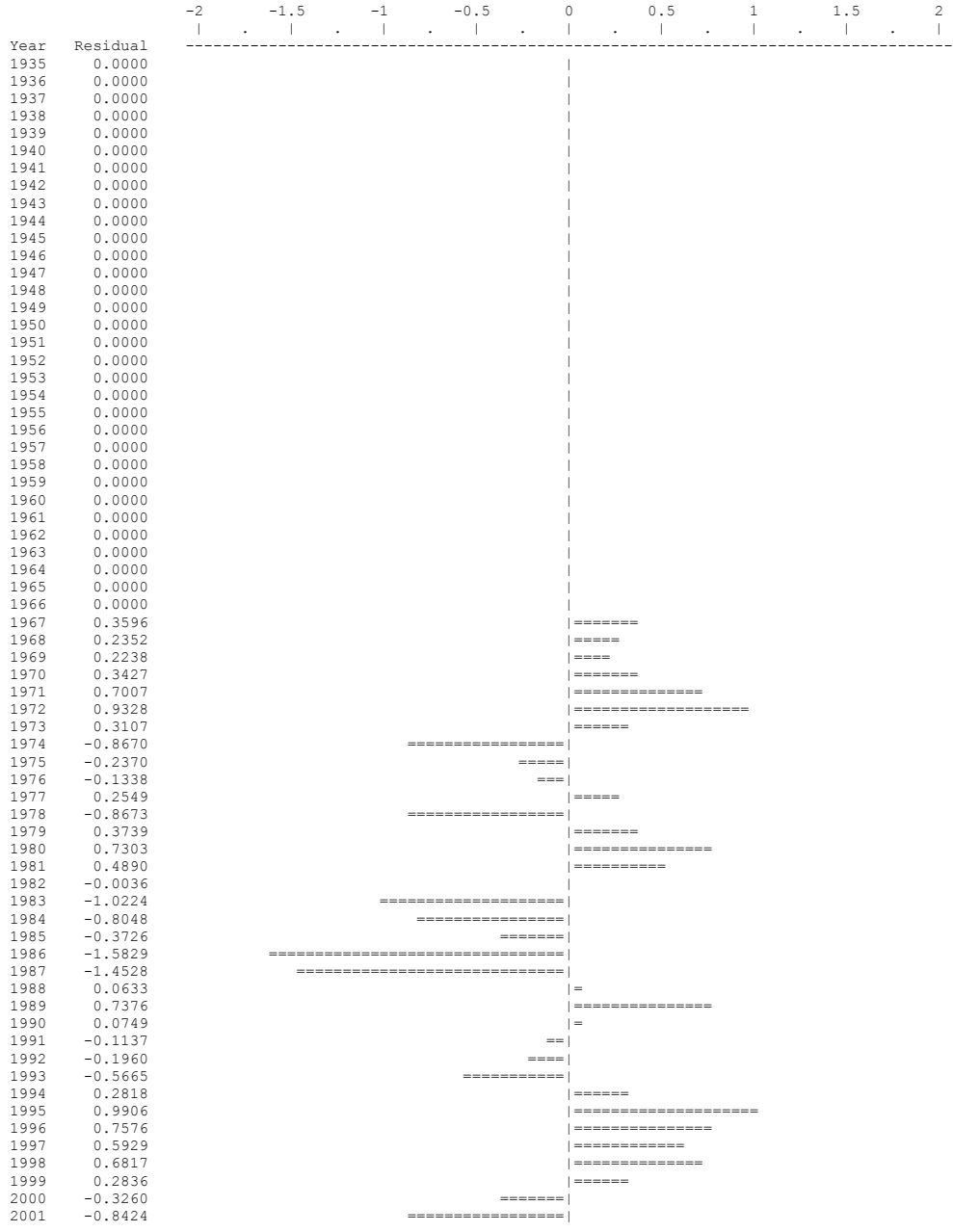
Data type I0: Start-of-year biomass index

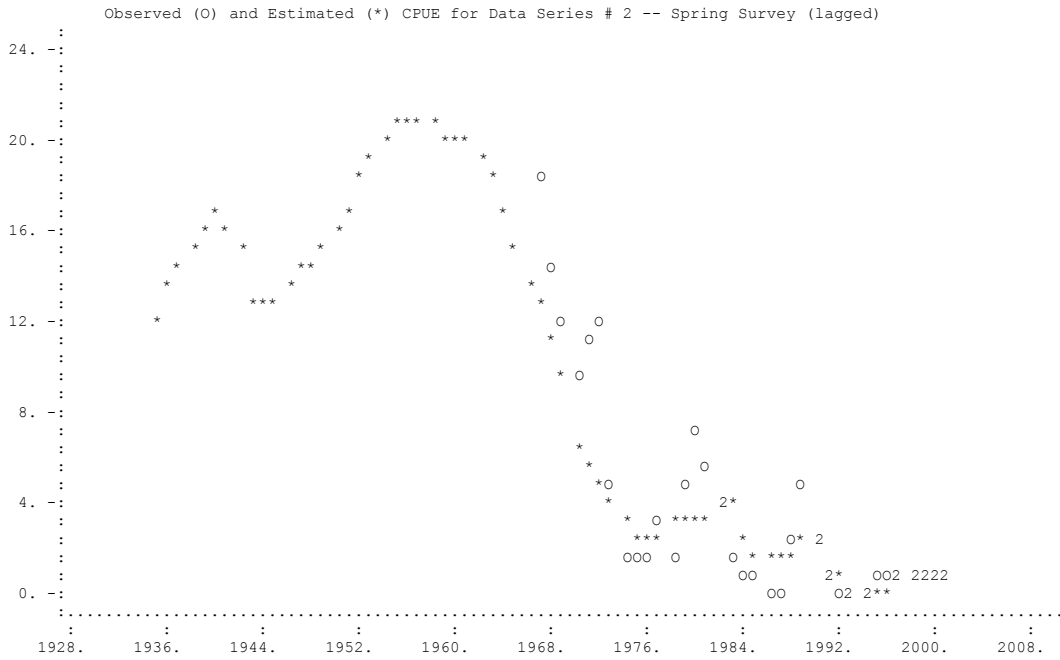
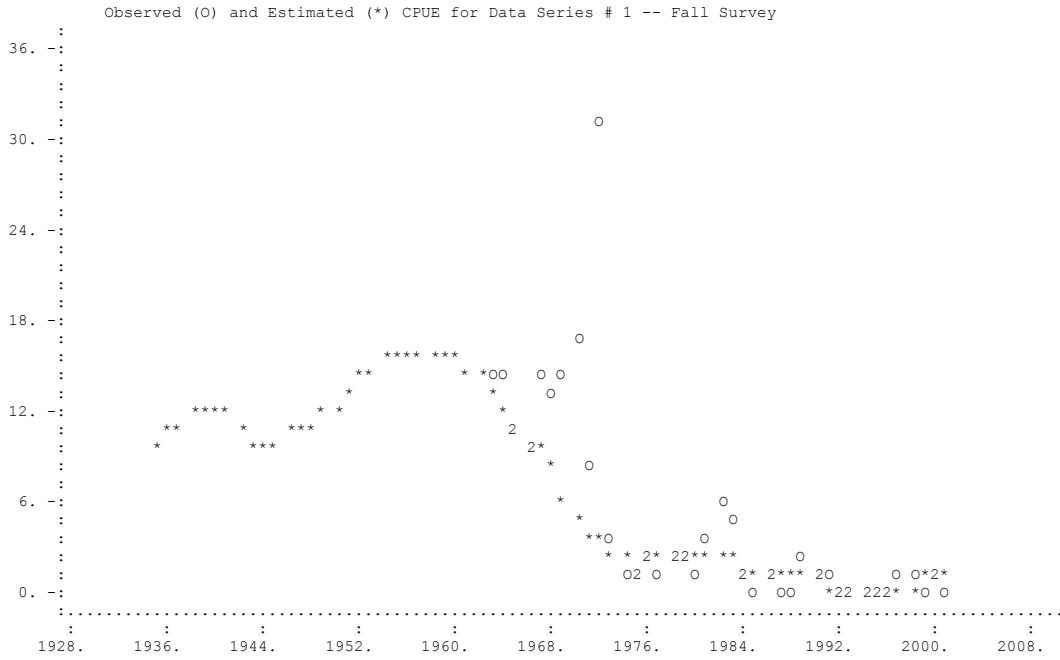
Series weight: 1.000

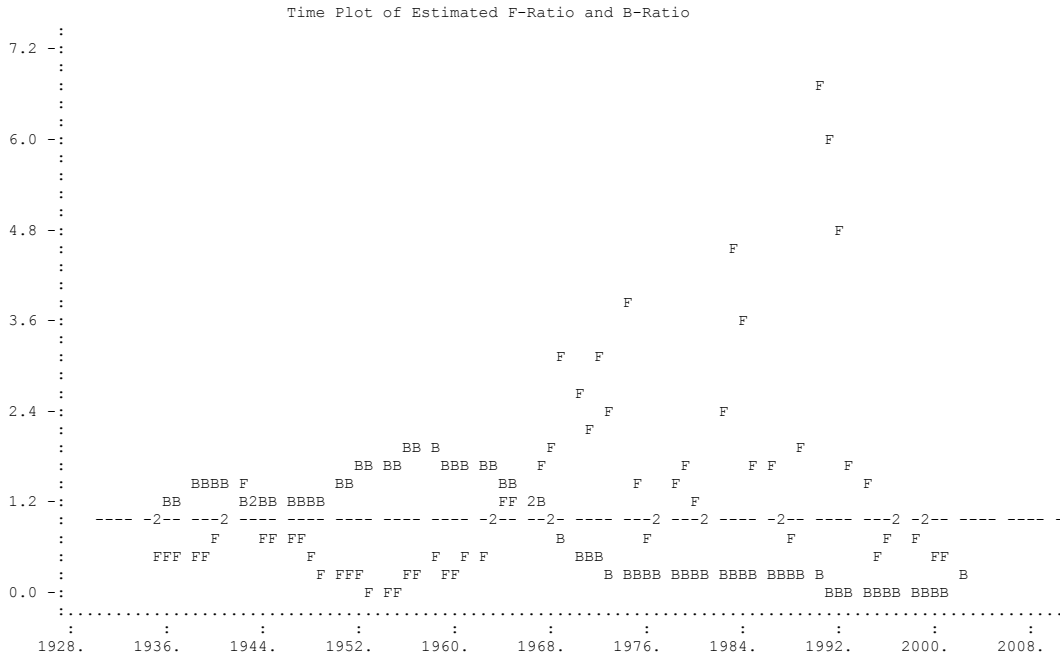
Obs	Year	Observed effort	Estimated effort	Estim F	Observed index	Model index	Resid in log index	Resid in index
1	1935	0.000E+00	0.000E+00	0.0	*	1.217E+01	0.00000	0.0
2	1936	0.000E+00	0.000E+00	0.0	*	1.345E+01	0.00000	0.0
3	1937	0.000E+00	0.000E+00	0.0	*	1.454E+01	0.00000	0.0
4	1938	0.000E+00	0.000E+00	0.0	*	1.541E+01	0.00000	0.0
5	1939	0.000E+00	0.000E+00	0.0	*	1.615E+01	0.00000	0.0
6	1940	0.000E+00	0.000E+00	0.0	*	1.653E+01	0.00000	0.0
7	1941	0.000E+00	0.000E+00	0.0	*	1.619E+01	0.00000	0.0
8	1942	0.000E+00	0.000E+00	0.0	*	1.516E+01	0.00000	0.0
9	1943	0.000E+00	0.000E+00	0.0	*	1.307E+01	0.00000	0.0
10	1944	0.000E+00	0.000E+00	0.0	*	1.249E+01	0.00000	0.0
11	1945	0.000E+00	0.000E+00	0.0	*	1.300E+01	0.00000	0.0
12	1946	0.000E+00	0.000E+00	0.0	*	1.358E+01	0.00000	0.0
13	1947	0.000E+00	0.000E+00	0.0	*	1.405E+01	0.00000	0.0
14	1948	0.000E+00	0.000E+00	0.0	*	1.430E+01	0.00000	0.0
15	1949	0.000E+00	0.000E+00	0.0	*	1.485E+01	0.00000	0.0
16	1950	0.000E+00	0.000E+00	0.0	*	1.608E+01	0.00000	0.0
17	1951	0.000E+00	0.000E+00	0.0	*	1.713E+01	0.00000	0.0
18	1952	0.000E+00	0.000E+00	0.0	*	1.828E+01	0.00000	0.0
19	1953	0.000E+00	0.000E+00	0.0	*	1.916E+01	0.00000	0.0
20	1954	0.000E+00	0.000E+00	0.0	*	1.997E+01	0.00000	0.0
21	1955	0.000E+00	0.000E+00	0.0	*	2.066E+01	0.00000	0.0
22	1956	0.000E+00	0.000E+00	0.0	*	2.106E+01	0.00000	0.0
23	1957	0.000E+00	0.000E+00	0.0	*	2.115E+01	0.00000	0.0
24	1958	0.000E+00	0.000E+00	0.0	*	2.095E+01	0.00000	0.0
25	1959	0.000E+00	0.000E+00	0.0	*	2.035E+01	0.00000	0.0
26	1960	0.000E+00	0.000E+00	0.0	*	2.008E+01	0.00000	0.0
27	1961	0.000E+00	0.000E+00	0.0	*	1.981E+01	0.00000	0.0
28	1962	0.000E+00	0.000E+00	0.0	*	1.906E+01	0.00000	0.0
29	1963	0.000E+00	0.000E+00	0.0	*	1.836E+01	0.00000	0.0
30	1964	0.000E+00	0.000E+00	0.0	*	1.688E+01	0.00000	0.0
31	1965	0.000E+00	0.000E+00	0.0	*	1.532E+01	0.00000	0.0
32	1966	0.000E+00	0.000E+00	0.0	*	1.399E+01	0.00000	0.0
33	1967	1.000E+00	1.000E+00	0.0	1.864E+01	1.301E+01	0.35958	5.631E+00
34	1968	1.000E+00	1.000E+00	0.0	1.431E+01	1.131E+01	0.23518	2.999E+00
35	1969	1.000E+00	1.000E+00	0.0	1.207E+01	9.647E+00	0.22378	2.419E+00
36	1970	1.000E+00	1.000E+00	0.0	9.552E+00	6.781E+00	0.34265	2.771E+00
37	1971	1.000E+00	1.000E+00	0.0	1.081E+01	5.367E+00	0.70066	5.448E+00
38	1972	1.000E+00	1.000E+00	0.0	1.212E+01	4.766E+00	0.93285	7.349E+00
39	1973	1.000E+00	1.000E+00	0.0	4.918E+00	3.605E+00	0.31066	1.313E+00
40	1974	1.000E+00	1.000E+00	0.0	1.307E+00	3.110E+00	-0.86695	-1.803E+00
41	1975	1.000E+00	1.000E+00	0.0	1.666E+00	2.111E+00	-0.23696	-4.455E-01
42	1976	1.000E+00	1.000E+00	0.0	1.963E+00	2.244E+00	-0.13384	-2.811E-01
43	1977	1.000E+00	1.000E+00	0.0	3.513E+00	2.722E+00	0.25492	7.905E-01
44	1978	1.000E+00	1.000E+00	0.0	1.318E+00	3.137E+00	-0.86727	-1.819E+00
45	1979	1.000E+00	1.000E+00	0.0	4.830E+00	3.323E+00	0.37394	1.507E+00
46	1980	1.000E+00	1.000E+00	0.0	6.930E+00	3.339E+00	0.73032	3.591E+00
47	1981	1.000E+00	1.000E+00	0.0	5.865E+00	3.597E+00	0.48902	2.268E+00
48	1982	1.000E+00	1.000E+00	0.0	4.097E+00	4.112E+00	-0.00365	-1.498E-02
49	1983	1.000E+00	1.000E+00	0.0	1.302E+00	3.619E+00	-1.02235	-2.317E+00
50	1984	1.000E+00	1.000E+00	0.0	9.480E-01	2.120E+00	-0.80478	-1.172E+00
51	1985	1.000E+00	1.000E+00	0.0	1.052E+00	1.527E+00	-0.37261	-4.750E-01
52	1986	1.000E+00	1.000E+00	0.0	3.190E-01	1.553E+00	-1.58286	-1.234E+00
53	1987	1.000E+00	1.000E+00	0.0	3.780E-01	1.616E+00	-1.45279	-1.238E+00
54	1988	1.000E+00	1.000E+00	0.0	2.090E+00	1.962E+00	0.06332	1.282E-01
55	1989	1.000E+00	1.000E+00	0.0	5.064E+00	2.422E+00	0.73761	2.642E+00
56	1990	1.000E+00	1.000E+00	0.0	2.508E+00	2.327E+00	0.07488	1.809E-01
57	1991	1.000E+00	1.000E+00	0.0	7.940E-01	8.896E-01	-0.11367	-9.559E-02
58	1992	1.000E+00	1.000E+00	0.0	3.410E-01	4.148E-01	-0.19602	-7.385E-02
59	1993	1.000E+00	1.000E+00	0.0	1.360E-01	2.396E-01	-0.56652	-1.036E-01
60	1994	1.000E+00	1.000E+00	0.0	3.290E-01	2.482E-01	0.28179	8.079E-02
61	1995	1.000E+00	1.000E+00	0.0	7.470E-01	2.774E-01	0.99059	4.696E-01
62	1996	1.000E+00	1.000E+00	0.0	7.890E-01	3.699E-01	0.75755	4.191E-01
63	1997	1.000E+00	1.000E+00	0.0	8.480E-01	4.687E-01	0.59285	3.793E-01
64	1998	1.000E+00	1.000E+00	0.0	1.138E+00	5.756E-01	0.68170	5.624E-01
65	1999	1.000E+00	1.000E+00	0.0	9.900E-01	7.455E-01	0.28360	2.445E-01
66	2000	1.000E+00	1.000E+00	0.0	6.570E-01	9.102E-01	-0.32600	-2.532E-01
67	2001	1.000E+00	1.000E+00	0.0	5.100E-01	1.184E+00	-0.84244	-6.742E-01

\* Asterisk indicates missing value(s).

UNWEIGHTED LOG RESIDUAL PLOT FOR DATA SERIES # 2







RESULTS OF BOOTSTRAPPED ANALYSIS

Param name	Bias-corrected estimate	Ordinary estimate	Relative bias	Approx 80% lower CL	Approx 80% upper CL	Approx 50% lower CL	Approx 50% upper CL	Inter-quartile range	Relative IQ range
Blratio	2.294E-01	1.054E+00	359.41%	2.371E-02	1.251E+00	8.543E-02	8.212E-01	7.357E-01	3.207
K	1.954E+02	2.093E+02	7.15%	1.666E+02	2.159E+02	1.854E+02	2.074E+02	2.203E+01	0.113
r	4.278E-01	3.878E-01	-9.36%	3.675E-01	5.150E-01	3.940E-01	4.681E-01	7.409E-02	0.173
q(1)	9.252E-02	8.312E-02	-10.16%	7.421E-02	1.130E-01	8.285E-02	1.002E-01	1.730E-02	0.187
q(2)	1.214E-01	1.103E-01	-9.14%	1.020E-01	1.678E-01	1.110E-01	1.381E-01	2.710E-02	0.223
MSY	2.112E+01	2.030E+01	-3.91%	1.983E+01	8.572E+01	2.041E+01	2.265E+01	2.244E+00	0.106
Ye(2002)	5.723E+00	5.109E+00	-10.73%	3.743E+00	8.730E+00	4.561E+00	7.007E+00	2.446E+00	0.427
Bmsy	9.768E+01	1.047E+02	7.15%	8.332E+01	1.080E+02	9.268E+01	1.037E+02	1.101E+01	0.113
Fmsy	2.139E-01	1.939E-01	-9.36%	1.838E-01	2.575E-01	1.970E-01	2.341E-01	3.705E-02	0.173
fmsy(1)	2.359E+00	2.333E+00	-1.11%	1.994E+00	2.815E+00	2.174E+00	2.593E+00	4.196E-01	0.178
fmsy(2)	1.759E+00	1.758E+00	-0.04%	1.478E+00	2.074E+00	1.605E+00	1.905E+00	2.992E-01	0.170
F(0.1)	1.925E-01	1.745E-01	-8.42%	1.654E-01	2.317E-01	1.773E-01	2.107E-01	3.334E-02	0.173
Y(0.1)	2.091E+01	2.009E+01	-3.87%	1.963E+01	8.486E+01	2.021E+01	2.243E+01	2.222E+00	0.106
B-ratio	1.448E-01	1.350E-01	-6.78%	9.656E-02	2.227E-01	1.190E-01	1.783E-01	5.925E-02	0.409
F-ratio	4.104E-01	4.672E-01	13.84%	2.718E-01	6.415E-01	3.426E-01	5.252E-01	1.826E-01	0.445
Y-ratio	2.688E-01	2.517E-01	-6.35%	1.838E-01	3.958E-01	2.239E-01	3.248E-01	1.009E-01	0.375
f0.1(1)	2.123E+00	2.100E+00	-1.00%	* * * * *	0.178				
f0.1(2)	1.583E+00	1.582E+00	-0.04%	* * * * *	0.170				
q2/q1	1.331E+00	1.327E+00	-0.34%	1.073E+00	1.632E+00	1.194E+00	1.488E+00	2.946E-01	0.221

NOTES ON BOOTSTRAPPED ESTIMATES:

- The bootstrapped results shown were computed from 500 trials.
- These results are conditional on the constraints placed upon MSY and r in the input file (ASPIC.INP).
- All bootstrapped intervals are approximate. The statistical literature recommends using at least 1000 trials for accurate 95% intervals. The 80% intervals used by ASPIC should require fewer trials for equivalent accuracy. Using at least 500 trials is recommended.
- The bias corrections used here are based on medians. This is an accepted statistical procedure, but may estimate nonzero bias for unbiased, skewed estimators.

Trials replaced for lack of convergence: 7  
 Trials replaced for MSY out-of-bounds: 0  
 Trials replaced for r out-of-bounds: 0  
 Residual-adjustment factor: 1.0356