

NORTHERN SHRIMP APPENDICES

APPENDIX A1: ASPIC BOOTSTRAP OUTPUT FOR NORTHERN SHRIMP ASSESSMENT THROUGH 2006

ASPIC -- A Surplus-Production Model Including Covariates (Ver. 3.91) BOT Mode

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ASPIC User's Manual is available gratis from the author.

Ref: Prager, M. H. 1994. A suite of extensions to a nonequilibrium surplus-production model. Fishery Bulletin 92: 374-389.

CONTROL PARAMETERS USED (FROM INPUT FILE)

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Number of years analyzed:          39      Number of bootstrap trials:      1000
Number of data series:            3        Lower bound on MSY:             1.000E+00
Objective function computed:      in effort Upper bound on MSY:             2.000E+01
Relative conv. criterion (simplex): 1.000E-04 Lower bound on r:                1.000E-02
Relative conv. criterion (restart): 3.000E-04 Upper bound on r:                3.000E+00
Relative conv. criterion (effort):  1.000E-04 Random number seed:             98769756
Maximum F allowed in fitting:     3.000   Monte Carlo search mode, trials: 2 50000
    
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PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS)

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Normal convergence.                                code  0
    
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CORRELATION AMONG INPUT SERIES EXPRESSED AS CPUE (NUMBER OF PAIRWISE OBSERVATIONS BELOW)

1	Fall Groundfish Survey	1.000		
		39		
2	Maine Summer Survey	0.751	1.000	
		16	16	
3	Summer Shrimp Survey	0.485	0.000	1.000
		23	0	23
			1	2
				3

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	0.0000E+00					
Loss(0) Penalty for B1R > 2	0.0000E+00	1	N/A	5.000E+00	N/A	
Loss(1) Fall Groundfish Survey	1.050E+01	39	2.838E-01	8.506E-01	8.706E-01	0.493
Loss(2) Maine Summer Survey	4.179E+00	16	2.985E-01	8.195E-01	7.976E-01	0.634
Loss(3) Summer Shrimp Survey	6.186E+00	23	2.945E-01	1.379E+00	1.360E+00	0.154
TOTAL OBJECTIVE FUNCTION:	2.08664327E+01					

Number of restarts required for convergence: 37
 Est. B/Bmsy coverage index (0 worst, 2 best): 1.3854
 Est. B/Bmsy 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)

Estimate	Starting guess	Estimated	User guess	Formula	Related quantity
B1R	Starting B/Bmsy, year 1968	1.484E+00		1.000E+00	1
MSY	Maximum sustainable yield	5.395E+00		7.000E+00	1
r	Intrinsic rate of increase	3.584E-01		5.000E-01	1
.....	Catchability coefficients by fishery:				
q(1)	Fall Groundfish Survey	9.618E-02		5.000E-01	1
q(2)	Maine Summer Survey	5.393E-01		5.000E-01	1
q(3)	Summer Shrimp Survey	8.101E-01		5.000E-01	1

MANAGEMENT PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter	Estimate	Formula	Related quantity
MSY	Maximum sustainable yield	Kr/4	
K	Maximum stock biomass		
Bmsy	Stock biomass at MSY	K/2	
Fmsy	Fishing mortality at MSY	r/2	
F(0.1)	Management benchmark	0.9*Fmsy	
Y(0.1)	Equilibrium yield at F(0.1)	0.99*MSY	
B./Bmsy	Ratio of B(2007) to Bmsy		
F./Fmsy	Ratio of F(2006) to Fmsy		
F01-mult	Ratio of F(0.1) to F(2006)		
Ye./MSY	Proportion of MSY avail in 2007	2*Br-Br^2	Ye(2007) = 5.064E+00Fishing effort at MSY
in units of each fishery:			
fmsy(1)	Fall Groundfish Survey	r/2q(1)	f(0.1) = 1.677E+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	1968	0.130	4.470E+01	4.394E+01	5.708E+00	5.708E+00	4.259E+00	7.249E-01	1.485E+00
2	1969	0.308	4.325E+01	3.936E+01	1.214E+01	1.214E+01	4.861E+00	1.721E+00	1.437E+00
3	1970	0.346	3.597E+01	3.279E+01	1.133E+01	1.133E+01	5.333E+00	1.928E+00	1.195E+00
4	1971	0.390	2.998E+01	2.719E+01	1.059E+01	1.059E+01	5.328E+00	2.174E+00	9.957E-01
5	1972	0.526	2.471E+01	2.134E+01	1.122E+01	1.122E+01	4.914E+00	2.936E+00	8.208E-01
6	1973	0.630	1.840E+01	1.539E+01	9.691E+00	9.691E+00	4.086E+00	3.515E+00	6.112E-01
7	1974	0.799	1.280E+01	1.004E+01	8.024E+00	8.024E+00	2.983E+00	4.459E+00	4.251E-01
8	1975	1.179	7.757E+00	5.210E+00	6.142E+00	6.142E+00	1.694E+00	6.579E+00	2.576E-01
9	1976	0.441	3.309E+00	3.146E+00	1.387E+00	1.387E+00	1.067E+00	2.460E+00	1.099E-01
10	1977	0.111	2.990E+00	3.358E+00	3.716E-01	3.716E-01	1.135E+00	6.176E-01	9.930E-02
11	1978	0.004	3.753E+00	4.444E+00	1.680E-02	1.680E-02	1.473E+00	2.110E-02	1.247E-01
12	1979	0.083	5.209E+00	5.892E+00	4.865E-01	4.865E-01	1.902E+00	4.608E-01	1.730E-01
13	1980	0.045	6.624E+00	7.605E+00	3.391E-01	3.391E-01	2.377E+00	2.488E-01	2.200E-01
14	1981	0.112	8.662E+00	9.543E+00	1.071E+00	1.071E+00	2.874E+00	7.264E-01	2.877E-01
15	1982	0.135	1.046E+01	1.133E+01	1.530E+00	1.530E+00	3.292E+00	6.536E-01	3.476E-01
16	1983	0.104	1.223E+01	1.337E+01	1.397E+00	1.397E+00	3.721E+00	5.832E-01	4.061E-01
17	1984	0.195	1.455E+01	1.510E+01	2.951E+00	2.951E+00	4.051E+00	1.090E+00	4.833E-01
18	1985	0.264	1.565E+01	1.566E+01	4.131E+00	4.131E+00	4.149E+00	1.472E+00	5.198E-01
19	1986	0.301	1.567E+01	1.540E+01	4.635E+00	4.635E+00	4.103E+00	1.680E+00	5.204E-01
20	1987	0.363	1.514E+01	1.446E+01	5.253E+00	5.253E+00	3.933E+00	2.028E+00	5.028E-01
21	1988	0.213	1.382E+01	1.425E+01	3.031E+00	3.031E+00	3.894E+00	1.187E+00	4.589E-01
22	1989	0.220	1.468E+01	1.504E+01	3.315E+00	3.315E+00	4.041E+00	1.230E+00	4.876E-01
23	1990	0.309	1.540E+01	1.509E+01	4.665E+00	4.665E+00	4.049E+00	1.725E+00	5.117E-01
24	1991	0.238	1.479E+01	1.502E+01	3.571E+00	3.571E+00	4.037E+00	1.327E+00	4.912E-01
25	1992	0.221	1.525E+01	1.560E+01	3.444E+00	3.444E+00	4.139E+00	1.232E+00	5.067E-01
26	1993	0.126	1.595E+01	1.706E+01	2.143E+00	2.143E+00	4.376E+00	7.010E-01	5.298E-01
27	1994	0.153	1.818E+01	1.906E+01	2.915E+00	2.915E+00	4.663E+00	8.535E-01	6.039E-01
28	1995	0.340	1.993E+01	1.899E+01	6.466E+00	6.466E+00	4.654E+00	1.900E+00	6.620E-01
29	1996	0.595	1.812E+01	1.540E+01	9.166E+00	9.166E+00	4.092E+00	3.321E+00	6.018E-01
30	1997	0.645	1.304E+01	1.097E+01	7.079E+00	7.079E+00	3.205E+00	3.600E+00	4.333E-01
31	1998	0.501	9.171E+00	8.336E+00	4.174E+00	4.174E+00	2.570E+00	2.795E+00	3.046E-01
32	1999	0.230	7.567E+00	7.883E+00	1.816E+00	1.816E+00	2.453E+00	1.286E+00	2.513E-01
33	2000	0.288	8.203E+00	8.288E+00	2.389E+00	2.389E+00	2.559E+00	1.609E+00	2.725E-01
34	2001	0.146	8.373E+00	9.075E+00	1.329E+00	1.329E+00	2.758E+00	8.173E-01	2.781E-01
35	2002	0.038	9.802E+00	1.117E+01	4.240E-01	4.240E-01	3.254E+00	2.118E-01	3.256E-01
36	2003	0.087	1.263E+01	1.392E+01	1.211E+00	1.211E+00	3.828E+00	4.856E-01	4.196E-01
37	2004	0.119	1.525E+01	1.640E+01	1.949E+00	1.949E+00	4.271E+00	6.631E-01	5.065E-01
38	2005	0.137	1.757E+01	1.859E+01	2.553E+00	2.553E+00	4.600E+00	7.663E-01	5.836E-01
39	2006	0.089	1.962E+01	2.113E+01	1.877E+00	1.877E+00	4.907E+00	4.957E-01	6.516E-01
40	2007		2.265E+01						7.523E-01

RESULTS FOR DATA SERIES # 1 (NON-BOOTSTRAPPED)

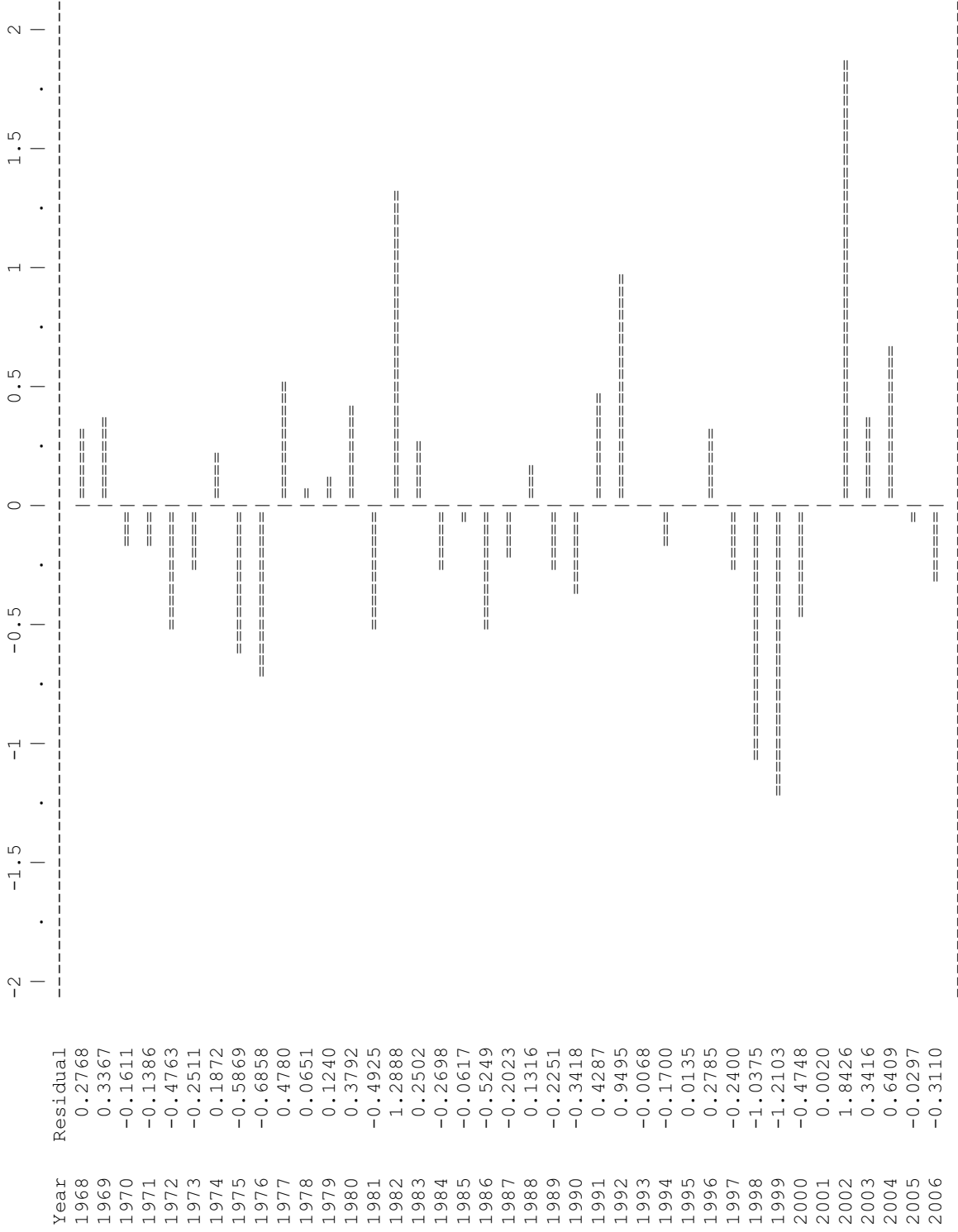
Fall Groundfish Survey

Data type CC: CPUE-catch series

Series weight: 0.851

Obs	Year	Observed CPUE	Estimated CPUE	Estim F	Observed yield	Model yield	Resid in log scale	Resid in log yield
1	1968	3.200E+00	4.221E+00	0.1299	5.708E+00	5.708E+00	0.27684	0.27684
2	1969	2.700E+00	3.781E+00	0.3083	1.214E+01	1.214E+01	0.33668	0.33668
3	1970	3.700E+00	3.150E+00	0.3455	1.133E+01	1.133E+01	-0.16107	-0.16107
4	1971	3.000E+00	2.612E+00	0.3896	1.059E+01	1.059E+01	-0.13858	-0.13858
5	1972	3.300E+00	2.049E+00	0.5260	1.122E+01	1.122E+01	-0.47635	-0.47635
6	1973	1.900E+00	1.478E+00	0.6298	9.691E+00	9.691E+00	-0.25108	-0.25108
7	1974	8.000E-01	9.647E-01	0.7990	8.024E+00	8.024E+00	0.18716	0.18716
8	1975	9.000E-01	5.004E-01	1.1789	6.142E+00	6.142E+00	-0.58690	-0.58690
9	1976	6.000E-01	3.022E-01	0.4408	1.387E+00	1.387E+00	-0.68580	-0.68580
10	1977	2.000E-01	3.226E-01	0.1107	3.716E-01	3.716E-01	0.47799	0.47799
11	1978	4.000E-01	4.269E-01	0.0038	1.680E-02	1.680E-02	0.06509	0.06509
12	1979	5.000E-01	5.660E-01	0.0826	4.865E-01	4.865E-01	0.12395	0.12395
13	1980	5.000E-01	7.305E-01	0.0446	3.391E-01	3.391E-01	0.37915	0.37915
14	1981	1.500E+00	9.167E-01	0.1122	1.071E+00	1.071E+00	-0.49246	-0.49246
15	1982	3.000E-01	1.089E+00	0.1350	1.530E+00	1.530E+00	1.28881	1.28881
16	1983	1.000E+00	1.284E+00	0.1045	1.397E+00	1.397E+00	0.25020	0.25020
17	1984	1.900E+00	1.451E+00	0.1954	2.951E+00	2.951E+00	-0.26984	-0.26984
18	1985	1.600E+00	1.504E+00	0.2638	4.131E+00	4.131E+00	-0.06174	-0.06174
19	1986	2.500E+00	1.479E+00	0.3010	4.635E+00	4.635E+00	-0.52493	-0.52493
20	1987	1.700E+00	1.389E+00	0.3634	5.253E+00	5.253E+00	-0.20227	-0.20227
21	1988	1.200E+00	1.369E+00	0.2217	3.031E+00	3.031E+00	0.13158	0.13158
22	1989	1.810E+00	1.445E+00	0.2204	3.315E+00	3.315E+00	-0.22514	-0.22514
23	1990	2.040E+00	1.449E+00	0.3092	4.665E+00	4.665E+00	-0.34175	-0.34175
24	1991	9.400E-01	1.443E+00	0.2377	3.571E+00	3.571E+00	0.42866	0.42866
25	1992	5.800E-01	1.499E+00	0.2207	3.444E+00	3.444E+00	0.94947	0.94947
26	1993	1.650E+00	1.639E+00	0.1256	2.143E+00	2.143E+00	-0.00683	-0.00683
27	1994	2.170E+00	1.831E+00	0.1529	2.915E+00	2.915E+00	-0.16996	-0.16996
28	1995	1.800E+00	1.824E+00	0.3405	6.466E+00	6.466E+00	0.01349	0.01349
29	1996	1.120E+00	1.480E+00	0.5950	9.166E+00	9.166E+00	0.27851	0.27851
30	1997	1.340E+00	1.054E+00	0.6451	7.079E+00	7.079E+00	-0.24002	-0.24002
31	1998	2.260E+00	8.008E-01	0.5007	4.174E+00	4.174E+00	-1.03754	-1.03754
32	1999	2.540E+00	7.572E-01	0.2304	1.816E+00	1.816E+00	-1.21026	-1.21026
33	2000	1.280E+00	7.961E-01	0.2883	2.389E+00	2.389E+00	-0.47483	-0.47483
34	2001	8.700E-01	8.717E-01	0.1464	1.329E+00	1.329E+00	0.00196	0.00196
35	2002	1.700E-01	1.073E+00	0.0379	4.240E-01	4.240E-01	1.84262	1.84262
36	2003	9.500E-01	1.337E+00	0.0870	1.211E+00	1.211E+00	0.34162	0.34162
37	2004	8.300E-01	1.575E+00	0.1188	1.949E+00	1.949E+00	0.64087	0.64087
38	2005	1.840E+00	1.786E+00	0.1373	2.553E+00	2.553E+00	-0.02972	-0.02972
39	2006	2.770E+00	2.030E+00	0.0888	1.877E+00	1.877E+00	-0.31104	-0.31104

UNWEIGHTED LOG RESIDUAL PLOT FOR DATA SERIES # 1



RESULTS FOR DATA SERIES # 2 (NON-BOOTSTRAPPED)

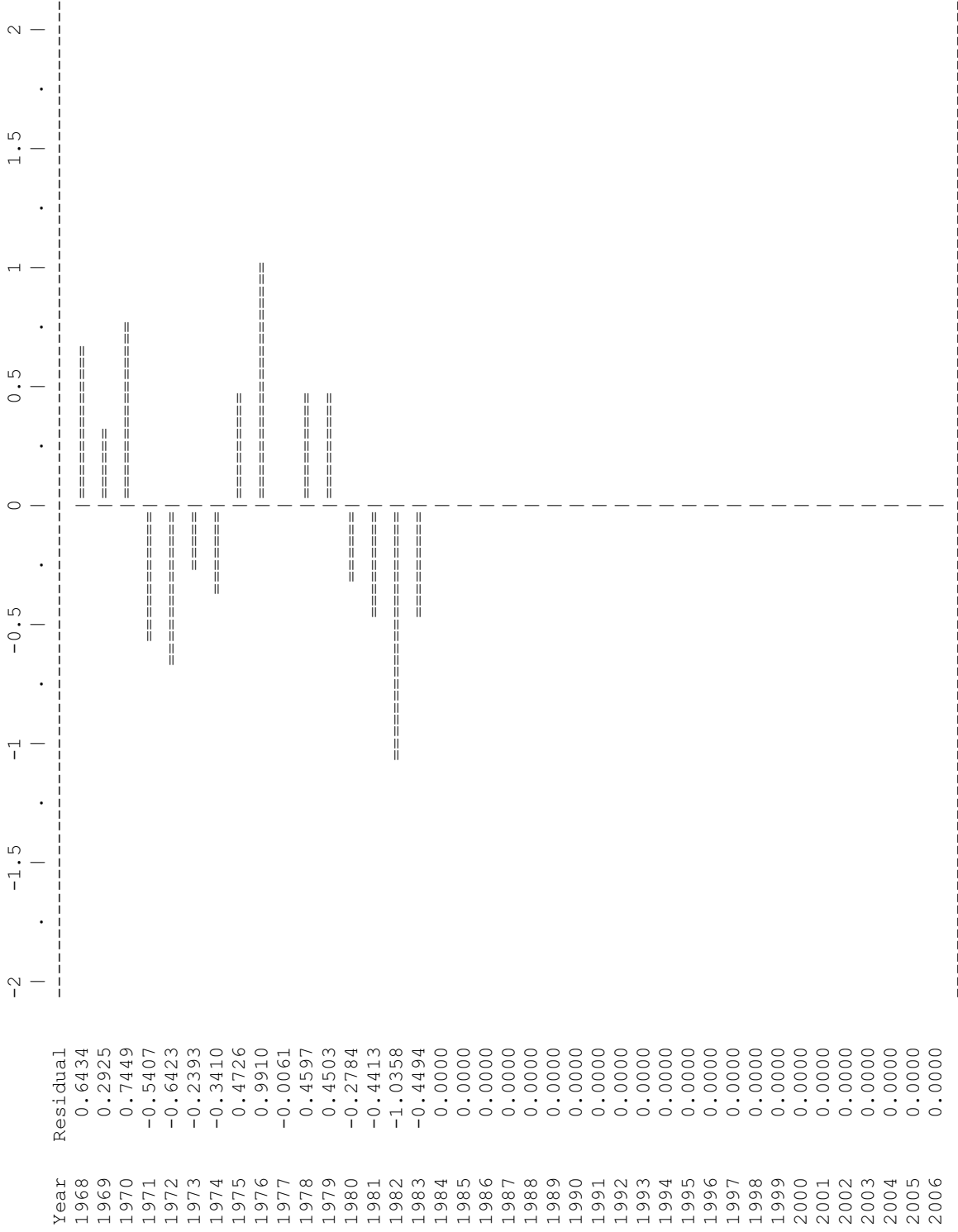
Maine Summer Survey

Data type I0: Start-of-year biomass index

Series weight: 0.819

Obs	Year	Observed effort	Estimated effort	Estim F	Observed index	Model index	Resid in log index	Resid in index
1	1968	1.000E+00	1.000E+00	0.0	4.580E+01	2.407E+01	0.64338	2.1173E+01
2	1969	1.000E+00	1.000E+00	0.0	3.120E+01	2.329E+01	0.29246	7.911E+00
3	1970	1.000E+00	1.000E+00	0.0	4.080E+01	1.937E+01	0.74490	2.143E+01
4	1971	1.000E+00	1.000E+00	0.0	9.400E+00	1.614E+01	-0.54072	-6.742E+00
5	1972	1.000E+00	1.000E+00	0.0	7.000E+00	1.331E+01	-0.64235	-6.307E+00
6	1973	1.000E+00	1.000E+00	0.0	7.800E+00	9.909E+00	-0.23932	-2.109E+00
7	1974	1.000E+00	1.000E+00	0.0	4.900E+00	6.891E+00	-0.34099	-1.991E+00
8	1975	1.000E+00	1.000E+00	0.0	6.700E+00	4.177E+00	0.47261	2.523E+00
9	1976	1.000E+00	1.000E+00	0.0	4.800E+00	1.782E+00	0.99096	3.018E+00
10	1977	1.000E+00	1.000E+00	0.0	1.600E+00	1.610E+00	-0.00611	-9.802E-03
11	1978	1.000E+00	1.000E+00	0.0	3.200E+00	2.021E+00	0.45968	1.179E+00
12	1979	1.000E+00	1.000E+00	0.0	4.400E+00	2.805E+00	0.45034	1.595E+00
13	1980	1.000E+00	1.000E+00	0.0	2.700E+00	3.567E+00	-0.27841	-8.668E-01
14	1981	1.000E+00	1.000E+00	0.0	3.000E+00	4.664E+00	-0.44125	-1.664E+00
15	1982	1.000E+00	1.000E+00	0.0	2.000E+00	5.634E+00	-1.03576	-3.634E+00
16	1983	1.000E+00	1.000E+00	0.0	4.200E+00	6.583E+00	-0.44944	-2.383E+00
17	1984	0.000E+00	0.000E+00	0.0	*	7.835E+00	0.00000	0.0
18	1985	0.000E+00	0.000E+00	0.0	*	8.427E+00	0.00000	0.0
19	1986	0.000E+00	0.000E+00	0.0	*	8.437E+00	0.00000	0.0
20	1987	0.000E+00	0.000E+00	0.0	*	8.150E+00	0.00000	0.0
21	1988	0.000E+00	0.000E+00	0.0	*	7.439E+00	0.00000	0.0
22	1989	0.000E+00	0.000E+00	0.0	*	7.904E+00	0.00000	0.0
23	1990	0.000E+00	0.000E+00	0.0	*	8.295E+00	0.00000	0.0
24	1991	0.000E+00	0.000E+00	0.0	*	7.963E+00	0.00000	0.0
25	1992	0.000E+00	0.000E+00	0.0	*	8.214E+00	0.00000	0.0
26	1993	0.000E+00	0.000E+00	0.0	*	8.588E+00	0.00000	0.0
27	1994	0.000E+00	0.000E+00	0.0	*	9.790E+00	0.00000	0.0
28	1995	0.000E+00	0.000E+00	0.0	*	1.073E+01	0.00000	0.0
29	1996	0.000E+00	0.000E+00	0.0	*	9.756E+00	0.00000	0.0
30	1997	0.000E+00	0.000E+00	0.0	*	7.024E+00	0.00000	0.0
31	1998	0.000E+00	0.000E+00	0.0	*	4.938E+00	0.00000	0.0
32	1999	0.000E+00	0.000E+00	0.0	*	4.074E+00	0.00000	0.0
33	2000	0.000E+00	0.000E+00	0.0	*	4.417E+00	0.00000	0.0
34	2001	0.000E+00	0.000E+00	0.0	*	4.508E+00	0.00000	0.0
35	2002	0.000E+00	0.000E+00	0.0	*	5.278E+00	0.00000	0.0
36	2003	0.000E+00	0.000E+00	0.0	*	6.802E+00	0.00000	0.0
37	2004	0.000E+00	0.000E+00	0.0	*	8.211E+00	0.00000	0.0
38	2005	0.000E+00	0.000E+00	0.0	*	9.461E+00	0.00000	0.0
39	2006	0.000E+00	0.000E+00	0.0	*	1.056E+01	0.00000	0.0

UNWEIGHTED LOG RESIDUAL PLOT FOR DATA SERIES # 2



RESULTS FOR DATA SERIES # 3 (NON-BOOTSTRAPPED)

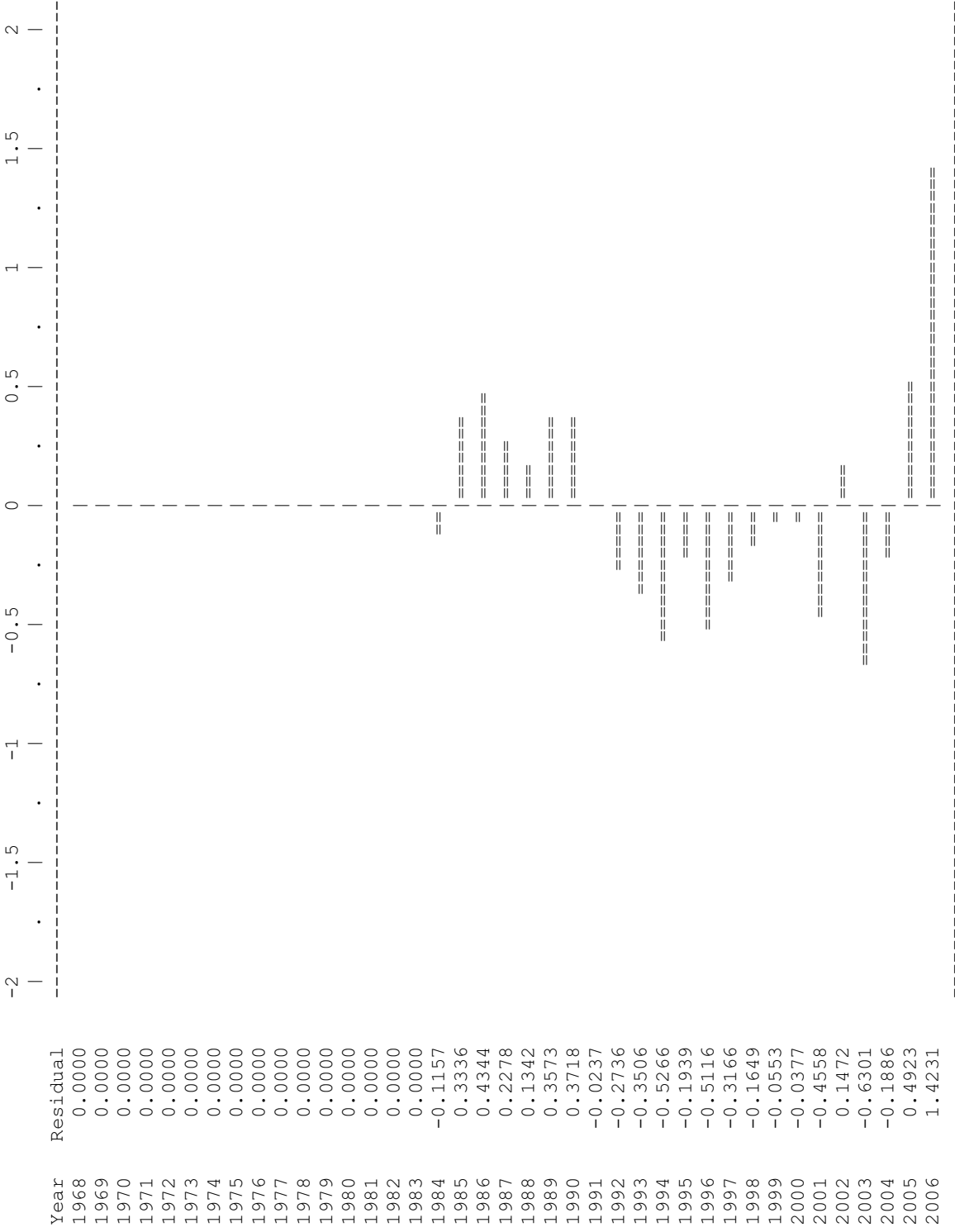
Summer Shrimp Survey

Data type I0: Start-of-year biomass index

Series weight: 1.379

Obs	Year	Observed effort	Estimated effort	Estim F	Observed index	Model index	Resid in log index	Resid in index
1	1968	0.000E+00	0.000E+00	0.0	*	3.621E+01	0.00000	0.0
2	1969	0.000E+00	0.000E+00	0.0	*	3.504E+01	0.00000	0.0
3	1970	0.000E+00	0.000E+00	0.0	*	2.914E+01	0.00000	0.0
4	1971	0.000E+00	0.000E+00	0.0	*	2.429E+01	0.00000	0.0
5	1972	0.000E+00	0.000E+00	0.0	*	2.002E+01	0.00000	0.0
6	1973	0.000E+00	0.000E+00	0.0	*	1.491E+01	0.00000	0.0
7	1974	0.000E+00	0.000E+00	0.0	*	1.037E+01	0.00000	0.0
8	1975	0.000E+00	0.000E+00	0.0	*	6.284E+00	0.00000	0.0
9	1976	0.000E+00	0.000E+00	0.0	*	2.681E+00	0.00000	0.0
10	1977	0.000E+00	0.000E+00	0.0	*	2.422E+00	0.00000	0.0
11	1978	0.000E+00	0.000E+00	0.0	*	3.040E+00	0.00000	0.0
12	1979	0.000E+00	0.000E+00	0.0	*	4.220E+00	0.00000	0.0
13	1980	0.000E+00	0.000E+00	0.0	*	5.366E+00	0.00000	0.0
14	1981	0.000E+00	0.000E+00	0.0	*	7.017E+00	0.00000	0.0
15	1982	0.000E+00	0.000E+00	0.0	*	8.477E+00	0.00000	0.0
16	1983	0.000E+00	0.000E+00	0.0	*	9.905E+00	0.00000	0.0
17	1984	1.000E+00	1.000E+00	0.0	1.050E+01	1.179E+01	-0.11570	-1.288E+00
18	1985	1.000E+00	1.000E+00	0.0	1.770E+01	1.268E+01	0.33362	5.021E+00
19	1986	1.000E+00	1.000E+00	0.0	1.960E+01	1.269E+01	0.43444	6.906E+00
20	1987	1.000E+00	1.000E+00	0.0	1.540E+01	1.226E+01	0.22780	3.137E+00
21	1988	1.000E+00	1.000E+00	0.0	1.280E+01	1.119E+01	0.13416	1.607E+00
22	1989	1.000E+00	1.000E+00	0.0	1.700E+01	1.189E+01	0.35734	5.108E+00
23	1990	1.000E+00	1.000E+00	0.0	1.810E+01	1.248E+01	0.37181	5.620E+00
24	1991	1.000E+00	1.000E+00	0.0	1.170E+01	1.198E+01	-0.02369	-2.805E-01
25	1992	1.000E+00	1.000E+00	0.0	9.400E+00	1.236E+01	-0.27357	-2.958E+00
26	1993	1.000E+00	1.000E+00	0.0	9.100E+00	1.292E+01	-0.35060	-3.821E+00
27	1994	1.000E+00	1.000E+00	0.0	8.700E+00	1.473E+01	-0.52657	-6.030E+00
28	1995	1.000E+00	1.000E+00	0.0	1.330E+01	1.615E+01	-0.19395	-2.847E+00
29	1996	1.000E+00	1.000E+00	0.0	8.800E+00	1.468E+01	-0.51164	-5.879E+00
30	1997	1.000E+00	1.000E+00	0.0	7.700E+00	1.057E+01	-0.31660	-2.868E+00
31	1998	1.000E+00	1.000E+00	0.0	6.300E+00	7.430E+00	-0.16494	-1.130E+00
32	1999	1.000E+00	1.000E+00	0.0	5.800E+00	6.130E+00	-0.05534	-3.300E-01
33	2000	1.000E+00	1.000E+00	0.0	6.400E+00	6.646E+00	-0.03766	-2.456E-01
34	2001	1.000E+00	1.000E+00	0.0	4.300E+00	6.783E+00	-0.45579	-2.483E+00
35	2002	1.000E+00	1.000E+00	0.0	9.200E+00	7.941E+00	0.14719	1.259E+00
36	2003	1.000E+00	1.000E+00	0.0	5.450E+00	1.023E+01	-0.63005	-4.783E+00
37	2004	1.000E+00	1.000E+00	0.0	1.023E+01	1.235E+01	-0.18862	-2.124E+00
38	2005	1.000E+00	1.000E+00	0.0	2.329E+01	1.423E+01	0.49235	9.055E+00
39	2006	1.000E+00	1.000E+00	0.0	6.595E+01	1.589E+01	1.42307	5.006E+01

UNWEIGHTED LOG RESIDUAL PLOT FOR DATA SERIES # 3



RESULTS OF BOOTSTRAPPED ANALYSIS

Param name	Point estimate	Estimated bias	Relative bias	Approx 80% lower CL	Approx 80% upper CL	Approx 50% lower CL	Approx 50% upper CL	Inter-quartile range	Relative IQ range
B1/Bmsy	1.484E+00	1.550E-02	1.04%	1.366E+00	1.565E+00	1.424E+00	1.514E+00	9.072E-02	0.061
K	6.021E+01	2.322E-01	0.39%	5.633E+01	6.695E+01	5.844E+01	6.337E+01	4.923E+00	0.082
r	3.584E-01	-1.849E-03	-0.52%	3.077E-01	4.033E-01	3.325E-01	3.816E-01	4.913E-02	0.137
q(1)	9.618E-02	-8.097E-04	-0.84%	7.689E-02	1.174E-01	8.659E-02	1.071E-01	2.051E-02	0.213
q(2)	5.393E-01	4.548E-03	0.84%	4.196E-01	6.964E-01	4.805E-01	6.245E-01	1.440E-01	0.267
q(3)	8.101E-01	-8.190E-04	-0.10%	6.501E-01	9.952E-01	7.267E-01	9.059E-01	1.792E-01	0.221
MSY	5.395E+00	-4.157E-02	-0.77%	5.088E+00	5.703E+00	5.269E+00	5.566E+00	2.968E-01	0.055
Ye(2007)	5.064E+00	-1.023E-01	-2.02%	4.484E+00	5.527E+00	4.802E+00	5.343E+00	5.402E-01	0.107
Bmsy	3.011E+01	1.161E-01	0.39%	2.817E+01	3.347E+01	2.922E+01	3.168E+01	2.461E+00	0.082
Fmsy	1.792E-01	-9.246E-04	-0.52%	1.538E-01	2.017E-01	1.662E-01	1.908E-01	2.456E-02	0.137
fmsy(1)	1.863E+00	3.226E-02	1.73%	1.605E+00	2.117E+00	1.707E+00	1.984E+00	2.771E-01	0.149
fmsy(2)	3.322E-01	4.402E-03	1.32%	2.708E-01	4.049E-01	2.972E-01	3.659E-01	6.868E-02	0.207
fmsy(3)	2.212E-01	2.450E-03	1.11%	1.893E-01	2.573E-01	2.035E-01	2.403E-01	3.678E-02	0.166
F(0.1)	1.613E-01	-8.321E-04	-0.46%	1.385E-01	1.815E-01	1.496E-01	1.717E-01	2.211E-02	0.137
Y(0.1)	5.341E+00	-4.115E-02	-0.76%	5.037E+00	5.646E+00	5.217E+00	5.510E+00	2.938E-01	0.055
B/Bmsy	7.523E-01	1.364E-02	1.81%	5.878E-01	9.313E-01	6.596E-01	8.462E-01	1.866E-01	0.248
F/Fmsy	4.957E-01	1.133E-02	2.29%	3.963E-01	6.374E-01	4.387E-01	5.677E-01	1.290E-01	0.260
Y-ratio	9.386E-01	-1.181E-02	-1.26%	8.301E-01	9.935E-01	8.850E-01	9.757E-01	9.072E-02	0.097
f0.1(1)	1.677E+00	2.904E-02	1.56%	1.445E+00	1.906E+00	1.536E+00	1.786E+00	2.494E-01	0.149
f0.1(2)	2.990E-01	3.962E-03	1.19%	2.438E-01	3.644E-01	2.675E-01	3.293E-01	6.182E-02	0.207
f0.1(3)	1.991E-01	2.205E-03	1.00%	1.704E-01	2.315E-01	1.831E-01	2.162E-01	3.310E-02	0.166
q2/q1	5.607E+00	1.566E-01	2.79%	4.497E+00	7.294E+00	4.973E+00	6.502E+00	1.530E+00	0.273
q3/q1	8.423E+00	1.431E-01	1.70%	7.033E+00	9.951E+00	7.526E+00	9.159E+00	1.633E+00	0.194

NOTES ON BOOTSTRAPPED ESTIMATES

- The bootstrapped results shown were computed from 1000 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.
- Estimates of bias and relative bias are known to be highly imprecise and may not be informative.

Trials replaced for lack of convergence: 0
Trials replaced for MSY out-of-bounds: 0
Trials replaced for r out-of-bounds: 0
Residual-adjustment factor: 1.0408