Stock assessment of

Chatham Rise smooth oreo (SSO4)

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Data and methods

- Data
- Model

Results

- Fit to data (selectivities, no cryptic)
- Posteriors
- Diagnostics (CPUE cv is already high)
- Sensitivities

Summary

Data

Biomass indices

CPUE series (pre- and post-GPS)	16 datapoints	lognormal error
Absolute acoustic survey series	2 datapoints	

Stock composition

C@L from commercial fishery	6 yrs $\times$ 2 sexes $\times$ 44 length bins	robust multinomial error
C@L from acoustic survey	1 yr $\times$ 2 sexes $\times$ 44 length bins	

Growth

L@A measurements	306 datapoints	lognormal error

Model

Software	Coleraine 4.4
Recruitment	deterministic Beverton-Holt
Selectivities	age-specific commercial, steep left-hand side length-specific survey, steep left-hand side
Catchability	separate pre-GPS and post-GPS CPUE, constant in time acoustic survey used as absolute biomass estimate
Growth	reparameterised von Bertalanffy (L_1, L_{80}, K)

Estimated parameters

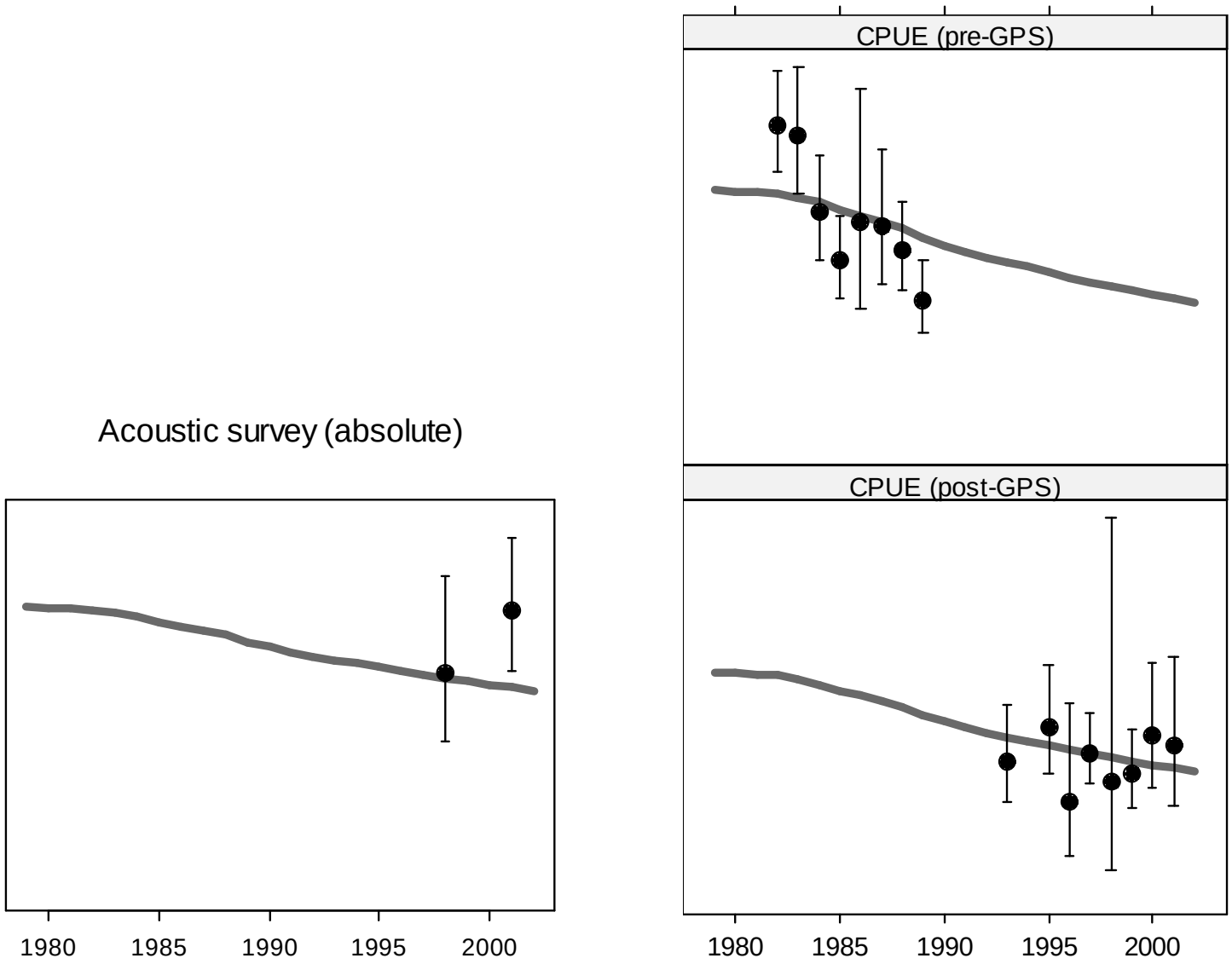
Base case

	R_0	expected recruitment of unfished population
	q_1	catchability coefficient for pre-GPS CPUE
	q_2	catchability coefficient for post-GPS CPUE
	S_{full}	age at full selectivity by commercial fishery
	A_{full}	age at full selectivity by acoustic survey
for each sex	L_{80}	expected length at age 80
for each sex	K	growth coefficient
for each sex	CV_{ratio}	uncertainty around length at age 80, as a ratio of the uncertainty around length at age 1

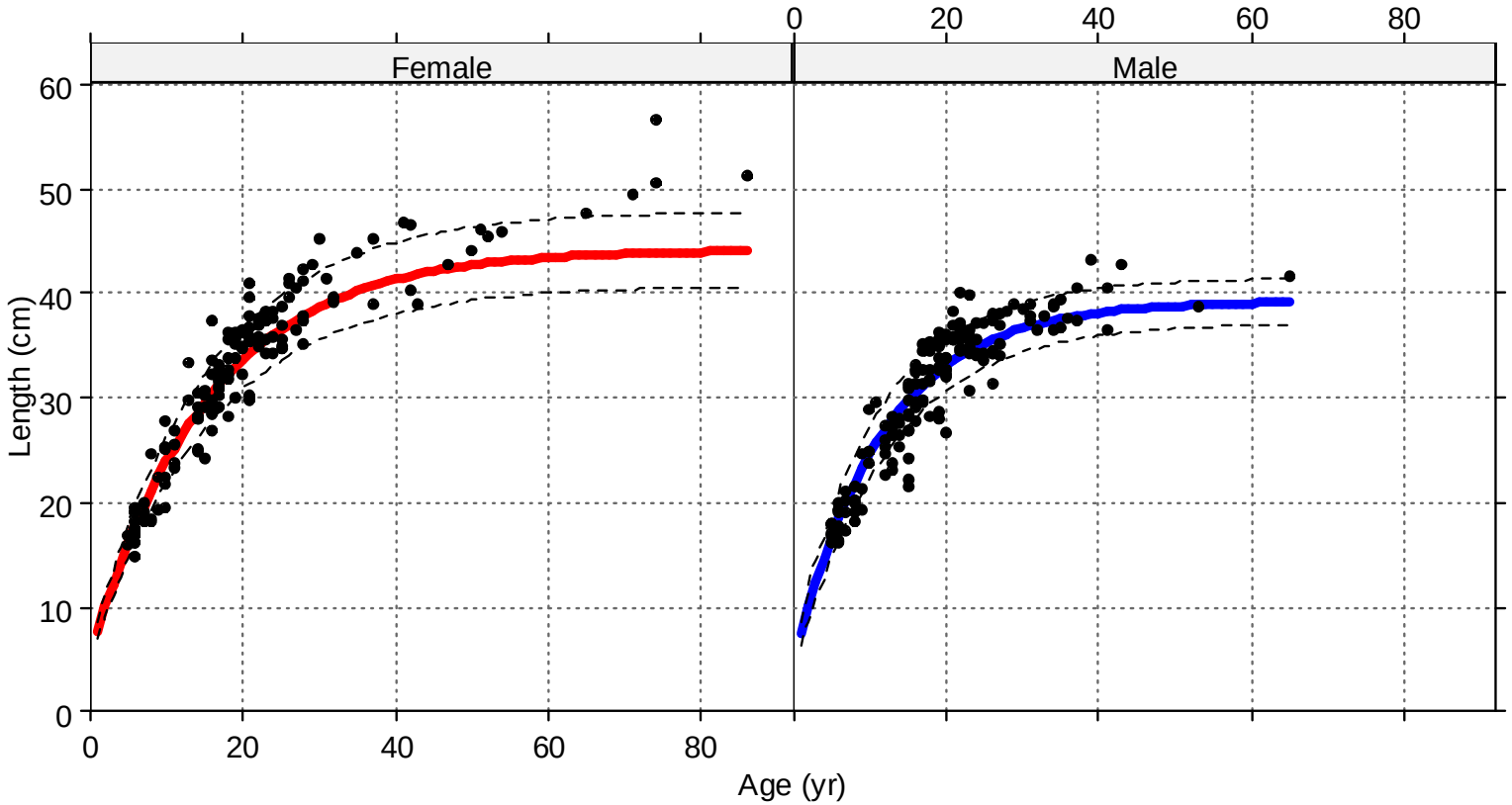
Sensitivities

for each sex	L_1	expected length at age 1
for each sex	CV_1	uncertainty around length at age 80
for each sex	M	natural mortality
	S_{left}	left hand selectivity (log σ^2) of commercial fishery
	A_{left}	left hand selectivity (log σ^2) of acoustic survey

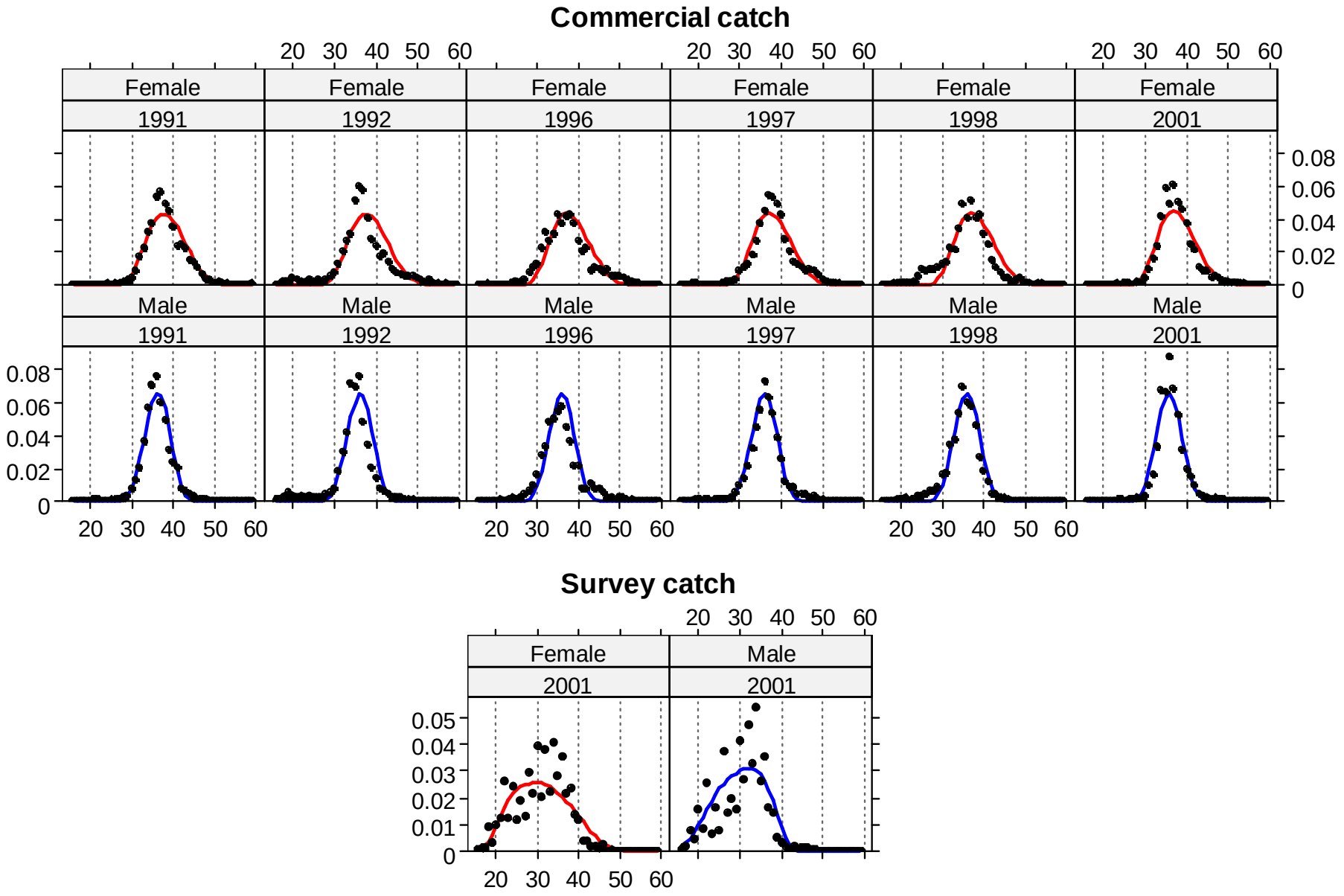
Base case fit to biomass indices



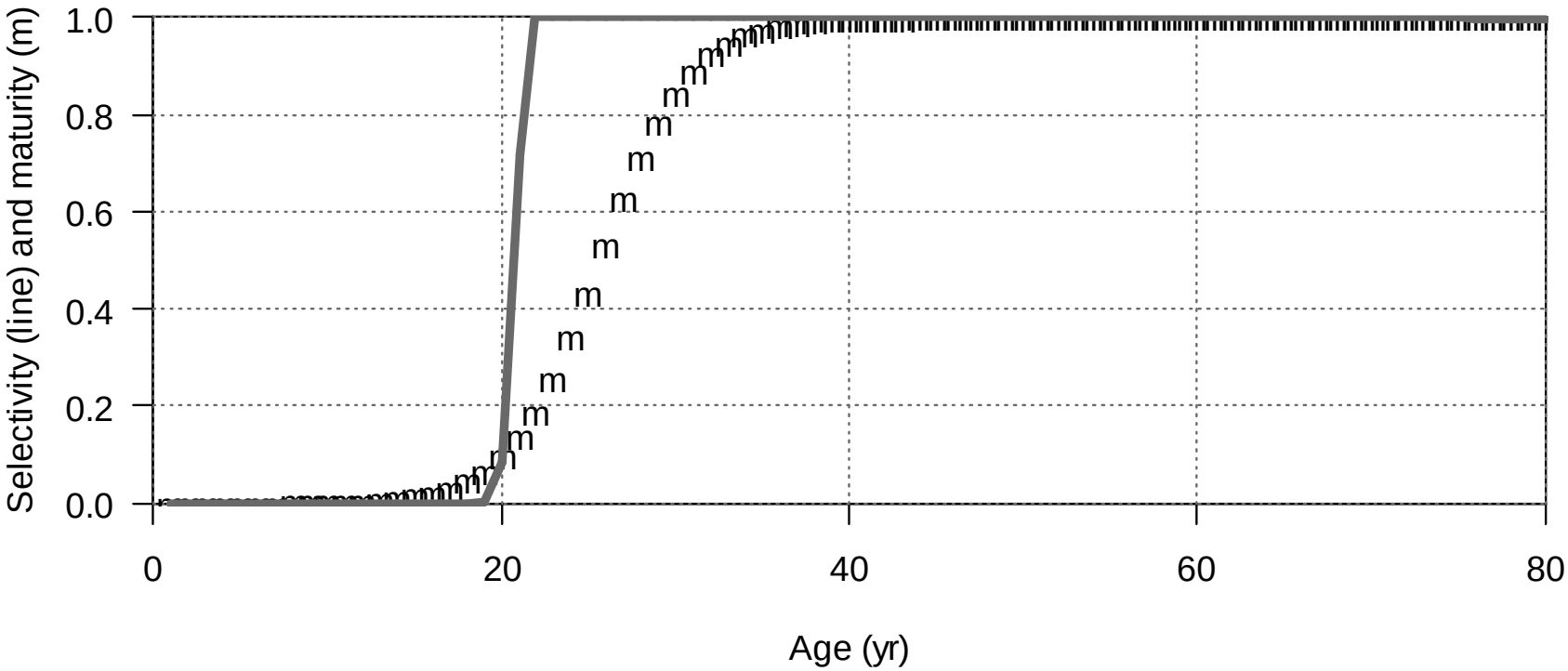
Base case fit to growth data



Base case fit to length frequencies

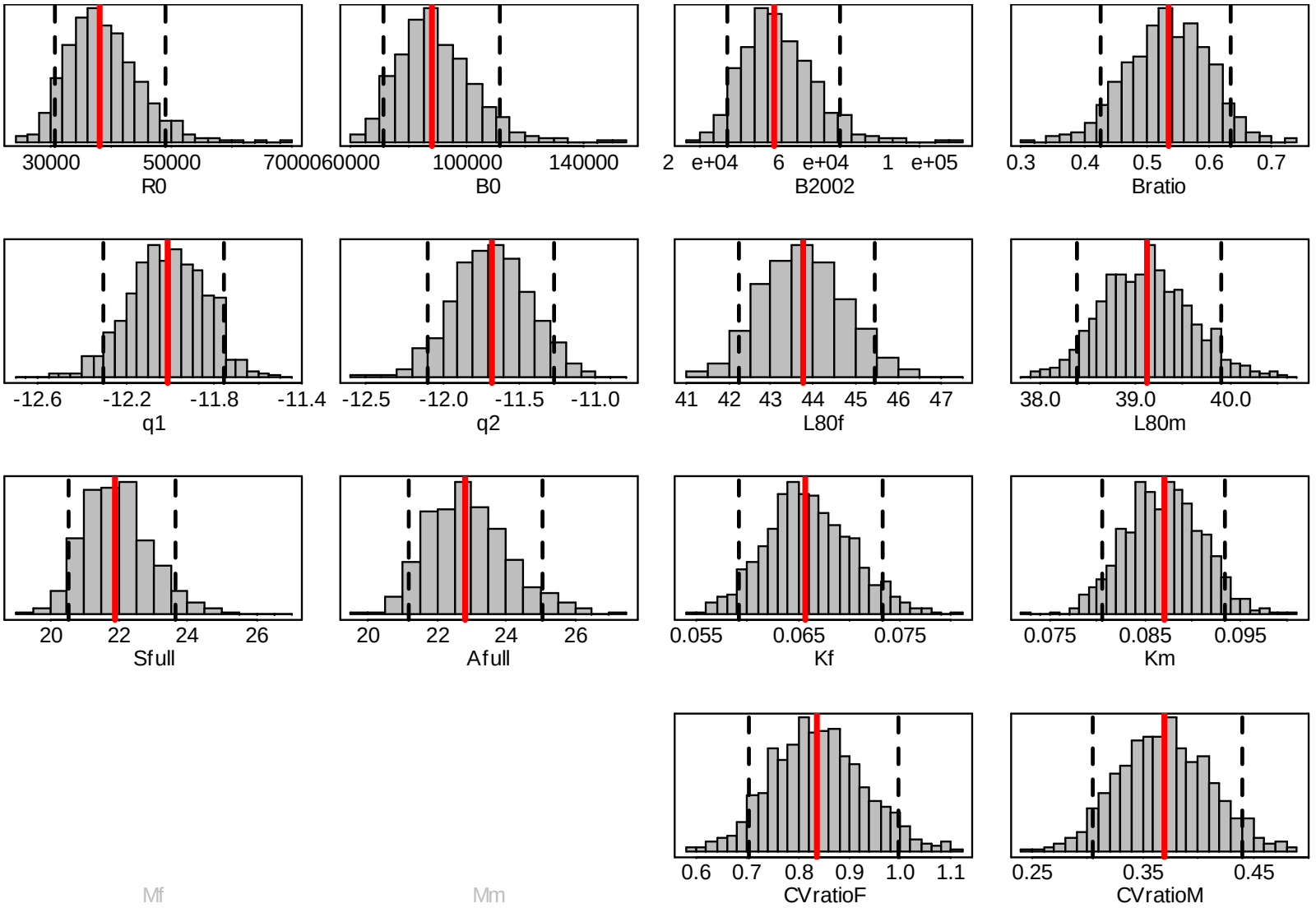


Selectivities and maturity

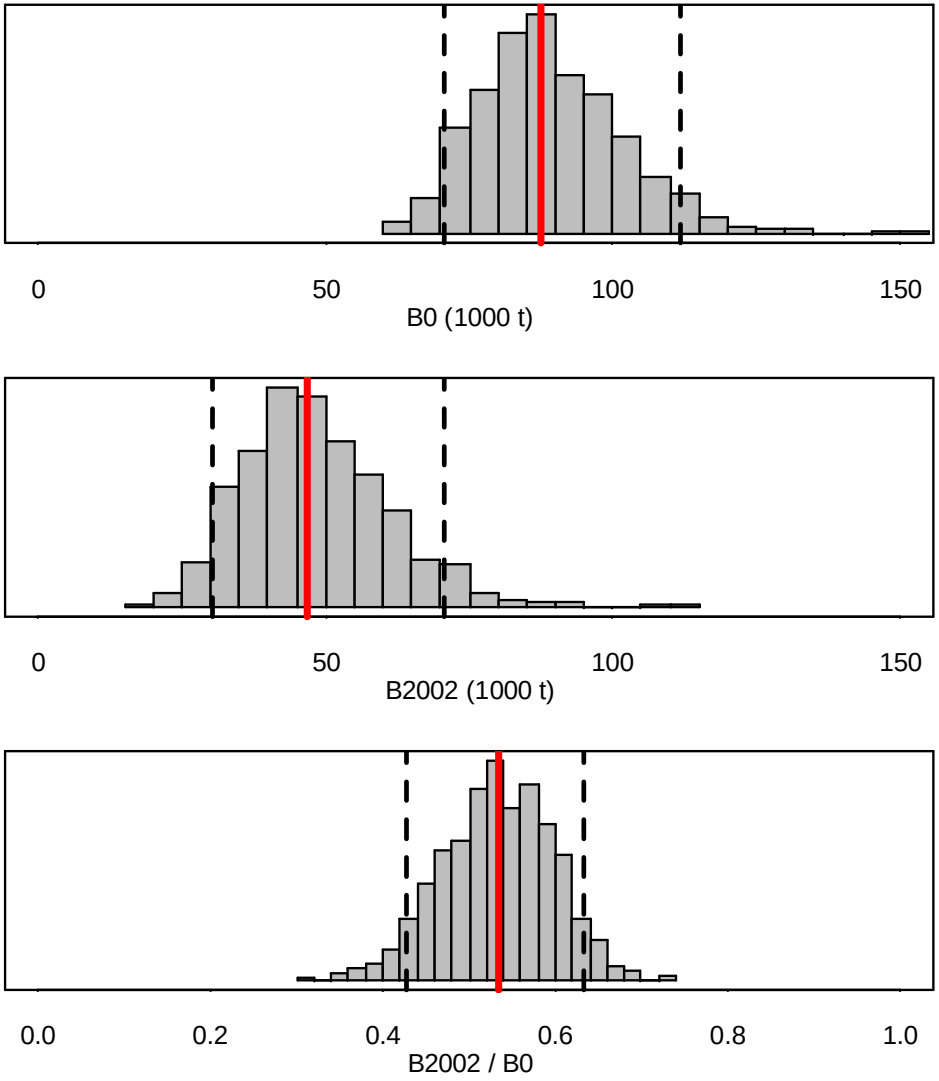


→ Practically all mature fish are available to fishery (no cryptic biomass)

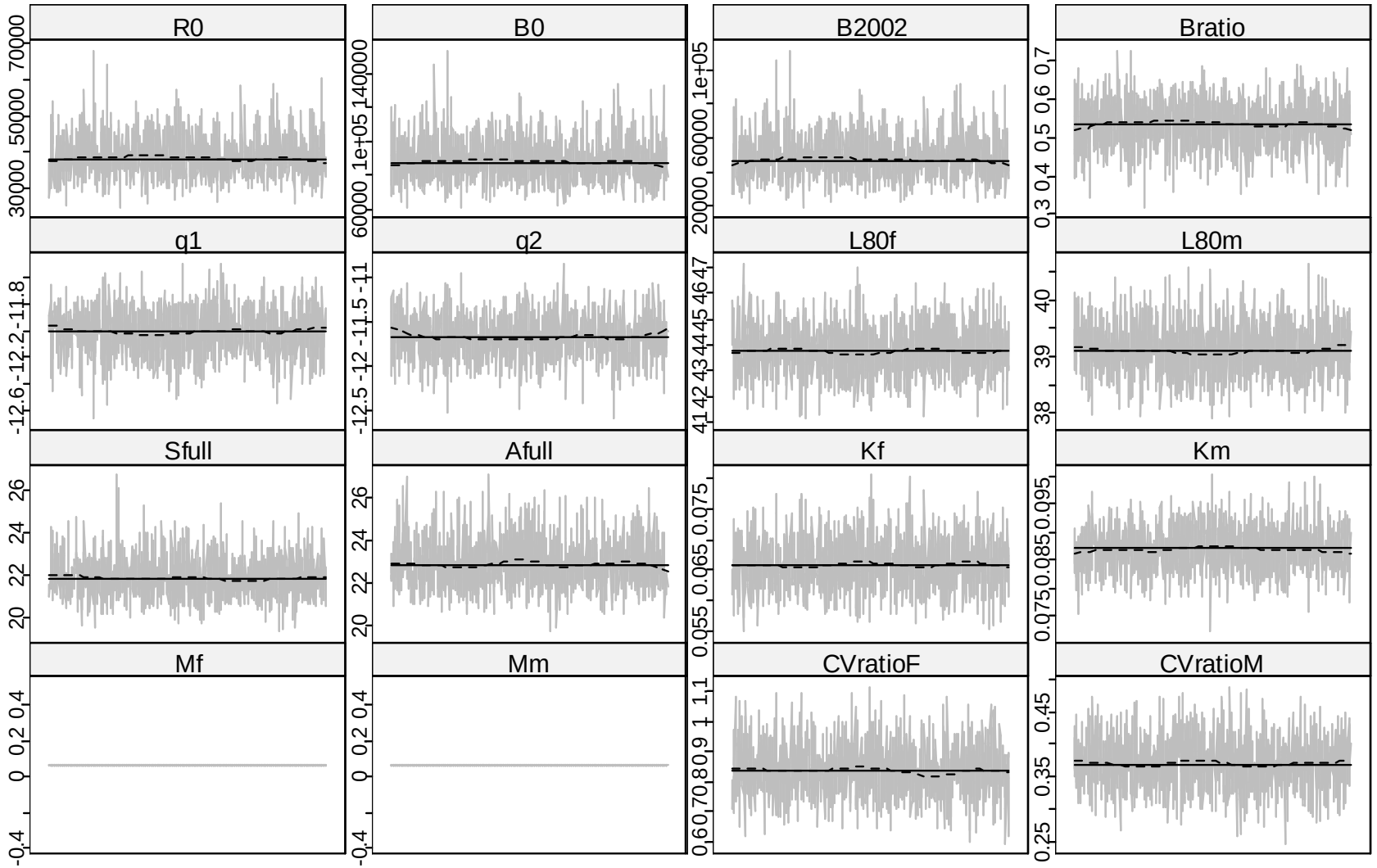
Bayesian posteriors



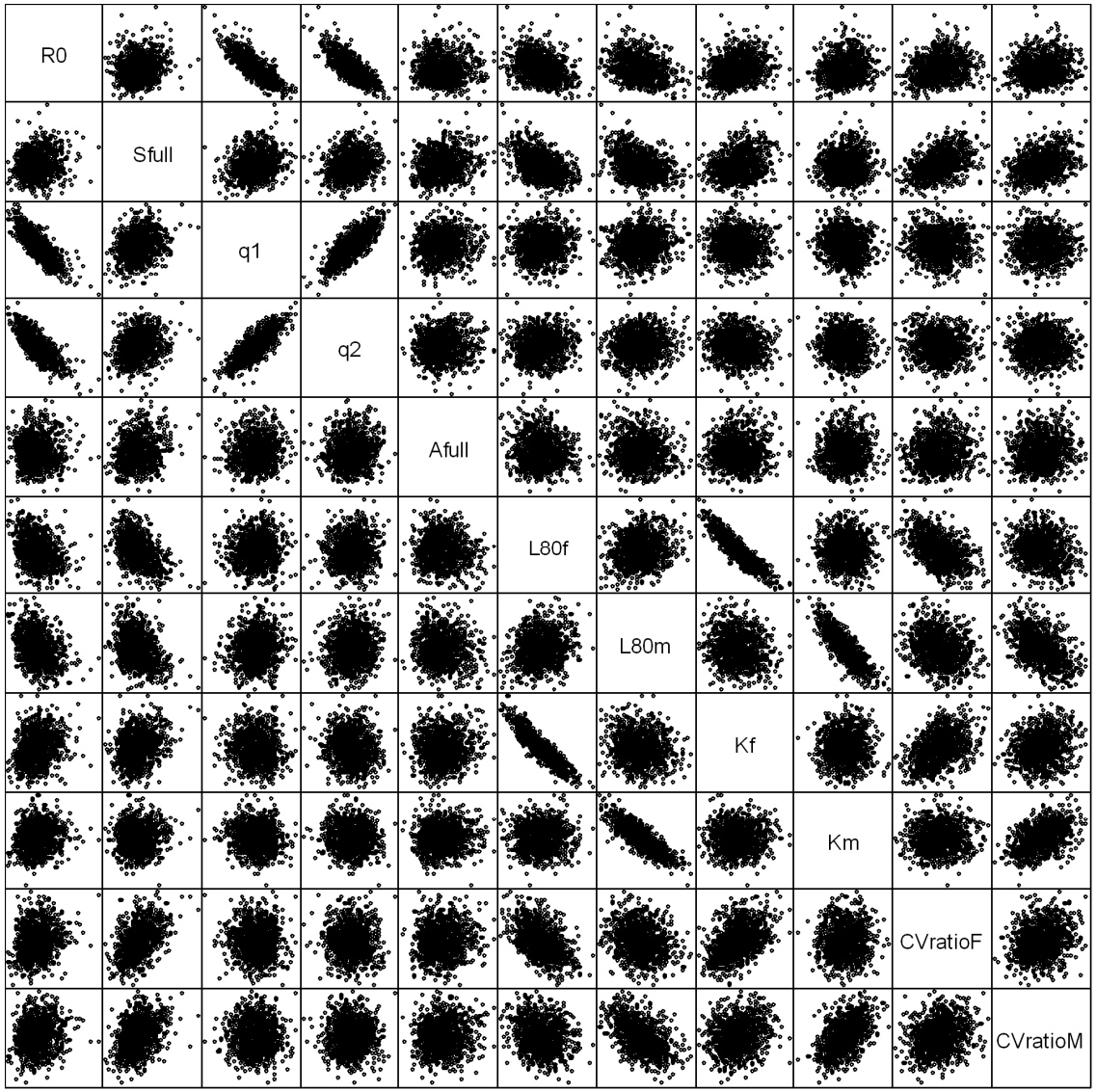
Bayesian posteriors



MCMC convergence



Parameter correlation



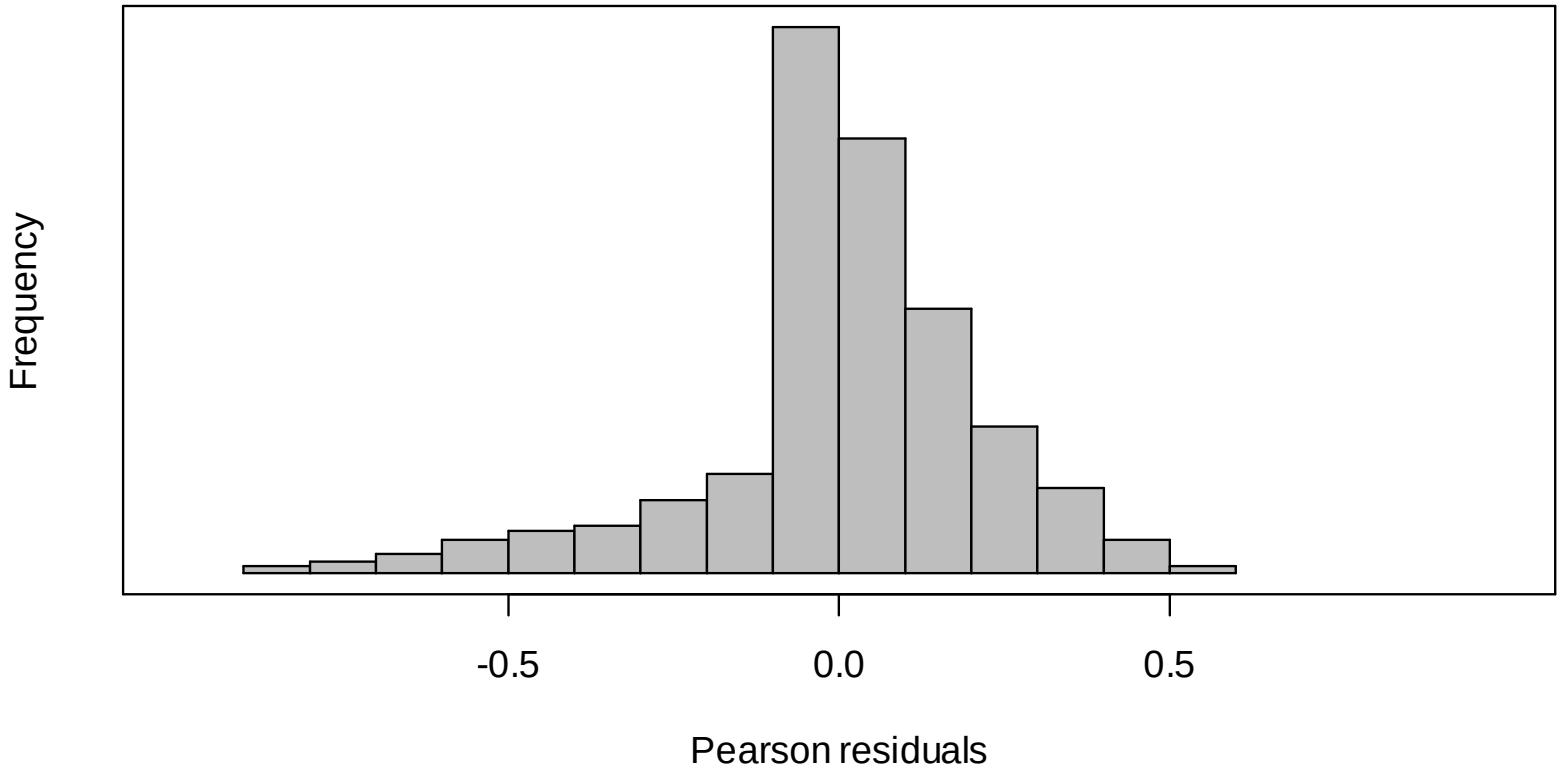
Diagnostics: CPUE process error

Standard deviation of Pearson residuals:

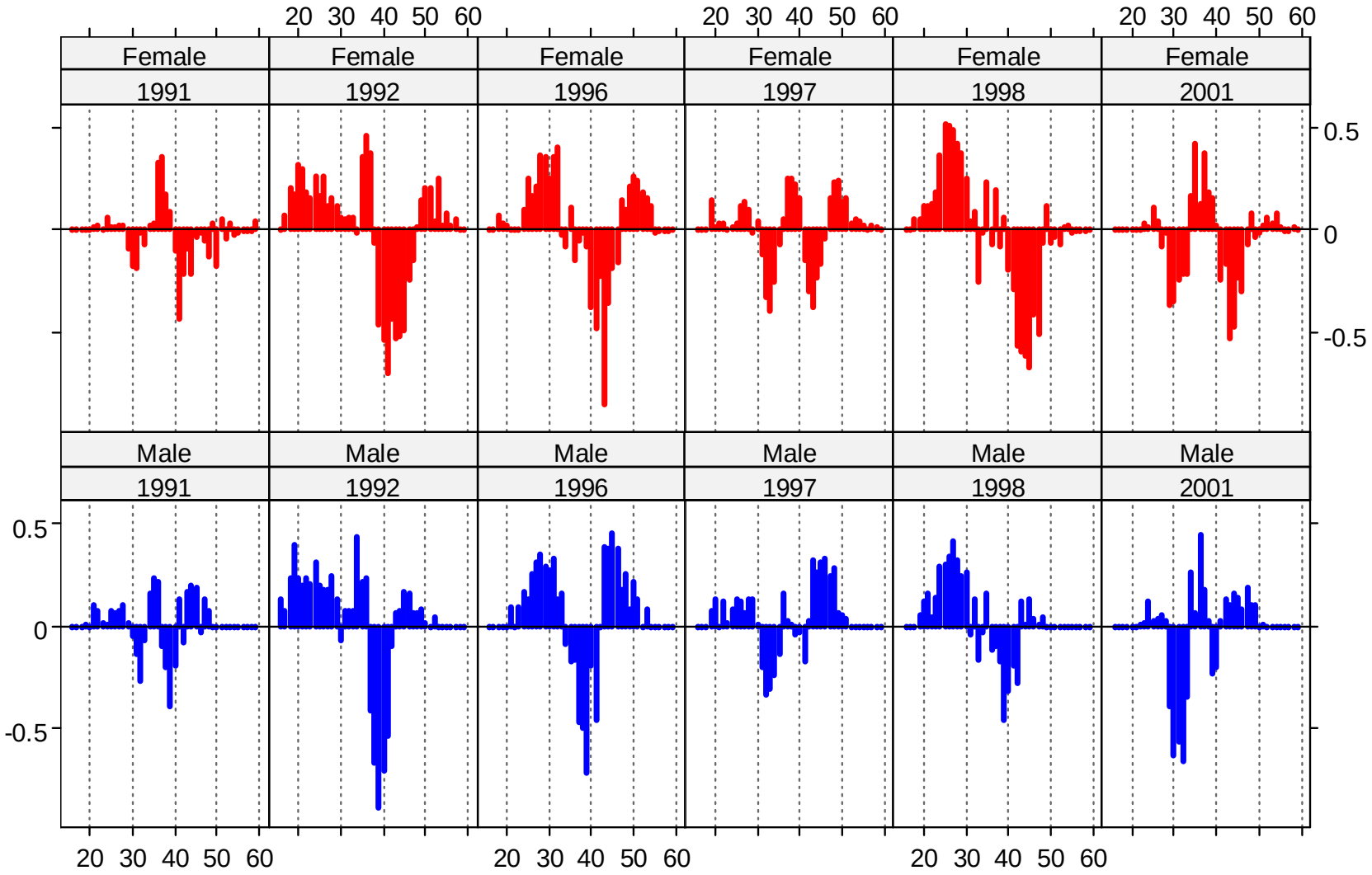
pre-GPS = 1.02
post-GPS = 0.81

Conclusion: keep CVs as they are

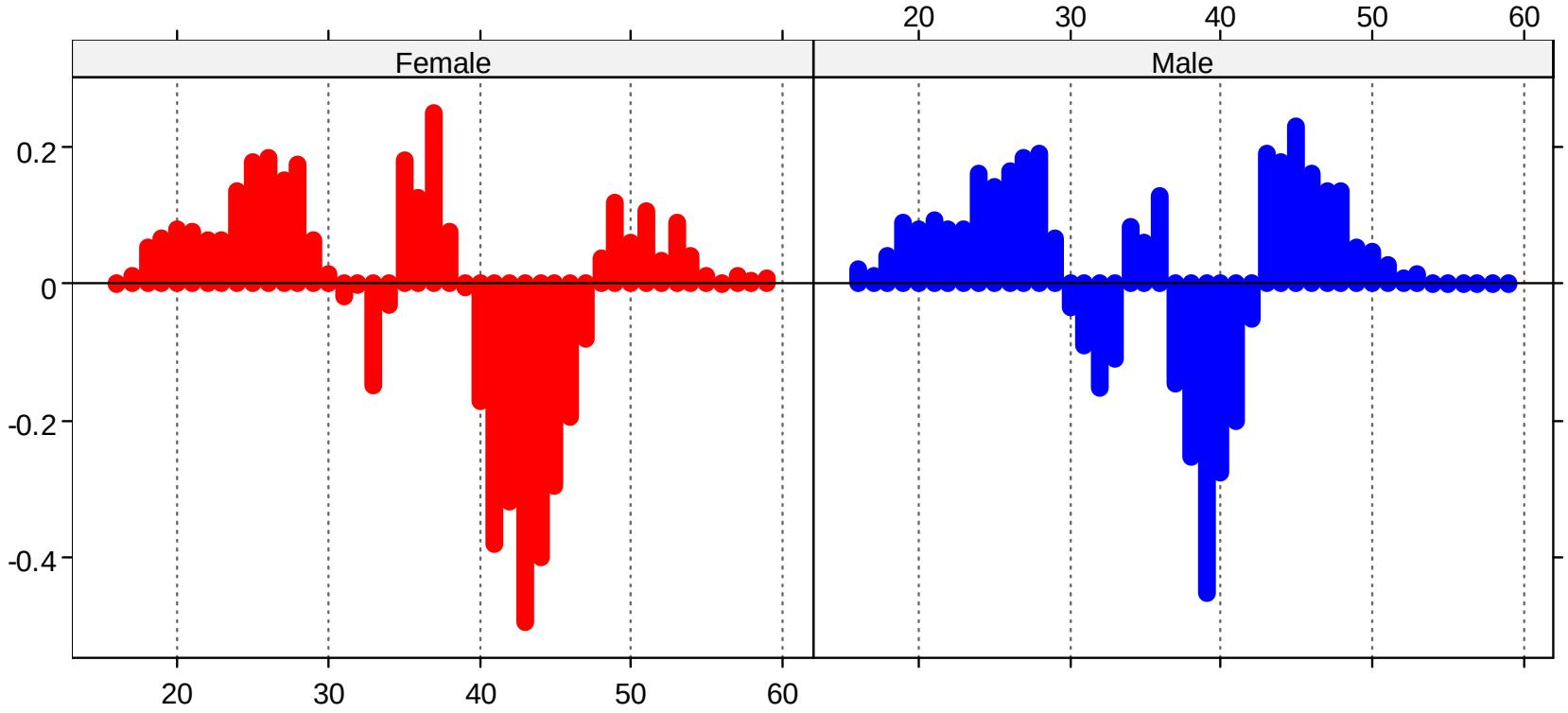
Diagnostics: C@L Pearson residuals



Diagnostics: C@L Pearson residuals



Diagnostics: C@L Pearson residuals



Average over years

Sensitivity cases

(1) Base	R_0 q_1 q_2 S_{full} A_{full} L_{80} K CV_{ratio}
(2) FixGrow	fix growth parameters at MPD
(3) logM	estimate M with a lognormal prior, CV=0.3
(4) NoCL	turn off likelihood and fix selectivity at MPD

Effect of LF data

	6 yrs LF data	3 yrs LF data	1 yrs LF data	no LF data
Likelihood				
Total	**150.9**	**148.5**	**146.6**	**145.1**
PreGPS CPUE	3.6	3.5	3.6	3.5
PostGPS CPUE	0.6	0.7	0.7	0.6
Acoustic survey	1.0	2.0	3.0	1.8
Commercial C@L	-1397.4	-697.0	-238.4	0.0
Acoustic C@L	-216.3	-215.4	-215.0	-211.9
L@A female	170.9	168.3	165.7	163.1
L@A male	191.0	189.5	188.5	188.0
Penalties	0.0	0.0	0.0	0.0
Estimated parameters				
R0	36939	33415	30808	32434
M female	0.063	0.063	0.063	0.063
M male	0.063	0.063	0.063	0.063
Sfull	21.6	21.6	22.5	21.6
Afull	24.9	24.4	24.2	22.8
Aleft	2.3	2.1	2.0	1.1
q PreGPS CPUE (10^{-6})	6.14	6.64	7.33	6.38
q PostGPS CPUE (10^{-6})	8.58	9.62	11.14	9.13
Linf female	44.2	45.2	46.4	48.2
K female	0.07	0.06	0.06	0.06
t0 female	-1.94	-2.00	-2.07	-2.13
cv1 female	0.10	0.10	0.10	0.10
cv80 female	0.08	0.08	0.07	0.06
(Linf male)	39.2	39.8	40.2	40.5
K male	0.09	0.08	0.08	0.08
(t0 male)	-1.43	-1.48	-1.52	-1.55
cv1 male	0.16	0.16	0.16	0.16
cv80 male	0.06	0.05	0.05	0.05
Derived parameters				
B0	85976	80666	77657	87316
B1979	85976	80666	77657	87316
B2002	45158	39371	35244	43610
B2002 / B0	**53%**	**49%**	**45%**	**50%**

Sensitivity cases

	Base	FixGrow	logM	NoCL
Likelihood				
Total	**-1246.4**	**-1222.8**	**-1256.7**	**145.1**
PreGPS CPUE	3.6	2.9	3.5	3.5
PostGPS CPUE	0.6	0.9	0.6	0.6
Acoustic survey	0.9	10.7	0.4	1.7
Commercial C@L	-1397.3	-1374.5	-1400.7	
Acoustic C@L	-216.1	-211.9	-214.0	-211.8
L@A female	170.8	162.5	163.0	163.1
L@A male	191.0	186.7	187.0	188.0
Penalties			3.6	
Estimated parameters				
R0	37022	22640	144089	32480
M female	0.063	0.063	0.111	0.063
M male	0.063	0.063	0.112	0.063
Sfull	21.6	20.4	21.8	21.6
Afull	22.4	22.3	27.2	22.0
q PreGPS CPUE (10^{-6})	6.10	8.55	7.62	6.36
q PostGPS CPUE (10^{-6})	8.51	14.65	10.30	9.10
Linf female	44.2	49.7	48.7	48.2
K female	0.07	0.05	0.05	0.06
t0 female	-1.94	-2.21	-2.19	-2.13
cv1 female	0.10	0.10	0.10	0.10
cv80 female	0.08	0.06	0.07	0.06
(Linf male)	39.3	41.9	41.4	40.5
K male	0.09	0.07	0.08	0.08
(t0 male)	-1.42	-1.69	-1.61	-1.55
cv1 male	0.16	0.16	0.16	0.16
cv80 male	0.06	0.05	0.05	0.05
Derived parameters				
B0	86299	63933	64028	87457
B1979	86299	63933	64028	87457
B2002	45482	20994	34794	43759
B2002 / B0	**53%**	**33%**	**54%**	**50%**