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Report from Panel meeting Held at NOAA Alaska Fisheries Laboratory, Seattle, 20-23 July 2004

The Panel Members Jim Ianelli, John Pope, Ray Hilborn, and Ana Parma, together with the Consultant Vivian Haist met in Seattle on 20-23 July 2004 to examine results from the mechanical update to the operating model (reference set) and to consider alternatives that might result in an improved reference set.

Introduction

The meeting took place a few days after Vivian Haist (VH) had completed the Mechanical Update (MU), including running the six scenarios selected to span the likely range of steepness and omega (curvature in the relationship of the yield per recruit to population size) parameters. The initial plan was to examine the results of the MU, propose alternatives and attempt to evaluate MCMC performance on them during the meeting. This process was compressed since time was unavailable prior to the meeting to examine the MU and the sensitivity to alternative assumptions, and because individual MCMC runs took about 36 hours to run.

Consideration of the mechanical update

The first task was to investigate whether or not the MU (an update including new data, constructed in the same way as the April 2004 reference set, except for changes noted in Appendix 1) was satisfactory as a new reference set. At the beginning of the meeting it became apparent that there were a number of problems with the MU. These were:

1) Natural mortality estimates seemed unrealistically high and with unrealistically low CVs (uncertainty). I.e., M10= 0.17 for runs with low h, omega 1, M10=0.16 for med h, omega 1, and M10= 0.16 for high h, omega 1.
2) Steepness estimates were very near the upper bound in three of the six scenarios that compose the reference set. Thus, there appeared to be too much information about steepness through constraints imposed by the model structure.
3) MCMC runs that start with the steepness parameter at the upper bound (where the variance on h was changed manually) moved away from the bound but did not explore the full interval on steepness (as was the case when the original scenarios were developed).
4) Selectivity for Indonesian fishery was estimated to be monotonically increasing from age 10 through age 30.
5) The error bounds on the low recruitment estimates for year classes 2000-2001 appeared to be unrealistically narrow given that they must be based upon rather little data.

The Panel therefore concluded that the performance of the MU was unsatisfactory, the causes of this needed to be investigated as far as possible in the time available and that another basis was needed to construct the reference set. Given the tight time line it was also concluded that, if possible, the reference set would need to be constructed from the minimum number of MCMC runs which could span the (previously) agreed range of steepness and omega values and any other important issues. This would alleviate having to do MCMC runs for each of the 6 combinations for ranges of steepness and omega. A number of sensitivity runs were conducted over the week beginning from a base model where steepness was given a truncated (0.3-0.8) normal prior with mean 0.55 and standard deviation equal to 0.1 (in later analyses, the standard deviation was increased to 0.3). Omega was fixed at one for the sensitivity runs and in a second stage it was estimated as a bounded parameter [0.75-1] with a normal prior with mean 0.875 and standard deviation equal to 0.1.

Sensitivity analyses

Several aspects of the model were explored; the table below shows a subset of all the runs conducted.

	Sample Size	Tagging Wt	Aus Sel Curv. Wt	Aus VarSel	LL1 Var Sel	SD h Prior	MaxAge Ind Sel	Prior M10	Omega Prior
Mod10_0	MU	MU	MU	MU	MU	0.1	30	0.1	Fixed, 1.0
Mod10_1a	Reduced	MU	MU	MU	MU	0.1	30	0.1	Fixed, 1.0
Mod10_1b	Reduced	Half	MU	MU	MU	0.1	30	0.1	Fixed, 1.0
Mod10_1c	Reduced	Half	low	MU	MU	0.1	30	0.1	Fixed, 1.0
Mod10_1d	Reduced	Half	low	Yearly from 97	MU	0.1	30	0.1	Fixed, 1.0
Mod10_1e	Reduced	Half	low	Yearly from 97	Yearly from 97	0.1	30	0.1	Fixed, 1.0
Mod10_1f	Reduced	Half	low	MU	Yearly from 97	0.1	30	0.1	Fixed, 1.0
Mod10_1g	Reduced	Nil	low	Yearly from 97	MU	0.1	30	0.1	Fixed, 1.0
Mod10_1h	Reduced	Quarter	low	Yearly from 97	MU	0.1	30	0.1	Fixed, 1.0
Mod10_1i	Reduced	Quarter	low	Yearly from 97	MU	0.3	30	0.1	Fixed, 1.0
Mod10_1j	Reduced	Nil	low	Yearly from 97	MU	0.3	30	0.1	Fixed, 1.0
Mod10_1k	Reduced	Quarter	low	Yearly from 97	MU	0.3	22	0.1	Fixed, 1.0
Mod10_1l	Reduced	Quarter	low	MU	MU	0.3	22	0.1	Fixed, 1.0
Mod10_1m	Reduced	Nil	low	MU	MU	0.3	22	0.1	Fixed, 1.0
Mod10_1n	Reduced	Nil	low	Yearly from 97	MU	0.3	22	0.1	Fixed, 1.0
Mod10_1o	Reduced	Nil	low	MU	MU	0.3	30	0.1	Fixed, 1.0
Mod10_1p	Reduced	Nil	low	Every 3 years	MU	0.3	30	0.1	Fixed, 1.0
Mod10_1q	Reduced	Nil	low	Yearly from 97	MU	0.3	30	0.13	Fixed, 1.0
Mod10_1r	Reduced	Quarter	low	MU	MU	0.3	22	0.1 fixed	Fixed, 1.0
Mod10_1s	Reduced	Nil	low	MU	MU	0.3	22	0.13 fixed	Fixed, 1.0
Mod10_1t	Reduced	Nil	low	Yearly from 97	MU	0.3	30	0.13 fixed	Fixed, 1.0
Mod11_1u	Reduced	Nil	low	Yearly from 97	MU	0.3	30	$N(0.1, 0.06^2)$	Estimated
Mod11_1v	Reduced	Quarter	low	Yearly from 97	MU	0.3	22	$N(0.1, 0.06^2)$	Estimated
Mod12_1o	Reduced	Nil	low	MU	MU	0.3	30	$N(0.1, 0.03^2)$	Estimated

Results for the baseline model Mod10_0 (same as MU, Med1 scenario but with expanded range on steepness, *h*, from 0.3 – 0.8) shared some basic problems with the MU (Fig. 1), namely:

- selectivity for LL1 becomes flat instead of dome-shaped
- selectivity for the Indonesian fishery monotonically increases to age 30
- M10 =0.16, very large

- Recruitment for 2000 and 2001 very low and with tight bounds (overly precise estimates)

Accordingly, we thought that Mod10_0 was an adequate basis as a single scenario to conduct the sensitivity tests, instead of the integrated set prepared from the six scenarios. As explained below, sensitivity tests were conducted using sbtmod10.tpl, a new version of the conditioning code in which the penalty for curvature in selectivities is applied every year (as opposed to only when selectivity changes). Appropriate weights were given to these penalties to produce the same effect as in the old code. Also, the variance for the prior on h used for the final runs discussed here was increased from 0.1^2 to 0.3^2 in an attempt to span the desired h range with the single scenario. Details for the different runs are shown in the table above. MPD results for a subset of those are summarized in Appendix 2.

Sample sizes for age-size composition data

We considered that the sample sizes for some of the size composition data in the final years (e.g., n=500 for LL1) were too large to be used in conjunction with constrained changes in selectivity as assumed in the model. We reduced sample sizes for all age and length compositions by taking sqrt of n times 5. This transformation retains some of the relative magnitude and reduces the contrast in sample sizes over time. Confidence bounds for recruitment (as approximated from the Hessian) were wider in this run (mod10_1a). The choice of sample sizes was arbitrary and we suggest that a potentially preferable alternative would be a log-normal likelihood with SD equal to that of the multinomial CV for the given sample sizes plus an additive term to account for process error. There was no time to explore this option during the meeting.

Curvature of selectivities

We found that the results were sensitive to the assumptions regarding smoothness in the Australian selectivities and also the intervals between selectivity changes. The code was not set up to allow exploration of effects of curvature penalties together with effects of changing selectivities over time because the curvature penalty was applied only in the years where the selectivity changed, which created interactions. Version **sbtmod10** was created to fix this problem by applying the curvature penalty every year independently of whether or not there was a change in selectivity. In order to obtain results consistent with previous results, the parameters sel_smooth_sd_f read from the input data file were multiplied by a factor= sqrt(number of years/number of changes). In the runs labeled as “low” Asutralian selectivity curvature weight, the penalty was reduced by multiplying the input SD by 10.

Weight given to tagging data

During the course of the meeting it became apparent that the tagging data could be causing problems, resulting in unrealistically tight confidence bounds for some parameters. As acknowledged in previous meetings, the way tagging data are applied is inappropriate because:

- reporting rates are assumed known and based on several assumptions that may not hold,
- recoveries are lumped over all releases.

Weights given to tagging data were reduced to 1/2,1/4th, and nil in sensitivity trials. Some of the fits obtained when nil weight was given to tagging data resulted in much lower M10 values. This lead us to believe that the tagging data was forcing the high M10 values and in turn leading to some of the other problems in the base run. However, these low-M10 estimates were later found to be interactions that led to a local minima solution. A lower minimum similar to the high-M10 runs was later found under nil weighted tagging data options (see **Mod10_1j** and **Mod10_1k** in Appendix 2).

Unfortunately, the false convergence was detected at the end of the meeting, when the model was modified to allow for estimation of the CPUE-omega parameter (sbtmod11). We decided to finish the MCMC runs that had been started with and without tagging data in order to provide a means for evaluating uncertainty under those conditions. Similar to the runs done with omega=1, the two runs with estimated omega (**Mod11_1v** and **Mod11_1u**) failed to show the intended contrast in M10 estimates and historical biomass trends (Figs. 3 and 4). Both show a very tight distribution of M10 with most runs between 0.17 and 0.20. The run based on the tagging data (mod11_1v) resulted in lower recent recruitment and spawning biomasses than the one without tagging (mod11_1u) and, not surprisingly, had narrower confidence bounds.

Shape of Indonesian selectivity

It has been very noticeable in recent years that the Indonesian fishery on spawning SBT has increasingly caught a greater proportion of younger fish. This observation might result from increased depletion of older fish, from an increased influx of younger fish or from redirection of the Indonesian SBT catch toward younger ages. The SBT catch in the Indonesian fishery is taken as bycatch in bigeye and yellowfin tuna fisheries. Anecdotal evidence suggests that changes in these fisheries may be shifting the size distribution of SBT catch in Indonesia towards younger fish. This possibility was investigated by fitting the model with selectivity in the Indonesian fishery being freed to change every year and by relaxing the constraint on the curvature of its selectivity. Neither of these modifications led to meaningful changes in the shape of the estimated selectivity curves for the Indonesian fishery.

In order to prevent the monotonic increase in selectivity obtained in the base run (Fig. 1), we constrained it to be flat over the range of ages 22 and older (runs **1k** through **1n**) and used this assumptions to generate one of the reference MCMC sets (PANEL_tag.mcmc = **Mod11_1v,** Fig. 2). Because flat (and increasing) selectivity appeared to favor high M10 values, in order to generate scenarios with lower natural mortalities, we did some runs estimating selectivity parameters up to age 30 as in the MU. The set PANEL_notag.mcmc (Figs. 5 and 6) is based on this assumption.

Inspection of a sample of LL1 and Indonesian selectivities from the MCMC set showed very un-smoothed selectivities. This suggests that the curvature penalties, while they may be adequate for the point estimates, do not seem to be effective for MCMCs. This problem may also affect other fisheries. The alternative of using functional forms may be preferable for MCMCs and should be explored farther.

Numerical problems and model structure

Vivian Haist had noted issues related to the local minima found for this model. Biomass values that are too low (i.e., not enough to sustain the observed catches) during minimization of the likelihood are frequent, and can cause numerical problems. The form of the catch equations used may limit solutions at the low biomass end, i.e., if alternative catch equations were used, lower abundance estimates may be possible for both mpd's (some fits) and certainly in the MCMC's.

Low recruitment estimates in 2000-2001

For the old reference case scenarios stock-recruitment auto-correlation (a value of ρ estimated empirically based on years 1965-1995) was forced in the model, beginning with the 1999 residual depending on the value of the 1998 residual. The 1998 recruitment residuals were all large negative throughout all MCMC chains. Vivian did a series of runs using the old data and model med1 specifications, except that the years (1989 and later) in which LL1 selectivity changed were modified. The MPD results were very sensitive to the assumptions about LL1 selectivity, as shown below:

S-R residuals when the years in which LL1 selectivity can change are modified.

	years LL1 sel changes	Obj Function	S-R residuals (tau's) 1993	1995	1995	1996	1997	1998	1999	2000	2001
med1	1989, 1993, 1997	775.95	-0.58	-0.05	-0.25	0.41	-0.43	-0.96	-0.57	-0.32	-0.18
med16	1990, 1995, 2000	752.92	-0.63	-0.01	0.03	1.00	0.46	-0.17	-0.12	-0.07	-0.04
med17	1990, 1997	777.05	-0.57	0.05	-0.04	0.70	-0.07	-0.58	-0.36	-0.21	-0.12

The new data resulted instead in low recruitment estimates in 2000 and 2001. We explored a number of model configurations to examine the effect on recent recruitment point estimates. Based on the previous results, we allowed selectivity of LL1 to vary every year for 1990-2003 with a CV=1, using weights as in 1b (see Table). Point estimates did not vary by much. Recruitments were higher in the 1990s and the selectivity was picking up some year class effects, but recruitments in 2000-2001 were still low relative to neighboring years. The recruitment pattern was also unchanged when the Australian selectivity was allowed to vary yearly since 1997 with CV=2.

After failing to remove the low recruitment estimates by changing structural assumptions in the model, we explored the effect of removing the last few years of different data sets. The following shows those that resulted in the largest change to the 2000 and 2001 recruitment residuals. These runs were based on the Base_1b model/data configuration.

Data configuration	SR residual 2000	2001
Base_1b	-0.81	-0.93
No 2002/2003 LL1	-0.64	-0.67
No 2002/2003 LL2	-0.90	-0.84
No 2002/2003 LL1 and No 2002/2003 LL2	-0.18	0.05

It appears that, in combination, the two last years of size composition data for LL1 and LL2, both of which show few small fish (< 102 cm), result in estimated weak 2000-2001 year classes.

Uncertainty axes and MCMCs

MCMCs were taking approximately 36 hours for a million trials, which is pushing the limits of feasibility for doing six separate scenarios. We thought that replacing the three steepness scenarios by a single one would be highly desirable. Our results indicate that MCMC runs done with the current model structure seem to adequately cover the range of steepness values considered reasonable. Performance of management procedures for more or less productive scenarios could still be explored by post-stratifying the posterior distributions.

Along the same line, we thought we might integrate the omega parameter in the single MCMC run by allowing it to be estimated within the bounds used as discrete scenarios in the old reference set. This was done in model sbtmod11.tpl. The two final MCMCs selected (with and without tag data) were run using this option. The marginal posterior for omega is centered around 0.8 and gives low probability to omega=1 (Figs. 3 and 6).

Where we ended up

Having rejected the mechanical update runs we spent the week striving for an acceptable replacement set of runs that could serve as the basis for evaluating MP's if the process were to conclude with a recommendation in October 2004. We attempted to produce two main scenarios that spanned the range of steepness and omega parameters, one with high M10 values as in the base run, and the other corresponding to a lower M10 and higher biomasses. These scenarios correspond to the last two rows in the table and were as follows.

(1) PANEL_tag.mcmc, produced with model/input data Mod11_1v:
Uses tagging data, Indonesian selectivity flat after age 22, prior on $M10 \sim N(0.1, 0.06^2)$, prior on $h \sim N(0.55, 0.3^2)$.

(2) PANEL_notag.mcmc, produced with model/input data Mod12_1o:
Nil weight to tagging data, Indonesian selectivity estimated up to age 33, prior on $M10 \sim N(0.1, 0.03^2)$.

At the end of the meeting we could only explore early MCMC performance of scenario (1) for Mod11_1v, which was found acceptable. We believe that PANEL_tag.mcmc is an improvement compared to the mechanical update; however, we felt that it fails to span an adequate range of mortality values. The second scenario without tagging and a tighter prior on M10 explored a broader range of values for steepness and M10 than the scenario with tagging data. However, the trace on M10 shows a gradual shift towards higher values indicating lack of convergence.

The need to produce MCMC runs by the end of the meeting meant that we were very constrained by time. The new data had a strong impact on model results, which will need to be examined in the light of the assessment results presented at the SAG. We feel that the conditioning options need to be further explored and discussed with all participants before deciding on whether it is worth tuning the MPs using these two scenarios.

If the MP process is to be completed this year, and the CCSBT is to make a decision on a MP at their October meeting, then we see no alternative but to use these two scenarios as the basis for the tuning and evaluation of MP's as the SAG/SC would not allow sufficient time to conduct new MCMCs, tune the MPs and evaluate results. This, however, is problematic, given that there has been no prior discussion of these scenarios and the impact of the addition of new data on conditioning results, that there were a number of changes in prior assumptions and some of these were arbitrary (e.g., modification of sample sizes used for length and age frequency data sets), and that other changes in model structure will be needed to improve performance. If further exploration of possible scenarios is required, this will necessitate extending the timeline for the evaluation and recommendation of MPs into 2005.

Appendix 1. Decisions about structure for Mechanical Update (MU)
Conditioning Code

Item:	Current structure:	Structure for "mechanical update:
"hardwired" autocorrelation in S-R residuals	empirical AC based on 1965-1995 estimates is applied from 1998 onward	empirical AC based on 1965-1998 estimates is applied from 2001 onward
length-at-age (and CV of length-at-age)	input arrays (and eq'n for cv's)	do not update with new length-at-age data; use 2001 length-at-age for 2002 and 2003
getting median CPUE value	Each of 5 CPUE series standardized to mean 1 over 1969-2000 period. Then median selected	Standardize over 1969-2003.
selectivity changes for LL1 and Aussie surface fisheries	every 4 yrs, except last change in 1997 continues through 2001	every 4 yrs, with change in 1997 and 2001 (last block will be 3 yrs)
sample weights for length freq. and age freq. data	variable over time	maintain weights used for 2000 data for 2001-2003 These are: LL1 length 500 LL2 length 50 LL3 length 0.7 Indo. age 300 Aussie age 15.7

Projection Code:

Item:	Current structure:	Structure for “mechanical update:
Projection period	2002-2032	2004-2032 , i.e. do not extend projection, keep same final year (and same year for tuning)
autocorrelation in S-R residuals	empirical, based on 1965-1995 estimates	Empirical based on 1965-1998
autocorrelation in CPUE residuals	empirical, based on 1969-2000 estimates	empirical, based on 1969-2003 estimates
st. dev. of S-R residuals	empirical, based on 1965-1995 estimates	Empirical based on 1965-1998
add targeting to Aussie surface fishery when prop. age 3 (as fraction of ages 1 to 5) is < historic average	historic average based on 1991-2000	historic average based on 1994-2003
Catch split for 4 fisheries	based on 1998-2001 averages	based on last 3 yrs (2001-2003)

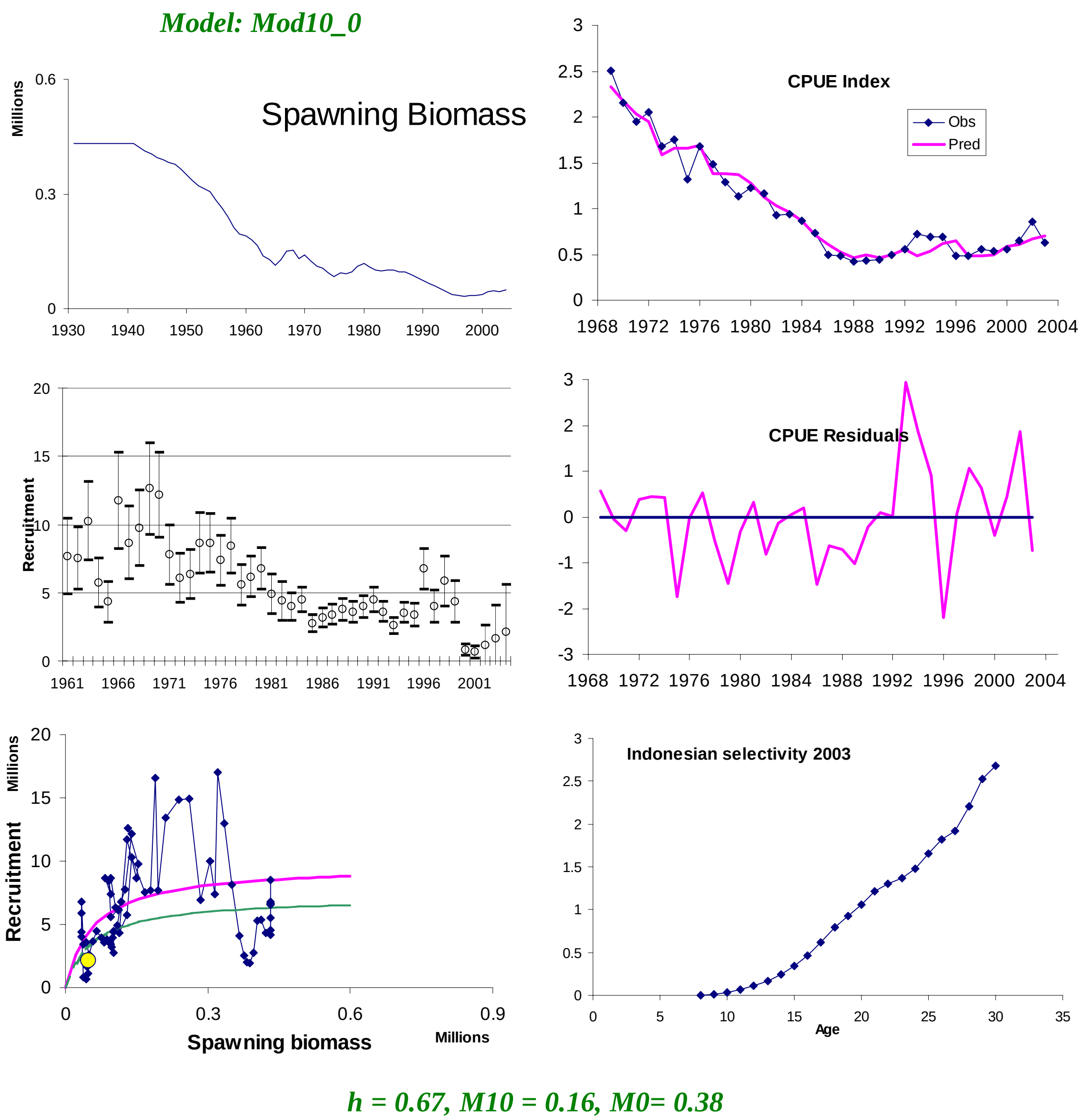
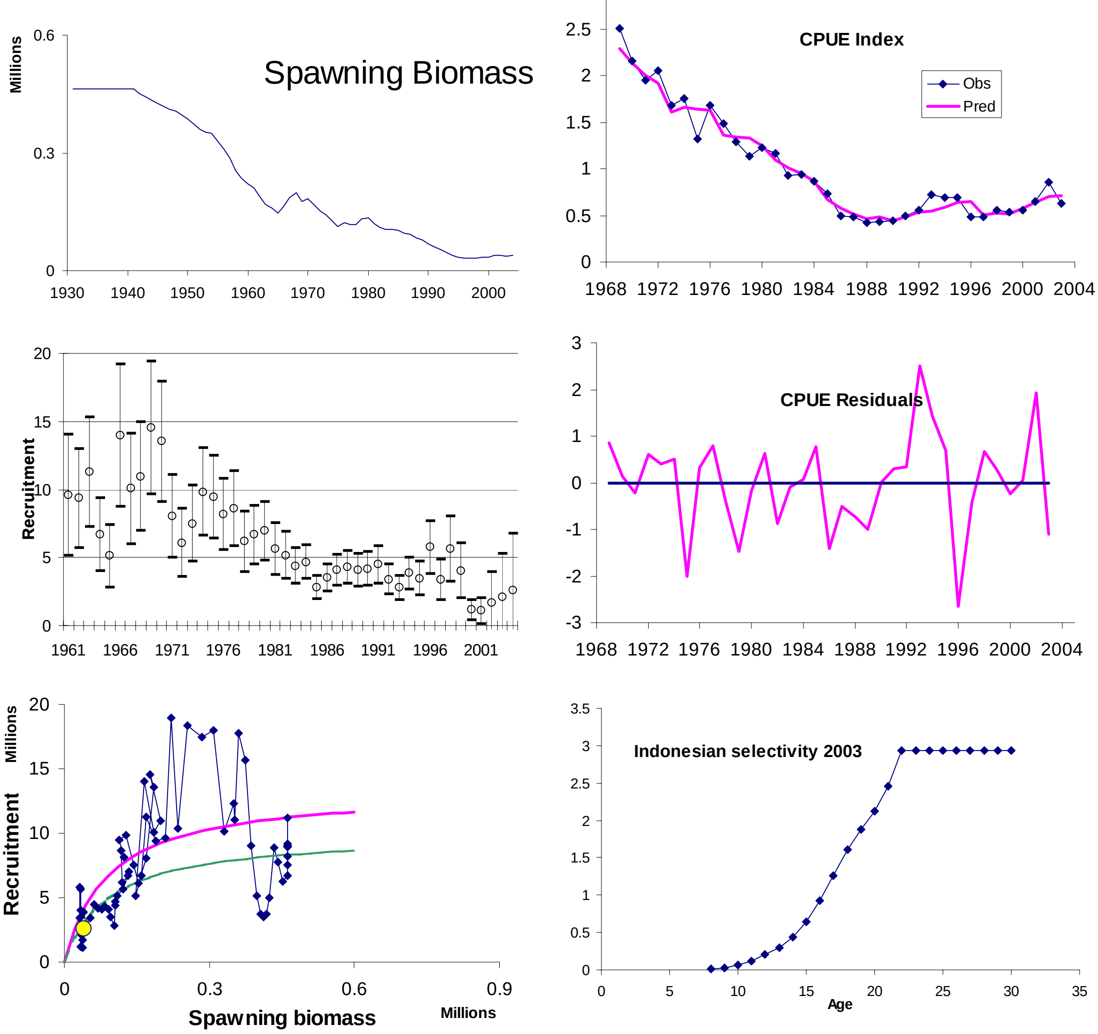


Figure 1. MPD fits for model mod10_0 used as a bases for sensitivity analyses. Error bars around recruitment correspond to MPDs ± 2 standard deviations as approximated from Hessian.

Model: PANEL_tag.mcmc



h = 0.60, M10 = 0.17, M0= 0.40

Figure 2. MPD fits for model PANEL_tag.mcmc (mod11_1v.dat). Error bars around recruitment correspond to MPDs ± 2 standard deviations as approximated from Hessian.

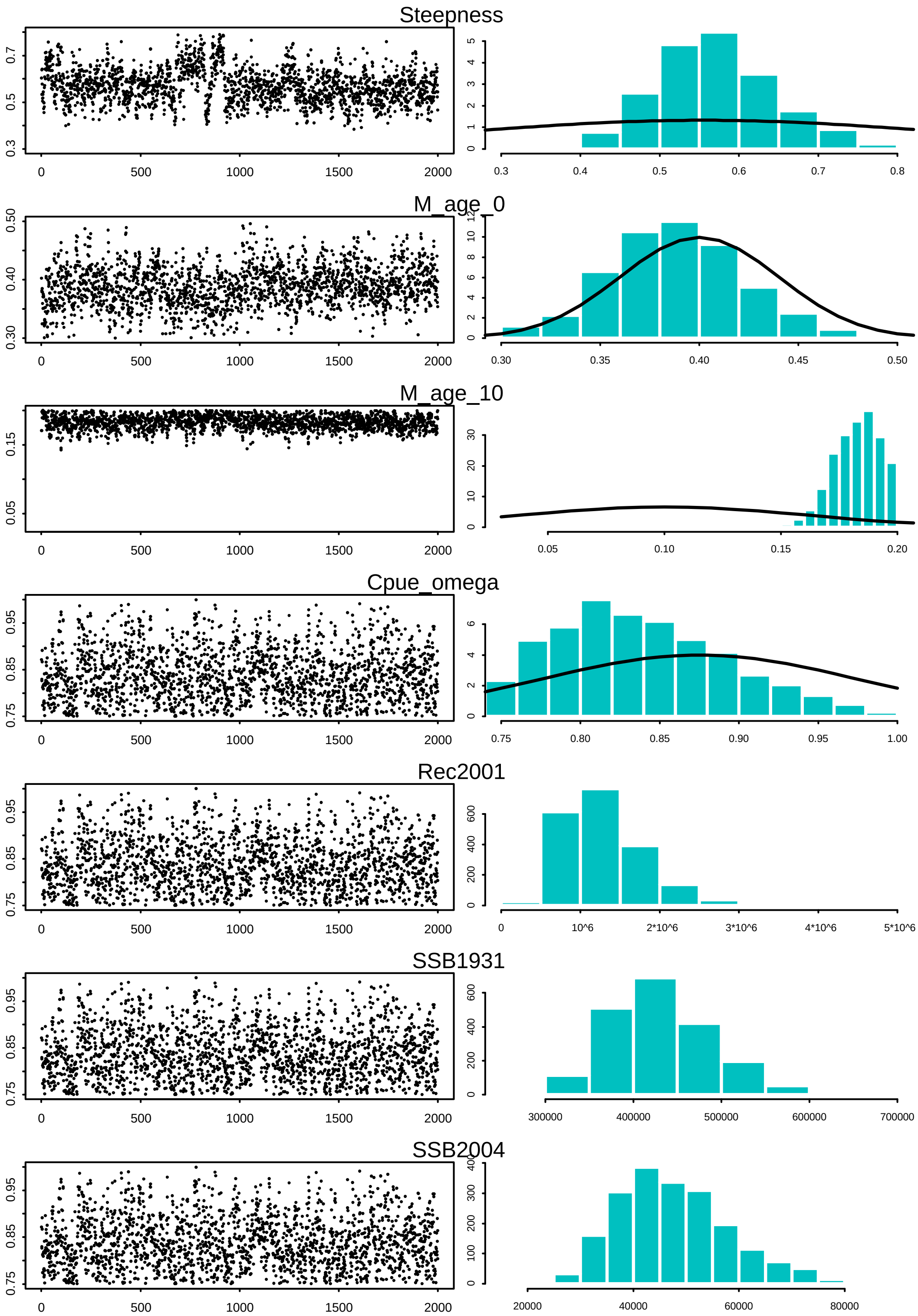


Figure 3. Parameter traces and posterior distributions of selected parameter for the mod11_1v (Panel_tag.mcmc). The prior distributions for fundamental parameters are shown with the black lines.

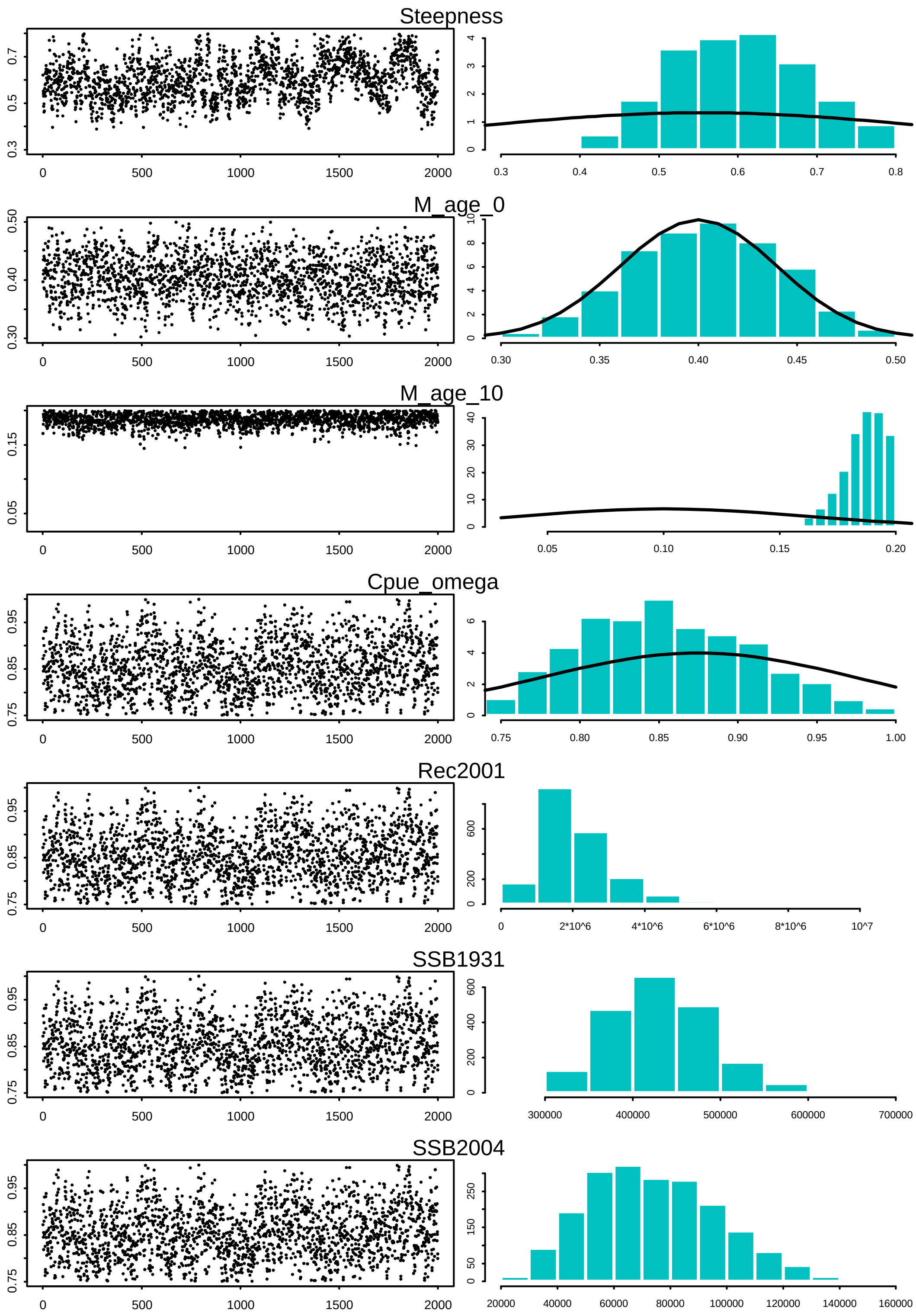


Figure 4. Parameter traces and posterior distributions of selected parameter for the mod11_1u. The prior distributions for fundamental parameters are shown with the black lines.

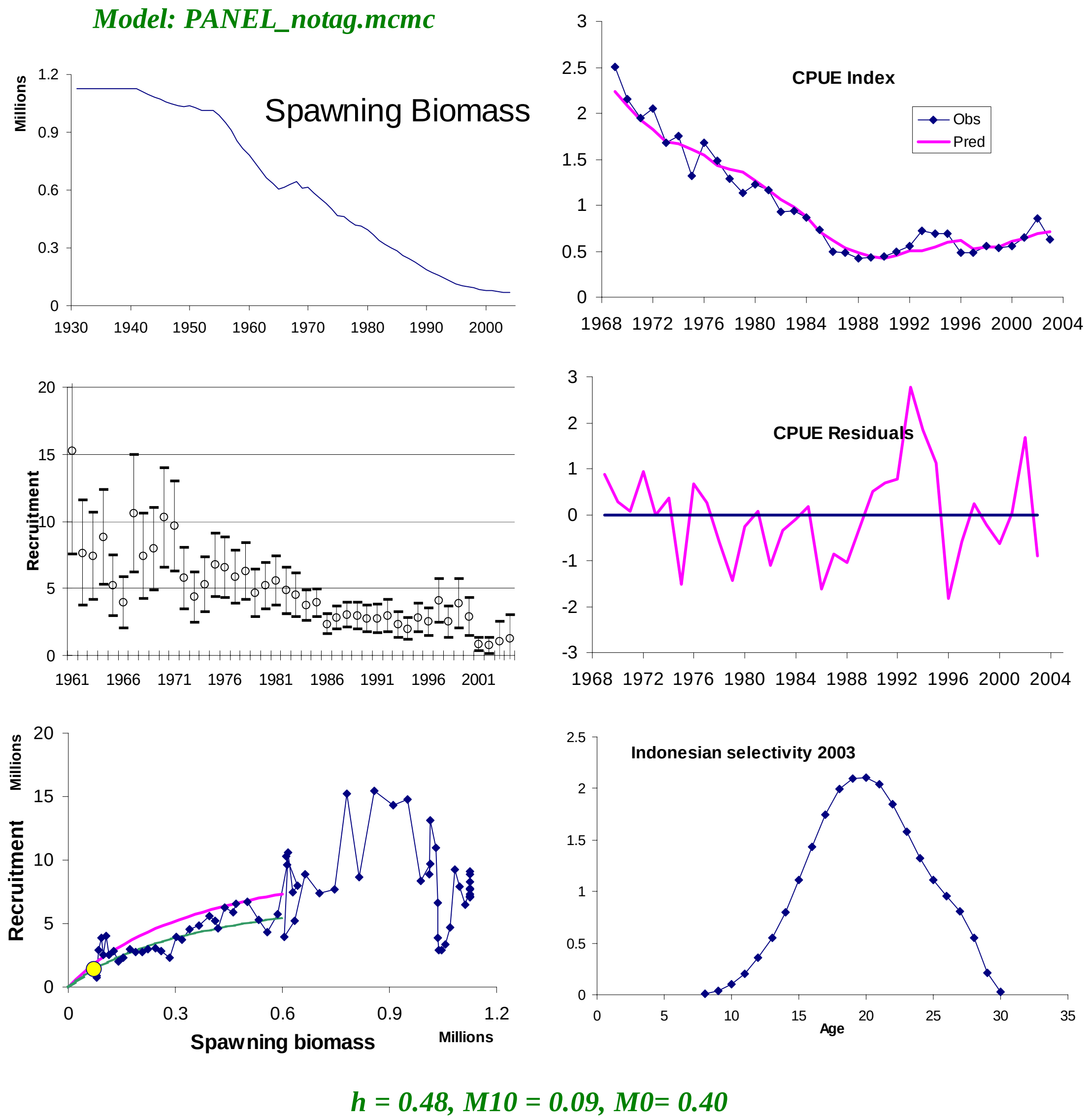


Figure 5. MPD fits for model PANEL_notag.mcmc (mod12_1o.dat). Error bars around recruitment correspond to MPDs ± 2 standard deviations as approximated from Hessian.

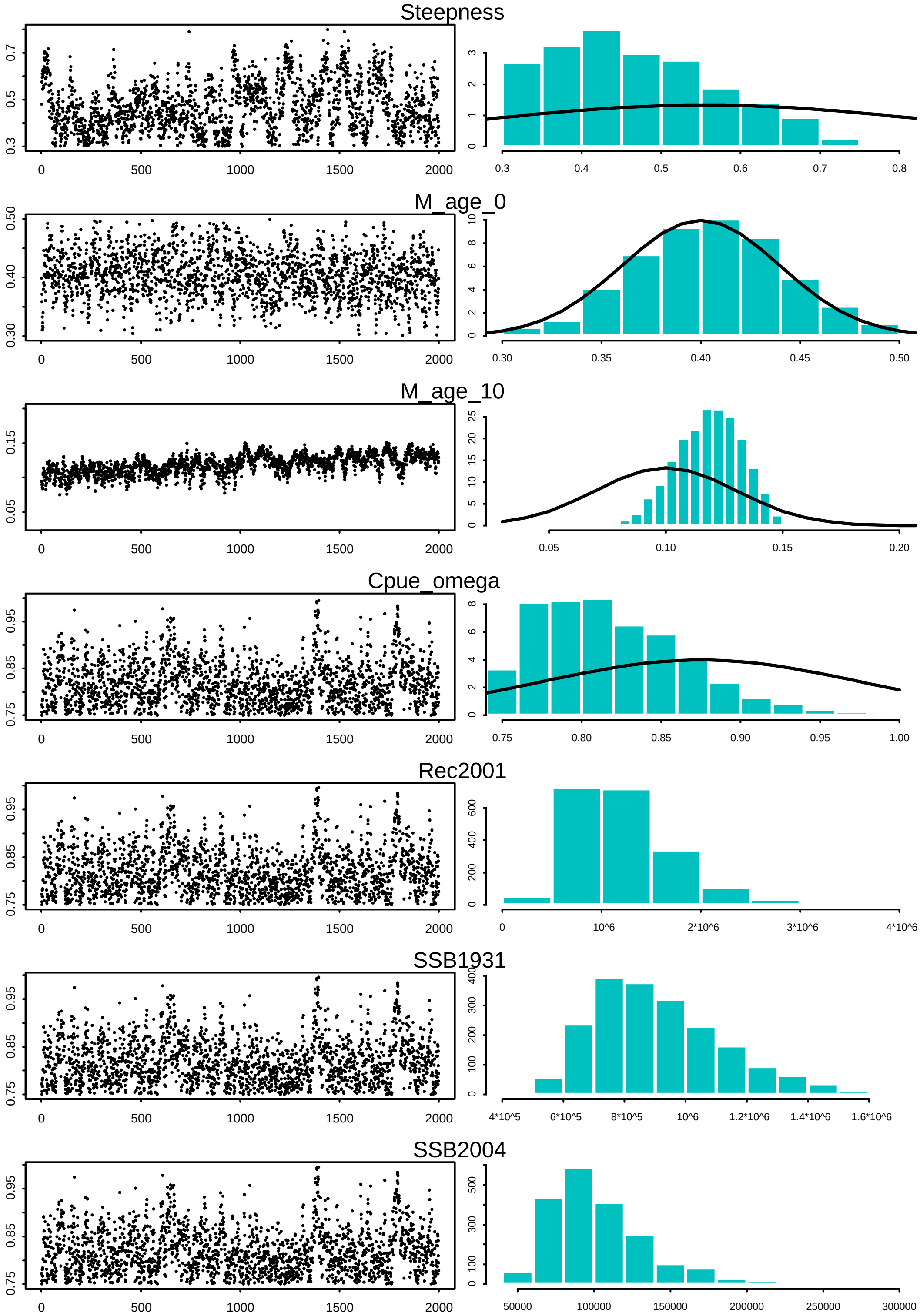


Figure 6. Parameter traces and posterior distributions of selected parameter for the PANEL_notag.mcmc (mod12_1o). The prior distributions for fundamental parameters are shown with the black lines.

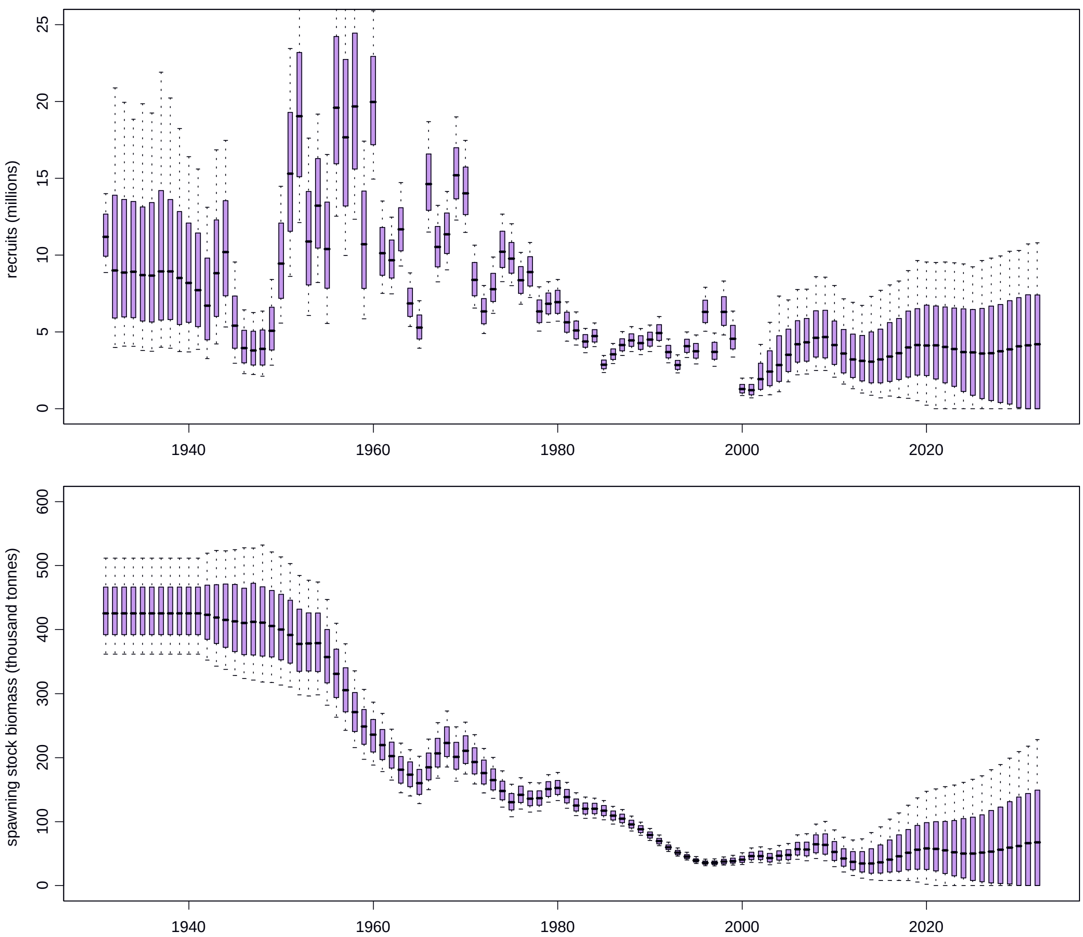


Figure 7. Stock and Recruitment projections at constant current TAC for the PANEL_tag.mcmc (mod11_1v) run. Boxes indicate the inter-quartile range and the "whiskers" show the 10th and 90th quantiles of the distributions.

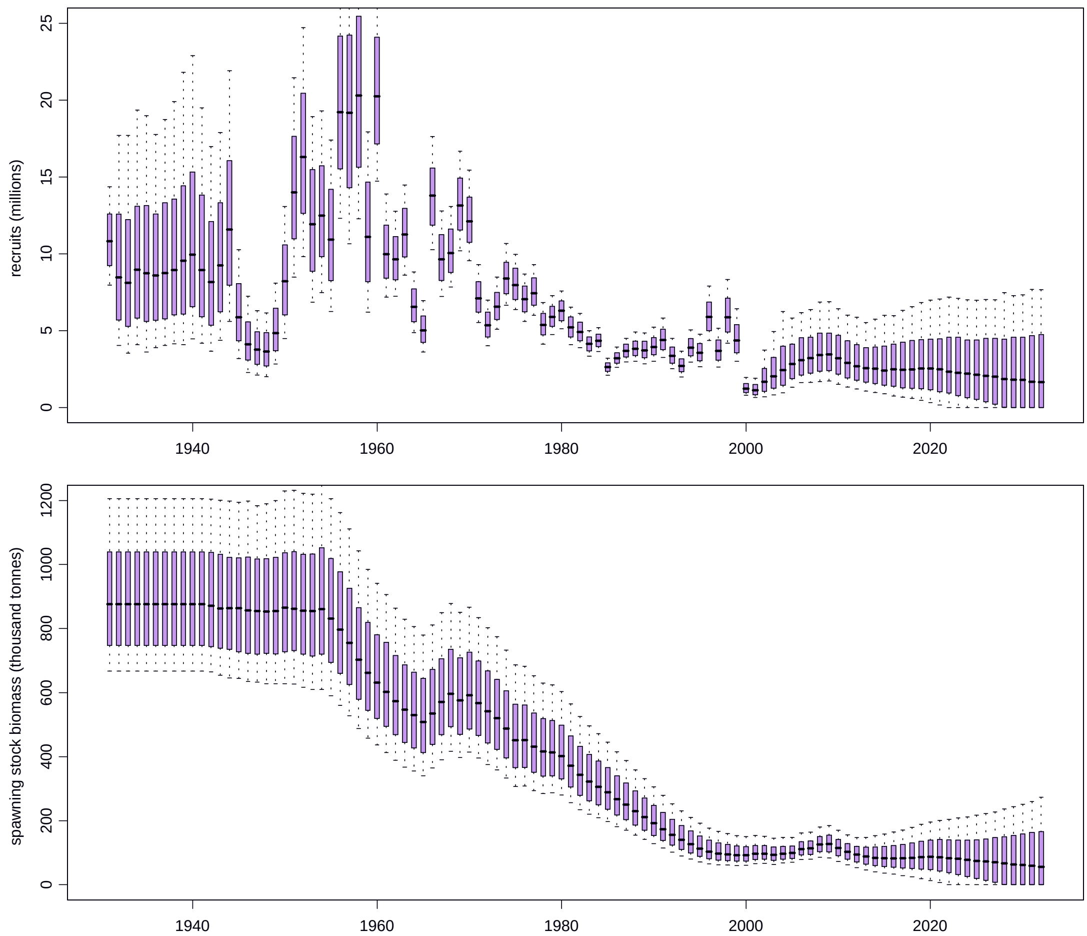


Figure 8. Stock and Recruitment projections at constant current TAC for the PANEL_notag.mcmc (mod12_1o run). Note change in y-axis scale for SSB.

Appendix 2. MPD results for some selected runs

	Name of Run	PANEL_notag mod12_1o	PANEL_tag mod11_1v	mod11_1u	mod10_1j	mod10_1k	Mod10_1a	Mod10_0
ρ	1931-Y	0.63	0.71	0.71	0.71	0.71	0.73	0.75
	1965-1998	0.45	0.60	0.61	0.61	0.60	0.63	0.67
	Model SigF	0.60	0.60	0.60	0.60	0.60	0.60	0.60
σ_R	1931-Y	0.39	0.45	0.44	0.45	0.45	0.45	0.57
	1965-1998	0.30	0.35	0.35	0.36	0.35	0.34	0.39
CPUE	1969-Y	0.30	0.07	0.07	0.02	0.03	0.04	0.20
Autocorr.	1990-2000	0.46	0.24	0.25	0.21	0.22	0.24	0.18
	Steepness	0.48	0.60	0.62	0.63	0.62	0.59	0.67
Likelihood	Total	474.85	482.37	479.14	475.48	483.34	555.96	929.91
	LL1	138.47	144.20	144.94	144.27	145.55	144.06	297.47
	LL2	48.95	48.54	49.03	48.42	48.50	49.67	74.15
	LL3	107.17	106.28	106.16	105.82	105.93	105.72	96.29
	LL4	136.14	138.07	138.28	138.61	138.56	138.88	203.49
	IND	35.59	34.08	33.07	32.52	34.31	33.46	95.76
	SURF	34.43	32.85	33.83	32.09	32.78	84.18	111.29
	CPUE	-54.88	-59.89	-60.28	-60.49	-60.57	-60.73	-52.97
	Tags	0.02	4.05	0.01	0.01	4.05	11.43	11.99
Priors	Sel.Ch	28.30	32.11	32.08	31.47	31.76	35.56	45.56
	Sel.sm	22.47	19.30	19.55	19.47	19.30	30.90	52.44
	Sg.R	-22.38	-17.93	-18.16	-17.45	-17.53	-18.13	-6.89
	M(0)	0.00	0.00	0.00	0.00	0.00	0.08	0.07
	M(10)	0.02	0.69	0.61	0.70	0.67	0.79	0.50
	Steepness	0.03	0.02	0.03	0.04	0.03	0.09	0.76
	msy	21,591	28,418	28,493	28,707	28,498	28,054	26,648
	S(msy)	403,661	141,266	139,632	130,143	132,996	140,836	118,768
	S(msy)/Bo	0.36	0.31	0.30	0.29	0.30	0.31	0.28
	M(0)	0.40	0.40	0.40	0.40	0.40	0.38	0.38
	M(10)	0.09	0.17	0.17	0.17	0.17	0.18	0.16
	S(2004)/S(	0.06	0.08	0.08	0.10	0.09	0.10	0.11
Resids-LL1	std.	0.47	0.47	0.47	0.47	0.47	0.47	0.68
	mar	0.26	0.27	0.27	0.27	0.28	0.27	0.33
LL2	std.	1.21	1.22	1.23	1.22	1.22	1.24	1.42
	mar	0.36	0.37	0.35	0.36	0.36	0.34	0.46
LL3	std.	0.59	0.57	0.57	0.56	0.56	0.56	0.52
	mar	0.19	0.19	0.19	0.19	0.19	0.19	0.10
LL4	std.	1.02	1.04	1.04	1.04	1.04	1.04	1.27
	mar	0.41	0.42	0.42	0.42	0.42	0.42	0.46
IND	std.	0.64	0.63	0.62	0.61	0.63	0.62	1.04
	mar	0.41	0.42	0.41	0.40	0.43	0.40	0.67
SURF	std.	0.52	0.50	0.51	0.50	0.50	2.83	2.26
	mar	0.25	0.21	0.25	0.21	0.21	0.50	0.46
CPUE	std.	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	mar	0.64	0.59	0.59	0.50	0.51	0.52	0.51
Tags	std.	0.03	0.47	0.02	0.02	0.47	0.79	0.81
	mar	0.02	0.30	0.01	0.01	0.30	0.61	0.57
Recruitmer	2000-2001	1878.30	2619.55	2443.60	1215.95	1211.55	1150.00	760.68
	CV	0.27	0.28	0.33	0.44	0.42	0.34	0.29
	Steepness	0.48	0.60	0.62	0.63	0.62	0.59	0.67
	CV Steepn	0.24	0.15	0.14	0.15	0.14	0.11	0.10
	Omega	0.77	0.87	0.87	1.00	1.00	1.00	1.00
		0.07	0.07	0.07				
	M0	0.40	0.40	0.40	0.40	0.40	0.38	0.38
	CV M0	0.10	0.09	0.10	0.10	0.09	0.09	0.09
	M10	0.09	0.17	0.17	0.17	0.17	0.18	0.16
	CV M10	0.15	0.08	0.08	0.09	0.08	0.07	0.07