

Modeling Parameters in Stock Synthesis

Outline

- Bounds and priors
- Temporal variation
- Relationship among parameters

Parameter elements

Specified in the SS control file, for example: petrale.ctf

Short parameter lines (7 elements)

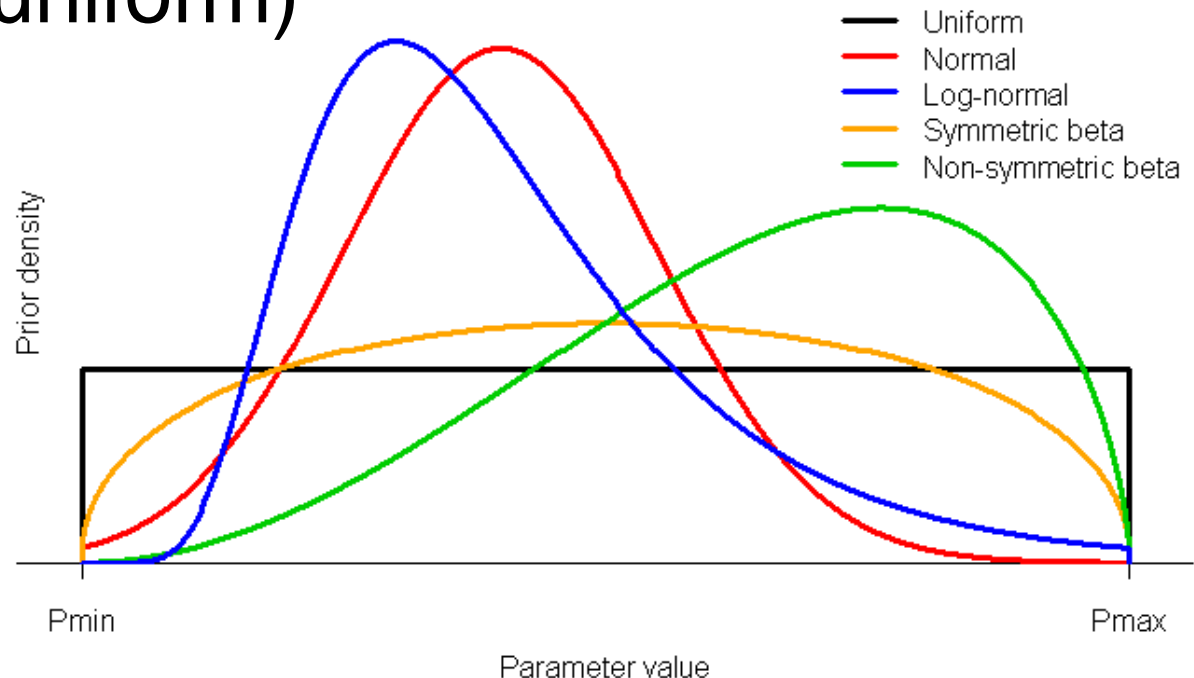
#_Spawner-Recruitment Parameters							
#_LO	HI	INIT	PRIOR	PR_type	SD	PHASE	
5	20	10	9	-1	10	1	#Ln(R0)
Bounds		Initial value	Prior		Estimating phase	Optional comment	

Full parameter lines (14 elements)

#Natural Mortality														
#LO	HI	INIT	PRIOR	PR_type	SD	PHASE	env-var	use_dev	dev_minyr	dev_maxyr	dev_stddev	Block	Block_Fxn	
0.01	0.50	0.15	-1.8	3	0.3	6	0	0	0	0	0	0	0	#M
Bounds		Initial value	Prior		Estimating phase	Time-varying properties							Optional comment	

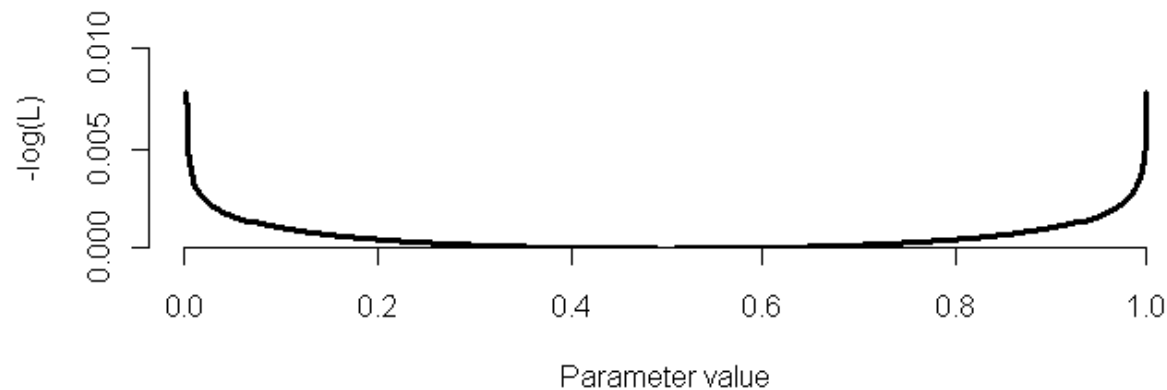
Bounds and priors

- All parameters bounded
- Prior options: uniform, normal, lognormal, symmetric and non-symmetric beta, or no prior (=uniform)



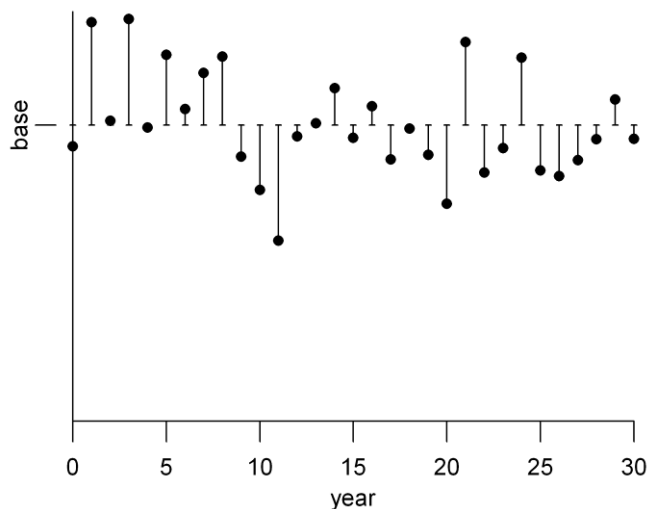
Soft bounds

- Optional penalty applied to all parameters
- Keeps ADMB from getting stuck on bounds
- Acts along with user-specified priors
- Equivalent to symmetric beta with shape parameter = 0.001

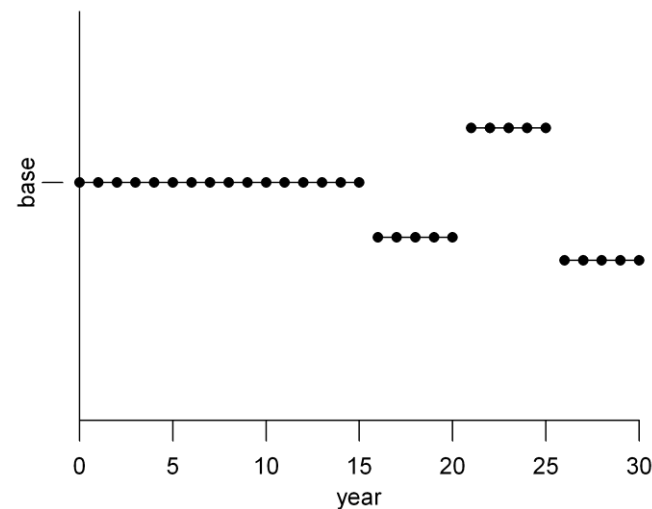


Temporal variation

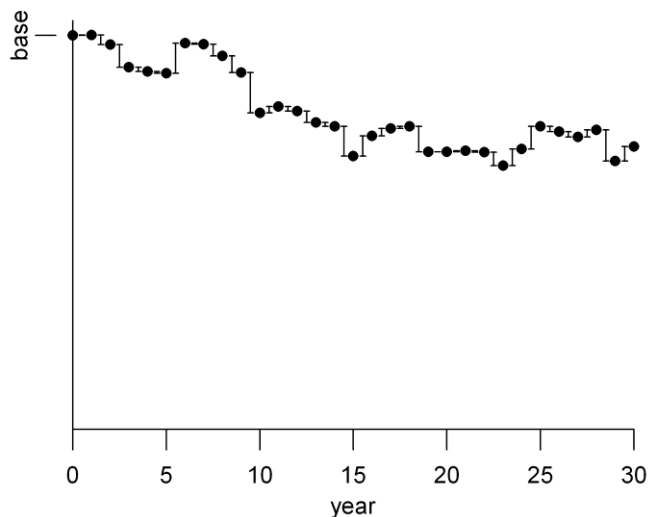
Deviations (N std. dev. pars.)



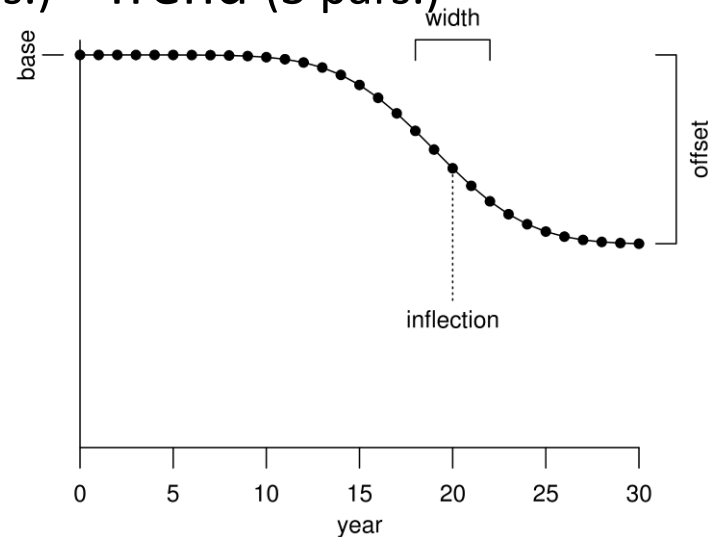
Blocks (1 par. per block)



Random walk ($N-1$ std. dev. pars.)

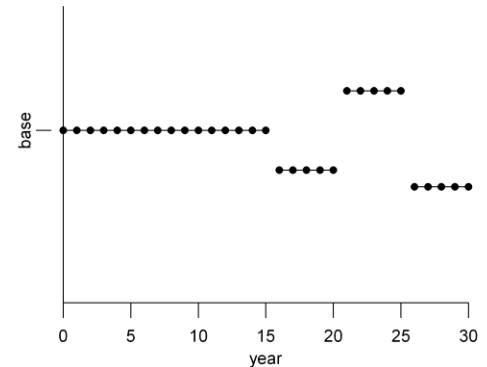


Trend (3 pars.)



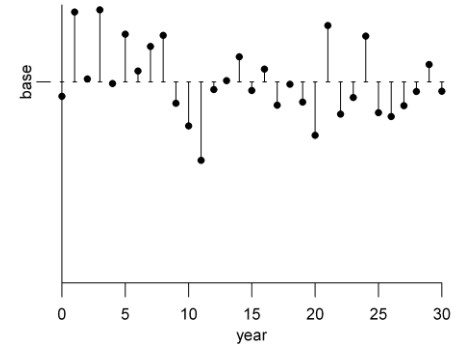
Temporal variation: blocks

- Requires conditional input for extra parameters lines (same as other variation types)
- Fixed time intervals specified in control file
- Additional parameters may be:
 - Multiplicative offset from base value
 - Additive offset from base value
 - Replace base value for interval of years
 - May have random walk from one block to next



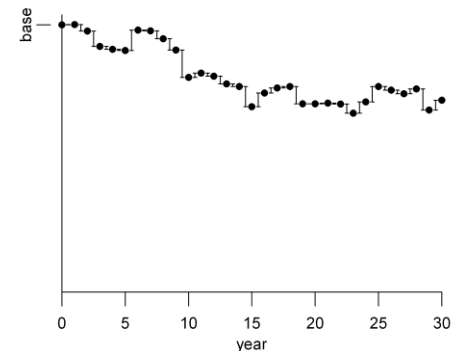
Temporal variation: deviations

- Defined by
 - Type (base+dev or base·e^{dev})
 - Start and end years for
 - Normal distribution penalty
- Not zero-centered



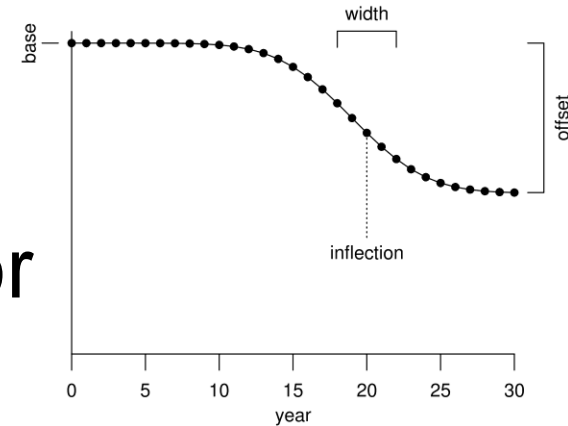
Temporal variation: random walk

- Similar to deviations,
but one fewer parameter
- Parameters represent differences
- Normal distribution penalty



Temporal variation: trends

- Only 3 parameters
- Smooth alternative to blocks for cases that don't support many parameters
- Final value may be offset from base or new value



Parameter as function of covariate

- Environmental variable: E_y
 - $\text{Par}_y = \text{base} + \text{link} \cdot E_y$ or $\text{base} \cdot e^{E_y}$
 - May be combined with other options
(i.e. deviations around environmental index)
- Covariate relationship to be used in future versions of SS for density dependence:
 - Mortality parameters as a function of biomass

Keeping time-varying parameters within bounds

Options:

- time varying parameters unconstrained by bounds on base parameter
 - straightforward interpretation of values
 - may go outside reasonable range
- logistic transformation to keep adjusted parameter value within bounds of base
 - transformed values harder to interpret
 - no problem with range

Offsets from other parameters

- Parameters for males often treated as offsets from females (can do reverse too)
 - growth
 - mortality
 - selectivity
- Additive or multiplicative options
- Makes hypothesis testing easy (either fix offset at 0 or estimate)
- Allows two-sex model with no additional data over single-sex model