

Table 4. The major parameters and input required to initialize and execute the environmental class Extended Stock Assessment Models (ESAM), with notations of the major structural features.

		Data description	Inputs Static (S) or Dynamic (D)	Spatially resolved (Y or N) [does not mean it is not done for different regions, but directly in the model]	units	Origin, source, or method for derivation of value	Variance incorporated (Y or N)	Timeframe for derivation of value	
Model Class	ESAM MRMs- Environmental Model	S-R							
		Required Inputs		N				In NEUS, usually 40+ yrs (1963-present)	
		R	Vector of Recruits	D		biomass or #	Survey data, age data	Y	
		SSB	Vector of Spawning Stock Biomass	D		biomass or #	Survey data, age data	Y	
		various	any covariates	D		variable	Oceanographic data, Climatological data	variable	
		Required Parameters	depending upon functional form:						
		α_{ij}	scalar	S		unitless	derived	N	
		β_{ij}	Exponential modifier	S		unitless	derived	N	
		γ_{ij}	Exponential modifier for covariates	S		unitless	derived	N	
		$F_{xx\%}$ optional β s	Fishing Mortality covariates	S S		rate, B per yr unitless	derived derived	Y N	

Table 4, continued. The major parameters and input required to initialize and execute the environmental class Extended Stock Assessment Models (ESAM), with notations of the major structural features.

		Data description	Inputs Static (S) or Dynamic (D)	Spatially resolved (Y or N) [does not mean it is not done for different regions, but directly in the model]	units	Origin, source, or method for derivation of value	Variance incorporated (Y or N)	Timeframe for derivation of value
Model Class	ESAM MRMs- Environmental Model	SS Prod						
		Required Inputs		usually time series	N			In NEUS, usually 40+ yrs (1963-present)
		B	Vector of biomass	D		Biomass (e.g. mt)	Survey data	Y
		L	Vector of landings (or catch)	D		Biomass (e.g. mt)	Landings data	Y
		various	covariates	D		variable	Oceanographic data, Climatological data	varies
		Required Parameters						
		r (derives Fmsy)	exponential rate of growth	S		rate, B per yr	derived	Y
		K (derives Bmsy)	carrying capacity	S		biomass	derived	Y
		optional β s	other tuning measures, associated with covariates	S		unitless	derived	varies

Table 4, continued. The major parameters and input required to initialize and execute the environmental class Extended Stock Assessment Models (ESAM), with notations of the major structural features.

		Data description	Inputs Static (S) or Dynamic (D)	Spatially resolved (Y or N) [does not mean it is not done for different regions, but directly in the model]	units	Origin, source, or method for derivation of value	Variance incorporated (Y or N)	Timeframe for derivation of value
Model Class	ESAM MRMs- Environmental							
Model	Age Structured			N				In NEUS, usually 40+ yrs (1963-present)
	Required Inputs							
	$N_{i,a}$	Matrix of N	D		#	Survey data, age data	Y	
	$B_{i,a}$	Matrix of B	D		biomass	Survey data, age data	Y	
	$W_{i,a}$	Wt-at-age	S		biomass	Survey data, age data	Y	
	$O_{i,a}$	Age-at-maturity	S		year	Survey data, age data	Y	
	$C_{i,a}$	Catch-at-age	D		biomass	Landings data, age data	Y	
	various	covariates, usually in matrices at age	D		various	Oceanographic data, Climatological data	varies	
	Required Parameters							
	q, λ	Selectivity & Catchability	S		unitless	Survey data, model derived	N	
	g	Growth between ages; in some forms	S		unitless	Age data	Y	
	F	Total Fishing Mortality	S		unitless	derived	Y	
	$M2$	Total Predation Mortality	S		unitless	derived	Y	
	$M1$	Total other Natural Mortality	S		unitless	derived	N	
	optional β s	covariates	S		unitless	derived	varies	