

# 1 Data structures

The following is a list of the input data structures used in data file for Gmacs.

Table 1: Input data structures

Variable	Symbol	Type	Description
styr	$t$	int	Start year
endyr	$t$	int	End year
tstep	NA	double	time step
ndata		int	number of data groups
nsex	$s$	int	number of sexes
nshell	$v$	int	number of shell conditions
nmature	$m$	int	number of maturity states
nclass	$l$	int	number of size classes in the model
ndclass	$l$	int	number of size classes in the data
ncol		int	number of columns in N-matrix
class_link		matrix(1,nclass,1,2)	links between model and data size-classes.

**Indexes** For consistency the following indexes are used to describe the various model dimensions:

**g** index for group (sex, shell condition, maturity state),

**h** index for sex,

**i** index for year,

**j** index for season or month,

**k** index for fleet,

**l** index for length class,

**m** index for maturity state,

**n** index for shell condition,

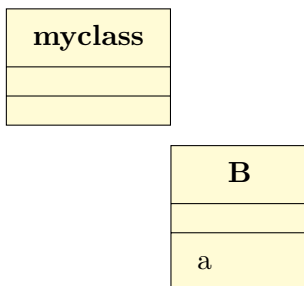


Table 2: Statistical catch-at-length model used in Gmacs

Estimated parameters

$$\Theta = (M_0, \ln(\bar{R}), R_\alpha, R_\beta, \alpha_h, \beta_h, b_h) \quad (\text{T2.1})$$

$$\sigma^2 = \rho/\vartheta^2, \quad \tau^2 = (1 - \rho)/\vartheta^2 \quad (\text{T2.2})$$

Unobserved states

$$N_{g,t,l}, Z_{g,t,l} \quad (\text{T2.3})$$

Recruitment size distribution

$$\alpha = R_\alpha/R_\beta \quad (\text{T2.4})$$

$$p(R_l) = \int_{x_l-0.5\Delta x}^{x_l+0.5\Delta x} \frac{x_l^{\alpha-1} e^{x_l/R_\beta}}{\Gamma(\alpha) x_l^\alpha} dx \quad (\text{T2.5})$$

Molt increment & size transition

$$a_{h,l} = \alpha_h + \beta_h x_l \quad (\text{T2.6})$$

$$p(x_l, x_{l'})_h = \int_{x_l-0.5\Delta x}^{x_l+0.5\Delta x} \frac{x_l^{a_{h,l}-1} e^{x_l/b_h}}{\Gamma(a_{h,l}) x_l^{a_{h,l}}} dx \quad (\text{T2.7})$$

