Example Table Summarizing Mathematical Symbology

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For this example, suppose you have a technical document with many equations and symbols. Of course, context would be provided for each equation and symbol in the text surrounding each equation, but it may be helpful for readers to have a table to summarize the symbology for them.

The equations below are a subset from Staton *et al.* (2020), and Table 1 is adapted from Table 2 therein. These equations represent the process equations of a state-space model that is intended to simultaneously describe the dynamics of several salmon populations harvested as a mixed-stock. The quantities $S_{t,j}$, H_t and $q_{t,a,j}$ are linked to observed data for estimation of unknown parameters and latent states: α_j, β_j, ϕ, Σ_R, $\pi_{1:n_a}$, D, $p_{y,a}$, U_t, and $R_{y,j}$.

TABLE 1. Definition of the symbology used in the description of the state-space model equations.

Symbol	Description	Eqns.
Dimensional Constants		
n_y	Number of brood years; here 45	
n_t	Number of calendar years for the population with the longest data time series; here 42	
n_j	Number of populations, here 13	
n_a	Number of possible ages of maturation; here 4	
a_{min}	The first age recruits can mature; here 4	
a_{max}	The last age recruits can mature; here 7	
Parameters		
α_j	Maximum recruits per spawner for population j	1, 2
β_j	Capacity parameter for population j	1, 2
σ_j^2	White noise recruitment process variance for population j	5
$\rho_{i,j}$	Correlation in recruitment process variance between populations i and j	5
Σ_R	Recruitment white noise process covariance matrix	3, 5
ϕ	Lag-1 serial autocorrelation coefficient	4
$\omega_{y,j}$	Serially autocorrelated portion of recruitment anomalies	3, 4
π_a	Mean proportion of adult recruits that mature and return at age a	6
D[a]	Dirichlet dispersion parameter for brood year-specific maturity schedules	6
$p_{y,a}$[a]	Probability adult recruits from brood year y mature at age a	6, 7
U_t[b]	Exploitation rate experienced by fully vulnerable populations in calendar year t	10, 12
v_j[b]	Relative vulnerability term for population j	10, 12
States		
$\dot{R}_{y,j}$	Deterministic (expected) recruitment in brood year y for population j	1, 2, 3
$R_{y,j}$	Realized latent (true) recruitment in brood year y for population j	3, 7
$N_{t,a,j}$	Age-structured run abundance returning to spawn in calendar year t for population j	7
$N_{t,j}$	Run abundance returning to spawn in calendar year t for population j	8
$S_{t,j}$	Spawner abundance in calendar year t for population j	2, 12
$H_{t,j}$	Harvest in calendar year t for population j	10
H_t	Mixed-stock aggregate harvest in calendar year t	11
$q_{t,a,j}$	Proportion of the run returning to population j in year t that is made up of age a	9

[a] Used only in complex maturity models: SSM-vM and SSM-VM. For simple maturity models (SSM-vm and SSM-Vm), $p_{y,a}$ took the value π_a.

[b] In the default case, all populations were assumed to be fully vulnerable to harvest (i.e., all $v_j = 1$), v_j was used in a sensitivity analysis to this assumption (see Online Supplement F).

First $a_{\max}$ brood years:

$$\dot{R}_{y,j} = \frac{\log(\alpha_j)}{\beta_j} \tag{1}$$

Brood years $a_{\max} + 1$ through n_y, where $t = y - a_{\max}$:

$$\dot{R}_{y,j} = \alpha_j S_{t,j} e^{-\beta_j S_{t,j}} \tag{2}$$

$$\log(R_{y,1:n_j}) \sim \text{MVN}\left(\log(\dot{R}_{y,1:n_j}) + \omega_{y,1:n_j}, \Sigma_R\right) \tag{3}$$

$$\omega_{y,1:n_j} = \phi\left(\log(R_{y-1,1:n_j}) - \log(\dot{R}_{y-1,1:n_j})\right) \tag{4}$$

$$\Sigma_R = \begin{bmatrix} \sigma_1^2 & \sigma_1\sigma_2\rho_{1,2} & \cdots & \sigma_1\sigma_{n_j}\rho_{1,n_j} \\ \sigma_2\sigma_1\rho_{2,1} & \sigma_2^2 & \cdots & \sigma_2\sigma_{n_j}\rho_{2,n_j} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{n_j}\sigma_1\rho_{n_j,1} & \sigma_{n_j}\sigma_2\rho_{n_j,2} & \cdots & \sigma_{n_j}^2 \end{bmatrix} \tag{5}$$

$$p_{y,a} \overset{\text{iid}}{\sim} \text{Dirichlet}(\pi_{1:n_a} \cdot D) \tag{6}$$

$$N_{t,a,j} = R_{t+n_a-a,j}\, p_{t+n_a-a,a} \tag{7}$$

$$N_{t,j} = \sum_{a=1}^{n_a} N_{t,a,j} \tag{8}$$

$$q_{t,a,j} = \frac{N_{t,a,j}}{N_{t,j}} \tag{9}$$

$$H_{t,j} = N_{t,j} U_t v_j \tag{10}$$

$$H_t = \sum_{j=1}^{n_j} H_{t,j} \tag{11}$$

$$S_{t,j} = N_{t,j}(1 - U_t v_j) \tag{12}$$

Side note: the manuscript from which this content was adapted was prepared using the 'bookdown' package, which produces a `.tex` file containing, among the rest of the manuscript content, the LaTeX code to reproduce this table. The journal was able to use this output to build the table for publication.