ワークショップで扱うモデル

一般式

$$p_1(i) = \beta_1(c_i, t_i) + \sum_{f=1}^{n_{\omega 1}} L_{\omega 1}(c_i, f)\omega_1(s_i, f) + \sum_{f=1}^{n_{\varepsilon 1}} L_{\varepsilon 1}(c_i, f)\varepsilon_1(s_i, f, t_i) + \sum_{f=1}^{n_{\eta 1}} L_1(c_i, f)\eta_1(v_i, f) + \sum_{p=1}^{n_p} \gamma_1(c_i, t_i, p)X(x_i, t_i, p) + \sum_{k=1}^{n_k} \lambda_1(k)Q(i, k) \tag{1}$$

$$p_2(i) = \beta_2(c_i, t_i) + \sum_{f=1}^{n_{\omega 2}} L_{\omega 2}(c_i, f)\omega_2(s_i, f) + \sum_{f=1}^{n_{\varepsilon 2}} L_{\varepsilon 2}(c_i, f)\varepsilon_2(s_i, f, t_i) + \sum_{f=1}^{n_{\eta 2}} L_2(c_i, f)\eta_2(v_i, f) + \sum_{p=1}^{n_p} \gamma_2(c_i, t_i, p)X(x_i, t_i, p) + \sum_{k=1}^{n_k} \lambda_2(k)Q(i, k) \tag{2}$$

Part Ⅰ

$$p_1(i) = \beta_1(t_i) + \omega_1(s_i) + \varepsilon_1(s_i, t_i) \tag{3}$$

$$p_2(i) = \beta_2(t_i) + \omega_2(s_i) + \varepsilon_2(s_i, t_i) \tag{4}$$

Part Ⅲ (i)

$$p_1(i) = \beta_1(t_i) + \omega_1(s_i) + \varepsilon_1(s_i, t_i) + \lambda_1 Q(i) \tag{5}$$

$$p_2(i) = \beta_2(t_i) + \omega_2(s_i) + \varepsilon_2(s_i, t_i) + \lambda_2 Q(i) \tag{6}$$

.....

(ii)

$$p_1(i) = \beta_1(t_i) + \omega_1(s_i) + \varepsilon_1(s_i, t_i) + \eta_1(v_i) \tag{7}$$

$$p_2(i) = \beta_2(t_i) + \omega_2(s_i) + \varepsilon_2(s_i, t_i) + \eta_2(v_i) \tag{8}$$

.....

(iii)

$$p_1(i) = \beta_1(c_i, t_i) + \sum_{f=1}^{n_{\omega 1}} L_{\omega 1}(c_i, f)\omega_1(s_i, f) + \sum_{f=1}^{n_{\varepsilon 1}} L_{\varepsilon 1}(c_i, f)\varepsilon_1(s_i, f, t_i) \tag{9}$$

$$p_2(i) = \beta_2(c_i, t_i) + \sum_{f=1}^{n_{\omega 2}} L_{\omega 2}(c_i, f)\omega_2(s_i, f) + \sum_{f=1}^{n_{\varepsilon 2}} L_{\varepsilon 2}(c_i, f)\varepsilon_2(s_i, f, t_i) \tag{10}$$

.....

(iv)

$$p_1(i) = \beta_1(t_i) + \omega_1(s_i) + \varepsilon_1(s_i, t_i) + \sum_{p=1}^{n_p} \gamma_1(t_i, p)X(x_i, t_i, p) \tag{11}$$

$$p_2(i) = \beta_2(t_i) + \omega_2(s_i) + \varepsilon_2(s_i, t_i) + \sum_{p=1}^{n_p} \gamma_2(t_i, p)X(x_i, t_i, p) \tag{12}$$

導出パラメータ

推定局所密度 d^*

$$d^*(s,c,t) = r_1(s,c,t) \times r_2(s,c,t) \tag{13}$$

CPUE や重量データの時

$$\begin{aligned} r_1(i) &= \mathrm{logit}^{-1}(p_1(i)) \\ r_2(i) &= a_i \times \log^{-1}(p_2(i)) \end{aligned} \tag{14}$$

個体数データの時

$$\begin{aligned} r_1(i) &= 1 - \exp(-a_i \times \exp(p_1(i))) \\ r_2(i) &= \frac{a_i \times \exp(p_1(i))}{r_1(i)} \times \exp(p_2(i)) \end{aligned} \tag{15}$$

資源量指数 I

$$I(c,t,l) = \sum_{x=1}^{n_x} (a(s,l) \times d^*(s,c,t)) \tag{16}$$

有効面積 A

$$A(c,t,l) = \frac{I(c,t,l)}{D(c,t,l)} \tag{17}$$

D は biomass-weighted average density で

$$D(c,t,l) = \sum_{x=1}^{n_x} \left(\frac{a(s,l) \times d^*(s,c,t)}{I(c,t,l)} d^*(s,c,t) \right) \tag{18}$$

重心 Z

$$Z(c,t,m) = \sum_{x=1}^{n_x} \frac{z(s,m) \times a(s,l) \times d^*(s,c,t)}{I(c,t,l)} \tag{19}$$