Quantifying interactions between two métiers

ind is the proposed index to quantify the intensity of the interaction between two métiers (TR1 and TR2) in terms of catches, *ind* was claculated from FLBEIA simulations :

$$ind = \frac{|\frac{\Delta_{C_1}}{\Delta_{m_i}}|}{|\frac{\Delta_{C_1}}{\Delta_{m_i}}| + |\frac{\Delta_{C_2}}{\Delta_{m_j}}|} \tag{1}$$

with

- $|\frac{\Delta_{C_1}}{\Delta_{m_i}}|$: slope métier 1
- $|\frac{\Delta_{C_2}}{\Delta_{m_j}}|$: slope métier 2
- C_1, C_2 : catches of métiers 1 and 2
- m_1, m_2 :q multipliers for métiers 1 and 2

Cobb-Douglas production function :

$$C = qE^{\alpha}B^{\beta} \tag{2}$$

Catches by métier in FLBEIA simulations :

$$C_1 = q_1 m_i B_{ij}^{\beta} E_1^{\alpha}$$
$$C_2 = q_2 m_j B_{ij}^{\beta} E_2^{\alpha}$$

with

- C_1, C_2 : catches of métiers 1 and 2
- q_1, q_2 : catchability of métiers 1 and 2
- m_i, m_j : q multipliers for métiers 1 and 2
- B_{ij} : biomass of the stock when m_i and m_j are applied
- E_1, E_2 : fishing effort of métiers 1 and 2
- α, β : parameters of Cobb-Douglas function

$$\frac{\Delta_{C_1}}{\Delta_{m_i}} = \frac{q_1 mi B_{ij}^{\beta} E_1^{\alpha}}{m_i} = q_1 B_{ij}^{\beta} E_1^{\alpha}$$

$$\frac{\Delta_{C_2}}{\Delta_{m_j}} = \frac{q_2 mi B_{ij}^{\beta} E_2^{\alpha}}{m_j} = q_2 B_{ij}^{\beta} E_2^{\alpha}$$

$$ind = \frac{q_1 B_{ij}^{\beta} E_1^{\alpha}}{q_1 B_{ij}^{\beta} E_1^{\alpha} + q_2 B_{ij}^{\beta} E_2^{\alpha}}$$

$$ind = \frac{q_1 E_1^{\alpha}}{q_1 E_1^{\alpha} + q_2 E_2^{\alpha}}$$

Interpretation of the index :

- $ind \to 1$ means low interactions : métier 1 is driving the catches
- $ind \to 0$ means low interactions : métier 2 is driving the catches
- $ind \to 0.5$ means high interactions between métiers 1 and 2