Feeding habitat index

The feeding habitat index measures how favorable a particular place and time is for feeding based on prey accessibility, considering the predator's ability and the water layer physical conditions inhabited by the forage component *FO*. Although the SEAPODYM model is two-dimensional in space, a third dimension is included in the feeding habitat index through the forage components vertical distribution. At each spatial position, the habitat H_F is the sum of prey abundances in the water column weighted by an accessibility coefficient for each z depth layer:

$$H_{FO} = \sum_z \theta_z \left(FO_{zz} + \tau \sum_{k \neq z} FO_{zk} + (1-\tau) \sum_{k \neq z} FO_{zk} \right)$$

where τ is the fraction of daylight in a day and FO_{zz} are the elements of the forage matrix, where the elements in the diagonal reside in the z-layer (non-migrant) and the off-diagonal elements are migrant forage components:

$$FO = \begin{pmatrix} FO_{11} & 0 & 0 \\ FO_{21} & FO_{22} & 0 \\ FO_{31} & FO_{32} & FO_{33} \end{pmatrix}$$

The accessibility coefficients depend on temperature and dissolved oxygen. The influence of the oxygen on the tuna habitat quality can be described by:

$$\Psi(O_z) = \frac{1}{1 + e^{\gamma(O_z - \hat{O})}}$$

where $\hat{O}$ value depends on the species, the accessibility coefficient is defined as the product of the influence of oxygen on habitat times the temperature habitat index (refer to Thermal Habitat Index):

$$\theta_{z,a} = \Psi(O_z) H_{T,a}$$

The habitat feeding index plays an important role in tuna movement towards favorable feeding grounds and is used to define the movement index.