Supplementary Materials for:

Fisheries Impact Pathway: Making Global and Regionalised Impacts on Marine Ecosystem Quality Accessible in Life Cycle Impact Assessment

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The derivation of the species-specific regional to global conversion factor (Equation 5 in main article) has several intermediary equations embedded in the creation of the final scaling factor formula. In order to construct the factor using proxies to reflect the functions of the original GEP equation, the following elements are provided.

The original GEP$_j$ [1] is interpreted as the average of the GEP of species groups in the region (Equation 1), where n is the number of species:

$$GEP_j = \frac{1}{n} \times \sum_i GEP_{i,j} \quad (1)$$

The product of the Area and Occurrence are replaced by the biomass of the stock in region j, as per Equation 2.1 and 2.2.

$$\sum_k A_{i,j,k} \times O_{i,j,k} \approx B_{i,j} \quad (2.1)$$

$$\frac{\sum_k A_{i,j,k} \times O_{i,j,k}}{\sum_{j,k} A_{i,j,k} \times O_{i,j,k}} \approx \frac{B_{i,j}}{\sum_j B_j} \quad (2.2)$$

Equation 2.3 expresses the proxy introduced to replace the IUCN Red List Threat Levels, which are not implemented due to a lack of data particularly for some highly commercial species. This has been replaced by the relationship between the current stock biomass ($B_{i,j}$) and its carrying capacity (theoretical maxima supported by the surrounding habitat) across all regions of occurrence ($\sum j K_i$), as expressed by Equation 2.3. The global summation introduces the relationship of regional biomass to its global "pristine" condition, completing the Threat Level proxy by giving an indication of the relative depletion of the stock towards extinction.

$$TL_i \approx \frac{\sum j K_i - B_{i,j}}{\sum_j K_i} \quad (2.3)$$

[1]   Verones, F.; Kuipers, K.; Núñez, M.; Rosa, F.; Scherer, L.; Marques, A.; Michelsen, O.; Barbarossa, V.; Jaffe, B.; Pfister, S.; et al. Global extinction probabilities of terrestrial, freshwater, and marine species groups for use in Life Cycle Assessment. Ecol. Indic. 2022, 142, 109204. https://doi.org/10.1016/j.ecolind.2022.109204.