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The community indices available on the website

Currently the following community indices are available:

- Total abundance (relative value) (**Ntot**)
- Total biomass (relative value) (**Btot**)
- Geometric mean of species abundances (**Gtot**)
- Average length of an individual (**Lbcomm**)
- Average weight of an individual (**Wbcomm**)
- Average mean weight (meanWbar)
- Average length of large fish (**meanMaxSIH** & **meanMaxDCF**)
- Large fish indicator (**propLWxx**)
- Indicator of the Conservation status of fish species (**ConsDCF** & **ConsSIH**)·
- Diversity index Δ_1
- Modified Shannon index

The community indices may be calculated by the operator for various species groups subject to the available data for the selected index. The list of species included in the computation of each selected index is presented in the "information.pdf" file included in the downloadable Zip file.

[1] Total abundance (Ntot)

The total number of fish and Invertebrates in the area. Community abundance indicates whether there are more or less fish and shellfish, irrespective of their species or size. When total abundance increases, it may reflect the increase in abundance either of the most abundant species, or of several species.

[2] Total biomass (Btot)

The total number of fish and Invertebrates in the area. Community biomass reflects both abundance and individual weight of the fish and Invertebrates, all species put together.

[3] Geometric mean of species abundances (Gtot)

Usually mean implies the arithmetic mean, that is, total abundance divided by the number of species. Unfortunately fluctuations in the arithmetic mean are driven by the most abundant species. To overcome this, the geometric mean is calculated as the arithmetic mean of log-transformed abundances.

This indicator varies as do most species in the community: its increase suggests that many species increase and few decrease.

[4] Average length of an individual (Lbcomm)

The average length (cm) of all fish and Invertebrates in the community, irrespective of species. Changes in average length result either from length changes within species or from changes in the species composition. This indicator tracks changes in the most abundant species.

[5] Average weight of an individual (Wbcomm)

The average weight (kg) of all fish and Invertebrates in the community, irrespective of species. Changes in average weight result either from demographic changes and growth changes within species or from changes in the species composition. This indicator tracks changes in the most abundant species.

[6] Average mean weight (meanWbar)

Average of the mean weight (kg) by species in the community. result either from demographic changes and growth changes within species or from changes in the species composition. This indicator is not sensitive to changes in the most abundant species only but in a number of species.

[7] Average length of large fish (meanMaxSIH & meanMaxDCF)*

This indicator is presented in two versions.

Average population maximum length (meanMaxSIH) is the un-weighted mean across populations of the length at the ninety-fifth percentile of the population length distribution (cm). This metric reflects variations of the right-hand side of length distributions within populations.

Average individual maximum length (meanMaxDCF) is the population-abundance weighted mean of a fixed index of large size in each population (the median of annual ninety-fifth percentile of the population length distribution, cm). This metric reflects primarily changes in species composition.

[8] Large fish Indicator (propLWxx)

The LFI is the proportion in weight of individual fish larger than a threshold length. This threshold is generally set as the seventy-fifth percentile of the community length distribution. This metric reflects the length distribution in the community. Weight-length relationships are used to estimate weight by length class.

[9] Indicator of the Conservation status of fish species (ConsDCF & ConsSIH)

This is an indicator of biodiversity to be used for synthesizing, assessing and reporting trends in the biodiversity of vulnerable fish species. Its purpose as a state indicator is to assess the performance of the Common Fisheries Policy at minimising the impact of fishing activities on the marine ecosystem. It is calculated in five steps according to the DCF regulation (ConsDCF):

1. Species selection: list of species sensitive to fishing, i.e. large. Those species identified reliably of which > 20 individuals are caught per year (all area), and of which L0.95 (the ninety-fifth percentile of the population length distribution) ≥ 40 cm are listed, of this list, the 20 largest species are the sensitive species.

2. Calculate the abundance index of individuals with length ≥ L0.95 /2 (a proxy for size at maturity)

3. On a 10 years gliding window, calculate a decline index: the slope of a linear model; if the species is not rebuilt since (≥ average abundance first 3 years) : score the decline index as follows:

- Min(decline) ≤ 90% 'critically endangered' CR 3
- Min(decline) ≤ 70% 'endangered' EN 2
- Min(decline) ≤ 50% 'vulnerable' VU 1
- Otherwise 'least concern' LC 0

The indicator is the average decline score across sensitive species; it varies from 0 (no species threatened) to 3 (all species critically endangered).

We also present an alternative version (ConsSIH), where only significant slopes (risk α=0.1) are taken into account, and the rebuilding criterion is more stringent (≥ 5 highest abundances in the time series).

* Warning: the length-based indicators are calculated directly on the length measurements, without accounting for survey stratification.

[10] Diversity index Delta1

Delta1 is the probability that two individuals taken at random in the community belong to different species. This index is sensitive both to species richness and relative species abundance.

[11] Modified Shannon index

The modified Shannon index is derived from the well known Shannon diversity index. Instead of standardising the abundance of each species by the total abundance in the same year, the standardisation is with respect to total abundance in the first year of the time series (Buckland et al. 2005). This has the advantage that the modified Shannon index increases when the abundance of all species increases at the same rate in addition to increasing with species richness and evenness as does the Shannon index. The index is therefore sensitive to changes in total abundance.

The estimators

Index	Required input	Estimator
Total abundance N	Catch haul k stratum j $y_{k,j}$ Swept area $a_{k,j}$ Stratum area A_j	$N=\sum_j N_{i,j}=\sum_j A_j \sum_{k=1}^{n_j}\sum_i^n y_{ikj} \Big/ \sum_{k=1}^{n_j} a_{k,j}$ $Var(N)=\sum_j \frac{A_j^2}{n_j-1}\sum_{k=1}^{n_j}\left(\frac{\sum_i y_{i,kj}}{a_{k,j}}-\frac{\sum_{k=1}^{n_j}\sum_i^n y_{i,,}}{\sum_{k=1}^{n_j} a_{k,j}}\right)^2$
Total biomass B	Catch weight haul k stratum j $w_{k,j}$ Swept area $a_{k,j}$ Stratum area A_j	$B=\sum_j B_{i,j}=\sum_j A_j \sum_{k=1}^{n_j}\sum_i^n w_{ikj} \Big/ \sum_{k=1}^{n_j} a_{k,j}$ $Var(B)=\sum_j \frac{A_j^2}{n_j-1}\sum_{k=1}^{n_j}\left(\frac{\sum_i w_{i,kj}}{a_{k,j}}-\frac{\sum_{k=1}^{n_j}\sum_i^n y_{i,,}}{\sum_{k=1}^{n_j} a_{k,j}}\right)^2$
Geometric mean G	N_i	$G_t=\exp\left(\frac{1}{n}\sum_i^n \log\left(\frac{N_{i,t}+1}{N_{i,1}+1}\right)\right)$ Variance by parametric boostrap
Average weight in the community	N, B	$\bar{b}=B/N$ $Var[\bar{b}]=Var[B]/N^2+B^2 Var[N]/N^4$
Average length	$y_l(t)$ catch per length class l $y(t)$ total catch (measured species)	$L_{bar_i}=\frac{\sum_{l=1}^{L} y_l\, l}{y}$ avec $y=\sum_{l=1}^{L} y_l$ $Var[L_{bar}]=\left(\frac{\sum_{l=1}^{L} y_l\, l^2}{y}-L_{bar}^{\ 2}\right)\Big/ y$
Average population length percentiles l_q	Population length percentiles $L_{q,i}$	$l_q=\sum_{i=1}^{S} L_{q,i} \Big/ S$

Index	Required input	Estimator
	S number of consistently measured species	$Var[l_q] = \sum_{i=1}^{S} Var[L_{q,i}]$
Mean length of large fish	Length of the population *i* at the quartile *q* L_{qi} Interannual median of lengths for population *i* at quartile *q* L_{qi}^m *S* number of species sized N_i total abundance of the population *i* *N* total abundance	meanMaxSIH: $l_q = \sum_{i=1}^{S} L_{q,i} \Big/ S$ $Var[l_q] = \sum_{i=1}^{S} Var[L_{q,i}]$ meanMaxDCF: $l_q = \sum_{i=1}^{S} N_i L_{qi}^m \Big/ \sum_{i=1}^{S} N_i$ $Var[l_q] = \sum_{i=1}^{S} (L_{qi}^m)^2 Var[N_i] \Big/ Var[N]$
Proportion of large individuals p_{large} with length higher than *lbig* = fixed threshold	$y_l(t)$ catch by size class *l* $y(t)$ total catch (measured species) Threshold large size *lbig*	$p_{\text{large}}(t) = \sum_{l>lbig} y_l(t) \Big/ y(t)$ $Var[p_{\text{large}}] = \frac{p_{\text{large}}(1 - p_{\text{large}})}{y(t)}$
Indicator of species conservation	$y_{i,l}(t)$ catch of the population *i* by size class *l*, $t=t_1 \ldots t_f$ *S* total number of species	1. SV : *Nsv* sensitive populations = $\{L_{0.95,i} > 40$ cm & $L_{0.95,i} > L_{0.95,j}$ $\forall j \in (S-SV)\}$; *Nsv* = max(20, number of populations > 40cm) 2. $a_i(t) = \sum_{l>L_{0.95,i}/2} y_{i,l}(t)$ 3. $t_k = t_1 \ldots (t_f - 10)$: $a_i(t)/a_i(t_k) = \beta_{1,k} t + \beta_{2,k}$, $t = t_k \ldots t_k + 10$ Id_i=score($\min_k(\beta_k)$) (*Cf* tableau) $R_i = I\{\exists t > t_{kmin}+10 \;\; a_i(t) > A_i\}$ avec $A_i = \sum_{t=1}^{3} a_i(t)/3$ ou $A_i = \sum_{j=1}^{5} \max(a_i(t))/5$ 4. $I = \sum_{i=1}^{N_{SV}} (1-R_i) Id_i \Big/ N_{SV}$
Diversity index Δ_1	N_i	$\Delta_1 = \frac{N}{N-1}\left[1 - \sum_{i=1}^{n} \left(\frac{N_i}{N}\right)^2\right]$ $Var[\Delta_1] \approx \sum_{i}^{n} Var[N_i] \left(\frac{2N_i}{N^2} - \sum_{i}^{n} \frac{2N_i^2}{N^3}\right)$ confidence interval by parametric bootstrap
Shannon index normalized wrt the first year	N_i (t)	$M(t) = -\sum_i q_i(t) \log(q_i(t))$ $q_i(t) = N_i(t) / \sum_i N_i(t=1)$

References

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