

# Standard indices calculated

The range of indices available is illustrated with the macrobenthic data Clyde macrofauna counts from the Clyde sludge dump-ground study, directory C:\Examples v7\Clyde macrofauna, last seen in Section 14. Analyses so far have used only the abiotic and biomass matrices, and the existing workspace Clyde ws may have become cluttered, so open Clyde macrofauna counts into a new workspace, and save it as Clyde ws2. Without pre-treatment, take **Analyse>DIVERSE>**(✓Results to worksheet). Look at the options on the first 5 tabs, taking only ✓S, ✓d, ✓J<sup>′</sup>, ✓H, ✓ $\alpha$ , ✓H<sup>′</sup> (log base e), ✓1 -  $\lambda$ <sup>′</sup>, ✓ES(n) with n values: 15, 30, 45 (there is no special significance to the index grouping under tabs, except that the last two tabs deal with taxonomic-relatedness measures, seen later). The abundance of the *i*th species is denoted by  $N_i$  ( $i = 1, 2, \dots, S$ ) and, as a ratio of their sum ( $N$ ), this is denoted  $P_i$  ( $i = 1, 2, \dots, S$ ). The first 5 tabs (where ✓ denotes the default selections) are:

## Other

✓Total species:  $S$

✓Total individuals:  $N$

✓Species richness (Margalef):  $d = (S - 1) / \log_e N$

✓Pielou's evenness:  $J' = H' / \log_e S$

Brillouin:  $H = N^{-1} \log_e \{ N! / (N_1! N_2! \dots N_S! ) \}$

Fisher's  $\alpha$  statistic

## Shannon

✓ $H' = - \sum P_i \log(P_i)$ , where the logs are to the base e

$H'$  as above but for logs to the base 2

$H'$  as above but for logs to the base 10

## Simpson

$\lambda = \sum P_i^2$

$1 - \lambda = 1 - (\sum P_i^2)$

$\lambda' = \{ \sum_i N_i (N_i - 1) \} / \{ N(N-1) \}$

✓ $1 - \lambda' = 1 - \{ \sum_i N_i (N_i - 1) \} / \{ N(N-1) \}$

## Hill numbers

$N_1 = \exp(H')$

$N_2 = 1 / \sum P_i^2$

$N_{\infty} = 1 / \max_i \{ P_i \}$

$N_{10} = N_1 / S$

$\{ N_{10} \}' = (N_1 - 1) / (S - 1)$

$N_{21} = N_2 / N_1$

$\{ N_{21} \}' = (N_2 - 1) / (N_1 - 1)$

## Rarefaction (Sanders/Hurlbert)

$ES_n$ , the 'expected' number of species from  $n$  individuals ( $n \leq N$ )

Clyde macrofauna counts

*Clyde macrofauna counts*

**Abundance**

Samples - Sites along

	S1	S2
Abra alba	0	0
Abra nitida	4	3
Abra sp.	0	0
Amaeana trilobata	0	3
Ampharete grubei	0	1
Amphipoda sp. ind.	1	0
Amphitrite	0	0
	0	0
	1	1
	2	0

Tables - Species

Analyse

Resembl

CASWEL

DIVERSE

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PCA...

SIMPER...

SIMPROF

Summar

DIVERSE

Other Shannon Simpson Hill Rarefaction Taxo

- Total species: S
- Total individuals: N
- Species richness (Margalef):  $d = (S-1)$
- Pielou's evenness:  $J' = H'/\text{Log}(S)$
- Brillouin:  $H = \text{Log}(N!/\text{PROD}(Ni!))/N$
- Fisher's  $\alpha$

DIVERSE

Other Shannon Simpson Hill Ra

- $N1 = \text{Exp}(H')$
- $N2 = 1/SI$
- $N\text{infinity} = 1/P\text{max}$
- $N10 = N1/S$
- $N10' = (N1-1)/(S-1)$
- $N21 = N2/N1$
- $N21' = (N2-1)/(N1-1)$

DIVERSE

Other Shannon Sim

$H' = -\text{SUM}$

Log base

- e
- 2
- 10

DIVERSE

Other Shannon Simpson

- $\lambda = \text{SUM}$
- $1-\lambda = 1$
- $\lambda' = \text{SUM}$
- $1-\lambda' = 1$

DIVERSE

Other Shannon Simpson Hill Rarefaction

- ES(n)

n values:

15, 30, 45

Results to work

Data1

*Clyde diversity indices*

Other

	S	d	J'	Brillouin	Fisher
S1	18	4.043	0.6485	1.5834	8.0713
S2	28	5.182	0.7774	2.3715	9.2183
S3	43	6.045	0.4081	1.4707	9.0441
S4	42	5.627	0.3705	1.3387	8.0717
S5	26	3.140	0.4490	1.4472	3.9455
S6	3	0.344	0.5479	0.5881	0.4554

Samples

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