Rocky shores

A good "model system" for studying how and why species distributions vary

We will compare within and between different rocky shores

(1) Describe rocky shore communities
(2) Ask how those communities differ within and among different shores
(3) Consider why these communities differ

Types of biodiversity

Biodiversity:

diversity of species, populations, individuals, genes

diversity of interactions within/between species

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There are three "kinds" of diversity **measure**

(1) Alpha (α): *diversity of a given area*

(2) Beta (β): *difference between 2+ areas ("turnover")*

(3) Gamma (γ): *combination of* α + β ("landscape")

Alpha diversity

Most simple:

How many species are there (**species richness**)?

VERY useful and easy to understand.
Why bother with anything else?

Only captures the *variety* not the *abundance*

Alpha diversity

Diversity is a function of:

(1) “variety” (species richness)

(2) “evenness” (relative abundance of each species)

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BUT…

without good abundance estimates (e.g. often the case with large-scale surveys) species richness *by far the best*

Alpha diversity

Therefore consider is *species richness* the best?

If not…

A (bewildering) diversity of diversity measures

Some emphasise species richness, others dominance/ evenness

(early lesson: no right answers about which to use)

We will use **Simpson's Index**

Simpson's index

Simpson's Index = **1 – D**

$$D = \Sigma\, ((n_i[n_i - 1])/(N[N - 1]))$$

Σ is "the sum of"

n_i = number of individuals in species i

N = the total number of individuals (all species)

If Index is **low** = **less diverse**, if **high** = **more diverse**

Simpson's index

$$D = \Sigma\ ((n_i[n_i - 1])/(N[N - 1]))$$

For each site, for each organism, tabulate

SPECIES	n_i	$n_i - 1$	N	N - 1	FORMULA
Edible crab	5	4	103	102	0.0019
Dog whelk	23	22	103	102	0.0482
Periwinkle	…	…	103	102	…
Another winkle	…	…	103	102	…

Beta diversity

How similar are two or more sites?

How do the species change (or “turnover”) between sites?

Beta diversity

How similar are two or more sites?

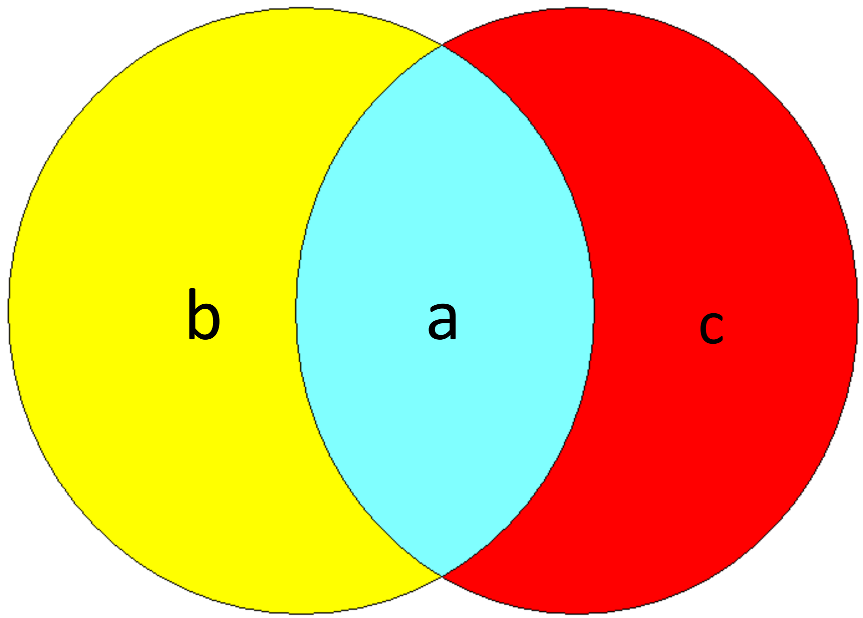
How do the species change (or “turnover”) between sites?

How distinct are samples?

Again, lots of measures…

(1) **Jaccard Index** (2) **Bray-Curtis Index**

Beta diversity



Jaccard Index

Jaccard Index = ***a* / (*a* + *b* + *c*)**

Where:

a = total number of *species* in *both* sample 1 and sample 2

b = number of species *only* in sample 1

c = number of species *only* in sample 2

“sample” could be a quadrat, a transect, a field…

The **higher** the JI the **more similar** (so the **less β diverse**)

Bray-Curtis Index

Bray-Curtis Index = $\mathbf{2\mathit{jN} / (\mathit{N_a} + \mathit{N_b})}$

Where:

N_a = total number of *individuals* in sample a
N_b = total number of *individuals* in sample b

$2jN$ = 2 times the sum of the *lower* of the two abundances for species present in *both* sites

Again, “sample” could be a quadrat, a transect, a field…

The **higher** the BCI the **more similar** (the **less β diverse**)

Bray-Curtis Index

Bray-Curtis Index = $\boldsymbol{2jN / (N_a + N_b)}$

SPECIES	SITE 1	SITE 2
Dog whelk	23*	45
Edible crab	2*	4
Periwinkle	48	31*
Springtails	57	0 **Miss out – not shared**
Starfish	1*	2

So, $2jN$ = 2 x [23 + 2 + 31 + 1] = 104

BCI = 104/(131+ 82) = 0.488

What we will do

For organisms with sensible “individuals” (top-shells, dog whelks, winkles, sea hares etc) we have **counts**[1]

For organisms like seaweeds, lichens, barnacles, sponges we have **% cover**[2]

For each station: 6 quadrats (or more)

1: average counts for each species

2: average % cover for each species

END WITH: one abundance or % cover for each species per station for analysis

What we will do

Use your data to describe your rocky shore community in terms of alpha and beta diversity, comparing stations

Tomorrow, we will extend to compare different shores

Think about: how to tabulate and organise data
(practise runs in notebook?)

how to organise for analysis