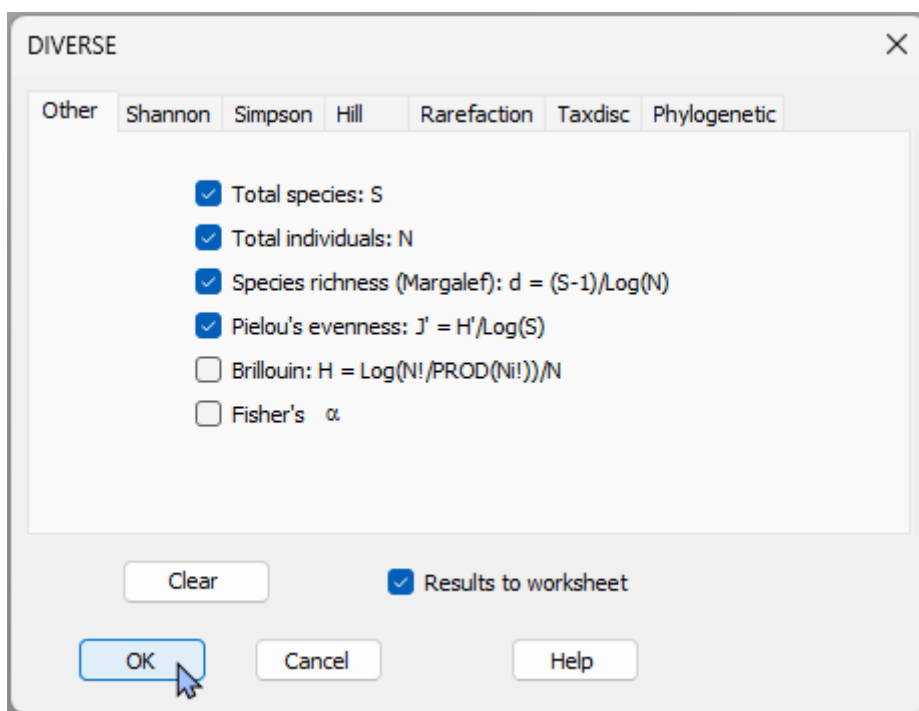


16.2 Example: Fal biota (one-way case)

Let's look at an example of a means plot for a one-way case using biotic data ($p = 131$ taxa) from the Fal estuary. The data consist of counts of organisms living in benthic sediments obtained from $n = 5-7$ sites in each of 5 creeks running into the Fal estuary, Cornwall, UK ([Somerfield et al. \(1994a\)](#) , [Somerfield et al. \(1994b\)](#)). These 5 creeks had differing levels of heavy metals in their sediments, due to historical tin and copper mining in their respective valleys. Interest lies in identifying whether the 5 creeks also differed in their diversity of benthic infauna. The full set of biotic data (macrofauna and also the meiofauna - comprised of nematodes and copepods) are contained in the file 'Fal_all_biotic_taxa.pri', found in the 'Fal_benthic_fauna' folder in 'Examples_P8'.

1. Start by calculating some univariate diversity measures for each sample. Open the 'Fal_all_biotic_taxa.pri' file in PRIMER 8, then click **Analyse > DIVERSE...**, take all the defaults and click 'OK'.



This will produce a sheet, called 'Data1' with values for various diversity indices for each of the sampling units.

Data1

Other

Variables							
	S	N	d	J'	H'(loge)	1-Lambda'	
R1	25	1681	3.2314	0.67663	2.178	0.83397	
R2	31	954	4.3728	0.5929	2.036	0.7535	
R3	22	880	3.0974	0.64547	1.9952	0.75677	
R4	24	760	3.4673	0.7003	2.2256	0.81383	
R5	22	1025	3.0292	0.7634	2.3597	0.87003	
R6	30	1495	3.9672	0.66217	2.2522	0.79938	
R7	25	653	3.7028	0.73937	2.3799	0.87205	
M1	39	5607	4.4023	0.59794	2.1906	0.77582	
M2	30	6744	3.2893	0.59137	2.0114	0.73151	
M3	32	6582	3.5259	0.67696	2.3462	0.87411	
M4	30	4462	3.451	0.72335	2.4602	0.8704	
M5	27	2329	3.3535	0.80175	2.6424	0.90906	
P1	43	9234	4.5999	0.69369	2.6091	0.88792	
P2	40	6789	4.4202	0.74913	2.7635	0.89843	
P3	45	11027	4.7271	0.67114	2.5548	0.87727	
P4	41	10191	4.334	0.71467	2.654	0.8988	
P5	40	7714	4.3572	0.64335	2.3732	0.85283	

- Calculate a means plot that shows the means $\pm$ 1 standard error for the 5 creeks for each of these diversity measures. From the 'Data1' sheet, click **Plots > Means Plot...**

PRIMER

File Edit Select View Wizards Pre-treatment Analyse **Plots** PERMANOVA+ Tools Window Help

Workspace

- Fal_all_biotic_taxa
 - DIVERSE1
 - Data1**

Data1

Other

Variables							
	S	N	d	J'	H'(loge)	1-Lambda'	
R1	25	1681	3.2314	0.67663	2.178	0.83397	
R2	31	954	4.3728	0.5929	2.036	0.7535	
R3	22	880	3.0974	0.64547	1.9952	0.75677	
R4	24	760	3.4673	0.7003	2.2256	0.81383	
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R6	30	1495	3.9672	0.66217	2.2522	0.79938	
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M4	30	4462	3.451	0.72335	2.4602	0.8704	
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P3	45	11027	4.7271	0.67114	2.5548	0.87727	
P4	41	10191	4.334	0.71467	2.654	0.8988	
P5	40	7714	4.3572	0.64335	2.3732	0.85283	

Plots

- Bar Plot...
- Box Plot...
- Dominance Plot...
- Dot Plot...
- Draftsman Plot...
- Empirical Distribution Plot...
- Geometric Class Plot...
- Histogram Plot...
- Line Plot...
- Means Plot...**
- Scatter Plot...
- Shade Plot...
- Species-Accum Plot...
- Surface Plot...
- Violin Plot...

Leave all of the defaults and click '**OK**'.

Means Plot

Factors

Factor A (different symbols/colours)
Creek

☐ Split into separate groups (along the x-axis) by Factor B
Creek

☒ Draw group separator lines

☐ Split into separate plots by Factor C
Creek

Display means as

☒ Points ☐ Bars

Join means

☒ Do not join means

☐ Join means

☐ Across levels of Factor A (within levels of Factor B)

☐ Across levels of Factor B (within levels of Factor A)

Error bars

☒ ± 1 standard error

☐ ± 1 standard deviation

Confidence interval

CI (%): 95.0

☐ t-based

☐ Normal-based

☐ Bootstrap percentile

Bootstraps: 1000

Error bars on

☒ Both sides ☐ Outer side only

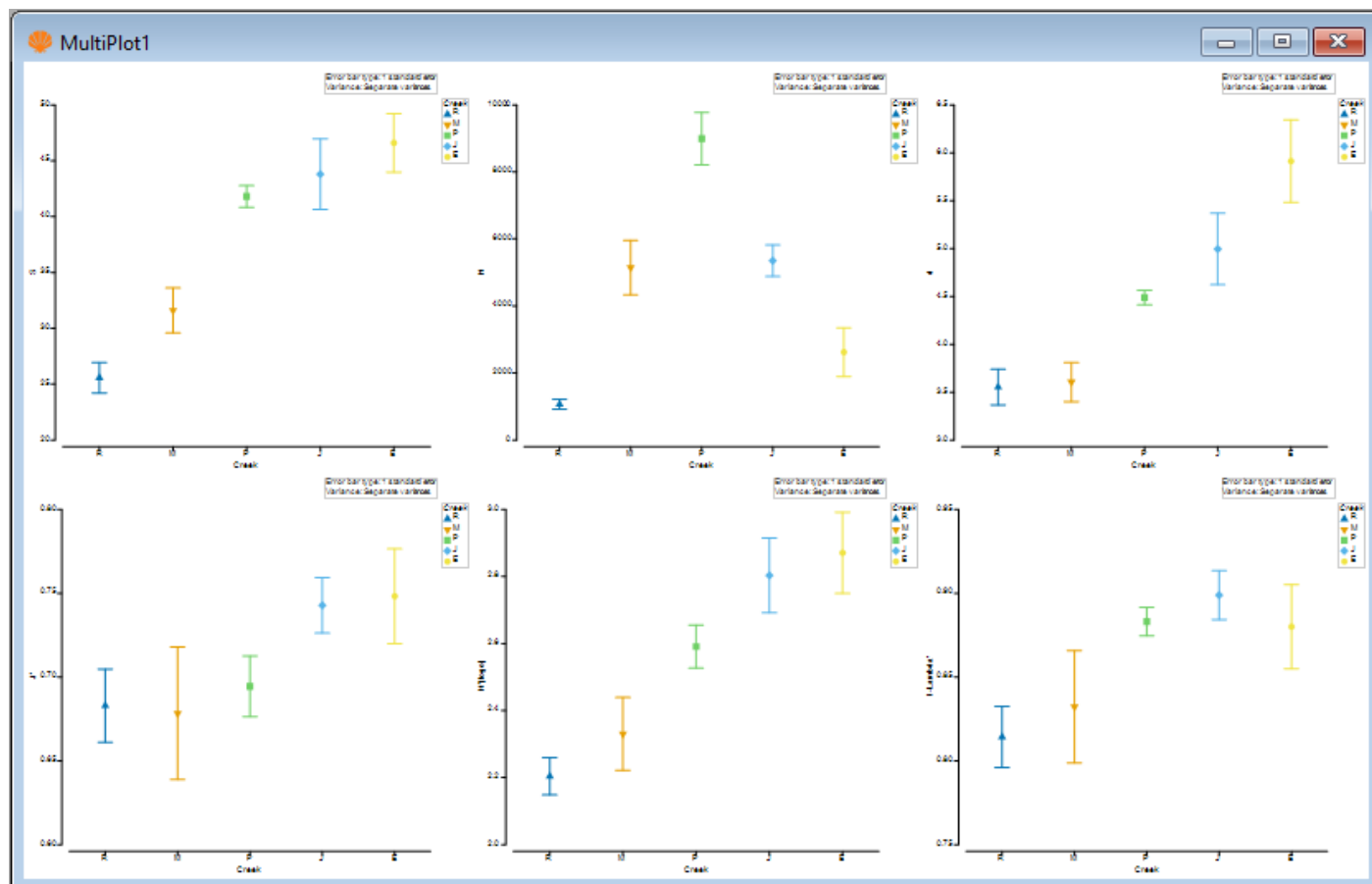
Variance

☒ Separate variances ☐ Common variance

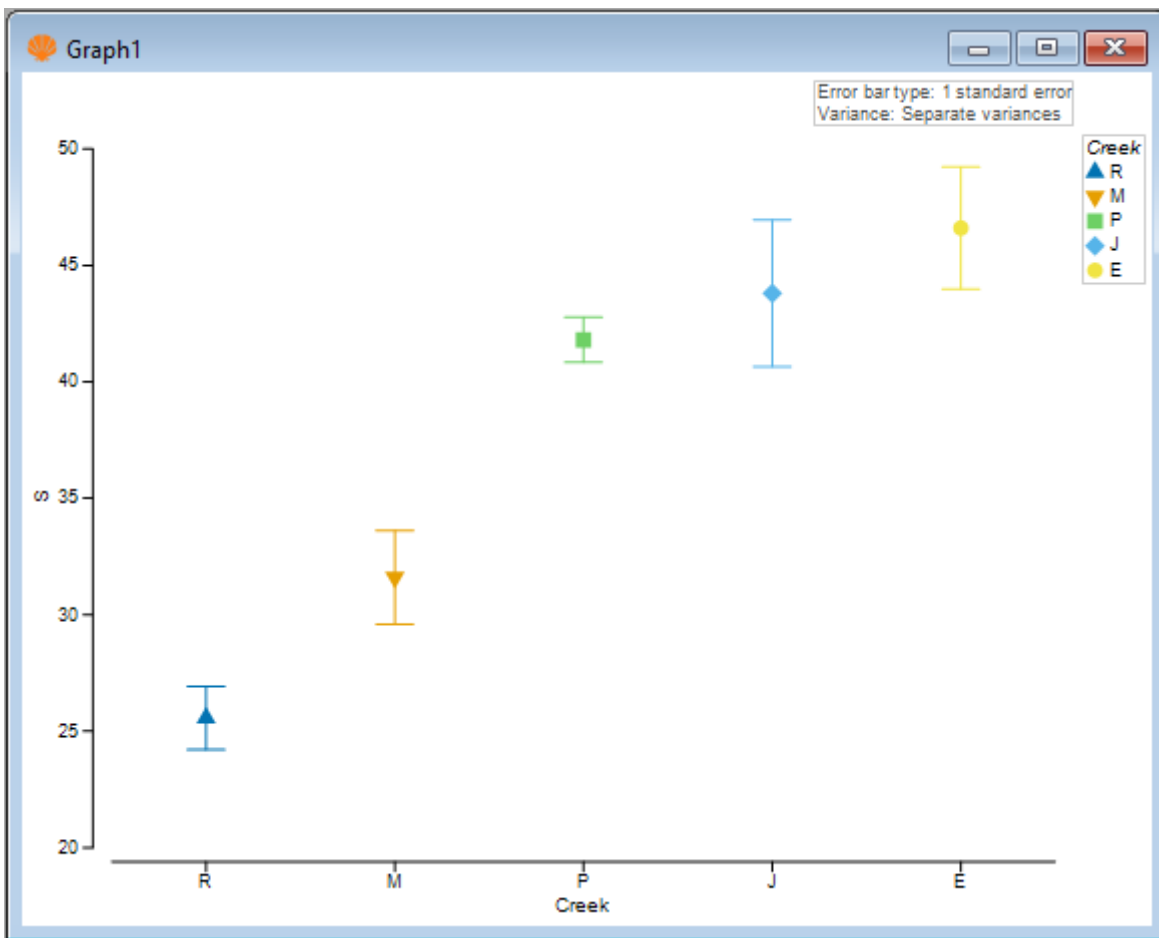
☐ Output means data to worksheet

OK **Cancel** **Help**

The result will be a 'Multi plot' item, that includes 6 individual plots - one for each of the 6 diversity measure variables in the original 'Data1' sheet.



3. View an individual plot by clicking on it. For example, you can click on the plot in the top left-hand corner of 'MultiPlot1' to see a means plot for the variable of species richness ('S', the number of different taxa). Alternatively, you can click on 'Graph1' in the Explorer tree.



4. To change the colours, symbols or line types, you can click **Graph > Special...**, which shows you a dialog with a plethora of options to modify all of these details of your means plot. For example, you can click the 'Key...' button next to the factor to change the colours/symbols, or choose to **Join means**, including the option to choose a custom colour for the joining line, like this:

Means Plot

Factor A: Key...

Factor B: Key...

Display means as
☒ Points ☐ Bars

Join means
☐ Do not join means
☒ Join means
☐ Across levels of Factor A (within levels of Factor B)
☐ Across levels of Factor B (within levels of Factor A)

Line appearance
☐ Default
☒ Custom Colour: Style:

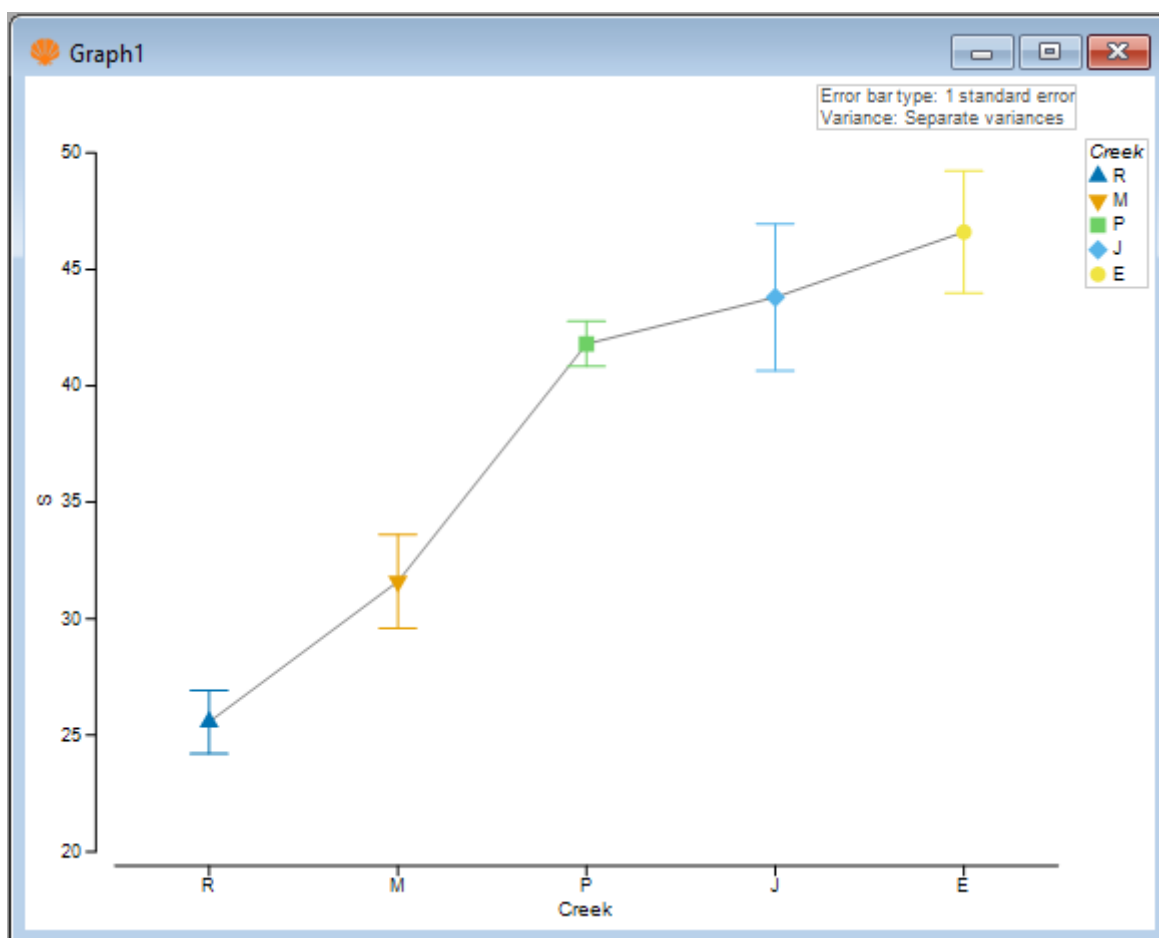
Choose gaps
 Within group gap: Across group gap:

Error bars
 Appearance
☒ Default (Factor A)
☐ Custom Colour: Style:
☒ Both sides ☐ Outer side only

Separator lines
☒ No separator lines
☐ Show separator lines Colour: Style:

OK Cancel Help

This will yield the following modified plot:



- You can also choose to show the means as bars instead. Click **Graph > Special...**, then (Display Means as > ☒ Bars) and (Error bars > Appearance > ☒ Custom).

Means Plot

Factor A: Key...

Factor B: Key...

Display means as
☐ Points ☒ Bars

Join means
☐ Do not join means
☒ Join means
☐ Across levels of Factor A (within levels of Factor B)
☐ Across levels of Factor B (within levels of Factor A)

Line appearance
☐ Default
☒ Custom Colour: Style:

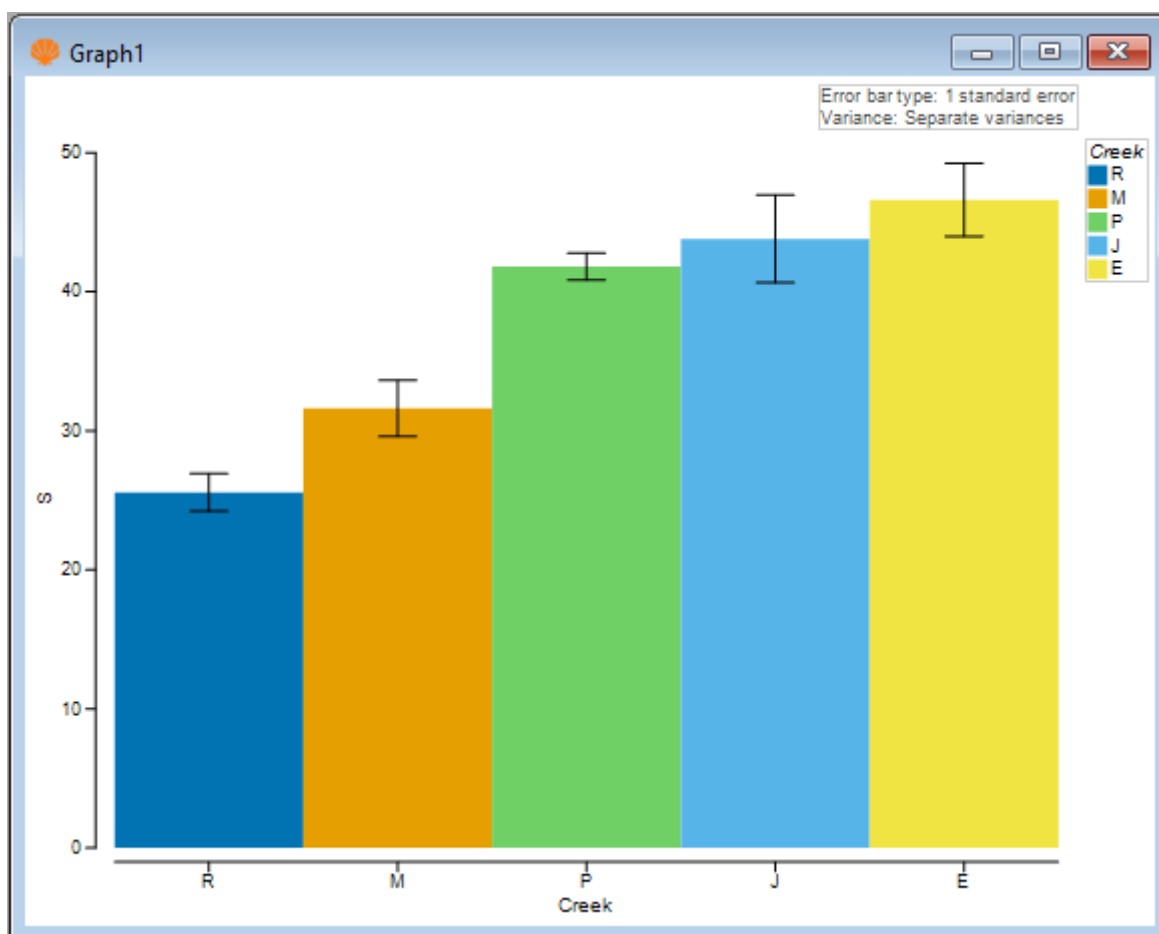
Choose gaps
 Within group gap:
 Across group gap:

Error bars
 Appearance
☐ Default (Factor A)
☒ Custom Colour: Style:
☒ Both sides ☐ Outer side only

Separator lines
☒ No separator lines
☐ Show separator lines Colour: Style:

OK Cancel Help

This yields the following plot:



Next, we shall consider some multi-factor plots.

