

Paleoecology Laboratory #9

Upper Ordovician Brachiopod Assemblages – The Report

October 3, 2019

Goals:

1. Practice simple population statistics on Upper Ordovician brachiopod assemblages, including chi-squared and Shannon-Wiener measures.
2. Explore additional capabilities of the PAST3 statistics software package.
3. Start your second paleoecology lab report. (Due in Dropbox folder by 5:00 pm, Tuesday, October 22.)

Exercise:

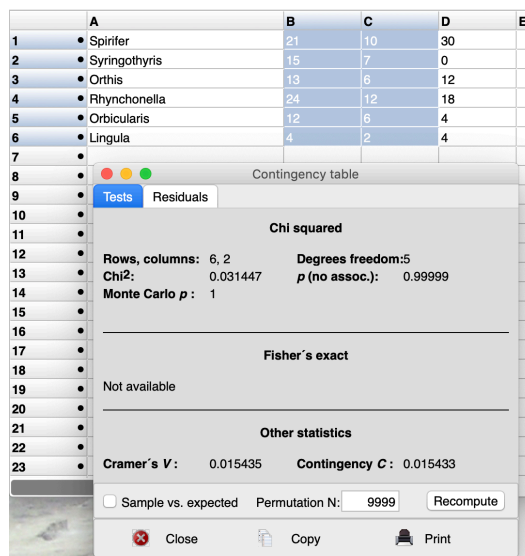
Materials needed -- Three collections of Upper Ordovician brachiopods (Assemblages 1, 2 and 3)
 Your laptop computer or tablet with PAST3 ready to use
 Your data from the previous lab (three completed forms)

Procedure –

1. Open PAST3 and key in the taxa and data you collected from the three assemblages. List the taxa in column A and the abundance data from the three assemblages in columns B, C and D. Use “0” for any blanks. Your spreadsheet should resemble this made-up data–

	A	B	C	D	E
1	• Spirifer	21	10	30	
2	• Syringothyris	15	7	0	
3	• Orthis	13	6	12	
4	• Rhynchonella	24	12	18	
5	• Orbicularis	12	6	4	
6	• Lingula	4	2	4	
7	•				

2. We have a hypothesis that Assemblages 1 and 2 (columns B and C) are from the same population of brachiopods, and that Assemblage 3 (Column D) is from a separate population. To test the first part of the hypothesis, we will examine the similarity of Assemblages 1 and 2 (B and C) by using a chi-squared test, with a $p > 0.05$ indicating the assemblages likely came from the same population (or more accurately, that they cannot be excluded from being of the same population). Select the data in columns B and C, choose “Univariate” and then “Contingency table” to get a screen like this – (Ignore warning pop-up.)



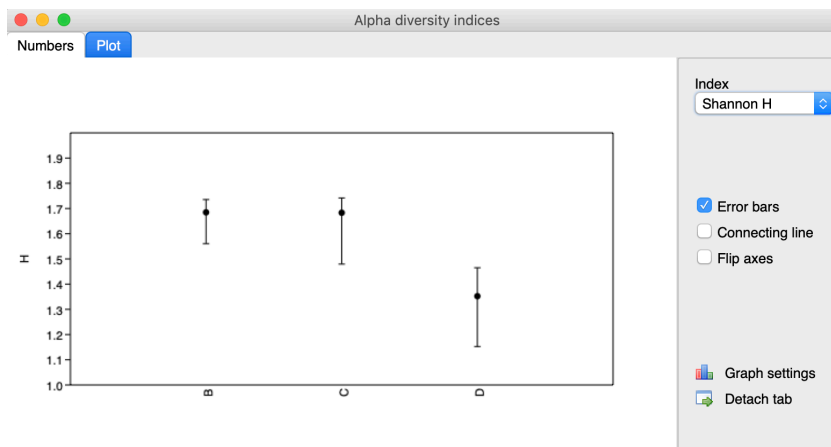
Note the p value under chi-squared. Are the two assemblages from the same population?

- Do the same chi-squared test with Assemblages 2 and 3 (columns C and D). Note the resulting p value. Are the assemblages from the same population or different populations?
- Now we want to simply calculate a measure of the diversity of the three assemblages. We will calculate the Shannon-Wiener Diversity Index (H). Select all three data columns, choose “Diversity” and then “Diversity indices” --

	A	B	C	D	E	F	G
1	• Spirifer	21	10	30			
2	• Syringothyris	15	7	0			
3	• Orthis	13	6	12			
4	• Rhynchonella	24	12	18			
5	• Orbicularis	12	6	4			
6	• Lingula	4	2	4			

	Alpha diversity indices						
	Numbers	Plot					
		Lower	Upper	C	Lower	Upper	D
10	Taxa_S	6	6	6	6	6	5
11	Individuals	89	89	89	43	43	68
12	Dominance_D	0.1983	0.1839	0.2395	0.1996	0.1823	0.3028
13	Simpson_1-D	0.8017	0.7605	0.8161	0.8004	0.728	0.6972
14	Shannon_H	1.685	1.56	1.736	1.683	1.479	1.352
15	Evenness_e^H	0.8986	0.7935	0.9453	0.8971	0.7356	0.7732
16	Brillouin	1.572	1.454	1.62	1.49	1.303	1.244
17	Menhinick	0.636	0.636	0.636	0.915	0.915	0.6063
18	Margalef	1.114	1.114	1.114	1.329	1.329	0.948
19	Equitability_J	0.9403	0.8709	0.9686	0.9394	0.8285	0.8402
20	Fisher_alpha	1.452	1.452	1.452	1.896	1.896	1.244
21	Berger-Parker	0.2697	0.2247	0.3708	0.2791	0.2326	0.4186
22	Chao-1	6	6	6	6	6	5

There's lots there, but for now simply record the “Shannon-H” for columns B, C and D. Choose “Plot” and then “Shannon H” and “error bars” in that window and get something like this --



Screen-capture this plot, print to pdf or otherwise export it to your files. You're done with the statistics!

- The lab report instructions. Again, you choose the format and style. The formal requirements are to address the following items and submit to the Dropbox folder a Word document by 5:00 pm on October 22. Note the time gives us a chance to discuss any questions in our October 15 lab session. The items to include in your report --

Locations and stratigraphy of the three brachiopod assemblages. Assemblages 1 and 2 are from the Whitewater Formation near Richmond, Indiana. Assemblage 3 is from the Liberty Formation near Liberty, Indiana. All are Upper Ordovician (Katian Stage).

List of identified taxa and abundances in each assemblage. (You can use your PAST3 spreadsheet or copy that data into your own table in Word. Don't forget to *italicize* genera and species names.)

Are assemblages 1 and 2 from the same brachiopod population? What is your evidence?

Are assemblages 2 and 3 from the same brachiopod population? What is your evidence?

What is the Shannon-Wiener Diversity Index for each assemblage, including error ranges? (Use your plot.)

Which brachiopod taxa are most prominent in each assemblage? How would you characterize the morphology of these dominant taxa? Can they tell us anything about the paleoenvironments? (Feel free to speculate on what you know about brachiopod ecology.)

As an appendix, please include one image of each brachiopod species in this study. The images need only a scale and a caption giving name and assemblage number.

That's it! Turn in your report to the Dropbox folder as a Word document by 5:00 pm on October 22.

