



PRIMER v7 and PERMANOVA+ WORKSHOPS
Long Beach, California, USA
Multivariate Analysis in Ecology (& other Sciences)

Presenters: **Dr. Paul Somerfield and Dr. Adam N. H. Smith**

Venue: **California State University, Long Beach, California, USA**

Dates: **Week 1: January 7th - 11th, 2019 – PRIMER v7** (Paul Somerfield)

Week 2: January 14th - 18th, 2019 – PERMANOVA+ (Adam N. H. Smith)

The workshops run over two weeks (5 days per week, Monday – Friday, (08:15 to 17:15 each day). Participants may register for **week 1 only**, **week 2 only**, or **both weeks**. Each week mixes lectures and computer lab sessions on literature data sets, and ends with a day in which participants can discuss and analyze their own data sets in consultation with the lecturer. **Participants are expected to bring their own laptop**. Software may be purchased (at a discounted price – see below) or a free fully functional but time-limited version can be made available to registered participants for trial use during the workshop. Note that PRIMER is a Windows-only product, so Macs need to run in Windows emulation.

Week 1

- The first week will provide an intensive and extensive overview of statistical methods in non-parametric analysis of multivariate data, encapsulated in the software: **PRIMER version 7**. The first week will cater to both those who are **new to PRIMER** and to those who are “**old hands**”, but have not yet had a chance to learn about version 7. Important new tools include: **shade plots** with flexible ordering & clustering of axes; **coherence plots** to show species displaying statistically distinguishable response patterns; **unconstrained** binary or divisive **flat clustering** (as in *k*-means) along with **SIMPROF** tests; **metric**, **threshold metric**, **non-metric** or **combined MDS** in any dimensions; **bootstrap averages** to show variation among averages in metric MDS space; **2-way versions** of BEST and RELATE; **new plot types** (bar, box, means, line, histogram, scatter, surface, shade) in 2-d or 3-d; **animations** of ordinations captured to video files; multi-factor and multi-variable **segmented bubble plots** in 2-d and 3-d; ANOSIM extended for **ordered factors** and **3-factor** designs and much more...
- As well as covering the new methods in PRIMER 7, basic multivariate routines will be fully discussed, e.g. pre-treatment of data; definitions of similarity; clustering; ordination by principal components (**PCA**), non-metric (and metric) multi-dimensional scaling (**MDS**); permutation tests on similarity matrices for structured (**ANOSIM**, **RELATE**) and unstructured (**SIMPROF**) cases; emphasis on species analyses; linking community to abiotic data (**BEST**); biodiversity indices; means plots (with approximate region estimates), and the many graphical tools available for effective presentation of results. Non-parametric statistics and permutation tests make the methods intuitively simple to understand, so **no prior background in statistics is assumed**.

Week 2

- The second week will focus on **PERMANOVA+**, an add-on package to PRIMER v7. PERMANOVA+ extends PRIMER to allow analysis of multivariate data in response to complex designs, using semi-parametric partitioning on the basis of a resemblance measure of choice and with rigorous inferences *via* permutation methods. PERMANOVA+ allows more formal models, tests and predictions for multivariate (or univariate) ecological (and other) systems that are over-parameterised (i.e., have too many variables) or that demonstrate substantial non-normality. Participants should have some prior knowledge or experience of basic multivariate methods (such as that covered in week 1), and some prior exposure to complex experimental/sampling designs from a practical perspective is also desirable (but not essential) for week 2.
- Participants will explore: analysis and estimation of components of variation in complex experimental designs, including interactions, covariates, contrasts, fixed or random effects, crossed or nested models, unbalanced designs, environmental impact designs, randomized blocks or repeated measures (**PERMANOVA**); tests for homogeneity of multivariate dispersions and analyses of beta diversity (**PERMDISP**); multivariate regression and model selection procedures (**DISTLM**); principal coordinate analysis (**PCO**); distance-based redundancy analysis (**dbRDA**); canonical analysis of principal coordinates (**CAP**), including leave-one-out allocation success for discriminant analysis or canonical correlation analyses based on resemblance matrices and the placement of new points into existing predictive canonical models.

Venue

The workshop will be held in the Hall of Science (HSCI), California State University Long Beach, 1250 Bellflower Blvd, Long Beach, California, USA 90840. For further local information, including directions, parking, and nearby options for accommodation, please contact the local workshop organiser directly, Dr. Christine Whitcraft, at christine.whitcraft@csulb.edu. Please note that it is each participant's responsibility to arrange and pay for their own accommodation - this is not included within the workshop registration fee.

Registration Costs (in United States dollars USD)

| | <i>For either Week 1 or Week 2:</i> | <i>For both Weeks 1 & 2:</i> |
|---|---|---|
| EARLY BIRD* <i>Before October 31st, 2018</i> | USD \$960 (\$660 for full-time students) | USD \$1,720 (\$1,190 for full-time students) |
| <i>After October 31st, 2018</i> | USD \$1,050 (\$750 for full-time students) | USD \$1,890 (\$1,350 for full-time students) |

The course fee **includes** all course materials, coffee/tea and snacks during breaks, free Wi-Fi, and (if needed) a temporary software licence key for the duration of the workshop, **but not** meals, accommodation or the separate (discounted) costs of purchasing software. All prices are in US dollars.

Software – discount prices for workshop participants

Participants wishing to purchase PRIMER software at the discounted prices shown below¹ should indicate this on the registration form. All prices are in US dollars².

| | New PRIMER 7 (USD) | Upgrade PRIMER 6 to PRIMER 7 (USD) | PERMANOVA+ add-on (USD) |
|-------------------|-----------------------|---------------------------------------|----------------------------|
| Private sector | \$800 | \$400 | \$400 |
| Public sector | \$600 | \$300 | \$300 |
| Academic | \$400 | \$200 | \$200 |
| Full-time student | \$200 | \$100 | \$100 |

Accommodation near CSU Long Beach

Discounted hotel rates can be arranged for participants by contacting Christine Whitcraft once registration is confirmed.

| Name | Address & Contact | Approx. Rate |
|--|--|---|
| Hotel Current (1.2 miles from CSULB, shuttle available) | 5325 East Pacific Coast Highway, Long Beach (562) 597-1341 hotelcurrent.com | Estimated rate \$119 per night (with discount code CSULB and proof of workshop registration) |
| Ayres Hotel Seal Beach (8.1 miles from CSULB) | 12850 Seal Beach Boulevard, Seal Beach (562) 596-8330 ayreshotels.com | Estimated \$161 per night |
| Holiday Inn Long Beach-Airport (2.5 miles from CSULB) | 2640 North Lakewood Boulevard, Long Beach (562) 597-4401 holidayinn.com | Estimated \$129 per night |
| Pacific Inn (3.4 miles from CSULB) | 600 Marina Dr, Seal Beach (562) 493-7501 thepacificinn.com | CSULB Leisure rate available (estimated \$20 off best available rate, between \$179 - 209) – to be confirmed. |

¹ The workshop discount applies only to purchases of 3 or fewer licences within a given sector, and excludes any additional discounts. Discounts for multiple purchases (i.e., up to 40%, see www.primer-e.com for details) accrue in the usual way for 4 or more licences.

² New Zealand residents attending the workshop must pay a 15% Goods & Services Tax (GST) for any software purchases.

About the Lecturers

Dr. Paul J. Somerfield (Plymouth Marine Laboratory) is a highly-cited and sought-after numerical ecologist who has been instrumental in developing and using the methods in PRIMER across many fields, having led and lectured PRIMER workshops across the globe for over two decades. With knowledge and broad experience in analyzing multivariate datasets of all kinds, Paul has mentored and published with hundreds of scientists and professionals from a wide range of disciplines: marine, freshwater and terrestrial ecology, oceanography, soil science, forestry, environmental science, microbial ecology, genetics, remote sensing and modelling.

Dr Adam N. H. Smith (Massey University, Albany, Auckland, New Zealand) is a highly sought-after ecological statistician who specialises in the application of modern statistical methods to ecology and management, including fisheries and marine reserve assessment. Adam obtained his PhD from Massey University and has a wealth of multi-disciplinary experience across a variety of sectors. He lectures across a wide range of areas, including both univariate and multivariate statistics, data mining, quantitative ecology and biostatistics. He has been a key consultant to industry and government, having worked as an in-house statistician for the Department of Conservation (DoC) and the National Institute for Water and Atmospheric Sciences (NIWA) in New Zealand. Adam is an enthusiastic and engaging lecturer with a passion for natural environments and for teaching and learning.

Contact and Registration

To express interest in attending this workshop, please send an email directly to the PRIMER-e office: primer@primer-e.com. You will be sent a **registration form** and a detailed **schedule**. To register, please fill out the **registration form** and return it directly to primer@primer-e.com to secure your place. Places are limited. **Registrations must be received by December 1st, 2018**. Late registrants will only be accepted if space permits.