

Presenters: **Dr Paul J. Somerfield** and **Distinguished Professor Marti J. Anderson**

Venue: **University of Trieste, Italy**

Dates: **Week 1: 9-13 September 2019 – PRIMER v7** (Paul Somerfield)
Week 2: 16-20 September 2019 – PERMANOVA+ (Marti J. Anderson)

The workshops run over two weeks (5 days per week, Monday to Friday, 09:00 to 17:45 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 datasets, and ends with a day in which participants can discuss and analyse their own data 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 recently released 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 get up to speed with the latest developments in 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, the core basic multivariate routines will all 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. Some prior knowledge of basic multivariate methods and experimental design is desirable 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, randomised blocks or repeated measures (**PERMANOVA**); tests for homogeneity of multivariate dispersions and analyses of beta diversity (**PERMDISP**); multivariate regression and model selection procedures (**DISTLM**); unconstrained (**PCO**) or constrained ordinations using distance-based redundancy analysis (**dbRDA**) or canonical analysis of principal coordinates (**CAP**), 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 is hosted by the Department of Life Sciences and will be held in the S. Giovanni Teaching Hub at the main site of the University of Trieste in Trieste, Italy. For further local information (e.g., directions, parking, nearby accommodation, etc.), please contact one of the local organisers: Antonio Terlizzi (aterlizzi@units.it), Stanislao Bevilacqua (sbevilacqua@units.it) or Giovanni Bacaro (gbacaro@units.it).

Registration fees (Euros)

EARLY BIRD* <i>On or before 1st June 2019</i>	For <u>either</u> Week 1 or Week 2: EUR € 780 (€ 530 for full-time students)	For <u>both</u> Weeks 1 & 2: EUR € 1,400 (€ 960 for full-time students)
<i>After 1st June 2019</i>	For <u>either</u> Week 1 or Week 2: EUR € 850 (€ 600 for full-time students)	For <u>both</u> Weeks 1 & 2: EUR € 1,500 (€ 1,100 for full-time students)

The registration fee includes workshop materials, morning coffee/tea break, free wifi and (if needed) a temporary (fully functional but time-limited) software licence key for PRIMER v7 / PERMANOVA+. The registration fee does not include other meals or the separate (discounted) costs of time-unlimited software. Note that it is also the participant's responsibility to arrange and pay for travel and accommodation – these are not included in the registration fee. All prices are in Euros. New Zealand residents must add 15% GST.

Contact and Registration

To express interest in attending, please send an email directly to the PRIMER-e office: primer@primer-e.com. You will be sent a **registration form** and a detailed **programme**. To register, please fill out the **registration form** and return it directly to primer@primer-e.com to secure your place. Places are limited. The **Early Bird** registration deadline is **1st June 2019**. The **Final Deadline** for registration and payment is **23rd August 2019**. Late registrants will only be accepted if space permits.

Software – discount prices for workshop participants

Participants wishing to purchase PRIMER software at the discounted prices shown below should indicate this on the registration form. All prices are in Euros. New Zealand residents must add 15% GST.

	New PRIMER 7 (EUR)	Upgrade PRIMER 6 to PRIMER 7 (EUR)	PERMANOVA+ add-on (EUR)
Private sector	€ 700	€ 350	€ 350
Public sector	€ 525	€ 265	€ 265
Academic	€ 350	€ 175	€ 175
Full-time student	€ 175	€ 90	€ 90

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 analysing 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.

Distinguished Professor Marti J. Anderson (Massey University and PRIMER-e, *FRSNZ*, Auckland, New Zealand) is an ecological statistician whose work spans several disciplines, from ecology to mathematical statistics. A Fellow of the Royal Society of New Zealand, she holds a Chair in Statistics in the New Zealand Institute for Advanced Study at Massey University and her core research is in community ecology, biodiversity, multivariate analysis, experimental design and resampling methods, with a special focus on developing novel statistical methods for ecology. Marti developed all the methods in PERMANOVA+ and especially loves engaging in the dynamic interactions with students, academics and professionals that have become a trademark of the PRIMER and PERMANOVA+ international workshops.