PRIMER v7 and PERMANOVA+ WORKSHOPS
Auckland, New Zealand
Multivariate Analysis in Ecology (& other Sciences)

Presenters: Dr Adam N. H. Smith *and* Distinguished Professor Marti J. Anderson
Venue: ecentre, Massey University, Albany, Auckland, New Zealand
Dates: Week 1: 11-15 February 2019 – PRIMER v7 (Adam N. H. Smith)
Week 2: 18-22 February 2019 – PERMANOVA+ (Marti J. Anderson)

The workshops run over two weeks (5 days per week, Monday – Friday, 08:30 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 analyse 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 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. Week 1 is a perfect segue into week 2.
- Participants will explore: analysis, visualisation 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 will be held at the ecentre, Oaklands Road, Gate 5, Massey University, Albany campus, Albany Highway, Auckland, New Zealand. For further information, including directions to the venue, parking for participants, nearby accommodation options, etc., please contact the local workshop organiser, *Lyn Shave* (PRIMER-e, lyn@primer-e.co.nz). Please note that it is the participant's responsibility to arrange and pay for their own accommodation - this is not included within the course fee.

Registration Costs (in New Zealand dollars NZD)*

*Prices shown excl. GST	For *either* Week 1 or Week 2:	For *both* Weeks 1 & 2:
EARLY BIRD *Before 20th December 2018*	NZD $1,150 ($900 for full-time students)	NZD $2,150 ($1,500 for full-time students)
After 20th December 2018	NZD $1,300 ($980 for full-time students)	NZD $2,300 ($1,630 for full-time students)

The course fee **includes** all course materials, coffee/tea and snacks during breaks, a pizza and drinks social event (at the end of the day on Monday of each week), free wifi 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 New Zealand dollars[1]. (Massey University staff and students are eligible to a 33% discount on registration prices shown above).

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. **Registration and payment must be received by 31 January 2019**. Late registrants will only be accepted if space permits.

Software – discount prices for workshop participants (in New Zealand dollars NZD)*

Participants wishing to purchase PRIMER software at the discounted prices shown below[2] should indicate this on the registration form. All prices are in New Zealand dollars; New Zealand residents must add GST[1].

*Prices shown excl. GST	New PRIMER 7 (NZD)	Upgrade PRIMER 6 to PRIMER 7 (NZD)	PERMANOVA+ add-on (NZD)
Private sector	$1,080	$540	$540
Public sector	$810	$405	$405
Academic	$540	$270	$270
Full-time student	$270	$135	$135

About the Lecturers

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 multiple 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.

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 is the Professorial 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 of 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 international workshops, shedding new light on multivariate data.

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[1] GST (Goods and services tax) is 15%.
[2] The 10% workshop discount applies only to purchases of 3 or fewer copies 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 copies.