PRIMER and PERMANOVA+

A Course in Multivariate Analysis for Ecology & Other Sciences

PRESENTERS:	Dist. Prof. Marti J. Anderson & Dr Adam N. H. Smith
DATES:	*Week 1*: **PRIMER** 20 - 24 October 2025
	Week 2: **PERMANOVA+** 27 - 31 October 2025
VENUE (in person):	The Marine Biological Association of the United Kingdom (MBA), The Laboratory, Citadel Hill, Plymouth, U.K.
or ONLINE:	*Week 1*: **PRIMER** British Summer Time (BST = UTC +1 hour)
	Week 2: **PERMANOVA+** Greenwich Mean Time (GMT = UTC +0)

OVERVIEW

PRIMER-e is pleased to announce a **hybrid course** (offered **in-person* and *online*) of back-to-back courses in *Multivariate Analysis for Ecology & Other Sciences* to be held over two weeks at the Marine Biological Association of the United Kingdom (MBA). *Week 1* will cover the core non-parametric methods implemented in PRIMER software. *Week 2* will cover the semi-parametric methods encapsulated in PERMANOVA+ and other advanced topics. Sessions will run daily, Monday to Friday, from **9:00 am to 5:45 pm** on each day. Online participants will join the course live *via* Google Meet (in the UK time-zones shown above). Participants may register for **week 1 only**, **week 2 only**, or **both weeks**. Each day will include a mixture of lectures and computer lab sessions, in which participants can practice implementing the new methods learned on example datasets. Participants will also have the opportunity to discuss and analyse their own data in consultation with the presenter. Participants attending in person must **bring their own laptop** to the venue. Software may be purchased at a discounted price (see below), or a *free* fully functional (but time-limited) licence of the software is available to registered participants for trial use during the course. Note that PRIMER is a Windows-only product, so Macs need to run in Windows emulation. This course will cater both to those who are new to PRIMER and to those who are familiar with PRIMER methods but would like a refresher regarding the latest techniques and approaches.

VENUE

All sessions will be held at [The Marine Biological Association of the United Kingdom](#), **The Laboratory, Citadel Hill, Plymouth, PL1 2PB, UK**. For local information, including directions to the venue, please click [HERE](#) or **for further information please contact the venue directly** on +44 (0)1752 426493 or email: info@mba.ac.uk.

*Important: please note that the venue will only accommodate a maximum of 24 participants to attend in person each week. If you wish to attend in person, please complete registration and payment as soon as possible to secure your place.

WEEK 1 - PRIMER

Week 1 will provide an extensive overview of statistical methods in non-parametric analysis of multivariate data implemented in **PRIMER** software. Non-parametric statistics and permutation tests make the methods intuitively simple to understand, so **no prior background in statistics is required**.

The topics covered in Week 1 include:

- Properties of multivariate data (summary statistics, shade plots, histograms, draftsman plots, etc.);
- Pre-treatment of data (transformations, normalisations, standardisations, dispersion weighting);
- Resemblance measures: distance, similarity & dissimilarity (Euclidean, Bray-Curtis, Sørensen, Jaccard);
- Cluster analysis (hierarchical agglomerative, divisive and k-R cluster methods using **CLUSTER**), including tests for significant structure within clusters (**SIMPROF**) to permit non-arbitrary classifications of samples/species;
- Ordination *via* projection using principal components analysis (**PCA**);
- Ordination to preserve sample relationships *via* non-metric, metric or threshold metric multi-dimensional scaling (**MDS**, **mMDS**, **tmMDS**);
- Non-parametric permutation tests for differences among *a priori* groups of samples (analysis of similarities – **ANOSIM**) for one-, two- and three-way multi-factor designs and for ordered factors);
- Visualising group differences and variation in the group averages using **bootstrap averages**;
- Tests of association between resemblance matrices (**RELATE**), e.g., relating biotic to abiotic data, including finding optimal subsets of environmental (or other) variables that generate a 'best' match to patterns among samples based on species (or other) variables (**BEST**);
- Measures of biodiversity, including richness, even-ness/dominance, abundance-biomass curves, and taxonomic and/or functional diversity and distinctness (**DIVERSE**);
- Identifying important subsets of species and their roles in generating overall multivariate patterns (**BIOENV**, coherence curves) or group/cluster differences (**SIMPER**);
- Identifying roles of environmental (or other) variables in generating biotic patterns or distinctive splits using non-parametric classification and regression trees (**LINKTREE**);
- Graphical tools for effective presentation of results, including **matrix displays** and a variety of plot types (bar, box, violin, means, line, histogram, scatter, surface, shade), **animations** of ordinations captured to video files, bubble plots and multi-variable **segmented bubble plots**.

WEEK 2 - PERMANOVA+

PERMANOVA+ allows robust analysis of multivariate data in response to complex sampling / experimental designs on the basis of a resemblance measure of choice, with rigorous inferences obtained using permutation methods. The broader suite of methods in PERMANOVA+ enable formal models, tests, and predictions to be achieved for multivariate ecological (and other) systems that are over-parameterised (i.e., have too many variables) and/or that demonstrate substantial non-normality. Familiarity with the core methods in PRIMER and/or some prior knowledge of basic multivariate methods is desirable. However, Week 2 (like Week 1) will emphasise conceptual understanding, software implementation of the methods and interpretation of results for scientists and practitioners, so **no prior specific background in statistics is assumed.**

The topics covered in Week 2 include:

- Partitioning variation for high-dimensional data in the space of a chosen resemblance measure – a geometric approach (**PERMANOVA**);
- Tests for differences in centroids among groups and constructing specific contrasts (**PERMANOVA**);
- Multivariate variation (spread), tests for homogeneity of multivariate dispersions and comparisons of beta diversity (**PERMDISP**);
- Constructing (pseudo) F-ratios and permutation methods for correct tests of individual terms in multi-factorial designs, based on expectations of mean squares (EMS).
- Complex multi-factor experimental designs, identifying **fixed and random factors** that are **nested in or crossed with** one another;
- Quantifying components of variation for individual terms in a PERMANOVA model, simplifying models by pooling or removing terms;
- Advanced experimental design topics, including repeated measures, randomized blocks, inclusion of covariates, imbalance & asymmetry, and BACI designs.
- Fitting multivariate response data (e.g., species) to continuous predictor variables (e.g., environmental), including model selection (**DISTLM**);

- Visualising and quantifying explained (fitted) variation using dissimilarity-based redundancy analysis (**dbRDA**);
- Dissimilarity-based discriminant analysis *via* canonical analysis of principal coordinates (**CAP**), including leave-one-out allocation success and the predictive placement of new points into existing canonical model spaces;
- Discriminate positions along an environmental (or other) continuous variable axis; rotate two sets of variables to explore inter-relationships in a (dissimilarity-based) canonical correlation analyses (**CAP**).

COURSE FEES

The course fee **includes** coffee/tea and snacks during breaks, lunch, free Wi-Fi (for those participants attending in person), all course materials and a temporary time-limited (but fully functional) software licence key for the duration of the course. *In person* course participants will also receive for free **a 1-year membership** to **The Marine Biological Association of the United Kingdom**. The fee *does not include* accommodation or other meals, or the separate (discounted) cost of purchasing time-unlimited software. Registration fees *for each week* are shown below:

Registration fees (in £GBP) *for each week*	**In person**	**Online only**
EARLY BIRD On or before 1st June 2025	GBP £850 (£600 for full-time students)	GBP £730 (£480 for full-time students)
AFTER 1st June 2025	GBP £970 (£690 for full-time students)	GBP £730 (£480 for full-time students)

All prices are in pounds sterling (£GBP). GST will be applied for New Zealand residents. Participants residing outside of the UK registering to attend this course *online only* may be eligible for a *Global Equitability Pricing* (GEP) discount on their registration fees, depending on their country of residence. Please note that the GEP *does not apply* to *in-person* registrations.

DISCOUNTED SOFTWARE PRICES FOR COURSE PARTICIPANTS

We are pleased to offer all course participants a **special discounted price** of *10% off* our standard base prices to purchase time-unlimited PRIMER software in **£ GBP**. The prices below show the special discounted prices for an **Individual licence of PRIMER 7 with PERMANOVA+** for UK residents:

Sector	Special Discounted Price (£ GBP)
Student Licence	£325.00
Academic Licence	£655.00
Public Licence	£980.00
Commercial Licence	£1,310.00

Course participants may also be eligible for a *Global Equitability Pricing* (GEP) discount on all our software products. Any GEP discount will be applied *on top of* the **special discounted price for course participants**. All discounts for which you are eligible (including, discounts for upgrades, etc.) will be applied at the time of invoicing. To receive a quote from us for course registration + software prior to registering, please get in touch with us directly at: primer@primer-e.com.

REGISTRATION

To register, please fill out the registration form available on the PRIMER-e website and return it directly to primer@primer-e.com to secure your place. The deadline for registration and payment is **1st October 2025**. Late registrants will only be accepted if space permits. Unfortunately, we cannot permit attendance at the course unless payment for registration has been **received in full** by PRIMER-e **prior** to the commencement of the course. Please get in touch with us directly if you have any questions primer@primer-e.com, and especially if you would like:

- to **obtain a quote** for your registration (with or without software), including all discounts for which you are eligible;
- to register **more than one individual** from your organisation and pay on a single invoice (please include separate registration forms for each individual participant); or
- to purchase **more than one software licence** at discounted prices on a single invoice.

ABOUT THE PRESENTERS

Marti J. Anderson is the Director of PRIMER-e (Quest Research Limited), a Fellow of the Royal Society of New Zealand and Distinguished Professor Emerita in the New Zealand Institute for Advanced Study (NZIAS) at Massey University in Auckland. 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. She has developed all of the statistical methods in PERMANOVA+ and especially enjoys engaging in the dynamic interactions with students, academics and professionals that have become a trademark of the PRIMER/PERMANOVA+ international courses, shedding new light on multivariate data.

Adam Smith has worked with PRIMER-e since 2017 as a Workshop Presenter and Statistical Consultant. Adam obtained his PhD in Statistics from Massey University (MU) in Auckland, New Zealand, where he lectured statistics for 15 years. He is Director of Sea Through Science Ltd., providing statistical consulting and marine ecological research services. Adam has extensive experience across a wide range of disciplines, including quantitative ecology, data mining, and biostatistics. He specializes in applying modern statistical methods to biology and ecology and is a key consultant to industry and government for fisheries and marine reserve assessments. As an educator, Adam is known for his enthusiastic and engaging teaching style and his passion for using statistical concepts to learn about our world. As a consultant, with over 20 years of scientific experience handling hundreds of datasets, Adam can quickly grasp his clients' analytical needs and identify the appropriate statistical methods to meet them.