

**Training workshop on MULTIVARIATE ANALYSIS in ECOLOGY & ENVIRONMENTAL SCIENCE
for COMPLEX DESIGNS, using PERMANOVA+ for PRIMER v6**

Led by **Professor Marti J Anderson** (IIMS, Massey University, New Zealand)
organised by PRIMER-E in conjunction with the 9th International Temperate Reefs Symposium
and held at the Marine Biological Association, **Plymouth, UK, 4-8 July 2011**

Workshop content

- Five-day workshop covering statistical analysis of multivariate data (and, in part, univariate data) from ecology and environmental science, e.g. in community ecology, biodiversity monitoring, environmental impact assessments, analysis of environmental quality metrics, physico-chemical data etc, where the emphasis is on designs for experiments or field surveys which involve several factors or explanatory variables
- Learn to use an advanced software tool: the PERMANOVA+ add-on for PRIMER6. The base PRIMER package (Plymouth Routines In Multivariate Ecological Research) is now a worldwide standard, used in at least 6000 SCI-listed papers for analysis of aquatic assemblages and, increasingly, terrestrial, palaeontological, microbial and genetic data, also for model output, ecotoxicology, morphometrics and even epidemiology, sociology etc. The PERMANOVA+ add-on to PRIMER v6, also a heavily cited methodology in a wide range of disciplines, greatly extends the capability for analysing multivariate data from complex designs with multiple factors
- Workshop led by the instigator of the PERMANOVA+ approach, Prof Marti J Anderson, Professor of Statistics, Massey University, New Zealand. Marti also holds a doctorate in marine ecology which makes her a compelling exponent of these methods to ecologists and other scientists with limited statistical background. This is an advanced workshop so participants are assumed to have some knowledge of multivariate techniques used commonly in ecology (cluster analysis, PCA and MDS ordination etc), but it is aimed primarily at practitioners not qualified statisticians. Though by no means obligatory, it would ideally suit those who have some experience of using PRIMER, perhaps from attendance at one of the many past PRIMER workshops worldwide (the next are scheduled for November 2010 and March 2011 in Plymouth, see www.primers-e.com), and are now seeking to extend their work to handle more complex designs and models. Some previous exposure to univariate ANOVA designs would also be helpful
- PERMANOVA+ provides permutation testing in general linear models for highly multivariate data, with no distributional assumptions and for any choice of similarity measure, integrating seamlessly with the PRIMER package for data handling and graphics. A by-product is permutation-based (distribution-free) tests for ANOVA and regression of univariate data. Covered are: the analysis and estimation of effect sizes and components of variation for individual terms in complex experimental designs, including those with interactions, contrasts, fixed or random effects, crossed or nested models, unbalanced designs, BACI environmental impact and asymmetrical designs, those lacking replication and/or with covariates (PERMANOVA); multivariate multiple linear regression, including model selection on the basis of forward, backward, step-wise or all-subsets procedures and with AIC/BIC-type criteria for model selection, with ordination plots using distance-based redundancy analysis (DISTLM); tests for homogeneity of multivariate dispersions (PERMDISP); ordination plots using unconstrained (PCO) or constrained (CAP) analyses of principal coordinates, including vector diagrams for individual variables, calculation of leave-one-out allocation success for either discriminant or canonical correlation-types of analyses, based on resemblance matrices, and placement and group allocation of new points into existing predictive canonical models
- Emphasis throughout is on practical application and interpretation, the week alternating between lectures and PC lab sessions, using literature case studies. Participants are encouraged to bring along some of their own data to analyse during the final day, with Marti's help. The workshop will be held in a computer lab with PC's installed with the PRIMER v6 and PERMANOVA+ software. Participants will share these, between two or three people, facilitating greater interaction in the lab sessions, but may also like to bring their own laptops for which they have purchased single-user licences (note, software cannot be mounted temporarily on a participant's PC)
- Workshop organised and administered by PRIMER-E Ltd, and both Professor Bob Clarke (PRIMER-E/Plymouth Marine Laboratory/Marine Biological Association) and Ray Gorley (PRIMER-E, coder of all the PRIMER v6 and PERMANOVA+ software) will be on hand to assist Marti in the computer lab sessions
- Held in the Resource Centre of the Marine Biological Association of the UK, Citadel Hill, Plymouth, PL1 2PB, the programme running from 4-8 July 2011, Monday to Friday, 09.00-18.00. A detailed provisional course programme is available from admin@primers-e.com. The workshop is open to all-comers, though **a substantial discount (c. 25%) on the course fee is offered to participants who are also registered for the 9th International Temperate Reefs Symposium**, to be held at the Sherwell Centre, University of Plymouth on the preceding week (27 June – 1 July 2011)

Workshop costs

These are in two parts: a **course fee** and (if wished) **licence costs** for PRIMER6 and PERMANOVA+ software. The lab sessions will take place on (shared) Resource Centre machines installed with both products, so software purchase is not mandatory, though it is expected that participants will want to purchase, or have already purchased, single-user licences for use on return to their home institution or on their laptop during the course (licence conditions allow a user to hold a copy of the software on a desktop machine at their workplace, and on a laptop or home machine, provided they are not used at the same time). Participants can avoid the usual added carriage charges if software is picked up at the course

• **Course fee.** **GBP £600** (+ VAT if appropriate), reduced to **£425** (+ VAT) for full-time students, for a full 5-day course. This includes all course materials, use of lab PCs with software installed, coffee/tea at breaks, full meals at lunchtimes and Monday evening reception, but **not** other meals, accommodation or software costs

• **Reductions.** The course fee for registered participants at the 9th International Temperate Reefs Symposium is reduced to **GBP £450** (+ VAT), or **£325** (+ VAT) for full-time students. **Note:** registration and payment for this training course is entirely through PRIMER-E (see below for booking form) **not** the Temperate Reefs Symposium organisers

Also included is one-year membership of the Marine Biological Association (without journal). The latter allows participants free access to MBA facilities 4-8 July only (National Marine Biology library, common room, terminal room, computing support, Wi-Fi access, car parking, modest phone and photocopying use etc); also a further week's bench space in the NMB library during the year starting that week (bench fees waived)

Existing members of the MBA will receive a discount of **£30** (**£20** for students) in addition to any other reduction

• **Software.** Cost of single-user licences for PRIMER v6 and PERMANOVA+ (plus VAT, where appropriate):

Private sector: £560 new PRIMER v6 (or £280 upgrade v5 to v6) + £280 PERMANOVA+ add-on

Public sector: £420 new PRIMER v6 (or £210 upgrade v5 to v6) + £210 PERMANOVA+ add-on

University: £280 new PRIMER v6 (or £140 upgrade v5 to v6) + £140 PERMANOVA+ add-on

Contact PRIMER-E at admin@primer-e.com for discounted prices if several PRIMER v6 licences are being purchased on the same invoice (see also www.primer-e.com), and for quotes of delivery costs if software is required in advance of the workshop

• **VAT.** In addition, VAT will be charged on all fees, with the exception of: a) non-EC participants, and b) EC participants (non-UK) who can provide the VAT registration number for their institution

This will be at the prevailing VAT rate at the time of registration/purchase (invoice date) – currently 17.5% but rising to 20% on 4 Jan 2011

Workshop registration Please e-mail/post/FAX/phone the following information to PRIMER-E Ltd (Cathy Clarke or Marg Moroney) at
E-mail: admin@primer-e.com; *Post:* 3 Meadow View, Lutton, Ivybridge PL21 9RH, UK; *Tel:* +44 (0)1752 837121 (*Fax* 837721)

Cathy or Marg can clarify your current software licence position and can send proforma invoices, if needed. **Places are limited and will be allocated in order of receipt of completed registration forms – expressing interest to us does not hold you a place in the queue**

Name: Organisation:

E-mail: Address:

Tel: Fax:.....

Fees: Note that, unless otherwise agreed with PRIMER-E, invoices must be settled by the **payment deadline of 10 June 2011**, by bank transfer, cheque, Mastercard or Visa (details will be on the invoice), or your place may be given to someone on the waiting list

I wish to be invoiced for the following (please cross the boxes [x], as appropriate):

- Course fees:** [] full course fee [] student course fee
 [] I qualify for discount as a registered participant at the 9th International Temperate Reefs Symposium
 [] I qualify for discount as an existing (and continuing) member of the MBA

- Software costs:** [] new PRIMER v6 licence [] upgraded PRIMER v6 licence, from v5 [] PERMANOVA+ 'add-on' licence
 [] software picked up at workshop [] software sent in advance to above address (at extra cost - ask for quote)

[] I am from a (non-UK) EC institution whose VAT number is

[] I require the invoice to be sent elsewhere (specify):

Notes on accommodation: It is the participant's responsibility to arrange and pay for their own accommodation in Plymouth. There are a large number of hotels and guest houses within walking distance of the venue, but note that this is a holiday period so early booking is advised. If needed, ask Cathy or Marg to e-mail you a map of Plymouth, showing location of the venue, rail station etc, and a list of accommodation that has been used by past participants. You should expect to pay about £65-£100 a night for an en-suite room at a Plymouth hotel, down to about £35 a night for an en-suite room in one of the many bed & breakfast guest houses along Citadel Road or adjoining streets (all within a km of the venue); there is also a back-packers hostel on Citadel Road, with dormitory style accommodation, for only about £15 a night. A useful web site can be found at www.plymouth.gov.uk → leisure and tourism → tourism and visitors