

Helen J. Edwards, BSc, MRes, PhD
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Nationality: British
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EMPLOYMENT HISTORY

abcGIS

Exeter, UK

Managing Director

JAN 2009 - Present

Helen is the co-founder and managing director of abcGIS consulting. abcGIS has been established to provide high quality, state of the art, GIS applications for the conservation of ecologically-important species. abcGIS offer a wide range of services including GIS needs analysis, database creation, GIS application development, web GIS interfaces, report generation and spatial data modelling and analysis.

abcGIS, in collaboration with the Marine Spatial Ecology Laboratory at the University of Exeter, were contracted by the European Space Agency to provide services for *remote sensing monitoring of coral reefs in the Belize region*, as part of the *Regional Project on Adaptation to Climate Impacts in Coastal Zones in the Caribbean*, currently under execution through the Caribbean Community Climate Change Center. The role of abcGIS in this project was the delivery of high-resolution maps and time-series of sea-state parameters that can help reef managers to quantify possible stress on the coral reef off the Belize coast via a web-based mapping server.

University Of Exeter

Exeter, UK

Post Doctoral Research Fellow

OCT 2005-OCT 2008

Helen's post-doctoral research, conducted at the Marine Spatial Ecology Laboratory, consisted of various projects related to coral reef ecology. Helen was funded by the US Environmental Protection Agency on a grant titled 'Connectivity in marine seascapes: predicting ecological and socioeconomic costs of climate change on coral reef ecosystems'. This involved using global climate model projections of sea surface temperature and historical hurricane datasets to map disturbance regimes across the Caribbean and the extension of an existing model of coral-algal-grazer interactions to explore the potential effects of climate change on coral reef ecosystems.

In collaboration with other members of the Marine Spatial Ecology Lab Helen has developed tools for conservation planning with the aim of integrating biodiversity and socio-economic perspectives into reserve-system design and of selecting networks of reserves capable of meeting conservation objectives under different climate change scenarios. Helen has also worked on matrix projection models of coral and algal populations and on the development and analysis of differential equation models of species interactions.

EDUCATION

University Of York

York, UK

PhD, Department of Biology

OCT 2002-SEP 2005

Thesis: *Individual-based models of the movement of Atlantic cod.* Supervisors: Dr Calvin Dytham, Dr Jon Pitchford, Dr David Righton (CEFAS).

Courses taken: behavioural ecology, ecological economic modelling, evolutionary ecology, introduction to C++, population genetics, transferable skills.

Demonstrating: Biology undergraduate scientific skills (introduction to C++), MRes Bioinformatics C++ course.

Master of Research (Pass with Distinction)

OCT 2001-SEP 2002

Dissertation: *Predator-prey models: investigation of two and three species complexes with application to the North Sea sandeel-cod-man interaction.* Location: Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowestoft, UK. Supervisors: Dr Carl O'Brian, Dr Ewen Bell.

Courses taken: applied statistics, data analysis, dynamical systems, ecological modelling, environmental issues, GIS, group project, multivariate analysis, programming in C, stochastic processes, transferable skills.

Bachelor of Science in Mathematics (2:1)

OCT 1998-JULY 2001

Dissertation: *Quaternions and octonions.* Supervisor: Prof Tony Sudbery.

Modules included: analysis, calculus, differential equations, finance, mathematical writing, matrices, mechanics and statistics.

Formby High School

Merseyside, UK

A-Levels

1998

art (C), general studies (A), geography (A), history (A), mathematics (A).

GCSEs

1996

art (B), biology (A*), chemistry (A), english language (A), english literature (A), french (A*), geography (A), history (A), mathematics (A*), physics (A).

EXPERIENCE

Geographic Information Systems

Helen first studied GIS during her Masters degree in 2002. Since then she has worked with a wide range of spatial datasets and models. Helen believes that the future of spatial modelling for conservation, especially in a changing climate, will involve close integration between models and GIS data layers. To achieve these objectives, Helen, together with Ian Elliott of the University of Exeter, UK, established abcGIS consulting in January 2009. abcGIS specialises in the provision of high quality, state of the art, web GIS applications for the conservation of ecologically-important species.

Helen is experienced in the creation of data layers, in particular using data from model outputs, in the manipulation of spatial data and formatting visual outputs for presentation. Helen's recent GIS work has included using hurricane and sea surface temperature data to map disturbance regimes in the Caribbean, and mapping reserve networks created using reserve-selection algorithms. As managing director of abcGIS Helen led the delivery of products for the European Space Agency via a web-based mapping server. Helen has experience with a wide range of geographic technologies, including ESRI ArcGIS and a number of open source initiatives.

Spatial Modelling

Helen has extensive experience of mathematical and computer simulation modelling of biological and ecological systems, utilising both analytical and numerical techniques. Helen has developed and analysed a wide-range of models from simple differential equation models to complex individual-based structured models of interacting populations. She has experience modelling both deterministic and stochastic systems and has explored various methods of incorporating space including the use of metapopulation, cellular automata and continuous-space models. Helen has worked with models in both discrete (e.g., difference equations, matrix models) and continuous time (e.g., differential equation models).

Programming

Helen is a very capable application developer and is familiar with a number of programming languages. She is proficient at programming in C/C++ and in Matlab and has programmed models of a variety of biological systems, including species interactions, species invasions, epidemiological and evolutionary models. Helen is also familiar with a number of web languages including HTML, Javascript, CSS, PHP and MySQL.

Spatial Analysis

Helen has taken several university courses in statistics and is familiar with a variety of statistical packages including R, SPSS and Sigmaplot and with the spatial statistics and mapping toolboxes in Matlab. During her research Helen has used spatial statistics to describe and summarise spatial data, to conduct pattern analyses and spatial autoregressions and to compute spatial autocorrelation statistics.

Database Development and Implementation

Helen has in-depth knowledge of relational database principles and has focused primarily on database design and development in Microsoft Access. She is also familiar with database-driven websites implemented using MySQL. In addition to working extensively with GIS data Helen has considerable experience in creating and maintaining meta data and in data sharing.

Nature Conservation

Helen has worked primarily on species of importance for conservation including Atlantic Cod (*Gadus morhua*) and the Caribbean reef-building coral *Montastraea annularis*. As a member of the

US National Science Foundation's Bahamas Biocomplexity Project Helen developed a new reserve-selection tool to integrate biodiversity and socio-economic perspectives into the reserve design process. Helen has also collaborated with members of the Marine Spatial Ecology Laboratory at the University of Exeter on a project to select networks of reserves capable of meeting conservation objectives under different climate change scenarios.

Communication

Helen possesses excellent written and oral communication skills and is able to articulate ideas clearly to a range of audiences. She has strong presentation skills and is a regular speaker at national and international conferences. Throughout her academic career Helen has demonstrated the ability to work with people from a number of different disciplines and has developed and maintained working relationships within the research community. Helen is a sound team player with strong leadership skills. Through a variety of roles Helen has demonstrated the ease with which she can take up new challenges and adapt to new environments and ecological case studies.

Helen is committed to the distribution of scientific information and has co-authored a number of reports and papers including an article in the leading scientific journal *Nature*. She is an experienced web developer and has a particular interest in the creation of geospatial web portals. These are designed to provide a means of locating, browsing, analysing and distributing spatial data and services within an organization and externally to partners and the public. Solutions have been designed using a range of technologies including ArcGIS, MapServer and OpenLayers.

PUBLICATIONS

Burgess, H.R., Edwards, H.J., Foster, N.L., Townley, S. & Mumby, P.J. (in prep). Size and shock-based impacts of hurricanes on the patch dynamics of a massive coral. *Oecologia*.

Edwards, H.J., Elliott, I.A., Eakin, C.M., Irikawa, A., Madin, J.S., McField, M., Morgan, J.A., Van Woesik, R. & Mumby, P.J. (2011). How much time can herbivore protection buy for coral reefs under realistic regimes of hurricanes and coral bleaching? *Global Change Biology* **17**: 2033-2048.

Mumby, P.J., Elliott, I.A., Eakin, C. M., Skirving, W., Paris, C.B., Edwards, H.J., Enríquez, S., Iglesias-Prieto, R., Cherubin, L.M. & Stevens, J.R. (2011). Reserve design for uncertain responses of coral reefs to climate change. *Ecology Letters* **14**: 132-140.

Renken, H., Mumby, P.J., Edwards, H.J. & Matsikis, I. (2010). Effects of physical environmental conditions on the patch dynamics of *Dictyota* spp. and *Lobophora variegata* on Caribbean coral reefs. *Marine Ecology Progress Series* **403**: 63-74.

Edwards, H.J., Elliott, I.A., Pressey, R.L. & Mumby, P.J. (2010) Incorporating ontogenetic dispersal, ecological processes and conservation zoning into reserve design. *Biological Conservation* **143**: 457-470.

Mumby, P.J., Hastings, A. & Edwards, H.J. (2007) Thresholds and the resilience of Caribbean coral reefs. *Nature* **450**: 98-101.

Edwards, H.J., Pitchford, J.W., Righton, D. & Dytham, C. (2007) Prey selection, vertical migrations and the impacts of fishing upon the population dynamics of a predator-prey system. *Bulletin of Mathematical Biology* **69**: 1827-1846.

Edwards, H.J., Roberts, P.D. & Vougioukalou, S.A. (2005) Can population biology inform the sustainable use of biodiversity? *Bulletin of the British Ecological Society*.

PRESENTATIONS

Spoken Papers

Integrating biodiversity and socio-economic perspectives into reserve-selection algorithms Bahamas Biocomplexity Project General Meeting, Davis, California, 24 January 2007.

Integrating biodiversity and socio-economic perspectives into reserve-selection algorithms. A case study: the Belize Barrier Reef Reef Conservation UK Annual Meeting, Zoological Society of London, London, UK, 9 December 2006.

Can cod behaviour be explained by variable prey preferences in a changing environment? CPB Graduate Student Workshop: Can population biology inform the sustainable use of biodiversity? Imperial College Silwood Park campus, Berkshire, UK, 5-7 January 2005.

The effects of individual behaviour on the dynamics of spatially-structured predator-prey interactions CPB Graduate Student Workshop: Recent advances in population ecology. Imperial College Silwood Park campus, Berkshire, UK, 16-17 December 2003.

Modelling the movement of cod: A behavioural approach FSBI Annual Symposium: Fish as models of behaviour. University of East Anglia, Norwich, UK, 30 June-4 July 2003.

Poster Presentations

The effects of dispersal on the persistence of individual-based predator-prey systems Joint Conference MPD 7 - DeStoBio 3: Computational and Mathematical Population Dynamics. University of Trento, Trento, Italy, 21-25 June 2004.

Reviewer for: Biosystems, Conservation Biology, Coral Reefs, Ecological Modelling, Marine Ecology Progress Series.

Microsoft Word, Powerpoint, Excel and \LaTeX proficient.

Languages: Basic French, Beginners German, Beginners Japanese.

Member: British Dragonfly Society, Devon Mammal Group.

Interests: natural history, wildlife photography.