

## PROJECT DETAILS

### Project Title

Harvesting invertebrates from coastal habitats: consequences for the invertebrates, their habitats and bird predators

### Project Summary

Understanding the impact of human activities on wildlife is an increasing conservation priority as human populations rise, methods of exploitation become more efficient and ecosystems come under pressure from climate change. This project will build on research (Stillman & Goss-Custard 2010) that has developed models to accurately predict the effect of environmental change on animal populations, allowing environmental managers and policy makers to make evidence-based decisions.

Coastal harvesting activities (e.g. shellfishing, bait digging) will have an array of effects on targeted species and their habitats, with knock-on consequences for coastal birds that predate the target species. Harvesting may also exclude birds from part of their feeding habitat if it occurs during their low tide feeding period. Harvesting activities will have a negative effect on bird populations if they reduce the number of birds that can be supported on a site, increase the overwinter mortality of the birds, or reduce the body mass of birds at the end of winter, and hence their ability to migrate to their breeding grounds and successfully reproduce.

Bournemouth University has developed models to predict the consequences of environmental change on the survival and body condition of over wintering coastal birds (Stillman 2008; Stillman & Goss-Custard 2010). These models mimic the behaviour of real birds as each attempts to meet its requirements by consuming the most profitable food and avoiding risks. The model birds respond to changes in their environment in the same ways that real birds do, by adopting behaviour that maximises their chances of surviving the winter in good condition. These models have been applied to 35 sites in Europe and have predicted the impact of shellfishing on birds in the Wash, Morecambe Bay, Dee Estuary, Traeth Lafan, Burry Inlet and Three Rivers, and Exe Estuary (Stillman & Goss-Custard 2010).

The overall purpose of the project is to assess the impact of existing and future harvesting methods in intertidal waters within the Solent, to provide an evidence-base for future management and conservation within the region. The project will make extensive use of the results of the Solent Forum, Solent Disturbance and Mitigation Project which assessed the distribution of human activities in the Solent region and potential impacts on birds (Stillman, West, Clarke & Liley 2012). The project will have the following objectives.

1. Assess the current and future extent of harvesting activities (including shellfishing and bait digging) within the Solent, including potential development of novel techniques. To do this through a combination of Southern Inshore Fisheries Conservation Authority (SIFCA) databases and horizon scanning with expert groups.
2. Assess the mechanisms through which these activities could affect bird populations – e.g. through the removal of food, changing the size distribution of prey, altering habitat structure, disturbing the birds. To do this through a combination of literature reviews and new fieldwork.
3. Conduct field surveys to determine the effect of invertebrate harvesting on the structure, sediment size and invertebrate populations of intertidal habitats. This will focus on clam dredging in the Solent, as this is a technique that is of particular conservation concern, but will also address any priority methods identified in Objective 1.
4. Develop detailed models of the interaction between birds and fishing in sites (termed focal sites below) for which suitable data on the abundance and size distribution of invertebrate prey species are available. Data and previous models are available for Southampton Water and Chichester Harbour, which were developed in the Solent Disturbance and Mitigation Project; these models will be to be adapted to incorporate harvesting activities.
5. Predict the effect of current and future harvesting on survival and body condition of birds in the focal sites. In doing so, highlight general predictions that are likely to apply more broadly across the Solent. For example,

threshold levels of depletion that adversely affect the birds, or the relative impact of activities that occur at low and high tide.

6. Apply the understanding gained from Objectives 1 to 5 to propose a strategy for managing harvesting activities within coastal habitats. This will include an assessment of the threats posed by existing and novel methods, methods to detect whether harvesting is likely to be adversely affecting bird populations, and proposed conservation measures to minimise the effects of harvesting.

### Academic Impact

Academic impact will be through papers advancing understanding in three subject areas: (i) the response of intertidal habitats and species to harvesting; (ii) the link between behaviour and population ecology of coastal birds; and (iii) the impact of harvesting on the size of coastal bird populations. The fieldwork and models developed during the project will be based on a thorough understanding on the behaviour and ecology of coastal birds and their prey species. Research will be directed towards filling gaps in existing knowledge of the effect of harvesting on coastal invertebrates, habitats and birds. The models provide the link between bird behaviour and population ecology, and the response of bird populations to prey harvesting. Applied papers will detail threshold amounts of harvesting that limit the number of birds that can be supported on coastal sites.

### Societal Impact

Societal impact will be achieved by assessing whether current or future amounts of harvesting are likely to adversely affect coastal habitats and bird populations. Coastal managers and conservationists often need to make decisions on the impact of harvesting in sites. Time and resources are usually limited and so decisions need to be made quickly and with little expense. The project will provide a quick way of assessing risks and prioritising the relative impacts of different types of harvesting on birds and their habitats. For example, conservationists could rank a number of harvesting types in terms of their potential impact on the birds, focussing their resources towards regulating or managing the most serious. Presently, there is a lack of information on which these decisions can be based, and as a result conflicts between interest groups often arise. The project therefore provides a means for a range of interest groups to work more efficiently, while safeguarding the conservation of the birds and their habitats.

### Training Opportunities

The project will build and test computer models using a combination of existing and newly collected field data. The student will gain field experience of coastal birds, their invertebrate prey species and habitats, through observations of bird behaviour, sampling intertidal invertebrates, analysing associated datasets, and understanding the needs of coastal interest groups. The student will gain technical experience in computer and mathematical modelling, video analysis of bird behaviour, and statistical analysis of bird and invertebrate datasets. The supervisory team has expertise in bird ecology and behaviour, intertidal invertebrates ecology and bird modelling, and understanding interest group needs on coastal sites, and so will be able to support the student in all aspects of the project. The student will be given opportunity to undertake specialist courses in computer modelling and statistical analysis.

## SUPERVISORY TEAM & RESEARCH ENVIRONMENT

<b>First supervisor</b>	Richard Stillman
<b>Additional supervisors</b>	Patrick Cooper (match-funding organisation) Roger Herbert
<b>Recent publications by supervisors relevant to this project</b>	Herbert, R.G.H., Willis, J., Jones, E., Ross, K.E., Hübner, R., Humphreys, J., Jensen, A. & Baugh, J. (2012) Invasion in tidal zones on complex coastlines: modelling larvae of the non-native Manila clam, <i>Ruditapes philippinarum</i> , in the UK. <i>Journal of Biogeography</i> , 39, 585–599.  Caldow, R. W. G, Stillman, R. A., Durell, S. E. A. le V. dit, West, A. D., McGrorty, S., Goss-Custard, J. D., Wood, P. J. & Humphreys, J. (2007) Benefits

	<p>to shorebirds from invasion of a non-native shellfish. Proceedings of the Royal Society, London, Series B, 274, 1449-1455.</p> <p>Stillman, R. A. (2008) MORPH – An individual-based model to predict the effect of environmental change on foraging animal populations. Ecological Modelling, 216, 265-276.</p> <p>Stillman, R. A. &amp; Goss-Custard, J. D. (2010) Individual-based ecology of coastal birds. Biological Reviews, 85, 413-434.</p> <p>Stillman, R. A., Moore, J. J., Woolmer, A. P., Murphy, M. D, Walker, P., Vanstaen, K. R., Palmer, D. &amp; Sanderson, W. G. (2010) Assessing waterbird conservation objectives: an example for the Burry Inlet, UK. Biological Conservation, 143, 2617-2630.</p> <p>Stillman, R.A., West, A.D., Clarke, R.T. &amp; Liley, D. (2012) Solent Disturbance and Mitigation Project Phase II: Predicting the impact of human disturbance on overwintering birds in the Solent. Report to the Solent Forum. pp 119.</p> <p>West, A. D., Stillman, R. A., Drewitt, A., Frost, N. J., Mander, M., Miles, C., Langston, R., Sanderson, W. G. &amp; Willis, J. (2011) WaderMORPH: A user-friendly model to advise shorebird policy and management. Methods in Ecology and Evolution, 2, 95-98.</p>
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<b>INFORMAL ENQUIRIES</b>
To discuss this opportunity further, please contact Professor Richard Stillman via email: <a href="mailto:rstillman@bournemouth.ac.uk">rstillman@bournemouth.ac.uk</a>
<b>ELIGIBILITY CRITERIA</b>
All candidates must satisfy the University's minimum doctoral entry criteria for studentships of an honours degree at Upper Second Class (2:1) and/or an appropriate Masters degree. An IELTS (Academic) score of 6.5 minimum (or equivalent) is essential for candidates for whom English is not their first language.
<b>HOW TO APPLY</b>
Please complete the BU Research Degree Application 2014 and submit it via email to the School Research Administrator - Louise Pearson - <a href="mailto:scitechresearch@bournemouth.ac.uk">scitechresearch@bournemouth.ac.uk</a> by <b>31 May 2014</b> . Further information on the application process can be found at <a href="http://www.bournemouth.ac.uk/phd2014">www.bournemouth.ac.uk/phd2014</a>