Conference report

The joint scientific meeting of Amphibian and Reptile Conservation (ARC) and the British Herpetological Society took place in the lecture hall of the Bournemouth Natural Science Society on 4 December 2011, and encompassed the following contributions.

Spatial learning and memory in amphibians and reptiles

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Spatial cognition is considered an essential survival tool as it allows an animal to navigate through complex natural environments. It permits efficient passage between feeding grounds, hiding places and sleeping areas, and thus provides the animal with a distinct evolutionary advantage. The navigational behaviour of mammals and birds is well understood, and a number of possible strategies have been demonstrated – these include beacon learning, path integration and the use of a cognitive map. The use of cognitive maps – orientation based on the configuration of distal landmarks – is commonly seen in mammals and in birds. The hippocampus is thought to play a critical role in this behaviour. Reptiles and amphibians do not possess a hippocampus; it has been suggested that they have brain areas that serve a similar function, however there is almost no behavioural evidence to support this. It is thus important to examine reptilian and amphibian spatial learning abilities in light of what is known about mammals and birds. This talk summarizes some of our recent research on spatial behaviour in reptiles and amphibians from both a comparative perspective and in terms of the problems experienced in their natural environment. The importance of the study of reptile and amphibian cognition for our understanding of cognitive evolution, welfare and conservation will also be considered.

The common toad: egg to first hiberntion

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During a 30+ year study of a single population of common toads in Dorset (1979–present) much has been revealed about the effects of climate on their survival and breeding behaviour e.g. what influences the timing of their spring migration to the breeding pond, the timing of spawning, and the duration of the tadpole stage. There are, however, two periods of their life that have received relatively little attention to date. These are the periods between emerging from the breeding pond as toadlets and entering their first hibernation, and the juvenile/sub-adult period following their first hibernation and their subsequent return to breed as sexually mature adults. The results of a three-year investigation (to date) of the first, and easiest to study, of these two periods are presented here.

The arrival of adults at the breeding pond in the early spring and the start of spawning are both highly correlated with climatic temperature such that both occur earlier when temperatures are high than when they are low. The duration of the tadpole stage is also highly correlated with the date of first spawn, being significantly longer when spawn is laid early (early February) compared with when it is laid late (mid-March). The duration of the tadpole stage is also dependent on the temperature the tadpoles are exposed to so that, when the mean temperature of the tadpole stage is high, its duration is low and vice versa. Tadpole growth rates also varied between years resulting in significant differences in tadpole body length just prior to emerging from the pond as toadlets. Similarly, toadlet growth rates also varied between years with significant differences in SVL at emergence (early June), at week 9 (late July) and week 18 (late September), and appeared to be correlated with climatic temperature. Toadlets attained a larger body size (SVL) by the end of warm summers than by the end of cool ones. This may potentially affect their ability to survive their first hibernation.

Funding for part of the study of toadlet growth was provided by the Amphibian Conservation Research Trust (ACRT).

Using Lagrangian drift trajectories to study the dispersal of hatchling sea turtles

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Small, widely dispersing marine species such as hatchling sea turtles cannot be tracked by conventional methods. Hatchlings are transported by surface ocean currents for their first few years of life, commonly known as "the lost years". Facilitated by recent advances in the resolution and global coverage of oceanographic data and models, state of the art ocean models coupled with the global array of Lagrangian drifter buoys can now be used to study these "lost years". In the North Atlantic, we used drifter buoys to calculate the drift time between nesting beaches in the USA and the sites where hatchlings are next encountered around Northern Europe and the Azores. Used in conjunction with the size increase that occur between these sites we provide the first robust assessments of juvenile growth rates in the wild and thus revise age at maturity estimates for loggerhead sea turtles. Whilst laboratory experiments have shown that hatchlings can orientate to the Earth's magnetic field, inputting directional swimming (parameterised from this empirical data) into ocean model particle trajectories enables us to investigate the impact of any directional swimming on their destiny. In doing so, we reveal that a little directional swimming by hatchlings can have a big impact in flows as strong as the Gulf Stream. Impacts of hatchling swimming behaviour and nesting

beach location are now being studied on a global scale and hatchling drift scenarios compared to the post nesting movements of satellite tracked adult turtles.

Developing a Habitat Suitability Index for the Smooth Snake (*Coronella austriaca*) in Dorset

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The smooth snake (*Coronella austriaca*) is the UK's rarest reptile species. It is a Biodiversity Action Plan (BAP) priority species and is strictly protected by UK and European law. Approximately 0.13% of the world population occurs in England and is largely confined to the lowland heaths of Dorset, Surrey and Hampshire. *C. austriaca* is predominantly found on mature dry lowland heath in Britain, although they may occur in a variety of other habitats. The future of all the UK's reptiles should be safeguarded as they are regarded as an integral part of the country's natural and cultural heritage, and are valuable indicators of environmental change. It is therefore important to improve the understanding of these species and their habitats in order to develop effective protection methods to ensure that viable populations are conserved throughout their traditional ranges. Scientific research that assesses the status of species' populations in order to better understand their ecology is a fundamental part of the effective conservation management of habitats and particularly species of concern. Development of standardized survey methods through use of up-to date and accurate information on reptile ecology and population distributions is critical to the effective implementation of site and species conservation management plans.

Coronella austriaca as individuals and populations depend upon habitats with a certain range of attributes. Variations in the quality and quantity of these attributes can play a part in determining the occurrence of individuals and size of populations. In measuring these key habitat variables, it becomes possible to make basic predictions of species occurrence.There is a clear practical need to make such predictions for conservation management, which is particularly important for rare or threatened species such as *C.austriaca*. In this research, key diagnostic variables for *C.austriaca* habitat were investigated through a comprehensive review of current literature, Geographical Information System (GIS) analysis of known distributions and the collection and statistical analysis of field data. The results of these analyses were used to develop a 'Habitat Suitability Index' (HSI) for C.austriaca; a conceptual model used to assess the suitability of a habitat for a species and can be used to predict species occurrence at a given location. The HSI has many practical applications which inform the conservation management of a species. This investigation successfully developed an HSI which can be used to evaluate the suitability of habitat present within an area and predict the occurrence of *C.austriaca*. Areas for further research to improve and extend the HSI are discussed.

Assessing and modelling the status of the great crested newt (*Triturus cristatus*) in North Wales

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Species distribution modelling techniques are being employed increasingly to address a variety of conservation problems. In particular, these techniques can help target efficient use of survey effort and inform conservation decisions. Following on from previous modelling work assessing population status of the great crested newt in Great Britain, Amphibian and Reptile Conservation (ARC) has carried out further research on this species focusing on the North East Wales – Cheshire West and Chester hotspot. This pilot modelling aimed to inform the determination of Favourable Conservation Status (FCS) and includes: 1) the selection of great crested newt survey areas, 2) setting Favourable Reference Values (FRVs) from which to determine FCS and 3) highlighting potential areas in which to target pond creation. This work shows the potential of combining local planning data with predictive modelling to produce spatially explicit options for improving conservation status. Current ARC research attempts to build on this approach by modelling this species at a finer resolution more appropriate for local planning considerations, and addressing various aspects of functional connectivity.

Extreme grass snakes

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How do reptiles such as grass snakes, considered a "southern" species in the UK and barely reaching Scotland, tolerate harsh winter conditions? Starting with a look at the UK's most northerly known population, Gibside,this presentation outlines the history of the Gibside estate and the records of grass snakes there, submitted by the forestry commission and local ecologists.

Looking at other populations across Europe on a similar latitude to Gibside, weather patterns and temperature extremes have been researched. It seems that the common perception of these snakes is that they are our delicate natives, but the opposite would appear to be true.

Habitat factors affecting colonization of Lowland heathland by wood ants (*Formica rufa* group): implications for reptiles

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Ad hoc observations suggest that southern wood ants (*Formica rufa* group) predate juvenile sand lizards (*Lacerta agilis*). It is also known that wood ants predate other invertebrates and therefore may be in competition with sand lizards and other reptiles for food resources. This study aimed to investigate whether colonization of lowland heathland sites by wood ants has a detrimental effect on reptile populations and to identify any habitat factors

resulting from management that are related to wood ant colonization. Twenty-four 30 x 30 metre quadrats were set up on four heathland sites (six per site) in the Wareham area of Dorset. The number of wood ant mounds in each quadrat was counted and four artificial refugia were placed within each quadrat in appropriate positions. Each site was surveyed for reptiles a total of 16 times throughout May and June 2011, recording species observed and location (i.e. quadrat number).

Although wood ants predate other invertebrates, they also obtain a significant proportion of their nutrition from feeding on the honeydew excreted by sap-feeding aphids. They are also known to utilize pieces of rotting wood and tree stumps when nest building. The numbers of saplings, trees, log piles and felled tree stumps were therefore identified as habitat factors potentially related to wood ant colonization and were recorded. In addition, invertebrate abundance in each quadrat was sampled via sweep netting.

Statistical analysis of the data did not indicate a relationship between number of wood ant mounds and reptile observations. However, there was indication of a non-significant negative trend between wood ant mounds per quadrat and invertebrate abundance. Principle Component Analysis of the habitat factors data identified three PC scores with eigenvalues >1. The relationship between PC scores and the number of wood ant mounds was analyzed using multiple regression and PC1 was shown to have a near significant effect (p=0.068). PC1 was positively associated with, and most influenced by, the number of stumps and the number of birch saplings. Linear regression showed a positive correlation between PC1 scores and number of wood ant mounds (R^2=0.1523), where the F ratio was near significant (p=0.059). These results suggest that birch sapling regrowth and felled tree stumps are likely to be contributing factors in encouraging colonization of lowland heathland sites by wood ants.

Improved Ranavirus sampling: pinning down an elusive frog pathogen

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Ranaviruses are emerging pathogens that are versatile in their host use: infections occur globally in amphibians, reptiles and fish. Reports of disease consistent with ranavirus infection are now widespread in England following likely introduction from North America. Unfortunately, this pathogen has proved elusive on a number of levels:

1. Ranavirus pathology was originally mistaken for a condition with suspected bacterial aetiology ('red leg'), which meant they escaped scientific investigation in the UK for years
2. In spite of two decades of research since, a reliance on host carcasses for molecular testing means that ranavirus continues to dodge fundamental questions in epidemiology
3. The standard method for ranavirus screening has been a polymerase chain reaction (PCR) to amplify a region of the gene which encodes the viral Major Capsid Protein (MCP).

Doubts surrounding the sensitivity of the PCR and the choice of tissue used mean that the virus may still evade detection even after sampling visceral organs. A strategy of toe-clipping live animals is effective for screening frogs elsewhere.Here, data are presented suggesting that this could also be a useful strategy in UK amphibians. A more robust assessment of toe-clipping and swabbing, as we move towards less invasive sampling for ranavirus, is also discussed.

Herpetofaunal surveys in the dry forests of NW Madagascar: exciting yet worrying times

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The Mahamavo region of North-west Madagascar is a diverse yet relatively unstudied region. It is comprised of a variety of ecosystems, including dry deciduous forests, freshwater wetlands and coastal mangroves. This area is under intense pressure from human activities and is currently not afforded any form of protection.

Here, we report on the results of herpetofaunal surveys and research conducted in this area with a special reference to recent surveys within the Matsedroy forest block; a patch of dry forest separated from other nearby forest blocks by a major river and denuded savannah. Prior to our surveys in 2011 no investigation into the biodiversity within the Matsedroy forest block had ever been undertaken.

As of August 2011, a total of 48 species (41 reptiles, 7 amphibians) comprising 32 genera have been identified from our study sites in the Mahamavo region. Of these species, four (three reptiles, one amphibian) have been found within the Matsedroy forest but nowhere else in Mahamavo, highlighting the importance of continued survey work at this site.