

## Conference report

# Joint scientific meeting of Amphibian and Reptile Conservation and the British Herpetological Society

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 6 December 2009. The meeting was dedicated to the late Julia Wycherley, and encompassed the following contributions.

### Is cattle grazing harmful to smooth snakes on lowland dry heath?

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A study of reptiles on an area of dry lowland heath in Wareham Forest was started in late 1992 and is ongoing. All six species of native British reptile (adder *Vipera berus*, grass snake *Natrix natrix*, smooth snake *Coronella austriaca*, common lizard *Zootoca vivipara*, sand lizard *Lacerta agilis* and slow worm *Anguis fragilis*) occur on the site and their populations have been monitored annually using hexagonal arrays of artificial refuges (corrugated tins). All captured snakes have been individually marked using pit-tags whilst only the number of sightings of each of the three lizard species have been recorded. The number and density of refuges varied between 1992 and 1997. Between 1997 and 2009 the number and density of refuges has been standardized so that the number of reptiles found each year can be compared.

Between 1997 and 2000, approximately 50 individual smooth snakes were found annually at the study site. Between 2000 and 2005 smooth snake numbers declined and have apparently stabilized, since 2005, at approximately 22 individuals. The most marked decline was in the number of females from approximately 27 per year (1997–2000) to approximately five per year (2005–2009). The decline in male numbers was more gradual, from 24 per year (1998) to 17 per year (2009). None of the other reptile species showed an equivalent decline, remaining either relatively stable between 1997 and 2009 or increasing (e.g. common lizard). Although there may be a number of possible explanations for the observed decline in smooth snake numbers (predation, emigration), the decline appeared to coincide with the introduction of cattle into Wareham Forest in 1996 as a means of heath management. A strong correlation between the cumulative effect of cattle on the heathland and the decline in smooth snake numbers found annually suggests that the cattle may be responsible, though the mechanism remains unclear and unproven.

With support from the Forestry Commission and Natural England, new fencing will be erected during winter 2009–2010 to exclude cattle from approximately half of the current reptile study area whilst allowing grazing to continue in the rest. Changes in smooth snake (and all reptile) numbers will continue to be monitored over the next 5+

years to determine whether any differences in reptile densities appear between the two treatments and, if so, whether cattle grazing has a deleterious effect, no effect or a beneficial effect on smooth snake (reptile) numbers.

### Comparative conservation ecology of *Vipera ursinii* populations in Italy

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The meadow viper (*Vipera ursinii*) is one of the most endangered snake species in Italy, where it occurs only at a few scattered sites, all situated about 1400–2400 m a.s.l. in the central Apennine massifs. The conservation ecology of this viper has been studied for approximately 20 years by myself and some associates (particularly E. Filippi), on behalf of several scientific and conservation governmental organizations in Italy. We conducted our research in several sites in the following mountain massifs: Gran Sasso, Majella, Marsicano Mount, Velino-Sirente, Duchessa Mountains and Terminillo. Our studies investigated aspects of population ecology (reproductive biology, thermal biology and dietary habits), demography and habitat suitability using a suite of empirical field techniques and modelling statistics. In this way, we assessed the main threats to each population and defined the overall present status and future prospects of this viper species for each massif.

The ecological traits of vipers are rather similar among sites: they are small sized (35–45 cm long), mostly insectivorous reptiles that give birth to 2–4 offspring per female, with the female reproductive cycle being on average biannual. We demonstrated that the viper is now abundant at only very few sites (particularly in the Gran Sasso massif and in a selected area of the Velino massif); it appears to be seriously declining at most of the sites. In particular, we found a constant decline in the population size and density in the Duchessa Mountains, Marsicano Mount and Majella massif. At least one population (inhabiting Terminillo mount) is extremely endangered and probably very close to extinction. The main threats were shown to vary from site-to-site, so that any generalization is problematic. For instance, the main threats for the vipers appear to be 1) overforestation by *Pinus mugo* in Majella massif; 2) microhabitat disturbance due to red deer (*Cervus elaphus*) overpopulation at Marsicano

mount; 3) overgrazing by cattle and horses at Duchessa Lake; and 4) mortality on roads at Gran Sasso. In Terminillo a combination of some of these main threats is seriously affecting the remnant viper individuals. Illegal collecting for the pet trade, contrary to expectations, does not appear to be a serious threat for meadow vipers. It is concluded from our studies that the best conservation strategies should work at the local scale given the specific nature of the threats experienced by vipers at each site, whereas it is doubtful that a global conservation strategy may really be effective.

## Phylogeography and conservation of Jersey's wall lizards *Podarcis muralis*

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Wall lizards (*Podarcis muralis*) on the island of Jersey are near the northern limit of their geographical range though the species has a wide distribution in continental Europe. The Jersey populations are typical of other northern European localities in that they are generally restricted to old fortifications and castle walls, living in relatively small, fragmented populations. The structure and origins of these populations and/or subpopulations are unclear.

Wall lizards are fully protected under the Conservation of Wildlife (Jersey) Law 2000. This research is being carried out to clarify the origins of the species in Jersey, assess its distribution and investigate the viability of its populations there. The research assesses the levels of genetic diversity in the Jersey populations, comparing these to levels of diversity in other populations in northern France in order to assign conservation priorities, address needs and clarify population origins.

DNA was obtained from a sample of six populations in Jersey and France. Captured lizards were measured and characterized (size, weight, age class, sex and breeding condition). In total, 176 tissue samples were prepared for DNA extraction. Currently the samples are being processed to determine gene flow between populations and describe the genetic variation in and between local and French populations. The research is being funded by the Jersey Ecology Fund and States of Jersey and is due to be finished by February 2010.

## Timing is everything: the role of the lunar cycle in amphibian reproduction

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Animals can perceive various cues arising from the 29.5-day synodic lunar cycle, including changes in gravity, geomagnetism and light intensity. The latter is likely to be particularly important in nocturnal animals (including most amphibians). The timing of amphibian reproduction depends on many factors and is highly influenced by climate at temperate latitudes, so most studies of amphibian breeding phenology consider mainly meteorological factors.

We collected data from various sources across the temperate northern hemisphere and looked at the effect of the lunar cycle on several species of anurans and urodeles. Large arrival, amplexus and spawning events were more frequent around the full moon than the new moon in the anurans we studied. The date that the first spawn was observed showed no lunar periodicity, possibly because early spawning events are more constrained by minimum temperatures. The urodeles in this study also arrived non-randomly with respect to the lunar cycle but the results corresponded more closely to the gravitational and geomagnetic cycles of the moon. Linking reproduction to lunar cycles is likely to be an adaptive response in some amphibian species, for the purpose of synchronizing reproduction to maximize mating success or to minimize predation on individuals. It is likely that the response of amphibians to lunar cycles is species-specific, and more research is needed to clarify lunar effects in different groups of amphibians. The results of this study have implications for amphibian conservation and monitoring. Very few studies aiming to monitor amphibian numbers from year to year take moon phase into account, which could give misleading results as lunar dates are out of phase with Julian dates. Taking into account the effect of lunar cycles on amphibian breeding can contribute to conservation measures; for example, road closure to avoid traffic related mortality could be timed at the appropriate part of the lunar cycle for the species in question.

## Diversity and mate choice in the palmate newt

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The maintenance of genetic resources is increasingly recognized as an important component of species conservation and management. Low levels of genetic diversity can reduce individual fitness through the effects of inbreeding depression and limit the evolutionary potential of populations in a changing environment.

Genetic diversity can be assayed using various strategies, with a focus on either gauging genetic variation across the genome using neutral genetic markers, or on using specific genes that are adaptively important and hence will directly contribute to individual fitness.

Here, I describe levels and patterns of genetic diversity at both neutral microsatellite markers and genes of the major histocompatibility complex (MHC) among Scottish populations of the palmate newt, *Triturus (Lissotriton) helveticus*.

The genes of the MHC encode proteins involved in antigen recognition and immune function. As such, MHC diversity is directly related to an individual's ability to cope with parasite and pathogen assault. Moreover, in several species, non-random mating among individuals can be mediated by females attempting to optimize offspring diversity at MHC genes, and can lead to male ornamental traits advertising aspects of MHC genotype. I characterize patterns of MHC diversity within and between populations of palmate newt to examine 1) the extent to which the visual and olfactory cues used by

male palmate newts during mating reflect MHC alleles or heterozygosity, 2) whether certain MHC genotypes are reproductively more successful than others and 3) the extent to which neutral microsatellite diversity across the genome predicts diversity at the MHC.

Patterns of microsatellite DNA variation are described with reference to the levels of population isolation among pond populations, under the null hypothesis that isolated populations are genetically fragmented and depauperate, given that they exist on the edge of the species' European range.

## Project *Tylotriton*, research and conservation by accident

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Found across Himalayan Asia, crocodile newts, genus *Tylotriton*, are rapidly becoming threatened by over-collection, habitat loss and competition with introduced species. Project *Tylotriton* was established as an in-house title for Reaseheath College's student research programme; since then the project has grown with links developing in Northern India, Thailand and Bhutan. Focusing on our work with *Tylotriton verrucosus*, the talk will explain our in situ work and our ex situ research activities as well as our developing interests in the other species in the genus.

## Wet and dry heath habitat selection in smooth snakes

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Research was conducted on three geographically separated smooth snake (*Coronella austriaca*) populations in the New Forest, Hampshire. The aim was to assess the relative importance of wet heath areas to the conservation of the species and to quantify the relative effect of a variety of habitat and environmental variables on *C. austriaca* presence.

An intensive survey of the three selected study sites was conducted over the active period of March to October through the use of artificial refugia in a stratified random design. Twenty-six survey visits were made to each site and classified into spring, summer and autumn seasons for direct comparison. The proportions of refugia occupied on dry and wet heath areas for each season were then compared by means of non-parametric analyses of variance. A variety of habitat and environmental variables were measured throughout the duration of the fieldwork in an attempt to quantify their relative significance on *C. austriaca* presence and absence data. The relative importance of these variables to *C. austriaca* presence under dry and wet heath refugia were then compared by means of forward stepwise binary logistic regression models.

Season was found to significantly influence the habitat selection of *C. austriaca* on dry heath in summer. The occupancy of wet heath increased throughout the survey season and peaked in autumn. However, this pattern was

not found to be statistically significant. The relative influence of habitat and environmental variables on *C. austriaca* presence was found to differ between dry and wet heath. The most influential variables on dry heath habitat were found to be a refugia aspect of SSE, percentage cover of pine (*Pinus sylvestris*), percentage cover of dwarf gorse (*Ulex minor*), proximity to wet heath and mean monthly temperature. The most influential variables on wet heath were found to be mean vegetation height, percentage cover of ling heather (*Calluna vulgaris*), proximity to dry heath and proximity to nearest refugia.

Overall, the most influential variables on both habitat types combined were found to be mean vegetation height, percentage cover of *C. vulgaris*, proximity to next habitat type, proximity to nearest refugia, total daily rainfall and mean monthly temperature. These results, in the context of previous research, are commented upon in reference to future surveys and the conservation management of this species.

## Insights into genetic mating systems of amphibians: examples from a toad, a newt and a caecilian

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For approximately the last two decades, studies based on DNA parentage testing have revealed a wealth of new information about genetic mating systems in vertebrates. However, most investigations have focused on birds and mammals and surprisingly little is still known for amphibians. To this end, I summarize the main findings of otherwise unrelated studies that revealed aspects of mate choice and reproductive success in each of the three amphibian orders.

The common toad (*Bufo bufo*) is characterised by external fertilization of a large number of eggs, and scramble competition among males for females at male-biased sex ratios. We determined the parentage of both field-collected eggs and eggs resulting from controlled matings, and demonstrated the regular occurrence of multiple fathers siring a female's offspring. In the smooth newt (*Lissotriton vulgaris*), on the other hand, eggs are fertilized internally after a complex courtship ritual, with females actively seeking to mate with several males sequentially during a relatively long mating season. In order to distinguish between the order of matings and the genetic quality of the inseminating males in determining reproductive success, we experimentally paired one female with each of two males, and repeated the same procedure in reverse order of the identical males after assumed sperm depletion. We observed multiple paternities throughout all mating trials, without significant first- or second-male sperm precedence. However, the paternity share of individual males was transitive across the two trials with male order switch, and successful males had a significantly higher genetic dissimilarity to the female than expected by chance. In the third study, we investigated the parentage of litters in the caecilian *Boulengerula taitanus*, a species where putative mothers guarding such litters provide their own skin as a food

source for the offspring. Our data suggest that two fathers sired some of the litters and, in addition to this, that some young had genotypes not matching the guarding female, suggesting that not all offspring are cared for by their biological mothers.

### **The Hog Island boa: conservation of an exploited insular boa constrictor (*Boa constrictor imperator*) in the Cayos Cochinos, Honduras**

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The “Hog Island boa” is a dwarf form of *Boa constrictor* known only from the two small islands of the Cayos Cochinos, Honduras. Widely prized within the pet trade

for its small size and attractive coloration, the Hog Island boa became severely threatened from over-collection during the 1980s and was once thought to have been extirpated from the wild. Fortunately, conservation efforts are allowing the gradual recovery of the population but the illegal removal of boas from the islands for the pet trade continues to be a real problem. Recently, the number of people being caught attempting to smuggle boas off of the islands appears to be increasing and “wild caught” Hog Island boas have begun to creep back into reptile dealers’ collections. If the long-term persistence of this unique island boa is to be assured, increased efforts are surely needed to provide local stakeholders with better incentives for protecting these snakes. Here, the effectiveness of current conservation strategies will be discussed, along with the potential for herpetologically-based ecotourism in the Cayos Cochinos.