

Editorial

Rodent biology and management

Rodent species comprise about 42% of the Earth's mammal biodiversity, with 2277 species and others still not described. As such they are key species in many ecosystems as herbivores, seed eaters and seed dispersers, and prey for many carnivores. Much of rodent biology and population dynamics goes on with little notice by humans, but a small number of rodent species are major pests for agriculture or reservoirs for diseases that can be transmitted to us. Because of their typically small size and rapid turnover, rodents are excellent subjects both for laboratory and field research. Postgraduate students can study rodent biology knowing that in the time frame of 3 years they can ask and answer interesting scientific questions.

The 5th International Conference on Rodent Biology and Management (5th ICRBM) in Zhengzhou, China, highlights the split personality of rodents as pests and rodents as good model systems for understanding basic biology. Two themes emerge from this issue of *Integrative Zoology*. First, that while rodents have some characteristic traits, species differ in the details of their biology in ways that illustrate very well the general admonition that 'the devil is in the details'. Second, that as we learn more about their biology, we find that pest management can be achieved with less poison and that more critical thinking and experiments are necessary for searching out the Achilles heel of pest species (Singleton *et al.* 2007).

Because there are so many rodent species with diverse ecological requirements and social systems, there is much to do to document and understand individual species in particular environments. The house mouse (*Mus musculus*) is a worldwide pest species, and because it is so plastic in its ecology we need data on it from all parts of its extensive range (León *et al.* 2013). Underlying all the aspects of the ecology of beneficial and pest rodent species are the basic sciences of physiology and behavioural biology. We need to understand the

mechanisms that generate patterns of social behaviour, including competition, and adaptation to human environments (Baudoin *et al.* 2013).

Pest management is the critical applied ecology side of rodent biology and the source of much interest by funding bodies. The principles of pest management for rodents are three: first, do not assume that all rodent species are pests. This goal must be achieved with good taxonomy and good field studies. Second, do not assume that poisons are the answer to managing rodents in agricultural or urban settings. Poisons are useful and necessary now but, as time progresses, their usage may be constrained because of their side effects on humans and wildlife. Fertility control is a continuing area of research and the use of synthetic estrogens like quinestrol show promising leads in what we might call the second generation of pest management strategies (Liu *et al.* 2013). Third, be clever and maximize cultural control of pest species in a way that protects both human health and crop damage. The end results we desire are reliable models that provide the understanding and prediction of coming problems like rodent outbreaks (Davis *et al.* 2004). Much research work and education needs to be done in these focal areas of rodent biology.

In a global sense, the role of rodents in urban, agricultural and natural ecosystems is largely unappreciated. A classic example is the role of many rodents as seed eaters. Viewed in a simple framework, this is a negative interaction for the plant providing the seeds and a positive interaction for the rodent who obtains food. But this simple framework ignores the role of rodents (and birds) as seed dispersers (Cao *et al.* 2011), and the role of rodents as sources of food for predators, be they specialists or generalists (Ruscoe *et al.* 2011). Rodents can be keystone species in many ecosystems, as you would find if you could remove them to see what effects occur at the community and ecosystem level.

But it is the basic biology of rodents that we must foster in our research and communication. Rodents in their many forms are as fascinating as lions, tigers, pandas and polar bears. As we study the behavioural ecology of rodent societies, the physiology of species that live in very hot and very cold environments and the genetics and evolution of all these forms, we enrich our understanding of life on Earth. The 5th ICRBM is one step along this long journey.

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