A2.27
Telemetry in the field: Practical refinements to improve animal welfare

P. Hawkins, (RSPCA, United Kingdom)

Biotelemetry and data logging devices are continually decreasing in size and mass, which is markedly reducing the impact of physiology and behaviour research on animals in the field and enabling the collection of data that it would previously have been impossible to obtain.
However, there are still three key issues associated with biotelemetry studies outside the laboratory that can affect both scientific validity and animal welfare:

- physiological effects of the device and the method of attachment or implantation;
- the reduced ability to monitor animals following release and to intervene if there are health or welfare problems;
- potential stress due to capture, handling and restraint by humans.

These issues have been addressed by an initiative set up by the BVA(AWF)/FRAME/RSPCA/UFAW Joint Working Group on Refinement. A group was established, with members including veterinary surgeons and field biologists, with the aim of making recommendations to help workers in the laboratory and field to improve both science and animal welfare.
The working group produced a report on refinements in telemetry procedures that sets out practical methods for minimising any stress to animals, improving practice for surgical implantation and external attachment, and ensuring that animals are fit for release. Accompanying online resources include guidance notes to assist with preparing telemetry project proposals for review by regulators, ethics committees or animal care and use committees (http://www.lal.org.uk/telemetry/index.html).

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A2.28
Laboratory studies in wildlife conservation: The case of the Steller sea lion

D. Rosen, A. Fahlman, A. Trites, (University of British Columbia, Canada); G. Hastie, (University of St. Andrews, United Kingdom)

The use of large captive vertebrates to address wildlife conservation issues raises at least two concerns: ethics of captivity and scientific relevance. To some degree the former is mitigated by the efficacy of the latter. For the past decade, laboratory studies with captive Steller sea lions (*Eumetopias jubatus*) have been central in efforts to understand the reasons for their precipitous population decline in the North Pacific, particularly in relation to the Nutritional Stress hypothesis. Research has concentrated on areas deemed most appropriate to the laboratory setting: physiology, bioenergetics, nutrition, and the development of techniques to study animals in the wild. Studies to date have quantified the nutritional value of prey items, the physiological response (and adaptive limitations) to changes in food intake (quality and availability), the energetic costs of various behaviours (including construction of a bioenergetic model), the energetic effects of changes in the physical environment, the hierarchy of bioenergetic and nutritional priorities, the cost of diving and foraging, the interaction between prey fields and diving behaviour, and the physiological constraints affecting concurrent bioenergetic demands. Experiments have taken place with trained sea lions both in an Aquarium and at an Open Water facility where animals can perform without unnatural physical constraints. These studies have yielded novel data that have permitted scientists to make inroads into the reasons for the Steller sea lion population decline. This is an example where controlled empirical experiments in an artificial setting have allowed researchers to test specific relationships hypothesised or observed to occur among their wild counterparts.

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A2.29
Differential sodium uptake kinetics in freshwater Atlantic salmon with alternative life histories

J. Murua, (University of Exeter, United Kingdom)

Atlantic salmon (*Salmo salar*) have alternative life history strategies; namely, freshwater resident (early maturing parr) or ocean migratory (maturing at a much larger size). We hypothesised that whilst still in freshwater smolting salmon would start to lose their freshwater ionoregulatory characteristics, whereas parr (whether still immature or early maturing) would not. In two experiments, we measured gill sodium uptake kinetics within freshwater in 18 and 52 juvenile Atlantic salmon in April 2001 and June 2006, respectively (K_m and V_{max} assessed from unidirectional $^{22}Na^+$ uptake rates). In the first study 3 out of 18 fish sampled were early maturing parr (no immature parr), the remainder being smolts. In the second experiment, 5 fish were immature parr (none early maturing) and the rest smolts. As expected, parr in both studies had higher plasma Cl− than their respective smolts following 24 h seawater challenge (179±7 v. 156±3 and 147±6 v.138±4 mM, respectively). In the first study, smolts had a 2-fold lower V_{max} (291±45 nmol/g/h) compared to early-maturing parr, and against the predicted trend, a lower K_m for Na^+ uptake (K_m=117.7±69 v. 438.5±127 μM, respectively). In study 2, the immature parr exhibited the expected pattern of a lower K_m compared to smolts (K_m=63±25 v. 174.5±27 μM) but no difference in V_{max}. There are therefore notable differences between immature parr, early maturing parr, and smolts in physiological parameters relating to ion uptake kinetics. We