

## **23. Acoustic tags**

*Mark Johnson, Woods Hole Oceanographic Institution, MA, USA*

Miniature tags that record the sounds made by, and heard by, an animal are leading a revolution in behavioural studies in the field. An increasing range of inferences about foraging, social organization and even energetics are being drawn from such tags. However, unlike supervised sound recorders, these tags must be completely autonomous and so their performance is critically dependent on good design decisions. We will discuss the constraints of dynamic range, noise floor, sampling-rate, anti-alias filtering, phase matching of recording channels, and memory capacity. An understanding of each of these factors with reference to the target recording environment is needed to get good recordings that faithfully represent the sounds impinging on the tag. Some methods that improve performance or relax constraints will be examined including pre-emphasis, sigma-delta analog-to-digital conversion and loss-less compression.

## **24. Underwater sound production**

*Magnus Wahlberg Fjord & Bælt, SDU, Denmark*

Producing sound underwater poses some different challenges to animals compared to the ones experienced in air. The medium has a much higher density, and the wavelengths are 4.4 times longer for a given frequency. Aquatic animals have solved the problem of producing sounds in many different ways, such as forcing an air bubble into oscillation (in fishes) or pneumatically drive tissue into vibrations (in dolphins). The type of sound production is intimately linked to the size of the animal compared to the wave length, and to the desired physical properties of the produced sound (band width and directionality).