Implanting Satellite Transmitters in Water Birds

Frequently Asked Questions

How are the transmitters attached? Why implanted?

There are many types of satellite transmitters, or Platform transmitting terminals (PTTs). In most water birds, particularly those that dive or spend most of their lives in water, we need to use an internally implanted transmitter. The reason for this invasive approach is that external appliances alter the position of the feathers and interfere with the microscopic alignment of the



barbs on the feather, which is their primary way of keeping their down dry and staying warm. Experiments performed with external harnesses demonstrated that the birds constantly preened at the expense of foraging or avoiding predators. Even with internal implantation we still have to work very hard to minimally disturb their feathers as it can take days for feather contamination to be preened off. To implant the PTT, we anesthetize the bird, surgically enter their abdomen, create space along their right side between the body wall and airsacs and organs, and using a special process, we insert the transmitter and lace the antenna through a new channel we create so that it exits beside the tail. The units are completely sealed but have a magnetically activated internal switch. During implantation I remove the external magnet to activate it. Although I may perform the surgeries in a variety of circumstances (sometimes clinic surgery rooms, sometimes



in tents in the middle of the arctic), we still use modern analgesics, local and general anesthetics, sterile instruments and supplies, suture, and post-operative fluid injections to do the job right. The techniques used are varied slightly after careful analysis of dead specimens (found dead) and are adjusted as new transmitter configurations become available. There are not many veterinarians that conduct these surgeries, perhaps 10 or so in North America. After surgery we hold the birds for a few hours or more and then release them back near where they were captured.

How do PTTs work?

PTTs provide global positioning information of the birds. Internally implanted models are the simplest as they need to conserve power since solar recharging is not an option. An internal chronometer activates the unit every so many hours per a preloaded program. The unit will

transmit a short burst of data once per minute. Internal units do not have an onboard GPS (requires too much power) so the position is calculated using Doppler shift as receiving satellites pass overhead. The duty cycle is long enough that multiple satellites pick up multiple transmissions, thereby increasing the accuracy with which they can calculate the bird's position. The data signal includes identification, internal temperature, battery status, activity sensor information (basically an accelerometer that detects the bird's movements). If temperature or activity readings fall below a threshold and the health of the



transmitter appears good, then it generally means that the bird has died. If this occurs in an accessible area, a team can be sent out to home in on the transmitter using a handheld antenna and receiver. Recovered transmitters can then be refurbished at a substantial savings over buying new units.

Why are PTTs used?

The position information tells us where the birds spend their time during different phases of their annual cycle. It can also tell us what routes they tend to use for migration and the timing of their movements in relation to weather, time of year, and man-made disturbances. We can also determine if some species tend to winter or breed in the same locations year to year. Finally, some

Small Canada Goose Satellite Telemetry Project Locations from 9/29/10 to 10/29/10



biologists are interested in seeing whether there are locations where populations intermingle (e.g., do sea ducks on the west coast breed in the same arctic locations as those from the east coast—important to know in assessing the stability of a species and for assessing risk of disease transmission).

How long do they last?

Implanted PTTs may last up to 2 years, depending upon the aggressiveness of its program (e.g., the frequency and duration of each transmission duty cycle). The more often and the longer each duty cycle, the more precise the information, but the units may only last 12 months. It's

generally expected that the PTTs will stay in place for the rest of the bird's life but this is very difficult to assess since once the units stop transmitting it is virtually impossible to follow the bird thereafter.

Do you remove them?

Not normally in wild birds. There are rare instances where implanted birds have been captured and the units removed. Sometimes captive ducks are implanted to test new PTT designs. These units are removed from captive birds after batteries or the units themselves have failed. Surgical removal appears to be well tolerated and it gives us a chance to analyze the condition of the units to assess what parts of their design we can improve. Sometimes units are spontaneously expelled by the birds. Essentially they are considered foreign material albeit sterile. In some cases the reaction results in a very slow process of walling off the PTT and gradually pushing it out through an opening that forms around the base of the antenna. A special



collar we install on the PTTs prevents infection during the initial days of healing following surgery.

Do PTTs interfere with the lives of the birds?

Certainly there is an impact on the lives of the birds for a short time. Everything possible is done to minimize the pain, stress, and trauma of the capture, surgery, and holding process. It's difficult to assess the exact impact but in most species, there appears to be a similar rate of attrition in un-



implanted birds (e.g., death by predation, disease, or hardship) to rates of death of implanted birds. A rule of thumb has developed that if a bird dies within its first 2 weeks post-surgery, the implant process may have served a role. Often, when a bird does die it is quickly predated or scavenged so it can be difficult to assess the cause of death, if the carcass can be located at all. Sometimes freshly dead birds are recovered and it has been rare to find evidence of systemic or serious local

infection. However, damage to waterproofing may take days to resolve and could play a role in consuming their precious energy reserves while they preen and deal with loss of heat at the expense of foraging. Fortunately, rates of death shortly after implantation are relatively low and the information we gain from the transmitters should help us better care for the populations of birds. Still, we take the individual welfare of the birds seriously and constantly strive to minimize our impact upon them. We also hope to develop less invasive techniques in the future that will still allow the capture of precise location information over great distances and long time periods. Less impact on the bird is better for them and better for the quality of the information we intend to collect.