GSM Transmitters

A description of cutting-edge technology utilized in the Golden Gate Raptor Observatory's GSM Tracking study. Please see more about our GSM tracking project here: www.parksconservancy.org/gsm-tracking

Background of Wildlife Tracking

Determining avian movement patterns has been a fundamental question in biology for centuries. Our ability to track birds has been always been reliant upon the technology of the age. Marking birds to allow identification of individuals began in the 14th century, and bird banding took off in the early 20th century. While banding provides a cheap way of monitoring bird movements, it is often labor-intensive and requires someone to catch the marked bird again. The chances of reencountering any individual banded bird are extremely low: only about 0.1-5% of birds banded in North America are ever found again after being trapped.

In the 1980s satellite transmitters lightweight enough to attach to birds became available, allowing researchers to remotely track their movements. This location information was then sent to the researcher via a system of satellites known as Argos, which provided researchers with a stream of relatively accurate location data for the life of the transmitter. In addition, increased efficiency of solar panels has meant that researchers can track birds longer, as batteries can be replenished while the transmitter remains on the bird. Today, the miniaturization of cell phone (i.e., Global System for Mobile communications or GSM), GPS and solar technologies allows us to track individuals for years with minimal effort.

GSM versus Argos

Currently, Argos PTTs (Platform Transmitter Terminals) are used extensively for wildlife tracking. PTT transmitters collect location data via Doppler shifts of orbiting Argos satellites relative to the ground unit or via standard GPS technology. The location data is then sent over the Argos satellite network back down to researchers. Transmitters generally collect 1-10 locations per day and scientists can prescribe different data collection protocols for different times of the year. For example, someone studying migration can get more data from the units during the migration period when an individual is likely to move more, and less data during the breeding season when the bird is likely to be more sedentary. Currently, Argos PTTs that utilize more accurate GPS technology weigh over 22 grams. As a rule of thumb, researchers limit the weight of a transmitter to less than 3% of a bird's body weight, meaning these units can't be used on birds that weigh less than 734 grams. (For reference, Red-tailed Hawks trapped in the Marin Headlands usually weigh between 660 – 1200 grams.) For us, it means we are limited to putting transmitters on larger, probably female, Red-tailed Hawks and Peregrine Falcons.

The down side to PTTs is that the technology to make these units and transmit data via satellite is expensive. Most Argos units cost $3,000-4,000 each. In addition, satellite communication costs are generally $1,000-1,500 per unit every year. Thus, to track one individual for 2 years would cost between $5,000-7,000. In addition, because information only flows from the unit to the researcher, the timing and type of data a unit transmits cannot be changed once the unit is deployed.

In recent years there has been a push to send location data via GSM messaging (a.k.a. text messaging), which, when combined with GPS technology, would allow a bird to essentially text in its location. Because of current industry demand to miniaturize cell phone components, these units can be made lightweight enough to be put on many bird species. GSM transmitters also utilize solar cells to provide recharging capacity for the transmitter, allowing them to transmit for several years. Another advantage is

that because these units are GSM capable, researchers can update them as research questions evolve. For example, if a hawk flies to an area with wind power development, researchers can increase the number of locations taken to assess the threat and movement patterns of the hawk around wind turbines.

The miniaturization of this technology also allows for significant cost savings. Units cost between $2,500-3,000 and data collection is projected to cost approximately $500 per year. Thus, to track an individual for 2 years would cost between $3,500-4,000. However, because the technology is new and the product is just being launched, Northstar Science and Technology (www.northstarst.com) is offering the GGRO GSM transmitter units at 25% of the cost (i.e., $1,000 per unit, which includes 2 years of data collection) to help test the product.

The Current State of GSM technology

GSM transmitter technology is very new and only became available on the market for use on birds in July 2012 by Northstar Science and Technology. Beta testing on Swainson's Hawks, Peregrine Falcons, Osprey, Sage Grouse and a number of falconry birds has demonstrated the utility of these transmitters and that they can function well on birds. Peregrine Falcons and Swainson's Hawks are wide-ranging species that have been able to transmit data in relatively remote areas (e.g., northern Saskatchewan, Canada). Also, if the transmitter does not have cell coverage, it has the ability to log several thousand points and send those points when it eventually locates a cell tower so the researcher doesn't lose any data. Units can also produce many GPS coordinates, altitude and other data that would be impractical or expensive to send over the Argos satellite network, allowing researchers to get more data about the movements and locations of tagged birds.

Why GGRO?

The Bay Area makes a good testing area due to the high coverage of cell towers. While its complex terrain can often impede cell signals for those of us on the ground, soaring hawks are not as limited. The eyes and ears of enthusiastic GGRO volunteers, and the large number of people in the Bay Area in general, also mean that a transmittered raptor is more likely to be observed and its condition assessed.

Benefits to GGRO/GGNPC

The cost reductions provided to the GGRO allows these units to be competitive with other technologies relative to the time investment needed. Aside from financial incentive, these units help the GGRO fulfill its core mission by providing the best assessment yet of the patterns of hawks migrating through the Marin Headlands, as well as future route(s) like spring migrations. This information could allow us to assess habitat use, potential hazards (e.g., wind turbines) and general movements of migratory raptors. As tagged birds age and take alternate migratory routes, we can also use these data to follow their movements and perhaps learn why the GGRO observes so few adult raptors.

The GGRO's broad volunteer base and other outreach venues give us a potential platform to include members of the public and generate excitement about raptor migrations. A real-time map on the website could update locations of tagged individuals as they are reported, engaging volunteers and interested members of the public with the hawks trapped in the Marin Headlands and the GGNRA in general. Through these hawks, we could help demonstrate the interconnectedness of the park system with the surrounding lands and spark interest and educational opportunities.

The Golden Gate Raptor Observatory is a program of the Golden Gate National Parks Conservancy in cooperation with the National Park Service. www.ggro.org