WINTER 2012 Volume 13, Issue 2

Tracker News

Microwave Telemetry, Inc.

Lifetimes in Technology – Generations Converge

Dear Customers and Friends,

Looking back, we can't help but think that we have achieved many of the company's goals set forth at the beginning of the year. Our conference in March was a grand success. The information disseminated from the cutting-edge research being performed around the world, all in an effort to conserve what remains, was truly humbling to us. It became clear to me that we scientists have always been walking this path together, some longer than others. In this issue of our newsletter Thomas Alerstam, Jim Watson, and Hiroyoshi Higuchi attest to this as they describe their nearly lifelong involvements in tracking birds, while newcomers from the Cape Eleuthera Institute, and Billie Roberts and Kelly Roche, (recipients of our educational award) update us on their students' projects. The next generation of budding scientists is showing so much promise. To see our sons and daughters (literally) joining us in our disciplines truly is a testament to the importance of the research being conducted.

The future is bright. Since the company's inception, our customers have inspired us to invent and provide technology to enable animal conservation. Per your request, we have unveiled our new line of telemetry products, which uses the GSM network to transmit data. For years, we have been asked to find ways to collect more GPS fixes. Now, we fear that we will receive complaints because there is too much data!

We know how difficult your work is – we are grateful for all your efforts (especially those who contributed to this newsletter and our 2013 calendar). The significance of the studies being performed is truly greater than anyone can fathom. In many instances, it now seems possible to see increased abundance of certain species, such as bald eagles and ospreys. It really is possible to adapt our ways, so that we humans can coexist with other animals. Hopefully, the next cohort of scientists will help us make even greater headway. As we start another year of hard work, let's keep the forward momentum going – it will be worth it.

From our family to yours, we wish you a relaxing and joyous holiday season and best wishes in the New Year.

Sincerely,

Paul and the Team at MTI

Photo by Jim Watson

Above: Juvenile ferruginous hawk tagged with a GPS/GSM transmitter.

Microwave Telemetry, Inc.

8835 Columbia 100 Parkway
Suites K & L
Columbia, Maryland 21045
USA

Phone 410.715.5292

Fax 410.715.5295

Email support@microwavetelemetry.com

www.microwavetelemetry.com

Revolutions in Animal Tracking

Thomas Alerstam received his PhD in 1976 at Lund University with his thesis "Bird migration in relation to wind and topography." He has been a professor of Animal Ecology at Lund University since 1994. His long-term research about bird migration has included the supervision of more than 20 successful PhDs over the years.

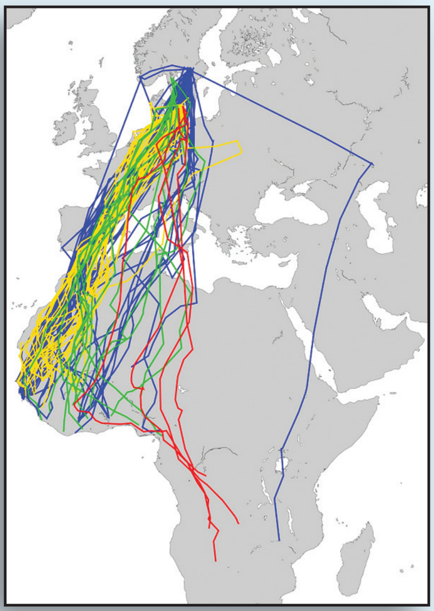
Growing knowledge about where and how birds migrate depends on a series of revolutions in the methodology for recording their travels. Having researched bird migration for 40 years now, my own experience began with the observations of visible bird migration in the field. This has remained a basic element in my life and research – to watch the seasonal passage of migrants. Joining my father on local flights in a Cessna airplane introduced me to the radar facilities at airports, and after reading the book "Radar Ornithology" (Eastwood, 1967) I decided to do migration research combining radar and field methods. I still believe that radar reveals the process of bird migration in an enormously fascinating way – either by showing the broad geographic migration pattern over a large region on a surveillance radar screen or the detailed track and wingbeat signature of a single bird or flock on the A-scope of a tracking radar (and when visual observations are impossible, at high altitudes, during the night, above clouds). Tracking radar became a main tool for my research about flight performance, orientation and wind responses among different species. I brought tracking radar stations onboard ships to Antarctica as well as to the Arctic Ocean, where we made a series of expeditions to explore the migration and orientation of birds under polar conditions. Tracking radar is still used in my projects, providing detailed information about bird flight trajectories and simultaneous winds that are crucial for testing hypotheses about optimal migration strategies.

Hobby (red track).

In the meantime, a new revolution in animal tracking took place – satellite tracking. The pioneering satellite tracking experiments with birds by researchers from Johns Hopkins University Applied Physics Laboratory in the mid 1980s, involved large species like eagles, swans and giant petrels. Paul Howey was among these pioneers, and has maintained a leading role in the development of satellite transmitters – from the first bird transmitters (> 0.1 kg) with batteries lasting only a few months, to PTTs of only 5-70 g with solar panels and GPS that are currently available from Microwave Telemetry. Many birds are still too small for carrying a satellite transmitter (although the development is extremely impressive with a 3 g prototype presently being tested). New possibilities are constantly emerging and animal tracking is indeed in a very dynamic phase of exploration!

Marsh harrier (yellow track).

My first experience with satellite tracking was in a 1992 –1993 study of brent geese migrating in spring from Iceland across the Greenland ice cap towards breeding destinations in northern Canada. Our friends and colleagues Silvano Benvenuti and Floriano Papi at the University of Pisa in Italy were eager to try the new technique and sought contact with us in Lund. The collaboration, coordinated by Gudmundur Gudmundsson, was very successful and gave fascinating insight about flight and orientation difficulties as the geese crossed Greenland where the ice cap is > 2500 m above sea level. Five geese were tracked successfully across the ice cap but their battery powered PTTs were exhausted within a month, and we could not follow the geese to their breeding destinations and then back to their winter quarters in Ireland, something easily accomplished today with improved transmitter performance. Next, in 1995 we initiated satellite tracking of raptors in Sweden, starting with osprey but soon extending the project to several other species (honey buzzard, common buzzard, marsh harrier, hobby) using constantly improving transmitters of reduced weight, longer tracking duration (several years) and higher location precision (GPS 3D location at close intervals). A new and amazing view of raptor migration has emerged from these results and the project is still running with several unanswered questions (see map). Our latest satellite tracking study is a cuckoo project (from 2010), where we are presently analyzing the full annual loop migration of birds from populations in both south and north Scandinavia (Lapland).


Tracks depicting migration systems of raptors travelling between Sweden and West Africa. Based on satellite tracking results obtained by Swedish raptor tracking group.

There is no doubt that the possibility of tracking the same individual over long distances and time periods, even during one or more complete annual migratory cycle, has opened up a new dimension in bird migration research (and satellite tracking is the most appropriate technique). Migrants seem to be surprisingly variable in their responses to wind concerning their exploitation of wind assistance as well as drift or compensation responses to crosswinds. Using satellite tracking data in combination with wind information from global databases can reveal how birds change and adapt their wind-related behaviour between seasons and geographic regions with different wind regimes. As with wind responses, migratory birds are also remarkably flexible in their migration strategies (flight/stopover, daily travel routines, speed of migration, etc.) and satellite tracking data are crucial to test hypotheses from optimal migration theory. Additionally, comparative analyses of migration of individuals from different populations will provide an understanding of how migration patterns evolve in relation to geographic and seasonal resource windows and wind regimes.

Honey buzzard (green track).

With the new possibilities of multi-year high-precision global tracking of individual birds added to older approved methods, we are indeed, once again, in a new era of bird migration research – an era with opportunities for new exploration and discoveries, but also for answering fundamental general research questions about bird migration.

Reflections on 40 Years of Research and Telemetry: Where Will the Next Generation of Biologists and Technology Lead Us?

Jim Watson, Wildlife Research Scientist with the Washington Department of Fish and Wildlife, oversees and conducts raptor research statewide and consults on technical raptor issues inside and outside the agency.

Forward thinkers spend less time contemplating how far they've come than how far they have to go. In fields related to research and technology this is probably especially true, where we spend more time thinking about the next giant leap we prepare to take rather than the first baby step taken. It seems, however, that as I work my way toward the end of a career I often find myself in that nostalgic mindset to that place in the good old days (that seems like yesterday) lost in thoughts of "…wow, I can't believe that's how we used to…!"

A young Jim Watson assisting with deployment of a VHF transmitter on a prairie falcon on the Pawnee Grasslands.

I grew up on the plains of Colorado where the annual cycle of nesting Swainson's hawks and wintering rough-legged hawks sparked my interest in elementary school. Where do they go? Do the same birds return every year? I was fortunate that my father was an aerospace engineer/ham radio operator/basement tinkerer with a keen interest in promoting my interest in raptors. The question was – how could he combine birds and electronics? By the time I reached junior-high school in 1971 there were only a few companies that manufactured VHF transmitters for avian use. My father was contacted by Al Harmata, a then-graduate student at Colorado State University (now Affiliate Research Professor at Montana State University) who needed transmitters for tracking fledgling golden eagles. Thus began my initiation into the field of telemetry – transmitter development in our home basement and raptor research on the Pawnee National Grassland working with Al during the summers of his graduate study.

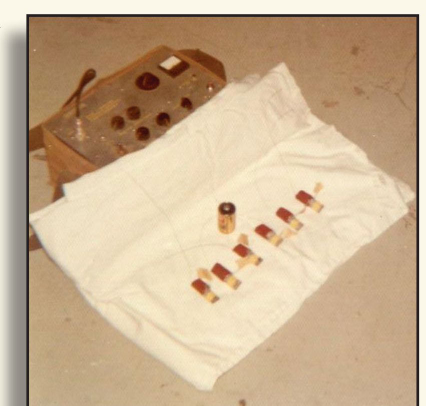


Photo by Jim Watson

VHF transmitters ready to be deployed, circa 1971.

By 1980 avian telemetry was answering research questions at an accelerated pace; transmitters of virtually every weight, power output, and configuration were starting to be manufactured. Would I finally be able to track a rough-legged hawk to its winter destination? I had the opportunity to study rough-legged hawk wintering ecology in southeast Idaho through Montana State University. With the assistance of my wife, Ranae, I was able to track several birds via tail-mounted VHF transmitters from a ground vehicle using a manually operated antenna mast. During occasional aerial flights to search for hawks it was tempting to stray northward to Montana, but flight costs were prohibitive. Hawks returning to winter on the study area were identified with patagial markers for longer tracking because transmitter batteries expired after a few months.

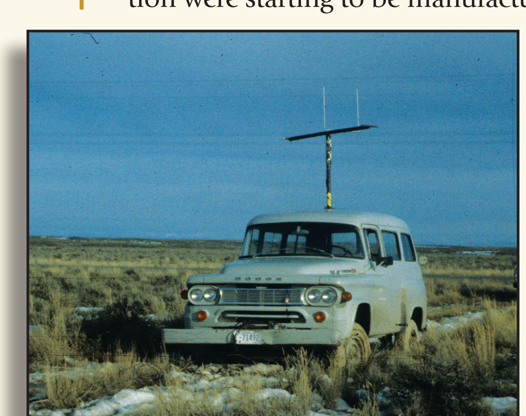
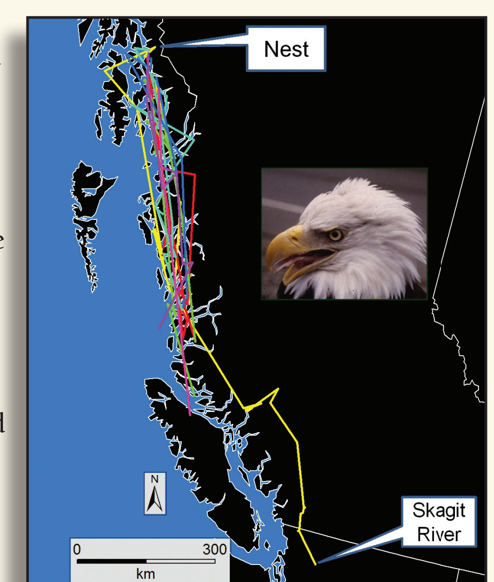


Photo by Jim Watson

Antenna mast atop tracking vehicle.

The frustration, risks, and challenges of tracking raptors long distances with VHF telemetry were experienced by most researchers in those years. After considerable field effort spent capturing and deploying transmitters, the study birds often disappeared quickly without garnering much information on their locations. Al Harmata was one of the few researchers to accomplish that feat, tracking migratory bald eagles from southern Colorado to Canada. I spent the next three years at Oregon State University where we telemetered bald eagles and aerially tracked them over the windswept hills of Columbia River, often losing them without a trace …but thankfully, always returned to solid ground.

Enter the era of avian satellite telemetry, circa 1990. Wildlife researchers were aware of John and Frank Craighead's satellite transmitter development and bear studies in the 1970s. It seemed an unlikely possibility that satellite transmitters could be deployed on birds after we saw those massive bear collars. Little did we know that for several years in the early 1980s a team that included Paul Howey had been developing and testing satellite transmitters on swans and golden eagles. I became aware of their work in the early 1990s when they published the successful satellite tracking of a bald eagle, working with Terry Grubb in Arizona. What did they call the transmitter? A PPT…or was it PTT? What did the acronym mean?



Annual migrations of bald eagle 28017 from 1998-2004 monitored with a 95-g Argos PTT. She was captured on the Skagit River in northwest Washington and nested in southeast Alaska.

As a researcher with the Washington Department of Fish and Wildlife, I initiated a satellite telemetry study on bald eagle migration in the mid-1990s to take advantage of this new technology. The process for public use of the Argos system was just being established, and while the paperwork was deep and the learning curve was steep, the rewards were plentiful. Over the course of 4 years, through funding by the US Fish and Wildlife Service, we monitored 35 adult eagles in Washington with 95g Argos PTTs to identify their movement corridors and identify their origins. We provided the movement data to the online science program "Journey North" for elementary students to track movements of telemetered eagles in near real-time. The advantages of satellite telemetry became obvious quickly: regular transmission of a large number of fixes that were accurate enough to determine flight corridors, monitor mortality, and could be uploaded conveniently via computer. We monitored individual eagles up to 7 years with PTTs that began to give a picture of the dynamics of lifetime movement patterns. Technology rewarded the researchers' push for smaller, lighter transmitters in 2001 and we used the opportunity to combine research with Microwave Telemetry's (MTI's) school program, "Science/Technology in the Classroom."

MTI awarded a scholarship to Liberty Bell High School in Twisp, Washington. Working with the students and Kent Woodruff of the Forest Service, we deployed solar Argos PTTs on Cooper's hawks and a northern harrier at Hawkwatch International's Chelan Ridge migration site in north-central Washington. The program provided the students at Liberty Bell High School first-hand research experience by allowing them to handle the raptors and map their latitude and longitude as we tracked them to the Great Basin.

Photo by Jim Watson

18g solar PTT on Cooper's hawk.

Photo by Jim Watson

Student releasing Cooper's hawk at Chelan ridge.

In the mid-2000s satellite-tracking technology of birds reached another milestone with the ability to acquire global positioning system (GPS) fixes. In 1999, we initiated a study of the wintering ecology of ferruginous hawks to better understand range-use patterns and survival for this state-listed species. Working with the Woodland Park Zoo, Seattle, we deployed Argos PTTs on 13 adult and 15 juvenile hawks. In 2001, Dan Svingen of the Forest Service, and Bob McCready of The Nature Conservancy were intrigued by the tracking results and contacted me about the possibility of expanding this study on an international scale to look at range-wide use patterns. We began using GPS PTTs in 2005. It was quickly apparent that this new technology provided a much better "behavioral" stamp than we could capture from birds with Argos PTTs because the high accuracy of fixes afforded the ability to delineate precise locations and habitat, and acquisition of sensor information on bird flight speed and altitude. In my experience, one of the biggest downsides of remote telemetry has always been the inability to collect behavioral information to complement movement data, that is best gleaned through focal observation of marked or radioed birds. So GPS PTTs provided a good step in that direction. In cooperation with multiple agencies, NGOs, private companies, and universities we have monitored the movements of 72 adult and 52 juvenile hawks since 1999 in on-going research.

Photo by Jim Watson

Juvenile ferruginous hawk with 25g GSM prototype.

The utility of solar GPS satellite technology has become more apparent in our recent investigations of home range and resource use of golden eagles and Buteos related to wind power development that began in 2004. Monitoring long-lived individuals for 5 to 7 years has provided a much better picture of the spatial and temporal dynamics of raptor ecology in the larger landscape compared to short-term (e.g., one year) studies. For golden eagles, this includes our ongoing research to understand potential sources of lead contaminants and wind turbine placement on adult range use (n = 19), as well as mortality factors and survival of juveniles (n = 10). In our cooperative study of Buteos with Oregon Department of Fish and Wildlife, GPS telemetry has been used as the primary tool to understand local movements with the secondary benefit of learning more about their migration.

We are currently testing the efficacy of GSM technology on eagles and Buteos to gather more details about flight behavior and characteristics related to habitat. This technology promises to be a step up in data collection, potentially at reduced costs for data retrieval. We are also working with Northwest Wildlife Consultants, Inc., and testing 5g Argos PTTs on merlins for future research.

Photo by Jim Watson

Merlin with 5g PTT.

As we look to the next generation, technology reaches for even lighter, more powerful, and longer-lived transmitters. In the meantime, the next generation of biologists is preparing to take the reins to test new technologies, including my son Jesse who is studying ferruginous hawks through the University of Alberta and opened his first Argos program earlier this year. So, the cycle continues…oh, and rough-legged hawks? A couple of years ago we finally telemetered three rough-legged hawks with PTTs and tracked them to Alaska.

Photo by Roxanne Shevolup

The next generation; Jesse Watson releasing a GPS-telemetered ferruginous hawk in southern Alberta, 2012.

Special thanks to: Paul and Chris, Cathy and the staff at MTI; Bob Davies, Karen Kronner and Bob Gritski; Wildlife Program of the Washington Department of Fish and Wildlife, National Grasslands of the U.S. Forest Service, U.S. Fish and Wildlife Service, Canadian Wildlife Service, The Nature Conservancy, Oregon Department of Fish and Wildlife, Partners for Wildlife of the Woodland Park Zoo, Hawkwatch International, Universidad Autónoma de Chihuahua, Profauna Chihuahua, Pronatura Noreste, Rocky Mountain Bird Observatory, Tierra Consulting, and many other private companies, organizations, and individuals who assisted, funded, or cooperated with this research.

Satellite Tracking of Birds Over the Past 20 Years

Hiroyoshi Higuchi is a Professor Emeritus to The University of Tokyo and Project Professor of Keio University. Dr. Higuchi's interests include various aspects of ecology, behavior, and evolution of birds. Recent research focuses on the migration of hawks, ducks, and swans.

My colleagues and I started satellite tracking birds in the early 1990s. The PTTs that we first used were Japanese-made for our migration research, weighed about 80 g with a battery life less than 1.5 months (below photo, left). We deployed them on four whistling swans *Cygnus columbianus* that migrated from the northernmost area of Japan. Three of the PTTs stopped functioning before the swans finished migrating, but one remained active to the mouth of the Kolyma River, a tundra habitat in Russia and the breeding area of the swans. I remember how excited we were looking at the computer screen tracking the daily movements of the swans. Every day, we marked the satellite locations on a map using pins with colorful heads.

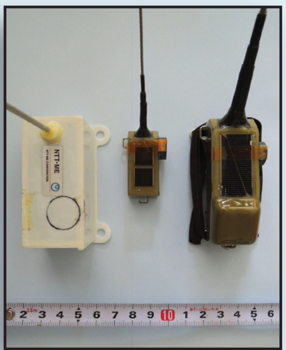
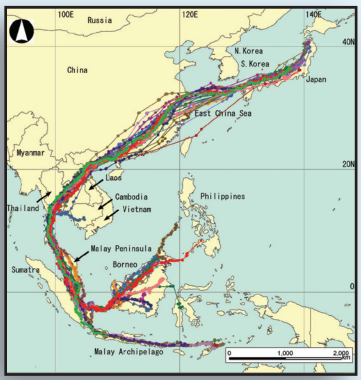


Photo by Hiroyoshi Higuchi

Type of satellite transmitters used during Dr. Higuchi's career thus far.

This success encouraged Japanese scientists to move further. The PTTs were getting smaller in size, and we succeeded in showing the migrations of white-naped crane *Grus vipio*, hooded crane *G. nonacha*, red-crowned crane *G. japonensis*, Siberian crane *G. leucogeranus*, demoiselle crane *Anthropoides virgo*, and whooper swans *Cygnus cygnus* between Japan and Russia. As a result, we identified some important stopover sites in East Asia. They included the Korean DMZ, Kumya in North Korea, and Lake Khanka on the Russia-China border. The main problem was the length of battery life. It was always worrisome when deciding to deploy PTTs, because if we deployed the PTTs months before the start of migration, the battery may be exhausted before the birds arrived at the destinations. On the other hand, capture time is limited and cannot be decided immediately before the migration start.



Autumn migration routes of 28 oriental honey-buzzards tracked between 2003 and 2009. Each color in the migration routes indicates the migration of the same individual.

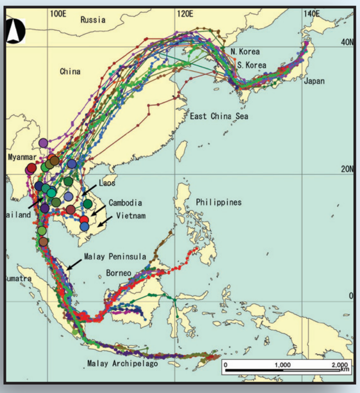
The Japanese companies stopped producing PTTs in the early 2000s probably in association with an economic collapse in Japan. We were disappointed with this situation, but by that time, American PTTs were easily available to us. The size was small enough to deploy on medium-sized birds such as hawks and ducks, and the battery was solar-powered, which enabled us to track for more than 2 years. Thanks to these technological developments, we were successful in tracking the migration of grey-faced buzzards *Butastur indicus*, which could not be managed with Japanese battery-powered PTTs even in several trials over the years.

The most exciting results came from tracking the migration of oriental honey-buzzards *Pernis ptilorhynchus* (Higuchi 2012: Journal of Ornithology 153:3-14), another migratory hawk species in Japan with unknown migratory routes. We used 20 Microwave Telemetry 30g solar-powered Argos/GPS PTTs, and succeeded in showing the detailed migration routes and patterns of about 30 individuals over several seasons. Their migration is summarized as follows: in autumn, after departing their breeding areas in Japan, they migrated west across about 700 km of the East China Sea, then moved through inland China, Vietnam, Laos and Thailand until reaching the Malay Peninsula. All the birds continued moving away from the Malay Peninsula, but the directions and terminal points differed among individuals. After reaching Sumatra, 18 birds changed their travel direction to the northeast. Only two individuals arrived in the Philippines, through Borneo, and 16 individuals ended their migration on Borneo and the other surrounding islands. The other 10 moved along the Malay Archipelago and ended their migrations at Bankga Island, central Java, and Flores Island, respectively.

Photo by Takanobu Mishima

Oriental honey-buzzard.

In spring, the oriental honey-buzzard mainly followed the same routes used during their autumn migration from their wintering sites to the end of the Malay Peninsula. They migrated northwestward along the Malay Archipelago and the Malay Peninsula, then moved to inland China after going north through Thailand, Laos, and Vietnam. The routes in inland China were located north of those used during the autumn migration, before the birds reached the end of Korean peninsula. During the autumn migration, the birds detoured around the East China Sea by migrating through the Korean peninsula and crossing the Korean/Tsushima Strait to reach Japan. Before travelling to China, all the birds stopped for several weeks in southeast Asia. Consequently, individual honey-buzzards visited most or sometimes all East Asian countries during their complete migration cycle of autumn and spring.



Spring migration routes of 28 oriental honey-buzzards tracked between 2003 and 2009. Each color in the migration routes indicates the migration of the same individual. The sites where the honey-buzzards stayed for more than seven days are shown by larger circles.

We have now opened our Hachikuma Project to the general public: http://hachi.sfc.keio.ac.jp/. Hachikuma is the Japanese name of the oriental honey-buzzard. The purpose of this project is to make public the real-time status of bird migration via satellite tracking, to show it to many people in Japan and other parts of the world, deepening their understanding of bird migration, and also of how nature works. To be able to observe on the internet how the birds' migration is proceeding every moment is very stimulating and, we believe will significantly contribute to social education, school education, and environmental conservation. As expected, lots of people have enjoyed watching the migration of the birds on the website.

I hope that satellite-tracking technology progresses further, which will enable us to track smaller birds in more detail for longer periods of time. My dream is to study the migration of passerines such as paradise flycatchers *Terpsiphone atrocaudata* and ashy minivets *Pericrocotus divaricatus*. As they are endangered species, if we could track them lots of important information would be obtained in terms of their conservation. Such information will greatly contribute to our understanding of the ecology and behavior as well as migration of these species. I really look forward to further development of the relevant technology. Thank you very much Microwave Telemetry for your great efforts.

Flying-Fox Diaries – High School Students Track Large Fruit Bats in Eastern Australia

Authored by the students: Kalyx Jorgensen, Lowana Littlechild, Rhiannon Pye and Annelise Rosnell.
Project coordination: Billie Roberts (Biologist, Griffith University) and Kelly Roche (Office of Environment and Heritage).

On the north coast of New South Wales, Australia, Maclean High School is home to a controversial colony of flying-foxes (large fruit bats of the genus *Pteropus*). Urban development has slowly encroached on the flying-fox roost ("camp") and in the 1960s the school was built next door. From that time, the presence of flying-foxes has created conflict with the local community. The camp is made up of both grey-headed (*Pteropus poliocephalus*) and black flying-foxes (*P. alecto*), which occupy lowland rainforest vegetation that is listed as an endangered ecological community under State legislation. In the case of the grey-headed flying-fox, this camp is considered to be habitat critical to the survival of this threatened species because it is used by such large numbers of animals and is an important maternity site.

Photo by Debrah Novak

Biologist Billie Roberts releasing one of the collared black flying-foxes. Fitted around the neck onto a leather collar is a 12g solar powered PTT (duty cycle 10 hrs ON 48 hrs OFF).

In early 2012 a group of 16-year-old senior Biology students from Maclean High School assisted local biologist Billie Roberts and the state environment agency (Office of Environment and Heritage) in a telemetry study of these bats, aimed at involving students in cutting-edge wildlife research and gaining knowledge of the migratory behaviours of black flying-foxes on the east coast of Australia. It was also hoped that the project would improve the public view of bats in the local area and gain knowledge of flying-fox behaviour which may help resolve future conflicts in the local and wider community.

Photo by Debrah Novak

One of the black flying-foxes captured in the mist nets. Biologist Billie Roberts secures the head while other volunteers detangle the animal's wings and feet.

Using a mist net held up by 11 m poles, the flying-foxes were trapped at dawn and dusk, when leaving or returning to the camp to feed. Every bat caught was aged, sexed, thumb banded for future identification, weighed, measured, assessed for general body condition and offered supplements (fruit juice) for their missed feed. A total of 63 flying-foxes (38 grey-headed and 25 black flying-foxes) was caught during the trapping. Four adult male black flying-foxes (> 700 g) were fitted with 12g solar powered bird PTTs, specially modified to be mounted to a neck collar. Students assisted with all aspects of field work including mist netting, measurements, and attachment of the satellite transmitters to sedated bats. Flying-fox numbers at roost sites in the area were also monitored every few months; along with information on flowering trees to assist with the interpretation of flying-fox movements. Three oral presentations were given about the project by the students to various community groups.

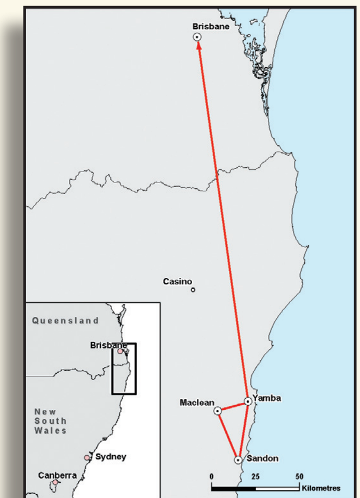


Figure 1. The movements of the black flying-fox named Wayne over the past four months. The white dots represent the four roosting sites used and the red line the direct line path.

The four male bats which were collared have been tracked for over four months, and we are still receiving regular data from the animals. Movement patterns have varied between individuals, with some moving long distances and others remaining relatively sedentary. Two flying-foxes (named Bruce and Ali) have had very stable roosting and feeding areas; using only one roost site over the past four months and feeding within 2 km of their roost. The other two flying-foxes (Wayne and Jonah) have been more mobile, moving between a greater number of roost sites (up to 4) and travelling longer distances to feed (Figures 1 and 2). The maximum distance moved between roost and feeding site was 32 km. One flying-fox migrated north 220 km over just a few days to roost in the metropolitan area of Brisbane.

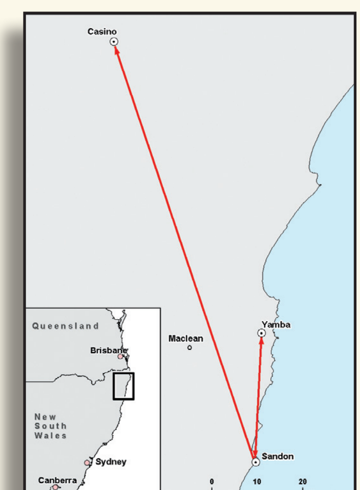


Figure 2. The movements of one of the collared black flying-foxes named Jonah. The white dots represent roost sites; the red lines represent the animal's movements between these sites over the past 4 months.

Photo by Debrah Novak

The Maclean High School Biology Students involved in the project, with teacher Wayne Rice, assisting wildlife carer Imelda Jennings and researcher Billie Roberts with measuring, weighing, tagging and collaring the flying-foxes.

The project has helped to clear up many misconceptions surrounding flying-foxes held by the students and teachers. Everyone touched by the project gained new insight and knowledge into flying-foxes' movements and behaviour and the intricacies of telemetry research; many preconceived opinions about bats were changed. It has also led to the general education of the community, through the presentations given by the now informed students. The students in particular gained valuable knowledge of the importance of flying-foxes in the ecosystem and the difficulties of managing this mobile species in an urban environment.

Recovering a Fish Tag – Worth the Effort

Annabelle Brooks is the Research Manager at the Cape Eleuthera Institute. Located on the southwest peninsula of Eleuthera, the Cape Eleuthera Institute is a non-profit organization dedicated to education and research in sustainability. For more information please visit www.ceibahamas.org.

Recently we have received several inquiries from customers hoping to recover their fish tags. Finding a still-transmitting fish tag is feasible with some specialized equipment – a simple receiver and a small directional Yagi antenna. Since our friends at the Cape Eleuthera Institute (CEI) have had such great success recovering tags, we asked them to write a short article about the trials and tribulations of recovering their tags.

Photo by Harry Parker

Edd Brooks and "Flat Stanley" find an X-Tag on Rum Cay.

Researchers at CEI and our collaborators studying pelagic, deepwater and coastal species of sharks in The Bahamas have deployed more than 50 X-Tags over the last year and a half. The Bahamas is situated on a large calcium carbonate bank and consists of over 700 islands with innumerable sand banks, mangrove creeks, channels and cays, creating one of the most diverse mosaic habitats anywhere in the Greater Caribbean region. Using pop-off satellite telemetry in this jigsaw of habitats presents a number of challenges and opportunities: challenges in that tags often wash up onto land prior to the complete transmission of the dataset via the Argos system, and opportunities in that these tags can be recovered, returned to MTI and the entire archived high-resolution dataset retrieved. Needless to say, we have put considerable effort into tag recovery all over The Bahamas, leading to some great adventures!

Photo by Harry Parker

Yagi antenna used to locate direction of transmitting tag.

Cat Island: Several tags deployed on oceanic whitetip sharks have popped-off very close to where they were originally deployed. Access roads to the beaches of Cat Island, home to less than 2000 people, are few and far between. This means a lot of beach walking on recovery missions – up to 5 km just to get close to the tag! On the most recent recovery trip, I walked two kilometers through spider infested bush before finding the tag buried several inches beneath sand and sargassum seaweed!

Rum Cay: Some islands in The Bahamas don't even have regular commercial flights. Edd Brooks from CEI managed to hitchhike on a private plane south to Rum Cay and narrowed down the tag's location from the plane by using the Yagi antenna and reciever during approach! Rum Cay is the only place in The Bahamas where you can skydive, and the team at Sumner Point Marina had just finished filming an episode of the Japanese equivalent of 'Jackass'! The skydive cameraman, Harry Parker, and his assistant 'Flat Stanley' helped out with the search, and after a quad bike and boat ride the X-Tag was found on an uninhabited beach inaccessible by land, on the north side of the island.

Photo by Edd Brooks

Rubble Beach of Long Island – not ideal for building sand castles.

Long Island: So sand and sargassum might not sound too tough, but what about a shoreline composed of thousands of lumps of coral?! An oceanic whitetip tag found its way a few feet deep into such a shoreline on Long Island last year. After moving about a ton of football (soccer) sized lumps of coral rubble the tag was eventually located, battered after its brush with the rocks, but otherwise intact.

Photo by Aaron Shultz

Spelunking for pop-up tags.

Eleuthera: The most recent find was only a few miles away from the Cape Eleuthera Institute on the Atlantic coast of Eleuthera, but still proved to be the most difficult recovery yet. After days of frustrating searching and miles of beach walking, the tag was located at the back of a limestone fissure in a rock under a boulder the size of a MINI Cooper. The team returned the next day armed with shovels, pickaxes and crowbars, and after several hours of digging the tag was recovered by a long armed member of the team who was under the boulder up to his waist.

Not all recoveries are as onerous, but they do require effort and financial expenditure, however, the benefits outweigh the costs. To date CEI and their collaborators have recovered 3 out of 5 tags deployed on Caribbean reef sharks, 6 out of 42 tags deployed on oceanic whitetip sharks, 1 out of 3 deployed on bluntnose sixgill sharks and 3 out of 14 deployed on gulper sharks... That's almost two million data points recovered from those tags!

GSM IS HERE – Update

Since obtaining PTCRB and worldwide certifications for our GSM20-70 product line, we have been busy with further field testing in North America, South America, Europe, Africa and the Middle East.

Results of field testing have been spectacular thus far – the high number of GPS positions per day will be extremely valuable for habitat-use studies. The GPS/GSM transmitters are able to transmit a considerably greater quantity of data than Argos/GPS PTTs, which have a more limited throughput ability. In addition, their enormous storage capacity allows the GPS/GSM transmitters to archive data for a more advantageous transmission time. Should a bird move to an area outside GSM range, where data cannot be uploaded, the device will transmit all unsent data in reverse chronological order to backfill the track once reconnected to the GSM system.

Similar to our Solar Argos/GPS PTTs that have been available since 2001, the GPS/GSM product line employs a microprocessor to control solar charging, enabling nighttime GPS fixes to be obtained and transmitted through the GSM system. The GPS/GSM transmitter has the added capability of varying its recording rate; when the conditions are sunnier and the unit has better battery charge, it will take more frequent GPS fixes.

Figure 1 shows the track of a lesser spotted eagle, tagged with a prototype 25g GPS/GSM transmitter in Germany, on its southerly migration through Africa. With GPS fixes often occurring only minutes apart (each with altitude, VDOP, and HDOP; averaging 70 fixes per day, up to 187 per day in this case), the level of resolution is a substantial increase compared to what can be obtained using a solar GPS PTT. The inset in Figure 1 shows how the bird hugged the shoreline of Lake Tanganyika as it traveled from Tanzania into Zambia. Although the route taken by this bird through Africa occurred mostly over land, the transmitter was out of range from GSM towers much of the time. However, the archived GPS fixes were uploaded once the transmitter reconnected with the GSM system. The uploading of GPS data from areas with sparse or zero coverage is significant for the track of an osprey that traveled south from Hispaniola over the Caribbean Sea on its migration to South America (Figure 2). Obviously, there is no GSM coverage in the middle of the ocean (yet). Thus, the GPS fixes that occurred during that time period were uploaded from the bird's 30g GPS/GSM transmitter a few days after this crossing. In southern Europe, where radio interference reduces the amount of data received through Argos, a 70g GPS/GSM transmitter deployed on a black vulture in Spain provides voluminous amounts of GPS data (Figure 3). We can't wait to see what amazing scientific progress will be made using this technology! This is merely the beginning. Please visit our website for more information about our GSM transmitters.

Figure 2. Osprey migration through Caribbean.

Figure 3. Black vulture movements in Spain.

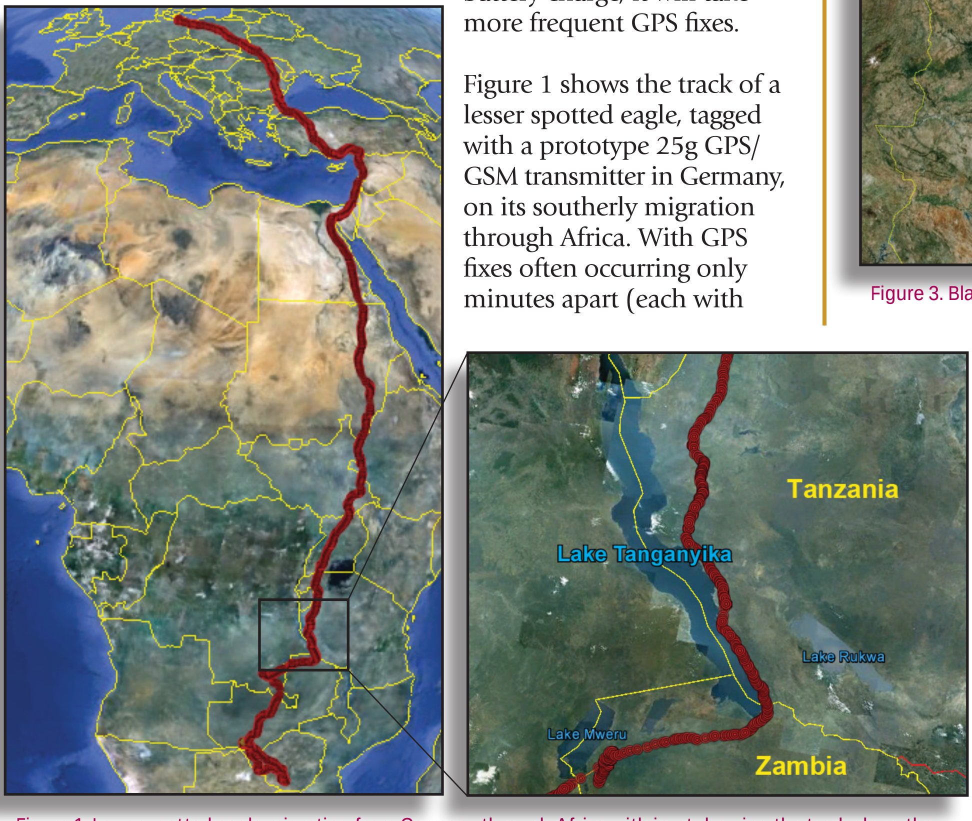


Figure 1. Lesser spotted eagle migrating from Germany through Africa with inset showing the track along the Lake Tanganyika shoreline.

Bits & Pieces

Our office will be closed December 24 through January 1.

Dust off your cameras for our 2013 Photo Contest!

Don't forget to send us your recently published 2012 and 2013 papers for our website.

A reminder: We do not accept bird PTTs for refurbishment from March 1 through August 31!