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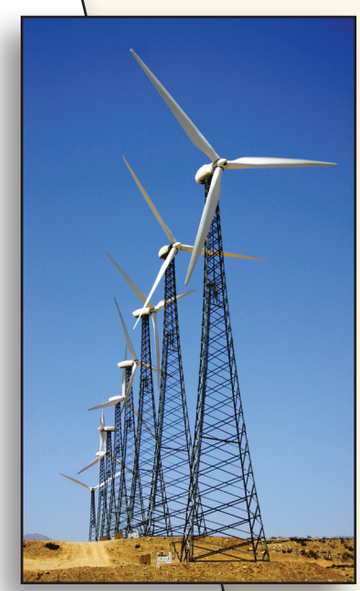
Tracker News

Microwave Telemetry, Inc.

Technology – Friend or Foe?



Dear Customers and Friends,

Throughout my lifetime I've been fortunate to witness some amazing technological advances. Many of these have enhanced humankind's quality of life and the understanding of our physical world. However, some of this technology, while making processes faster and more efficient, have lasting environmental impacts. We built dams for harnessing hydroelectric power not realizing or ignoring the effects on native fishes. We used insecticides to increase our crop production without understanding how bioaccumulation of these chemicals would affect higher trophic levels on the food chain. We deforested millions of hectares of diverse tropical forest to increase agricultural production not knowing its effect on Earth's atmosphere. We can only hope that future attempts to introduce new technologies will come with more environmental foresight.

Many researchers use our devices in an attempt to restore populations devastated by our past technological "breakthroughs." And, amazingly, for many species there is hope. Understanding migration patterns and habitat use can be a powerful tool. We are thankful for our customers' efforts to make conservation windfalls and proud that our products can help.

In this issue of Tracker News: Gilles Lacroix shares his findings from tracking Atlantic salmon, we learn from Sonja Krüger and Ian Rushworth how the foraging behavior of Bearded Vultures makes them vulnerable to wind-turbine strikes, Reese Pedler explains the movement behavior of Banded Stilts, and (last, but certainly not least) Roy Dennis updates us on Scottish Osprey equipped with GPS/GSM transmitters migrating through Europe on the way to Africa. Thank you all for your contributions!

Lastly, we've had a fun time here judging pictures submitted for our 2014 Photo Contest and also evaluating proposals for the 2014 Rising Scholar Award. I know that Chris would have really enjoyed seeing all these. Thanks for the submissions. If you didn't win this time, don't despair; there will be other opportunities in the future.

Wherever the New Year takes you, safe travels.

Sincerely,

Paul and the Team at MTI

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Above: Wind Turbine Farm - Mourgefile.com

Endangered Atlantic Salmon Curtail Their Oceanic Migration

Gilles Lacroix is a research scientist who, over his 40 year career, has witnessed and studied many of the impacts leading to the continued decline of Atlantic salmon. His interest in the mysteries of the silver leapers' migrations steered him to novel telemetry tools to track salmon in the past two decades.

The Atlantic salmon (*Salmo salar*) undertakes extensive migrations, first from natal rivers to oceanic feeding grounds in the North Atlantic, then back to home rivers to spawn. Unlike other salmon species, they can survive spawning to repeat this migration several times. Atlantic salmon abundance has steadily declined throughout its range during the last century because of freshwater habitat loss and pollution, and overexploitation. More recently, the decline accelerated in some regions even with habitat restoration and reduced exploitation, resulting in some populations being listed as endangered. Mortality at sea, possibly related to climate change, is thought to be responsible, though there are few data on the marine phase of salmon. The return of adult salmon to the ocean to recondition, combined with the X-Tag's small size and ability to detach and report at death, provided an ideal opportunity to determine where, when and why salmon are dying in large numbers at sea.

Photo by Ross Jones

Attaching X-Tag to Atlantic salmon in the river. A tagged salmon is recovering in the foreground.

Between 2008 and 2011, 55 salmon were captured and tagged as they returned to sea after spawning in rivers of the Bay of Fundy, Canada. Salmon ranged from 50 to 90 cm, which makes them some of the smallest fish tagged with PSATs. They originated from populations that either persist or are endangered. A secure method of tag attachment had been developed and tested with dummy tags on salmon held in captivity; the tags did not impede swimming or feeding activity, and there was no tag-related mortality or attachment failure. X-Tags were specially programmed to take into account salmon habitat and behaviour to avoid failure in freshwater or premature at-sea triggering of the constant depth release. Thirty-nine of the salmon migrated to sea in the season of tagging, and their tags all provided some archived data. They transmitted at death or after the programmed 4 to 6 months, or they were recovered by beachcombers. A quarter of these tags were returned for full data extraction which gave uninterrupted light intensity, depth and temperature series.

Migrating salmon spent most of their time near the surface which increased the accuracy of light-based daily raw geolocation estimates. Population-specific migration routes were detected for salmon that survived to the end date. Filtered tracks of 2600 to 5000 km were obtained for salmon from the population that persists. They migrated northward along the Continental Shelf, swimming near the surface against the prevailing Labrador Current at a rate of 27 to 50 km per day, which suggests that the tags did not seriously impede performance. Salmon from endangered populations did not complete this rapid migration to distant feeding areas, but proceeded slowly in the coastal zone, making repeated daytime shallow dives indicative of feeding as soon as they left the rivers.

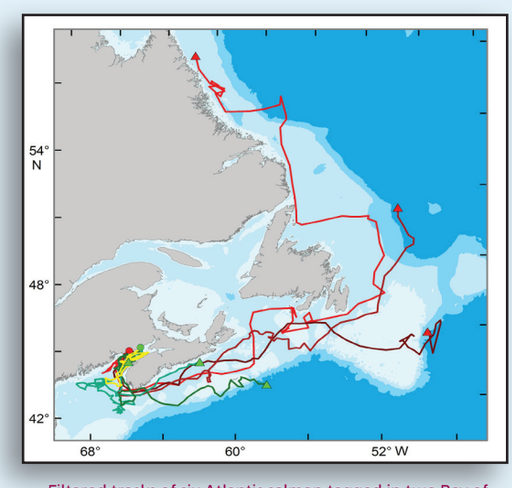
Photo by Tom Benjamin

Details of X-Tag attachment to Atlantic salmon. Monofilament leads from tag to each side of the salmon stabilize the tag.

The distinctive behaviour of the endangered salmon resulted in a curtailed home range. The range boundaries for both coastal and distant migrants were further defined by their thermal preference at sea (0 to 15°C), and their avoidance of adjacent warm waters. For instance, distant migrants avoided entrainment into the warm Gulf Stream and North Atlantic Current, and coastal salmon sought cold thermal refuges in the Bay of Fundy and northern Gulf of Maine during summer. In winter, coastal salmon stayed in freezing habitat by changing their vertical habits and avoiding the supercooled surface layer that can kill salmon. Salmon were previously thought to be absent from these cold, freezing coastal areas during winter.

Changes in bathymetry along migration tracks resulted in marked changes in the vertical movements of salmon that possibly aided in orientation and in locating abundant resources. Salmon made repeated deep dives, some up to 1000 m, lasting up to 2 days when crossing deep ocean channels or when reaching the edge of the Continental Shelf. They then adjusted their migration course or spent time in the area making shallower diurnal dives associated with feeding. Their ability to make repeated dives or rapid deep dives through the thermocline, remain in cold deep water for several hours, and make a gradual ascent back to the surface and regulate buoyancy all attest to the minimal impact of the tags and the benefits of the method of attachment used.

The X-Tags provided evidence of extensive natural mortality of salmon in coastal areas within 2 months of leaving the rivers and no evidence of fishing mortality. Mortality of the endangered coastal salmon was clustered in a few areas inside the Bay of Fundy, whereas the mortality of distant migrants occurred mostly along the Scotian Shelf. Sudden changes in light intensity, depth, and temperature indicate that salmon and tag were frequently eaten by apex predators (11 cases). The identification of key predators from the depth and temperature profiles is the subject of a soon to be published article.



Filtered tracks of six Atlantic salmon tagged in two Bay of Fundy rivers (circles) that survived to end date. Triangles show pop-off locations along Canadian coast for distant (red) and coastal (green) migrants.

Wind Farms Threaten Southern Africa's Critically Endangered Bearded Vulture

Sonja Krüger and Ian Rushworth, Ezemvelo KwaZulu-Natal Wildlife,
P.O. Box 13053, Cascades, 3202, South Africa. Email: sonja.krueger@kznwildlife.com

Wind energy is commonly understood to be clean and environmentally friendly and many African countries are planning, or have already constructed, wind farms. In southern Africa, South Africa is investigating the large-scale exploitation of wind power for electricity generation and Lesotho is proposing to develop two wind farms in the Maluti Mountains. The proposed developments are within the breeding and foraging range of the Endangered Bearded Vulture *Gypaetus barbatus meridionalis* (Figure 1).

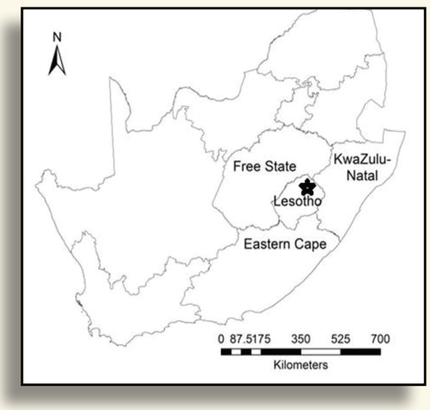


Figure 1. The range of the Bearded Vulture in southern Africa covering the Maluti-Drakensberg mountains of Southern Africa, including the Kingdom of Lesotho and the Free State, KwaZulu-Natal and the Eastern Cape provinces of the republic of South Africa. The proposed wind farms are located in north-eastern Lesotho(*).

A number of recent studies have confirmed that wind farms negatively impact birds, causing avoidance behavior and disturbance or fatality through collisions with rotor blades and the associated power line infrastructure. Since wind farms are often placed in areas heavily used by raptors, there is real potential for interaction between vultures and wind turbines in southern Africa, posing an additional threat to a population that only has about 109 breeding pairs left. There is no quantitative data on the extent of the impact of wind farms on vultures in Africa. We therefore used a Population Viability Analysis model to predict the population level impacts of the anticipated establishment of wind energy developments on Bearded Vultures in southern Africa, with existing information on their distribution and ranging behavior from long-term monitoring of the population.

We used data from 10 Bearded Vultures fitted with 70g solar-powered Argos GPS transmitters between 2007 and 2012 to determine the size and location of the core foraging range of the species as well as the speed of travel and height above ground at which they forage. The ranging data comprised 5.8 juvenile years, 4.8 immature years, 1 sub-adult year and 2 adult years. Only data points representing foraging behaviour (those with a speed of 11-77 km/h) were used in the analyses. A total of 10640 flying records in Lesotho was used for the analysis.

Adult Bearded Vultures foraged predominantly within a 15 km radius of their nest site while non-adult birds foraged extensively over the highlands. Bearded Vultures spent 92% of their flying time at foraging speeds (11-77 km/h) and more than half (53.5%, n=9791) of this was spent ≤100 m AGL (i.e., within the blade swept height and hence at risk of collision). All age classes selected upper slopes, mountain tops, and high ridges (RSI=1.491) where they spent 44% of their time, and used valleys (RSI=0.744) and plains (RSI=0.255) less than expected (n=10201). The Population Viability Analysis predicted the impacts of mortalities caused by wind farms to be extreme with the population rate further declining from the current -1.4% per annum (baseline model) to -3.7% per annum (Figure 2). The predicted time to extinction of the species was reduced from 260 years to 110 years.

Photo by Shane Ellitott

Adult Bearded Vulture with transmitter.

The fact that Bearded Vultures actively select ridge tops and upper slopes and spend at least half their foraging time less than 100 m above ground level, puts them at risk both in terms of the areas they select and the height at which they fly. This coupled with a small, isolated and declining population means that wind farm developments in the Lesotho highlands, even at a modest scale, will have a catastrophic impact on this species. Because of their low reproductive rate and long life span, this population will be unable to recover from a cumulative loss of individuals. The model's predictions are conservative because it does not take into account an increase in the number of wind farms to meet the energy demand or ever-increasing mortalities from other anthropogenic factors such as power line collisions and poisoning. The Bearded Vulture is the iconic symbol of the Maloti Drakensberg Park World Heritage Site, and the focus species of the Maloti Drakensberg Transfrontier Programme. The extinction of this iconic species will be a public failure of transfrontier conservation efforts and efforts to conserve our natural heritage for future generations.

We thank EzemveloKZN Wildlife, Wildlands Conservation Trust, Endangered Wildlife Trust and Maloti Drakensberg Transfrontier Programme for funding this study.

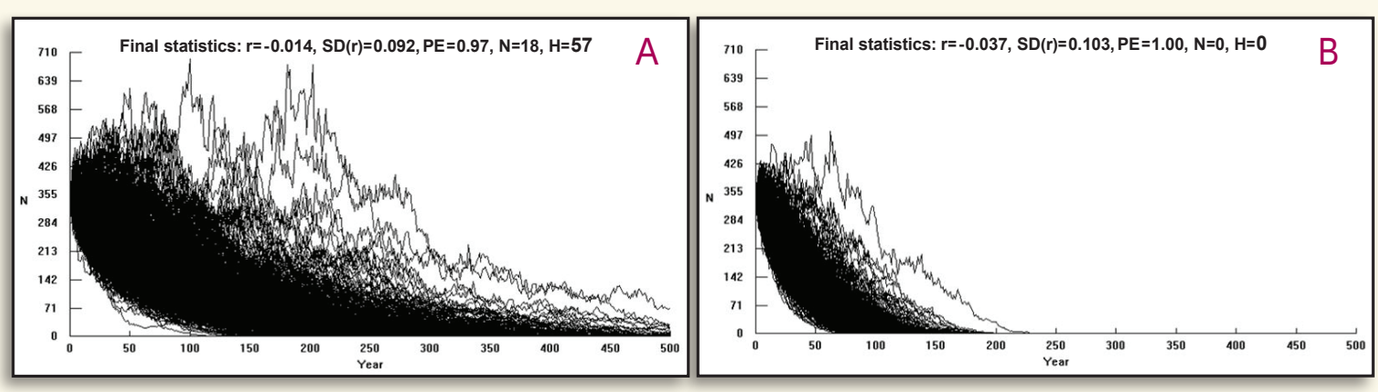


Figure 2. Population trajectories for the Bearded and Cape Vultures in the Maluti-Drakensberg; A) pre-wind farm and B) post-wind farm

Unlocking the Secrets of Nomadic Desert Waterbirds: Satellite Tracking of Banded Stilt

Reece Pedler is a PhD Candidate at the Centre for Integrative Ecology, Deakin University. He is interested in arid-zone ecology and his thesis focuses on the movements and breeding of Banded Stilts in the Australian desert.

Early results from the first tracking of Banded Stilts (*Cladorhynchus leucocephalus*) have provided some important insights into the lives of these enigmatic birds. Banded Stilts are an endemic Australian shorebird of conservation concern. Their 'boom and bust' life history strategy sees them breeding only on the rare occasions when vast desert salt lakes are inundated by intense rainfall or flooding; transforming the lakes from inhospitable wastes to shallow salty soups teeming with rich Brine Shrimp (*Parartemia* spp.). Banded Stilt are anecdotally well known for their ability to rapidly move to these inland sites following inundation, flying hundreds of kilometres from coastal wetlands and breeding almost immediately in densely packed nesting colonies of tens of thousands of pairs while the highly ephemeral resources last. The tendency for Banded Stilts to breed *en masse* in such remote desert lakes kept their breeding strategy a mystery for many decades. But, since its discovery around 80 years ago, just 30 breeding colonies have been recorded and many important aspects of their life ecology are poorly understood.

The movement behaviour of stilts is important for understanding their conservation needs. Although we know that stilts arrive at inland sites within just hours or days following rainfall, it is not known where the breeding birds originate and for some time the populations in eastern and western Australia have been assumed separate. The movements made by the stilts to detect and rapidly exploit these inland breeding opportunities are unknown, as are their dispersal movements following breeding. Perhaps even more important are the wetland sites that the stilts use between breeding events, particularly during unpredictable prolonged droughts, for which the Australian climate is famous.

To answer these questions this Deakin University project, funded by BHP Billiton, has begun tracking Banded Stilt using 5g Solar PTTs. Following captive trials, a Teflon ribbon leg loop harness was selected and tags were fitted to 10 adult breeding Banded Stilts during a rare filling event of Lake Eyre; a vast salt lake in arid central Australia. As Lake Eyre dried, the birds captured from nests in just a few square metres of the densely packed nesting colony dispersed to all corners Australia with most moving 800 to 3000 km from their tagging location. Almost all birds made major overnight flights of 500-700 km to reach coastal saline wetlands. Some extensive rapid dispersals to south-western Australia also confirm that there is interchange between the eastern and western populations, with implications for the previous population estimates in these areas. The use of many diverse artificial and natural saline wetlands during an extended dry period following the breeding event was also critical in highlighting the essential non-breeding habitats used by this species and the number and diversity of sites that are important in sustaining their population between unpredictable and infrequent breeding events.

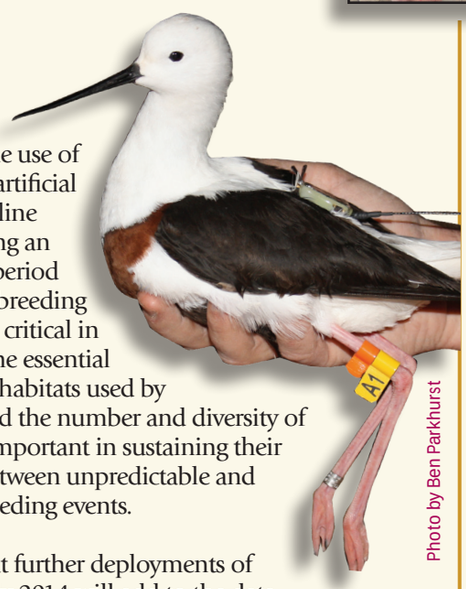


Photo by Ben Parkhurst

It is hoped that further deployments of 5g PTTs in early 2014 will add to the data already gained and continue to gather important behavioural information to unlock conservation-relevant secrets of Banded Stilt behaviour.

Photo by Lynn Pedler

Above Photos: Banded Stilts wearing 5g Solar PTTs at capture.

Photo by Ben Parkhurst

Above and Below: Breeding Banded Stilts pack a tiny nesting island during a rare filling of Lake Eyre in the South Australian desert.

Photo by Ben Parkhurst

Wow – Is That How They Really Do It?!

Roy Dennis MBE is a field ornithologist and wildlife consultant specialising in raptor conservation, satellite tracking, bird and mammal reintroductions and rewilding in the UK and abroad. His MBE is for services to nature conservation in Scotland and he is also a writer, broadcaster and lecturer. (www.roydennis.org)

This past autumn, the Highland Foundation for Wildlife deployed its first two 30g GPS/GSM transmitters on osprey, and they have brought another huge leap in knowledge and understanding. I remember the incredible excitement in 2007 when we used our first Argos GPS transmitter on the famous Scottish osprey named Logie, and put on our website the groundbreaking daily migration maps using Google Earth. This new system allowed us to take another big new step in tracking technology.

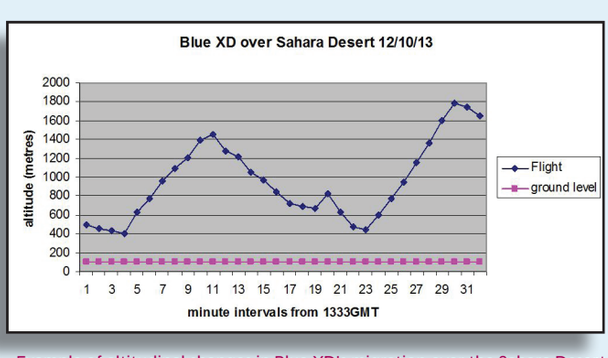
Blue XD is a male osprey breeding not far from Loch Garten, the osprey mecca in the Highlands of Scotland. He is a bird I know well, having ringed him as a sub-adult in 2000. His mate is 22 years old and winters in central Spain. After feeding his young through post-fledging, he set off on his autumn migration at 0730 GMT on 10 September and the migration data started pouring in, often at one-minute intervals – GPS location, heading, speed, and altitude. He flew through Scotland and England, over the sea to France and then 475 km over the Bay of Biscay. He did not stop on the North Spanish coast but headed on until he settled for the night near Plasencia in Extremadura – 2025 km in one flight of 35 hours and 10 minutes, at an average speed of 57.6 km/h.

Blue XD fishing at Rothiemurchus Fishery, Scottish Higlands.
Photo by: Neil MacGregor

On 12 September he roosted just north of Cadiz in southern Spain and next morning flew out over the Atlantic Ocean to Africa. His flight was 254 km to the coast of Morocco. The early morning fixes were at half-hourly intervals but as the sun came up, the GPS fixes were coming in every minute to give us the best-ever track of an osprey crossing from Europe to Africa, a region notorious for interference to the Argos system and unreliable satellite reception.

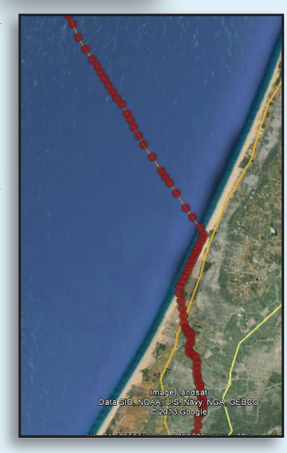
At home, I had seen the value of the new GSM tracking system as I could follow Blue XD on his summer forays to catch fish. He had four favourite localities between 8 and 16 km from his nest, one being the famous Rothiemurchus trout fishery, where bird photographers gather to get fantastic fishing shots. I could now see his daily behaviour; if unsuccessful at one place, he'd take a shortcut over the hills to another, and in between times would visit small lochs and rivers to try his luck. For the first time ever, the one-minute daytime signals gave a complete picture of his ranging behaviour – using an area of 380 km^2.

On 14 September Blue XD tracked along the front of the mountain chain south of Marrakesh and then over the High Atlas. The rapid series of fixes showed how this seasoned traveller just took the highest barriers in his stride, rising to 3000 m when crossing highest peaks 700 m below. More exciting revelations were to follow.



Example of altitudinal changes in Blue XD's migration over the Sahara Desert.

Communication was lost when he was crossing the Sahara desert, until he reached the Senegal River between Mauritania and Senegal and the first mobile phone masts downloaded the stored data. It was very exciting to check the maps on Google Earth and when I looked at his migration track over the Sahara desert, I could see step-like patterns. An examination of the one minute fixes revealed that they showed exactly his soaring and gliding behaviour when crossing the hot, inhospitable deserts. Clicking on individual fixes showed that for six or seven minutes he was rising rapidly from the desert surface (about 100 m ASL) from low points of 400 m to peak at 1400-1800 m altitude and then losing height and gliding for periods of 11 to 14 minutes. This pattern was repeated with variations. By tilting the migration track on Google Earth one could see this beautiful rising and falling pattern as he headed south through Africa.



Blue XD arriving on coast of northern Morocco 1113 GMT on 13 September 2013.

Blue XD reached his winter quarters in the mangrove backwaters of the Casamance estuary in southern Senegal at 1530 GMT on 22 September and that's where he settled down, undoubtedly a place he has known well in winter. The complete migration path was so accurately displayed using the GPS/GSM system that we could work out he flew 5455 km in 13 days. This experienced migrator flew a fast, accurate track, considering that the direct distance between the nest in Scotland and African winter quarters is 5060 km.

The other transmitter was on Yellow HA, another breeding male. He delayed his departure from Scotland until 26 September, when the wintering geese were arriving from Iceland and Greenland. His data was just as illuminating. For example, on 11 October, in northern Mauritania he soared to 2530 m before his last glide of the afternoon, one hour and 62 km to his night roost at 200 m ASL. There is a mountain of data to explore this winter. He reached the Sine Saloum delta in Senegal on 14 October.

Migration routes of two male ospreys crossing from Europe to Africa.

Blue XD (right track 13 Sep 2013); Yellow HA (left track 7 Oct 2013).

We now realise that it's essential for osprey conservation that ever-better links are established between the people of Europe and Africa. The satellite tracking data reveal the dangers of migration, the important stop-over locations, how they cross the ocean and the desert, where they winter, and how young ospreys learn to survive in Africa. The excitement of the satellite data has proved to be one of the most successful ways of bringing us together, especially when linking schools together over the whole migration route. (www.ospreys.org.uk/osprey-flyways-project/). The new GPS/GSM trackers will bring that into even sharper focus.

MTI News

Full Steam Ahead on 17g GPS Production

In 2011, we introduced our 17g Solar Argos/GPS PTT as a limited-production item. This is our smallest GPS transmitter and, as we have learned over the years, it takes time for us to become efficient in assembling newly designed units. However, the 17g GPS PTT is ready to take its role among our established line of transmitters.

The 17g GPS PTT retains the features of our larger Solar Argos/GPS PTTs including microprocessor-controlled battery charge management, which allows the PTT to charge during the day and collect data and transmit at night. The 17g GPS PTT comes standard with 3D firmware and will allow biologists to study migration and habitat use (with GPS accuracy) in birds weighing 580 to 700 g.

Philippines Relief Aid

We were all so saddened to learn about the devastation caused Typhoon Haiyan in the Philippines. Tens of thousands people have been left without life's basic needs. The people of the Philippines are strong and will rebuild their country in time but they now require help from their global neighbors.

Here, at MTI, we have done a few things to help. Several of our employees are of Filipino descent and have organized a clothing drive for our staff in which items will be shipped to a church in the Philippines for direct distribution. As a small company, we can only scratch the surface of the overall recovery effort. In addition to the donations made by our staff, MTI made a donation to Direct Relief (directrelief.org) which has been delivering medical supplies to hospitals in the Philippines. During this holiday season our thoughts are with all those families affected by this disaster. Perhaps there is a way you can help too?

Christiane Howey Rising Scholar - Katharine Goodenough

To honor the life of Christiane Howey, her incredible dedication to our company, her passion for conservation and helping researchers worldwide, we created the Rising Scholar Award – an annual award to foster career development in researchers starting on their professional journey.

For this inaugural award, it was an extremely difficult decision to choose among all the applicants. However, the award committee was finally able to agree on the best proposal. Kate Goodenough is the recipient of the inaugural Rising Scholar Award. Kate's proposal is titled "Black Skimmer (*Rhyncops niger*) and Large-billed Tern (*Phaetusa simplex*) intra-tropical migration across the Amazonian Basin". She will use 5g Solar PTTs to examine unknown locations used by these two migrating water birds. **Congrats to Kate!**

For those interested in applying for the 2014 award, see our upcoming Summer 2014 Tracker News for the call for proposals.

Printed on Recycled Paper

Photo Contest Winners

We had a large number of entries for our 2013 Photo Contest, making it difficult for us to choose the winner. All of the photos were unique, impressive and highly creative. The photos were judged anonymously by the staff on the basis of composition, clarity, balance and originality.

1st Prize.....

goes to **Manuel Grosselet** and **Georgita Ruiz** for their photo of a male Blue-Winged Teal tagged with a 9.5g Solar Argos PTT. First prize is the winner's choice of a free transmitter.

..... 2nd Prize

goes to **Salim Javed** for his photo of a Flamingo tagged with a 70g Solar Argos/GPS PTT. Second prize is one free refurbishment.

3rd Prize.....

goes to **Simon Cherriman** for his photo of a Wedge-tailed Eagle and her ch ck. Both are tagged with 70g Solar Argos/GPS PTTs. Third prize is a Yagi antenna and Ground Track (GT™) reciever.

Honorable Mention ...

1.

2.

3.

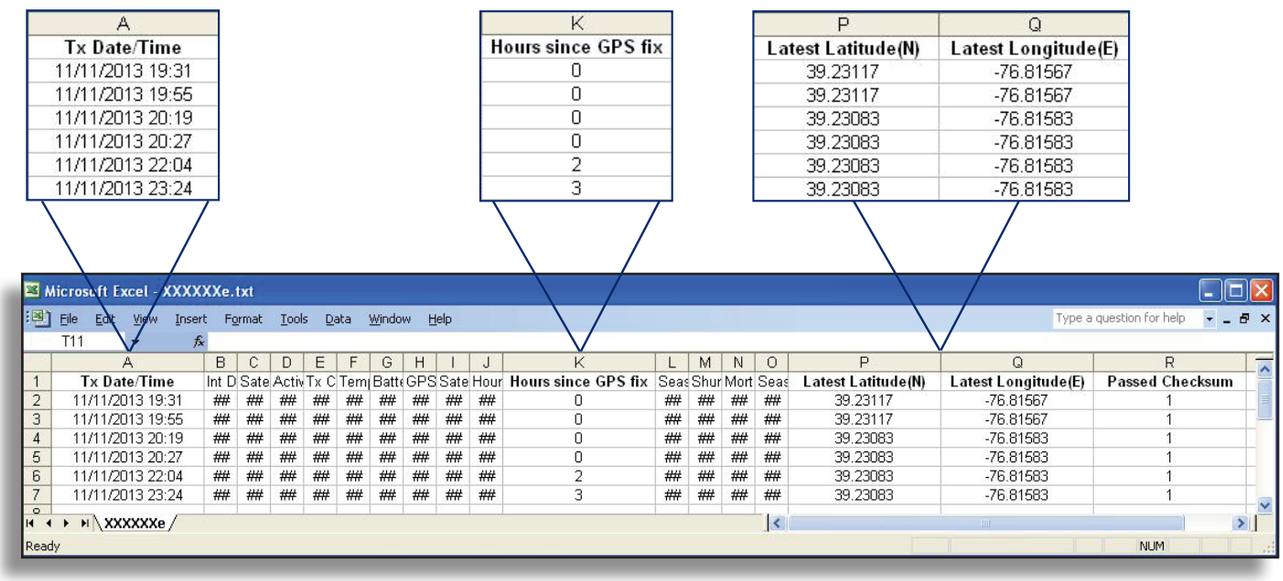
1. Common Wood Pigeon in flight. Tagged with a 12g Solar Argos PTT. Photo by François Sabathe.
2. Soaring Ross's Gull. Tagged with a 5g Solar Argos PTT. Photo by A. Andreev.
3. Osprey Family Meal. Tagged with 30g Solar Argos/GPS PTTs. Photo by Jane Purslow and the "Positive Osprey Paparazzi Team".

Our thanks to all who submitted photos to this year's contest!

Tips from Ted: Useful Information

Did you know… that the engineering file for our Argos/GPS PTTs contains the latitude and longitude of the last fix acquired? Engineering data are transmitted messages that contain real time sensor data (temperature, activity, battery voltage), as well as information relevant to the operation of the PTT. Many people don't realize that they also include information about the GPS.

From your engineering data file (*e.txt), the columns labeled "Latest Latitude" and "Latest Longitude" contain the most recent GPS location recorded at the time of transmission. To narrow the time more accurately, subtract the hour value in the "Hours since GPS fix" column from the time of transmission ("Tx Date/Time"); this will give you the time that the GPS fix was taken, to the nearest hour.



This is useful if:

a) You are testing 2D GPS PTTs; 2D PTTs only transmit engineering messages during the first 8 hours of transmission after the magnet is removed (GPS data messages are transmitted after the first complete duty cycle).

b) You would like to know the GPS location soon after the beginning of the PTT's transmission period. Every eighth transmission is an engineering message; because of the random-access nature of the Argos System, there is a good chance that an engineering message is received before the newer(-est) GPS data messages.

c) The Argos System has, for whatever reason, received few valid and uncorrupted GPS data messages. This could be the case when a PTT is on the ground or in areas of low reception such as southeast Europe and China.

Reminders

Refurbishment
We have set aside the months of August through February in our production schedule for refurbishment of avian transmitters. If you have transmitters that need refurbishment for the 2014 field season, please send them back to us without delay! March is the beginning of our busy season, when we must devote all our time and materials to new production. Customers outside the USA should contact us for instructions on returning PTTs. (support@microwavetelemetry.com)

Pop-Up Tag Customers
Please confirm deployment information and include pre-deployment test data when you send us data for processing.

Bits & Pieces

If you would like to receive an electronic copy instead of a paper copy of our newsletter, please let us know via email.

Newly published papers? Please let us know so we can include them in our online archive.

Production slots are assigned on a first-come, first-served basis. We require a Purchase Order and Production Form to lock in a slot.

Our office will be closed December 23rd through January 1st 2014. Happy Holidays!