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Tracker News

Microwave Telemetry, Inc.

Hedging Against Extinction – Populations and Migrations

Dear Customers and Friends,

Paul has been very busy lately (more so than normal). Lucy has been away teaching science in India, and Russell has been engulfed in a variety of interesting projects. As a result, I have been asked to write the letter for this edition of Tracker News. While reviewing the articles submitted for this issue, I noticed a recurring theme: many species tracked with our devices exhibit broad geographical distributions comprised of unique populations, with many of the wide-ranging species undergoing long-distance migrations. However, some species have evolved an alternative approach whereby all individuals are somewhat confined in a particular region during certain times of year. Both strategies appear to function; yet, the latter approach seems particularly vulnerable to extinction.

In this issue of our newsletter, we see clear examples of species having near-cosmopolitan distributions (and multiple populations) and species somewhat limited to a single geographic region during certain seasons. Dennis Jorgensen discusses migration of long-billed curlews, a species that has undergone a human-induced range reduction. Ben Koks and Raymond Klaassen reveal results from their years of work on Montagu's harriers, once again shifting a paradigm of a "known" migration pattern. Brett Falterman and Jennifer McKinney explain Gulf of Mexico yellowfin tuna movements and how they have adapted new tag attachment techniques. Using our GSM/GPS devices, Jesse Watson provides an update on his ferruginous hawk project. And, lastly, Szabolcs Solt, Péter Fehérvári and Péter Palatitz describe their work on migrations of Amur and red-footed falcons using 5g PTTs. To the authors: thanks very much for your submissions. It's clear that much effort was put forth in your studies.

As always, we are grateful for your patronage and truly enjoy working with you to help your projects succeed. We hope 2015 brings great joy in your work and personal lives.

Sincerely,

Lance and your Team at MTI

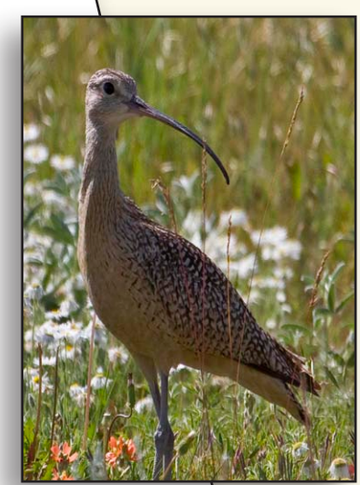


Photo by Dennis Linghor

Above: Long-billed Curlew

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

10 Years Tracking Montagu's Harriers, a Story About Science, Travels and People

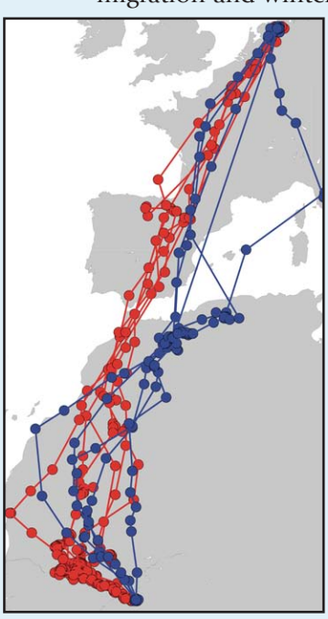
Raymond Klaassen is a researcher at the Dutch Montagu's Harrier Foundation and the University of Groningen, the Netherlands. His main interest lies in animal movement, in particular bird migration. Ben Koks is the founder of the Dutch Montagu's Harrier foundation. He has developed a lifetime fascination for Montagu's Harriers and has studied these birds all over Europe and in Africa.

Our story starts in 2005, when we tagged the first two Montagu's Harriers in the Netherlands. In spring 2005 we learnt that MTI had succeeded in producing a satellite transmitter small enough to be used on Montagu's Harriers. We were keen to track this elegant migratory raptor to learn more about its life outside the breeding period. We are a small NGO protecting farmland biodiversity in the Netherlands, where the Montagu's Harrier acts as a 'flagship species', and we realized that we need to protect migratory birds year-round. All the millions of euros spent on improving the conditions during the breeding season are wasted if the species faces more serious problems during migration or in Africa.

Photo by Theo van Kooten

'Franz' a male Montagu's Harrier that we tracked for six autumn and five spring journeys.

The first birds we tracked opened our eyes about the power of tracking individual birds. We could, for example, directly falsify two ideas about the migration and winter ecology that had been persisting in literature for a long time. First we could show that Montagu's Harriers do not use an anti-clockwise loop migration pattern, as had been concluded from field observations and analyses of ring recoveries, but instead the birds travel via a narrow clockwise loop! Secondly, we could debunk the idea that the harriers are nomadic during the winter, tracking locust outbreaks. Instead the birds have a limited number of wintering sites to which they return year after year.



Tracks of 'Franz'. Autumn migration in red, spring migration in blue.

It was a great adventure to track 'our' harriers on their travels to the western Sahel. However, we also realized that the tracking results would be even more valuable if we could compare with eastern populations. By collaborating with harrier specialists in Denmark, Germany, Poland and even in Belarus, we could track Montagu's Harriers from the whole northern breeding range, resulting in one of the finest examples of migratory connectivity in the Palaearctic-African migration system (Proc R Soc London B. 2014; 281: 20132897). In 2014, we significantly expanded our range by tagging harriers further to the west (UK) and further to the east (eastern Belarus) than ever before. This is a huge project involving many birds (58 birds in total, still counting) and it was truly fascinating to visit all these harrier places in Europe, meeting many interesting people.

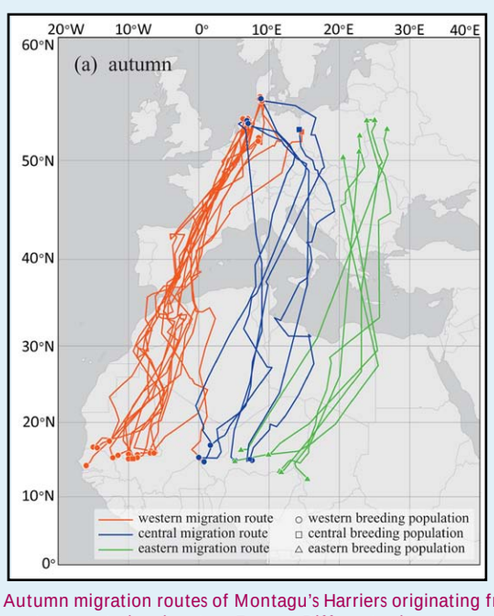
Most researchers probably are happy when they have obtained their tracking data that they can inspect behind their computer. We followed a different approach. We considered tracking as the starting point for a number of expeditions to the key sites the harriers visited in Africa. On the tail of our transmitter birds we visited stopover sites in Morocco and wintering sites in Senegal, Mali, Niger and Benin, to measure local conditions and abundance of main prey (J Anim Ecol 2013; 82:107-20). During these expeditions we often succeeded in finding our transmitter birds. The feeling when seeing 'your' bird in these African landscapes is indescribable. The trips to Africa always have been extremely interesting, not in the least for the lifelong friendships that one makes on the way.

Nowadays, different alternative systems such as GPS-loggers exist to track birds. However, an important disadvantage of loggers is that data is only obtained from the individuals that return, resulting in a funny bias towards successful birds. The ability to track birds in real time not only has the advantage that one could visit the bird wherever it is (cf., above) but also that information is obtained about the birds that did not make it. And this latter information is extremely valuable! For example, we recently compiled an overview of when and where raptors die, providing unique insights in the patterns in mortality throughout the year (J Anim Ecol 2014; 83:176-84). These results are extremely relevant for conservation issues, and would be practically impossible to obtain without the use of transmitters.

Photo by Ben Koks

Transmitter bird 'Dominik' is foraging in its traditional wintering site in Niger.

2014 was the 10th year in a row we tagged Montagu's Harriers with satellite transmitters. It has been a truly fascinating decennium during which we have learnt incredibly much from tracking individual harriers back and forth between Europe and Africa. We almost cannot comprehend the faint level of understanding we had about their lives outside the breeding season before tracking devices were available! A huge thanks to MTI for developing and producing such excellent devices which has given us so many rewards in terms of science, travels and people!



Autumn migration routes of Montagu's Harriers originating from western, central and eastern Europe. Different colours represent different main migration routes.

Tracking Small Falcons Around the Globe

Szabolcs Solt MMEBirdLife Hungary Red-footed Falcon Workgroup
Péter Fehérvári Hungarian Natural History Museum (HNHM)
Péter Palatitz MMEBirdLife Hungary Red-footed Falcon Workgroup
All are based in Budapest, Hungary

Avian migration has always fascinated people; now recent advancement of technology has allowed us to glimpse into the journey of two long distance migrants in the 130-200 gram average body mass range: the Amur and Red-footed Falcons, two closely related species. Amur Falcons have the longest known migratory routes amongst raptors, up to 20,000 km. The conservation ecology research team of falcoproject.eu has now tracked the journey of 3 Amur (since 2013) and 18 Red-footed Falcons (in 2009 and 2014), using 5g Solar PTTs.

Although the two species have distinct breeding ranges in the steppe zone of Eurasia and Northern Asia, both are highly gregarious throughout their life cycle. Aggregation in the breeding period, en route and in the wintering grounds makes a substantial portion of the population vulnerable to local threats such as the practice in Nagaland, India of harvesting Amur Falcons for bush meat. According to some sources up to 120,000 birds were estimated to be consumed by locals annually.

The shores of the lake near Doyang Dam, Wokha district, Nagaland, India (see map/area 1) are known as the Falcon Capital of the World. This is no exaggeration; our research team estimated a minimum of 1 million Amur Falcons present at a single roost site (see photo 1). Aided by local former hunters, the team trapped and tagged two adult females and an adult male. Surprisingly, all birds flew nearly non-stop crossing the Indian subcontinent and Arabian Sea to reach the shores of Somalia. This 5600 km non-stop flight took approximately 5.5 days, with an average speed of 43 km/h. Spring migration commenced in late March, early April. The first individual left the Horn of Africa on 18 April at nearly the exact location it arrived in autumn. Once again the Arabian Sea and India were crossed rapidly and the bird's stopover site in northern Vietnam (map/area 3) was reached less than 10 days after leaving Africa (map/area 2). This area has never before been recognized as a stopover site for the species. The male reached its breeding grounds in Inner Mongolia in early May, while the female that remained active to date reached the area a month later.

The breeding distribution of Red-footed Falcons ranges from northern Italy to Kazakhstan. We tagged individuals in various locations within this vast area. Initially 8 birds were tagged within the Carpathian Basin in the breeding season of 2009; in 2014 we tagged 1 bird from Italy, 3 birds in Hungary and 3 birds in Kazakhstan. We tagged 3 birds in eastern Romania that were already on migration. Currently, we have results of the post-nuptial migration of the species. The birds from the eastern extent of the breeding range circumnavigated the Caspian Sea from the north in late August, early September and utilized a stopover region around the northern Black Sea coastline (map/area A). Annually

Photo by Péter Fehérvári

Photo 1. Amur Falcons over the Doyand Dam, Nagaland, India.

conducted weekly surveys of roost sites in the Carpathian Basin and reports of roost sites up to tens of thousands strong in southern Ukraine, both suggest that this area is of utmost importance to fuel up prior to southward movements. The birds left the area predominantly in the last week of September and with long, nearly non-stop flight migrated across the Mediterranean Region and the Sahara, drifting westwards due to northeasterly trade winds in the desert. The first major stopover region is the Sahel region (map/area B). Later the birds crossed the equatorial rainforest region and reached their wintering grounds in southwestern Africa. Individual tracking did not provide sufficient data on spring migration to date; however the patterns observed in this species suggest that they take a more westerly route in the northern hemisphere. Often large number of individuals can be observed in western Europe in spring, probably due to the more westerly routes and cyclone systems in the Mediterranean Basin.

Tracks of tagged and active falcons, and other species, can be followed in "near-real time" on the satellitetracking.eu website. One of the most valuable results of tracking the migration of these remarkable species is identification of migratory stopover sites. Implementing legislative efforts to

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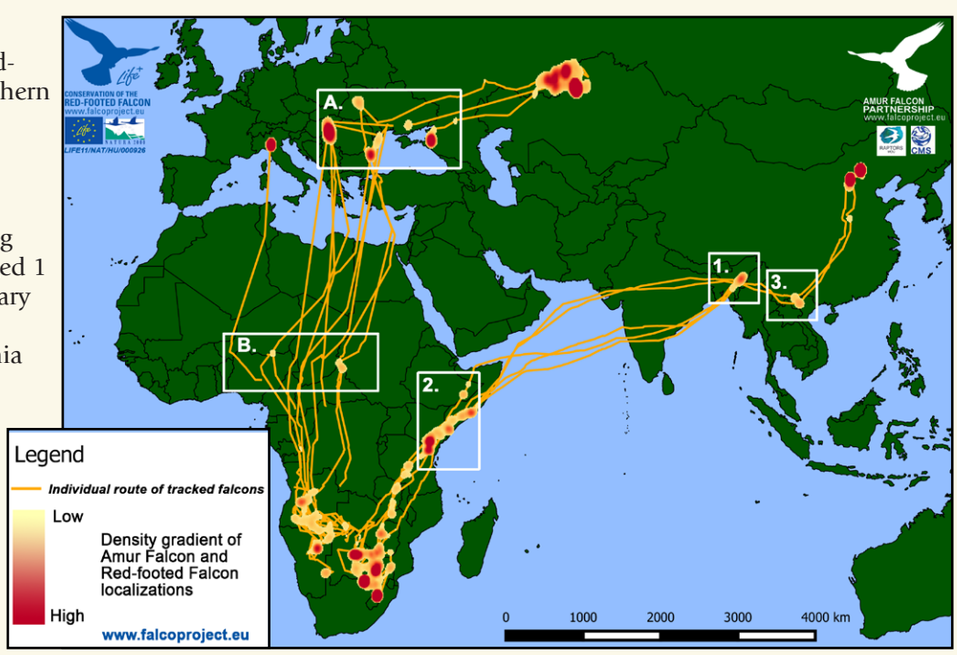
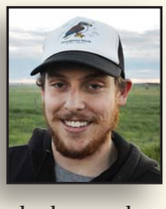


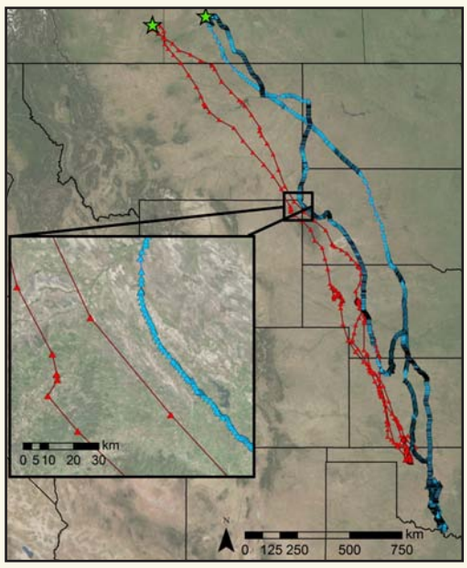
Migratory route and stopover sites of Red-footed and Amur falcons.

Technology Comes of Age: Soaring into the Future…



Jesse Watson is a M.Sc. student at the University of Alberta studying the movement patterns of Ferruginous Hawks in relation to industrial development. He has been working with Ferruginous Hawks since 2007 and with raptors for 15 years.

In early February, 2012, I delved into the world of satellite telemetry. As part of a team at the University of Alberta studying Ferruginous Hawks under the guidance of Drs. Erin Bayne and Troy Wellicome, I embarked on my first M.Sc. field season in the prairies of southern Canada. Canada has always been a stronghold for this migratory hawk, but it is now endangered in Alberta and the focus of my research is to investigate local and long-range movements of adult hawks in relation to industrial development. To that point in time, movement of Canadian Ferruginous Hawks had been assessed from banding studies and more recently, monitoring with Argos PTTs, but my study needed location precision to assess home range and resource selection. After several weeks of scouring telemetry websites, making phone calls, and writing emails, I opted for 30g solar Argos/GPS PTTs. During that 2012 breeding season I deployed Argos/GPS PTTs on seven Ferruginous Hawks. I was pleasantly satisfied with the data I received every 3rd day at my office in chilly Edmonton, Alberta, that allowed me to analyze home ranges. Before I knew it, 2012 was coming to a close and the 2013 field season was fast approaching…it was already time to order transmitters for my second field season.



A comparison between hawks monitored with Argos/GPS and GSM/GPS satellite telemetry. I began tracking 118208 (Argos/GPS PTT – in red) in 2012 and began tracking 202 (GSM/GPS – blue) in 2013, both hawks are currently transmitting data.

Photo by Janet Ng

Adult male Ferruginous Hawk 203 with his GSM/GPS transmitter in 2013.

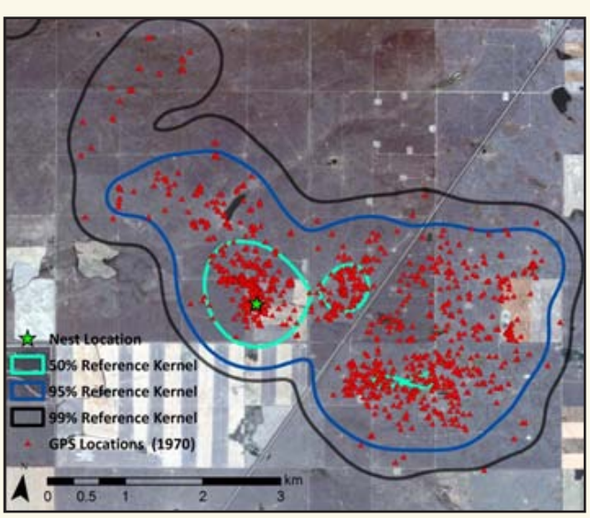
The GSM/GPS transmitter is the most technologically advanced avian telemetry device on the market. Fix rates are dynamic and can acquire up to 1 location/minute as opposed to the 1 location/hour provided by Argos/GPS PTTs. The high frequency and volume of GPS locations are now allowing some researchers to understand flight patterns in relation to wind speed, topography, and bird elevation. My biggest concerns when stepping into this technology were the potential "dead zones" throughout the Canadian prairie. The GSM network is available throughout most of the world. Although GSM coverage is often available at the broad scale in most countries, "dead zones", with a lack of GSM coverage may occur, depending on the region where transmitters are deployed. After studying maps, I could see this potential lack of coverage for areas of southeastern Alberta and southwestern Saskatchewan, but opted to order GSM transmitters because the migration of these hawks through the lower 48 would bring them into GSM coverage providing a mega-download of backlogged data.

Since then I have deployed 29 GSM/GPS transmitters on adult male Ferruginous Hawks and now have some insight into the efficacy of the use of GSM/GPS technology on Buteos. When shifting from Argos/GPS PTTs to GSM/GPS transmitters, the first difference I noticed was the increase in the number of emails in my inbox on a daily basis. The transmitters will attempt to transmit data 3 times each day and if the bird is within GSM range the user will receive an email with the most recent data within minutes. If you're like me, you look forward to checking each of those emails to see where your bird has spent the past day, and to get instant information in case of mortality.

Although, initially my biggest concern was deploying GSM/GPS units in dead zones, 24 out of my 29 hawks nested in areas where GSM coverage was consistent. Of the 5 hawks in dead zones, 4 had their first transmission once migration began (~2 months after deployment) and each transmitter backfilled their entire summer's dataset…let me tell you, receiving those emails was like an early Christmas! The increased volume of data provided by GSM/GPS transmitters is striking. Throughout one breeding season (April 1 – Sept 20), one breeding male transmitted just shy of 80,000 locations in comparison to another hawk wearing an Argos/GPS unit which has transmitted around 3,000 locations throughout the same duration. I am just beginning my analysis, but due to the volume of information transmitted from the GSM/GPS units I expect to gain insight into previously unstudied flight characteristics of Ferruginous Hawks at fine and large scales, and habitat use both on the home range and during migration. Adding to the appeal of GSM/GPS transmitters is the decreased amount of paperwork to get a program running and lower cost of data retrieval. I estimate that for 1 year of Argos/GPS service for 1 PIT costs around $1200 while yearly service for a GSM/GPS unit costs around $400.

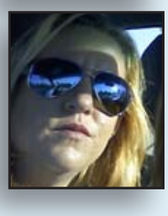
As technology moves forward, we can only expect that it will allow us to peer deeper into the daily lives of the wild birds we study in order to preserve their populations. I am pleased to say that GSM/GPS technology has helped the success of my M.Sc. research and I thank MTI for their continued support!

Photo by Jesse Watson



Adult male Ferruginous Hawk 118208 (left) with Argos/GPS PTT in 2012 and his home range (right).

Electronic Tagging Yellowfin Tuna in the Gulf of Mexico – Some Preliminary Observations



Brett Falterman is a Biologist Manager with the Louisiana Department of Wildlife and Fisheries and manages and directs the agency's pelagic research and monitoring projects. Brett has been working on pelagic research projects for almost 20 years and has been addressing issues in fisheries management in the Gulf of Mexico with satellite tags now for 10 years, including projects on billfishes, tunas, coastal and pelagic sharks, and tarpon.

Jennifer McKinney is a fisheries biologist with the Louisiana Department of Wildlife and Fisheries in New Orleans, LA. Her research focuses on movement and habitat use of pelagic species in the northern Gulf of Mexico

Yellowfin tuna (*Thunnus albacares*) is a circumglobally distributed fish that supports substantial fisheries in tropical and subtropical waters throughout its range. The fishery in the Atlantic Ocean is managed as a single stock by the International Commission for the Conservation of Atlantic Tunas (ICCAT). While Atlantic stocks of yellowfin tuna have historically been in good shape, the most recent stock assessment indicates that stocks may be falling below target levels. One assumption of the single-stock hypothesis is that yellowfin tuna production in the Atlantic is driven by the spawning grounds in the Gulf of Guinea, off the west-central coast of Africa. However, all life stages of yellowfin tuna are known to occur in the Gulf of Mexico. And while tuna are a highly migratory species, substantial recreational and commercial user groups are based in the state of Louisiana and preliminary tagging studies have suggested a high-degree of site fidelity in the region. Given that the connectivity between the Gulf of Mexico yellowfin tuna resource and the Atlantic-wide population is unresolved, the Louisiana Department of Wildlife and Fisheries (LDWF) has initiated a comprehensive research project in the northern Gulf of Mexico to better understand the Gulf of Mexico yellowfin tuna resource.

The offshore waters adjacent to the Louisiana coast provide a unique and productive habitat for yellowfin tuna and other pelagic fishes. The Mississippi River, North America's largest drainage system, discharges nutrient-rich fresh water into the Gulf of Mexico which then interacts with the offshore Loop Current. This interaction occurs along a narrow continental shelf containing over 4,000 fish-aggregating structures (i.e. oil rigs), resulting in an oceanographically dynamic and productive ecosystem which supports a rich, diverse, and accessible fishery.

A primary objective of our study is to describe long-term movement of yellowfin tuna in the northern Gulf of Mexico. Pop-up satellite tags (PSATs) are great tools for describing horizontal and vertical movements of fishes and have been used extensively on many pelagic species. However, yellowfin tuna are a challenging candidate for this approach, as most researchers to date have experienced poor tag retention. We've made three adjustments to our methodology in order to increase retention and achieve our objective: increase the minimum size for satellite tagging candidates (120 cm curved fork length), improve attachment (described below), and incorporate internal archival (IA) tags.

Our team has been refining our handling and tagging techniques since 2003. Using heavy recreational gear to minimize fight times and optimize release condition, tuna are landed quickly, brought on board with a large landing net, and transferred to a padded cradle where the gills are aerated with seawater. We anchor the tag in the area of the second dorsal pterygiophores where bone density is heaviest using a dart-less attachment method that involves inserting a heavy, hollow splicing needle into the fin base through which we then thread a short section of 300-lb monofilament line. In order to comply with MTI's recommendation about proximity of metals to the tag release wire, our initial tether design had a 1.5-in "pigtail" between the crimp at the rear-margin of the fin and the tag. This tether design and our strict minimum size (120 cm CFL) have resulted in a three-fold increase in the average days-at-large (DAL) when compared to other published studies in the region. We have since moved to a "figure 8" configuration with the crimp anterior to the second dorsal fin, thus completely removing any tether-length between the tag and the fish. Our hope is that this will greatly reduce tag movement during deployment and produce superior retention times.

Photos by B. Falterman, LDWF

The base of the second dorsal fin was targeted for MTI X-Tag attachment in yellowfin tuna, following a "pigtail" (left) and "figure 8" (right) approach in an attempt to improve tag retention.

The incorporation of IA tags has also benefited the scope of our tagging study. While recapture is required to recover the data, the tags we're using can record data for 3-5 years. After just 1.5 years since our first IA deployment, we've experienced a recapture rate of almost 10%. Additionally, IA tags have allowed us to incorporate smaller size classes than PSAT attachment (IA: n=102, range 66-133 cm CFL, mean= 102.1 cm; PSAT: n=16, range 121-150 cm CFL, mean 136.8 cm).

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Photo By L. Kitchens, TAMUG

Yellowfin tuna being netted in preparation for MTI X-Tag attachment.

Tracking the Migrations and Stopover Behaviors of Long-billed Curlews Nesting in the Northern Great Plains of Montana

Dennis Jorgensen is the Program Officer for the World Wildlife Fund in the Northern Great Plains.

Many grassland bird species are of conservation concern due to large-scale, continuing habitat loss and degradation over much of their range. Forty percent of North America's declining bird species are those that depend on grasslands. Among grassland birds, the Long-billed Curlew, North America's largest shorebird, is perhaps one of the most recognizable, if not the most charismatic among them. In 2009 the U.S. Fish and Wildlife Service, Region 6, Nongame Migratory Bird Program published the "Status Assessment and Conservation Action Plan for the Long-billed Curlew (*Numenius americanus*)". This assessment highlighted significant concern regarding the conservation status of Long-billed Curlews due to loss of portions of their historical breeding range and apparent population declines, particularly in the short-grass and mixed-grass prairies of the western Great Plains.

The Montana Long-billed Curlew project was undertaken to fill gaps in scientific knowledge of the migrations of Long-billed Curlews originating from breeding grounds in Montana, and was a component of the larger Pacific Shorebird Migration Project (http://alaska.usgs.gov/science/biology/shorebirds/migration.php) which tracked curlews from breeding grounds in Oregon and Nevada. The Montana Long-billed Curlew project was initiated by the US Geological Survey – Alaska Science Center (USGS – ASC), Point Blue Conservation Science, World Wildlife Fund's Northern Great Plains Program, The Nature Conservancy Montana, and The Nature Conservancy Migratory Bird Program.

The project area was situated within the northern Great Plains in the Prairie Pothole Region, which is one of the regions encompassing the greatest abundance of breeding Long-billed Curlews throughout their current range. More specifically the study took place in Phillips County in north central Montana, bounded by the Milk River to the north and the Missouri River to the south. The topography was composed of predominantly flat to rolling upland grasslands and sagebrush steppe, and the dominant land use in the project area was cattle grazing.

In May of 2009 and 2010,14 adult curlews were located and captured on nests. Despite their size and the relatively well grazed short grass in which they prefer to make their nests, curlews were remarkably well camouflaged, and tended to remain perfectly still with their long bills laid flat on the ground when approached. Their mottled brown feathers often left us creeping up on surprisingly similar looking cow pats, likely an adaptation to resemble the pats of the once abundant bison on the grasslands of North America. Finding nests was in fact the most time consuming activity and averaged over 8 person hours per nest.

Photo by Nils Warnock - Audubon Alaska

Dennis Jorgensen releasing a PTT tagged curlew in the northern Montana prairies.

When a curlew was captured it was sexed, weighed, and equipped with an18g solar-powered Argos PTT. PTTs were attached using a leg-loop backpack-harness with Teflon straps. After PTT attachment the curlew was released back to its breeding territory. The transmitters were programmed to transmit for 10 hours and to rest for 24 hours. CLS America (Argos) provided the raw data, which was subsequently processed using software developed by USGS-ASC (Douglas Argos-Filter Algorithm).

The results of the tracking of Long-billed Curlews in Montana, Oregon and Nevada were published in the peer reviewed journal *The Condor: Ornithological Applications* (Vol. 116, 2014, pp. 50-61) in a research article entitled "Annual migratory patterns of Long-billed Curlews in the American West." With respect to the 14 curlews tagged in Montana we found that all wintered within the species' known winter range, wintering inland from the Texas Panhandle south to the Mexican Plateau, or near the Gulf of Mexico. Montana breeders migrated east of the Rocky Mountains and traveled more than twice the distance of Oregon and Nevada breeders. Montana birds all exhibited stopovers; not all birds tagged at other sites did. Montana birds also stopped more often and longer during most passages. Individuals exhibited strong fidelity to breeding and wintering sites, though pairs tended not to winter together, and many birds showed a strong propensity for agricultural regions during winter. Ultimately the project results underscored the importance of tracking migration across multiple breeding populations to capture broad variation in migration patterns and findings that curlews from Montana, Oregon and Nevada all occupied agricultural landscapes during winter suggesting that they are important to Long-billed Curlews at this time of year.

Photo by Dennis Linghor

Long-billed Curlew in the northern Montana prairies.

The project partners were excited by the prospect of using tags that were sufficiently small and light to place on Long-billed Curlews, which of course was enabled by the fact that the PTTs were solar powered. However, few might anticipate that now five years and five months after their initial deployment in May 2009 two units are remarkably still sending data on the movements of tagged curlews, revealing the value of both the technology and the company that produced it to those seeking novel insight through tracking.

Tracking Small Falcons Around the Globe

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protect the birds is challenging in countries en route. Illegal hunting or unsustainable harvest is still a very potential threat for both species.

However, the situation is not without hope, as demonstrated by the story of the Naga people, India and the local and regional conservation authorities. Understanding the importance of what happens in their backyard, they went from harvesting tens of thousands of birds in 2012 to completely halting trapping and hunting in 2013. They aided conservation and public awareness programs and when releasing Pangti, the tagged female falcon named after their village, they prayed to god for her safe return (photo 2).

Photo by Nick Williams

Photo 2. Researchers and locals pray for the return of the satellite tagged falcons.

The REDFOOT project is supported by the European Union's LIFE-Nature Fund. The Amur Falcon Partnership is supported by UNEP CMS Raptor MoU and the Government of India. The falcoproject.eu community is supported by BirdLife and includes researchers and NGOs from 3 continents.

Electronic Tagging Yellowfin Tuna in the Gulf of Mexico...

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The fishery dependent nature of the IA recaptures is quite apparent from Figure 1, strengthening the argument for using these two different tag types in concert. While average DAL for IA deployments is 169.3 days (range 5-417 days) versus 90.1 DAL for PSATs (range 14-131 DAL), average displacement is greater for PSAT deployments (204.1 km versus 63.4km). Once completed, this electronic tagging dataset should greatly improve the body of knowledge on the yellowfin tuna resource in the GOM and its connectivity with the Atlantic-wide population, thereby improving managers' abilities to assess stocks and manage the fishery.

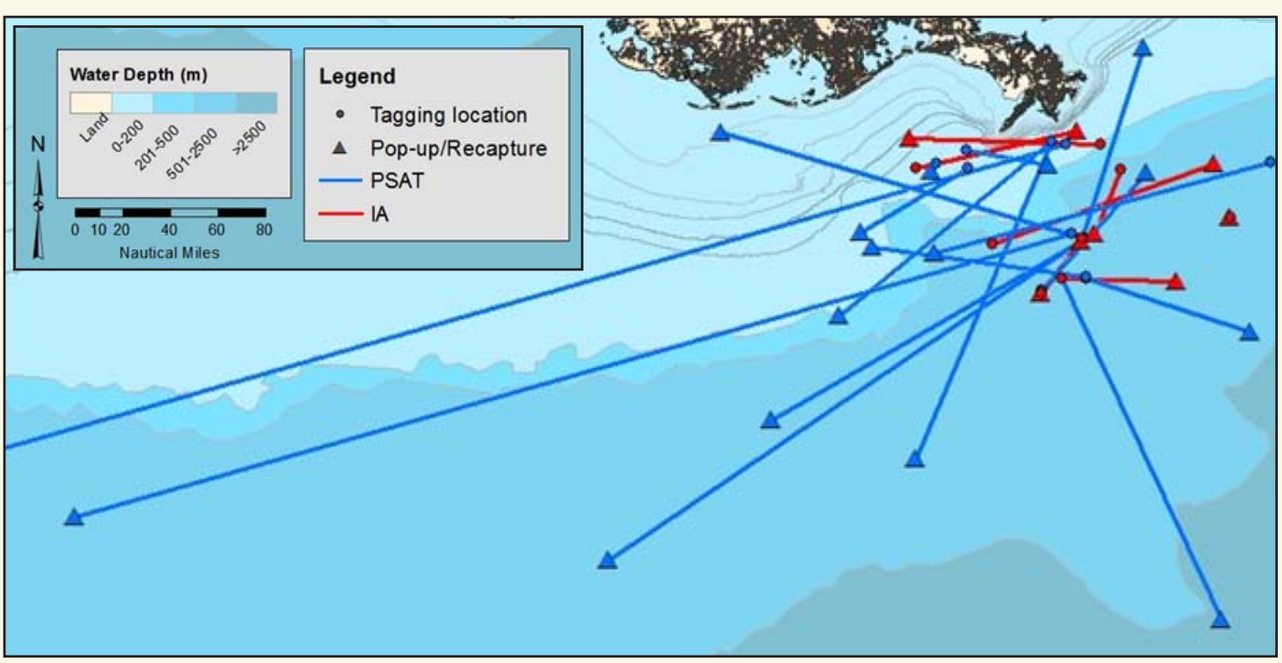


Figure 1. Displacement of yellowfin tuna fitted with MTI X-Tags (PSATs) and IA tags.

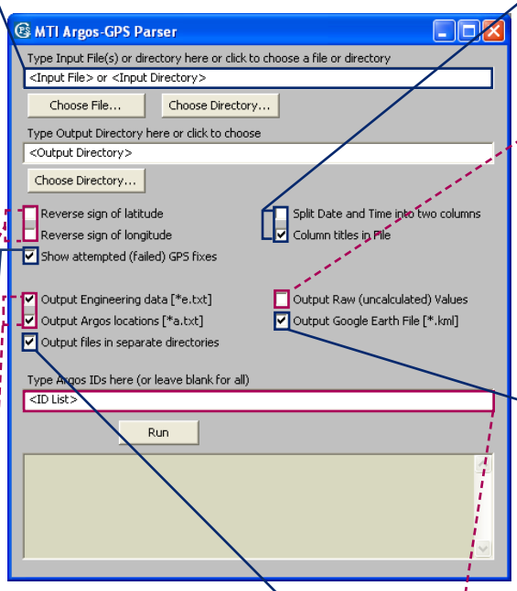
Tips from Ted: GPS Parser Options

We have tried to make the MTI parser a straightforward and robust tool for handling GPS PTT data. While we preset the options on the parser to what we think will be the most useful settings for our customers, there may be occasions when users would prefer other settings. To help guide these decisions, the following is some useful information about your parser options.

Location of data files to be parsed. **If a directory location is entered, all files in a directory will be parsed.** This enables the user to store multiple files of source data (downloaded at different times, for example) in the same directory and parse them all at once.

By convention the latitude and longitude coordinates are output with North & East as positive and South & West as negative. Select these options if the opposite is required (South or West as positive).

If a PTT is unable to acquire a fix, this option will output this information in the GPS locations file. This information is useful in determining whether the PTT has adequate charge to take all the scheduled fixes.



These options alter the output files. Some secondary programs used to interpret and store data prefer specific formatting when inputting files.

Sensor values such Temperature, Battery Voltage, and Altitude must be converted from the source data to get the actual units (Celsius, volts, meters, etc.). Select this option to get the raw unconverted values. This can be useful for certain diagnostic purposes. **Normally, this should not be selected.**

Creates a Google Earth™ readable file. Unselect this if Google Earth™ is not used. (This may save processing time.)

When these options are selected, Argos locations and engineering data files are created. These options are RECOMMENDED ON; the engineering data contains information such as temperature and activity and the Argos files contain PTT operations information. Both of these types of data are useful in determining the behavior of a tracked animal and identifying a possible mortality or downed transmitter.

The parser creates a subdirectory for each PTT when this option is selected.

If only a subset of PTT data in the input file/directory is to be parsed, putting those IDs here will restrict the files outputted (and, to some extent, processing time). **Ranges of IDs can be used, for example 130000-140000 or 130001, 130002, 130004; these are separated by commas.**

Christiane Howey Rising Scholar

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 in 2013 – an annual award to foster career development in researchers starting on their professional journey.

We are pleased to announce the winner of the 2014 award: **Marla Steele**. Marla will use GSM/GPS transmitters to study habitat ecology and migration of the globally vulnerable Pallas's fish eagles in Mongolia. Congrats to Marla!

Interested in applying for the 2015 award? See our upcoming Spring 2015 Tracker News and website for the call for proposals.

Bits & Pieces

Please see our website for our new refurbishment policy.

Our production schedule for 2015 is filling up fast. If you plan to order devices, please let us know at your earliest opportunity.

Please remember to send us your 2014 publications so that we may add them to our online reference library.

Our facility will be closed from 24 December through 2 January 2015. Happy New Year!