

Tracker News



Microwave Telemetry, Inc. Amazing Journeys

Dear Customers and Friends,

As our anniversary celebration winds down, we look back at the last fifteen years with gratitude. We feel privileged to have gone on many amazing journeys, with birds and fish that researchers around the world have tracked. We have shared our customers' excitement when their birds have crossed continents and their fish have circumnavigated oceans.

Come along with us as we follow this 275 gram Eurasian Hobby on a truly amazing journey across two continents, from Sweden to Africa. We thank Roine Strandberg, Thomas Alerstam, Mikael Hake and Patrik Olofsson for sharing this story with us.

Next we fly from Chile to California on the wings of the pink footed shearwater. Our thanks to Peter Hodum and David Hyrenbach for taking us on their shearwaters' journey.

Last but not least, we follow the travels of the Atlantic sailfish from the Charleston Bump Complex to the Bahamas. We thank Josh Loefer, George Sedberry, Dan Russ, Jonathan Geddings and Philip Weinbach for taking us into the deep with their sailfish.

Please join the school children of Box Elder School District in Utah and from Erdenebulgan Sum, northern Mongolia as they prepare to track the Marbled Godwit and Great Bustard, respectively. Congratulations to both schools for winning free PTTs for their school projects. We share their excitement and look forward to their reports.

A year from now, we may be looking at discoveries made possible by our new smaller GPS unit and smaller popup tag. Every time we introduce a smaller unit, we are happy to achieve a new milestone but always doubtful whether we can further miniaturize our design. So, it is with great pleasure that we introduce our new 22g GPS unit and our tiny next generation Archival Popup tag. Though our task gets harder as we go smaller, we continue on our journey with much enthusiasm.

We thank you for the opportunity to serve you, our customers, over the last fifteen years and look forward to many more years together. We wish you happiness, health and joy in 2007.

Sincerely,
Paul and the staff at MTI



Photo by Patrik Olofsson

Above:
Adult female Hobby with a 9.5g PTT.

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The Journey of a Female Hobby Across Two Continents: From Sweden in Northern Europe to Zambia in Southern Africa

Roine Strandberg, Thomas Alerstam, Mikael Hake and Patrik Olofsson, Department of Animal Ecology, Lund University, and Grimsö Wildlife Research Station, Swedish University of Agricultural Sciences, Sweden

During the summer of 2005 an adult female Eurasian Hobby *Falco subbuteo* was equipped with a 12g solar PTT* at Kristianstad, at latitude 57 degrees north in Sweden. The Hobby is one of the smallest European falcons, with the females slightly larger than males, with body mass about 275g. This species is known to spend the winter in the southern parts of Africa, mainly south of 10 degrees south, some 8000 km (5000 miles) from Sweden. However, there are no Swedish ring recoveries to show the migration routes and non-breeding distribution south of Sahara.

After attachment to the bird, the transmitter worked without interruptions and provided 660 positions from 17 July to 23 November. In the end of the transmitting period, the bird had been stationary in an area of 1800 km² (800 square miles) for more than ten days, indicating that it had arrived in its winter grounds in northwestern Zambia.

Following a straight route from Sweden, the winter area was situated 7650 km (4750 miles) away from the breeding ground. However, the real migration journey by the bird was more than 10500 km (6500 miles)! The female departed from her breeding site on 9 September and arrived in Zambia on 10 November, which gives a mean migration speed of 167 km/day (104 miles/day).

The journey started via the islands of Bornholm and Rügen as stepping stones across the Baltic Sea. She continued across the European continent, passed west of the Alps and reached the French Riviera. Starting early in the morning of 29 September she made a nonstop flight over a distance of 760 km (470 miles) across the Mediterranean Sea, arriving in Algeria 25 hours later. Thus, she completed half the sea passage during the night! Sahara was passed during two weeks and the course was, somewhat surprising, to the SSW towards West Africa. After a few days stopover in northwest Ivory Coast in mid October, she abruptly veered east. Reaching Cameroon, she again changed course and headed southeast without any contact with the coastline. Passing over the extensive rain forests of Congo and into the highlands of Zambia, she suddenly stopped and settled in a forested area 12.5 degrees south of the Equator.

An amazing journey like this flight of the female Hobby certainly gives fuel to wonderings and theories about migration patterns for species traveling via West Africa towards southern Africa including not only Hobby but also, for example, swallows and swifts. Why did the Hobby make a detour of 3500 km (2200 miles) via West Africa rather than flying directly south towards Zambia? Perhaps she followed prey, like swallows, on migration? Did she travel alone or with other Hobbies? Are the males and juveniles traveling by the same routes? Must juvenile Hobbies rely exclusively on inherited information for their migratory orientation and navigation or can they accompany and learn from adults? To what degree does an individual's experiences and learning during one journey affect its next journey? We have indeed many good reasons to continue tracking Hobbies by satellite telemetry during the coming years, and hopefully some of the questions will be answered. This year we are obtaining further exciting results about the migratory journeys of Hobbies equipped with the smallest 9.5g solar PTT.

* The harness was made of thin 1.4 mm nylon cord (as used in Venetian blinds) covered by Tygon® plastic tubing. The knot of the cord at the transmitter was secured with rapidly drying glue. The harness was secured by an aluminium clip covered with adhesive tape where the harness crosses over on the chest.



Female Hobby with 9.5g solar PTT in 2006.

All Hobby Photos by Patrik Olofsson

Satellite tracking of hobby (adult female) 2005



AUTUMN JOURNEY:
Distance 10,500 km
Duration 63 days
Migration speed 166 km/d

Roine Strandberg with female Hobby



Conservation Implications of Migration Routes of Pink-footed Shearwaters

Peter Hodum, Juan Fernández Islands Conservancy and Oikonos Ecosystem Knowledge and David Hyrenbach, Duke University Marine Lab

After more than three months of provisioning their single, slow-growing chick, pink-footed shearwaters, a species of seabird endemic to Chile, depart the breeding colonies to begin their migration. For shearwaters, this migratory journey is merely a continuation of an inherently wide-ranging lifestyle. During the chick-rearing period, satellite-tracked breeding shearwaters from the Juan Fernández Islands extensively used continental shelf waters south of Concepción, Chile. These trips to provision their chick, impressive journeys in their own right, commonly exceeded 1500 km roundtrip and ranged from 5-12 days in length.



Adult pink-footed shearwater on the surface of the colony at night, Isla Santa Clara, Juan Fernández Islands.

Photo by Peter Hodum

In late April to early May, shearwater chicks fledged from the colonies, and breeding adults, no longer constrained to return to the colony, migrate out of the region. During the northern summer, large numbers of pink-footed shearwaters are seen in the continental shelf waters of the west coast of the U.S. and British Columbia, a distance of at least 12,000 km from the breeding islands in Chile. Although these northern wintering grounds have been well documented by at-sea surveys, the migratory routes to these areas from the breeding colonies remained undescribed. In late April 2006, we attached five Microwave 12g solar satellite transmitters to post-breeding pink-footed shearwaters to obtain preliminary information on the migratory routes and habitat use patterns of the species.

Following their departure from the breeding colony on Isla Santa Clara, Juan Fernández Islands, all five birds traveled to the continental shelf/shelf-break area of Chile and rapidly headed north. Four of the tags transmitted long enough to track the birds along the shelf/shelf-break to the central Peruvian coast, in the Bahía de Salinas region. The birds covered approximately 2500-3000 km along this route, moving quickly through zones of relatively low productivity. All four birds spent significant time in the central Peru region, presumably exploiting its highly productive upwelling system. In fact, only one of the four birds left Peruvian waters, the rest remaining in the same area for several



Pink-footed shearwater with satellite tag being returned to its breeding burrow, where it had a near-fledgling chick.

Photo Courtesy of the Peter Hodum Collection

weeks to nearly two months. These tracking data, although limited, suggest that the area may be an important wintering hotspot for the species.

The lone bird that continued northward traveled rapidly and consistently through the low-productivity offshore waters off Central America to arrive at the southern tip of Baja California. It then slowed

considerably, moving gradually up the Pacific coast of Baja and remaining in shallow shelf waters until it reached the Bahía Magdalena region. Upon reaching this area, the bird remained for several weeks, apparently utilizing a consistent local upwelling zone. To reach this zone, the bird traveled at least 10,000 km.

A fundamental challenge to any seabird is to find food in a patchy environment. Given that seabird prey resources can frequently be unpredictable both spatially and temporally, it can be advantageous to exploit areas of consistent productivity, such as coastal upwelling areas, where they exist. Our results suggest that pink-footed shearwaters

frequently utilize such areas of highly productive coastal upwelling both in Chile during the breeding season and during migration. Not coincidentally, these regions are also heavily exploited by fisheries, thus leading to potential interactions with shearwaters. Such interactions may be negative, including competition for prey and/or mortality as bycatch in net or hook fisheries, or positive, primarily food subsidies in the form of fisheries discards tossed overboard.

Additional challenges to shearwaters using shelf and shelf-break waters have to do with other uses of these waters by humans. These waters frequently have heavy shipping traffic and are also sites for oil exploration and extraction. Both of these activities increase the risk of oil spills, which can obviously have significant impacts on seabird populations in the affected regions.

This apparently consistent use of shelf and shelf-break waters by pink-footed shearwaters and their consequent overlap with fisheries and other human activities is potentially a concern, as the species is globally listed as Vulnerable by the IUCN and is designated as a Species of Common Conservation Concern by the tri-national Commission for Environmental Cooperation (CEC). Future work, under the auspices of the CEC, will focus on describing habitat usage patterns within North American wintering grounds and will replicate the migration tracking study described here to provide a more robust understanding of pink-footed shearwater migration.

email: peter@oikonos.org
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Movements of five post-breeding pink-footed shearwaters (*Puffinus creatopus*) satellite-tracked from Isla Santa Clara, Juan Fernández Islands (JFI). Tracking began on April 21 – 22, 2006. The Argos data were filtered to remove low quality fixes (class B) and locations requiring unrealistic flight speeds (> 60 km hr⁻¹). The track of each bird is color-coded and the extent of the continental shelf (200m depth) is highlighted by the light blue shading.

Have Sail Will Travel: Long-distance Migrations of Western North Atlantic Sailfish

J.K. Loefer, G.R. Sedberry, D.C. Russ, J.E. Geddings, and P.W. Weinbach. South Carolina Dept. of Natural Resources. P.O. Box 12559, Charleston, SC, USA 29412

Biologists with the South Carolina Department of Natural Resources have been conducting satellite tagging studies of billfishes and sharks in offshore

waters of the southeastern United States since the year 2000. We have attached PTT-100 Archival Pop-Up Standard Rate or High Rate Archival Tags to 11 different highly migratory fish species that spend at least part of their lives in a broad area known as the “Charleston Bump Complex”. The Charleston Bump Complex is made up of two basic parts: The “Charleston Bump” and the “Charleston Gyre”.

The Charleston Bump is an area of high relief that rises out of the Blake Plateau approximately 90 nautical miles southeast of Charleston, South Carolina. The Charleston Bump causes an offshore deflection of

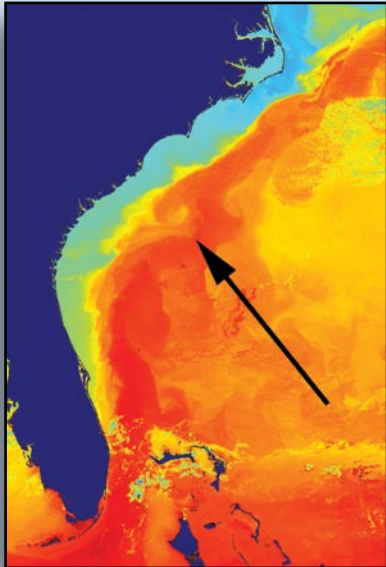
the Gulf Stream which forms a semi-permanent gyre (an area of counter-clockwise circulation) known as the “Charleston Gyre”. The Charleston Gyre causes upwelling of cold, nutrient rich bottom waters off the coast, and creates numerous thermal fronts and eddies. These hydrographic features make this a highly productive area which is important to a variety of highly migratory fish species during different stages in their life history.

Rather than focusing on any one species, our research focuses on the habitat of the Charleston Bump Complex and the highly migratory species that this habitat is important to. The goals of our research are to estimate migration patterns, habitat partitioning, post-release survival, and seasonal residency times for species that use this habitat.

One of the more common highly migratory species in the Charleston Bump Complex is the Atlantic sailfish (*Istiophorus albicans*). Atlantic sailfish are one of the smaller members of the billfish family Istiophoridae, and are widely distributed in tropical and temperate waters throughout the Atlantic and Pacific Oceans (Indo-Pacific sailfish are arguably a distinct species, *I. platypterus*). The Atlantic sailfish is common in our study area from approximately May to October, and

abundance varies roughly in accordance with seasonal surface water warming in spring and cooling in fall. Sailfish are commonly regarded as the fastest fishes in the ocean (capable of burst speeds in excess of 60 mph/97 kph), and are extremely slender and acrobatic.

Long term tag retention is one of the greatest difficulties encountered when conducting satellite tagging of any fast-swimming and agile fish. Though it seems counter-intuitive, we have found sailfish to have one of highest long-term tag retention rates of any species we have studied despite its slender build and acrobatic nature. Over the past three years, 50% (three of six) of 240-day interval tags attached to sailfish were retained for the



Sea-surface temperature satellite image of the southeastern United States. Note the deflection of the Gulf Stream current by the Charleston Bump and the resulting Charleston Gyre (black arrow).



A sailfish about to be fitted with a PTT-100 Archival Pop-up Tag.

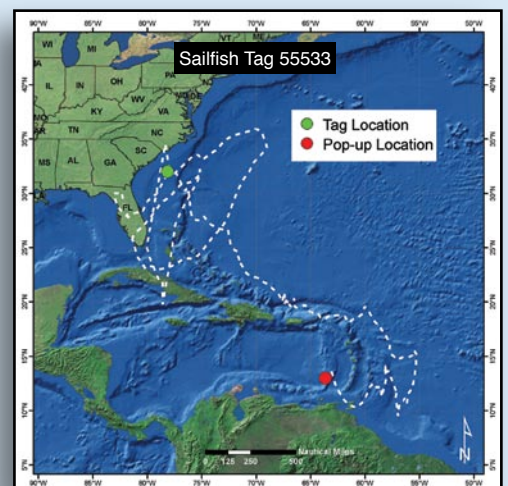
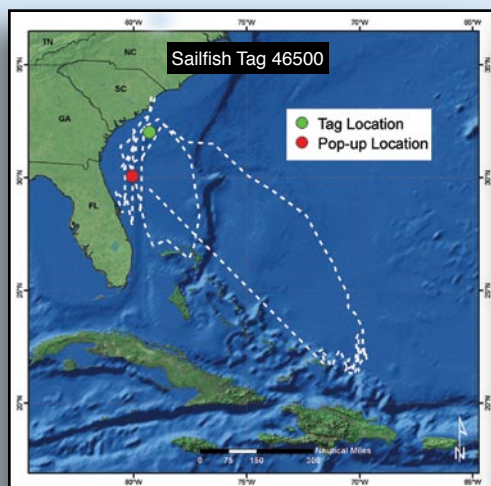
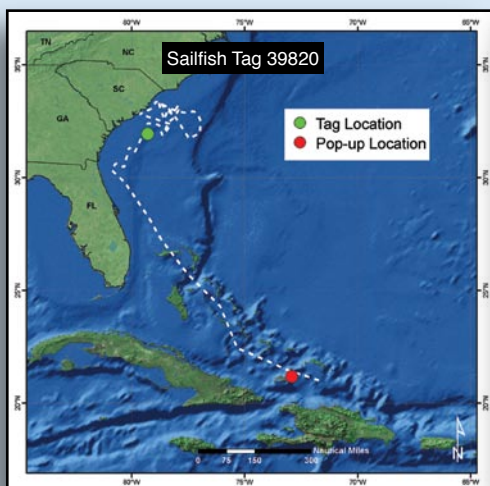
Photo by P. Weinbach

entire study period. Retention times for the other 240-day tags deployed on sailfish ranged from 6 to 81 days.

Light level geolocation data (*Footnote) from the three fully-retained 240-day tags has provided some interesting insights into potential sailfish migration patterns. All three of these long-term studies indicated movement from the Charleston Bump Complex to some area of the Caribbean or beyond.

Tag 39820 was deployed on 7/10/2003 and stayed in the Charleston Bump Complex for 130 days before beginning a long journey to the southeastern Bahamas on 11/19/2003. The tag made first satellite contact several km east of Great Inagua Island in the southeastern Bahamas 110 days later (on 3/10/2004). Tag 46500 was carried for the entire deployment interval and released on schedule off the coast of northern Florida. Geolocation estimates for this tag indicated a migration of approximately 1500 km from the tagging location off of South Carolina to the southeastern Bahamas by January of 2005. The fish apparently began to move back up the southeastern U.S. coast on a return migration when the tag reached its pop-off date in April 2005.

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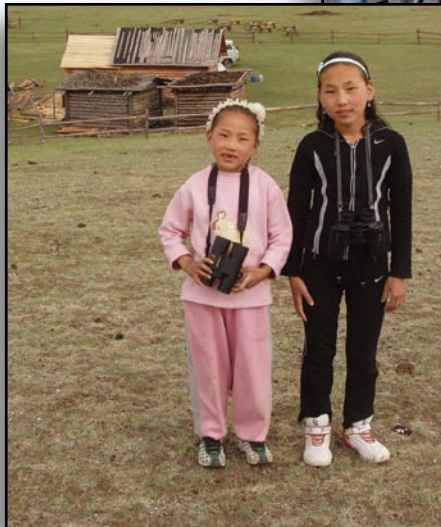
4 Tagging/pop-up locations and averaged geolocation calculations for three 240-day tags that remained attached to sailfish for the entire study interval.

A New Generation of Scientists

In celebration of our 15th anniversary, and as detailed in our last newsletter, we offered free transmitters for use in a project involving school children. Our aim is to introduce middle and high school kids to satellite tracking and an opportunity to experience field research. In so doing, we hope to foster a love of science and conservation.

We decided to sponsor not one, but two very deserving projects. The projects were chosen based on the benefit to the school children, their involvement in the project and the scope of the project.

We are delighted to sponsor the school children from Erdenebulgan Sum in rural Mongolia who will be tracking the Great Bustard breeding in their region, and from the Box Elder School District (four schools submitted one proposal) in Utah who will be tracking Marbled Godwits that migrate through the Great Salt Lake and Bear River Refuge.



A. Bulgan and A. Nyamaa, two school children from Erdenebulgan Sum, northern Mongolia, participating in Great Bustard pilot research in June 2006.



Photo by Kathi Stopher

Two classes of fourth graders from Box Elder School District are happy having just found out that they had won the free PTTs for their school project.

*Congratulations
to the winners!*

*We look forward to reading about their
projects in upcoming newsletters.*

Photo by Aimee Kessler

Max Update

Our readers may remember Max, the White Stork, from our winter 2005 newsletter. Max, born in May 1999 in Switzerland, was fitted with a solar 35 gram PTT in July 1999. Over the next 6 years Max was tracked to her wintering ground in Africa and back. This is an update on Max from Adrian Aebischer.

In 2006, Max was in her 5th breeding season near the village of Salem in Southern Germany. After having reared 4 young, Max left the breeding site on 9 September 2006. She took the same route as in past years to reach Spain. On 17 September, she crossed the Strait of Gibraltar for the 15th time and reached Africa. On 28 September, after having visited several places in Morocco, she arrived in her wintering quarter near the town of Guercif, Morocco.

Max has now been tracked for more than 7 years and 161 days as of December 1. We look forward to seeing her at her breeding site in 2007.



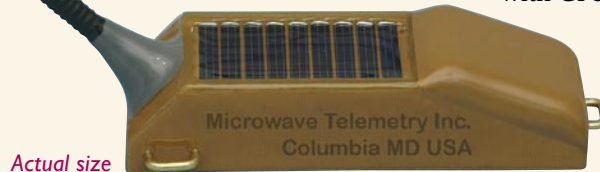
New Products

We start 2007 with two new exciting products, both of which are the result of extensive developmental efforts over the last 12 months. It is our Company's aim to continually stretch the limits to bring you, the biologist, the smallest, most advanced and reliable satellite telemetry devices available. It becomes ever harder to reduce the size and weight of devices as we get closer to the Holy Grail of a unit that weighs nothing and lasts forever!

22 Gram Argos/GPS PTT

In 2001 we introduced the 70 gram GPS enhanced solar backpack PTT; since then we have continually developed the technology through 5 generations of GPS PTTs.

Satellite tracking of birds has been revolutionized by the ability to track birds with GPS accuracy worldwide.



This latest version, weighing a mere 22 grams, continues this evolution. It retains all of the features of the larger versions, which include:

- 16 channel micro power GPS receiver
- Microprocessor controlled battery charge management
- SiV™ transmission schedule optimized for the new JTA schedule
- Temperature & Activity sensors
- Ground Track GT™ option

New GPS Data Parser

The latest version of our GPS parser software includes some new options. Temperature and battery voltage readings can now be output in raw or engineering values. PTTs fitted with Mortality Ground Track GT™ now indicate triggering of the mortality mode.

LC4™ GPS enhanced PTT data can now also be decoded with this parser.

New GPS PTT Software Option

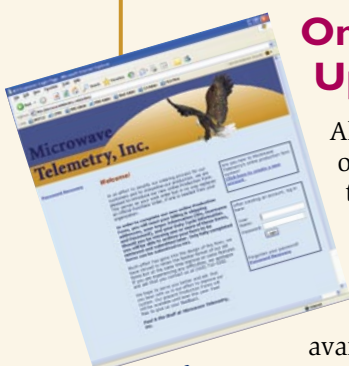
The present solar powered Argos/GPS PTTs record GPS location in 3D; they record altitude, heading and speed as well as latitude and longitude. An alternative version of the firmware will soon be available which records location in 2D only. This allows more data to be carried in each Argos message and so has several advantages:

- Lower overall power requirement to get locations “through” the system
- Capability of collecting more locations
- Better chance of receiving locations in areas of interference, e.g., Europe

FREE Mortality GT™ Option

Since its introduction in 2003, Ground Track GT™ has become one of the most valuable tools that researchers routinely add as an option to their PTTs to enhance their satellite tracking. Mortality GT™ switches your PTT into a conventional tracking transmitter when no activity is detected and mortality is sensed. Mortality GT™ is being used very effectively to find dead birds or detached PTTs. Seasonal GT™ comes on during certain “seasons” allowing researchers to locate the bird or the nest.

To celebrate our 15th Anniversary, we want to show our appreciation to you our customers by making Mortality GT™ free to all orders delivered in 2007. This would otherwise be a \$200 option. No substitution allowed or discount given in lieu.



Online Production Form Update

Almost all of our customers are now using our online Production Form. We are happy to report that the minor glitches we encountered, when first launched in June, have been ironed out. If you have not registered to use our new system, we encourage you to do so as our downloadable Production Forms will no longer be available after January 1, 2007.

The Winners are....!

The drawing for the winners of the GPS and 9.5g Solar PTTs will be made December 15 at our 15th Anniversary Celebration and Holiday party. The winners' names will be posted on our website within 24 hours of the drawing.

Next Generation Archival Popup Tag

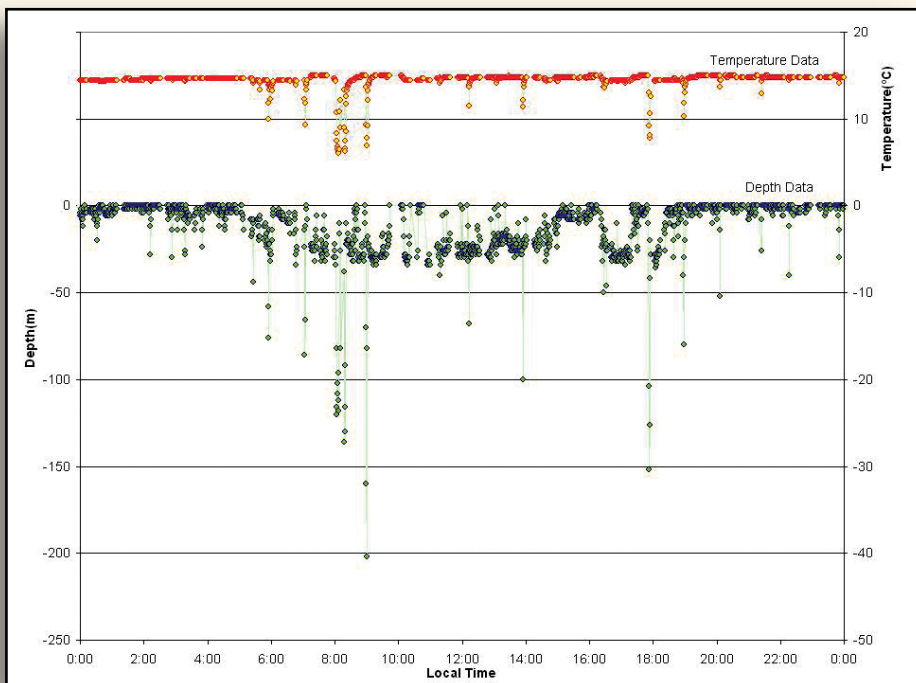
The introduction of our popup tag in 1997 revolutionized research on the travels of large pelagic fish. Since then, we have upgraded this tag's features many times though it physically remains the same as the original tag.

Over the last 2 years we have tested many new ideas on variants of this original tag. Fifteen years of miniaturizing our bird transmitters has made it possible for us to reduce the size of our electronics to around 2 grams. The challenge remained to design an effective smaller packaging. These innovations have now been put together in a smaller Archival popup tag. This new tag is roughly half the size and weight of the original tag and yet retains all of the original features plus many new ones. Full specifications will be available on our website in January. The improvements include:

- lower hydrodynamic drag
- lighter weight (40g)
- 15,000 message transmission capability
- embedded checksums with error correction capability
- 64 Mb non volatile memory
- longer battery shelf life

At the time of writing we have several of these next generation Archival popup tags deployed, both long term geolocating versions and high rate versions.

As we receive results from these tags, we will make them available on our website for your reference. So far the first three tags that have surfaced have performed as expected and transmitted impressive data sets back through Argos.



Graph shows one of many days of temperature and depth data transmitted back through Argos from this first new, smaller high rate tag deployed on a giant Bluefin tuna off Nova Scotia. In this high rate tag, measurements were recorded at a 40 second sample interval.

We expect this smaller tag to create a new revolution in fisheries research, making it possible to study smaller species and reveal their behavior and travels. The lower drag design is also an obvious advantage for studies of larger fish. It will be available in both a High Rate and long term Archival version in the spring of 2007 and will be competitively priced.

Sailfish, *continued from page 4*

Tag 55533 was deployed off South Carolina on 6/16/2005. Geolocation data suggested the sailfish stayed off the southeastern U.S. coast for approximately 85 days before making a gradual southeast movement to the Bahamas and eventually East of the Lesser Antilles until finally entering the Venezuelan Basin on approximately 1/8/2006. This is the longest recorded movement of any specimen of any species we have studied (approx. 2600 km straight-line distance). The fact that all three of these long term tags made a similar migration pattern from the Charleston Bump Complex to the Bahamas with broadly similar timing makes us suspect that this could be a major migration route for the western North Atlantic sailfish stock.

* Please note that geolocation estimates based on light levels are mathematically complex and provide a very broad estimate of a daily position for an animal that potentially moves hundreds of kilometers or more per day. Furthermore, geolocation estimates are subject to varying degrees of seasonal error (for example, during equinoxes), the error around each location is elliptical in nature (more error in latitude than in longitude), and error increases with proximity to the equator or the poles. Therefore, some daily position estimates may end up on land.



Challenge 06

Amidst cheers and people trying to get out of the way, “Red the Robot” rolled from our kitchen, down the corridor, took several turns and eventually emptied its container of water in a bucket! This was D day for Challenge 06 which Paul had given to two teams on our staff, the Red team and the Blue team. The aim was to build a robot capable of acquiring, transporting and watering a plant in our lobby. This fun exercise was designed to promote critical thinking, planning, designing, team work and ability to execute.

The two teams were each given a robot kit as a basic

tool but were allowed to order any other supplies needed. The robot had to carry at least 8 oz. of water but each additional ounce carried would score an extra point. One point would also be added for



Red the Robot: the winning entry of Challenge 06. Red weighed 2.25 lbs., carried one gallon of water, and had an ingenious design incorporating optical encoders around the wheels and bumper switches at the front.



Suzanne Colvin, from M&T Bank, and Paul present the awards.

each ounce that the robot weighed less than 8 lbs. A totally autonomous robot, completing his task without human intervention or radio control, would have its score doubled.

Each team met twice a week from mid May to mid August while keeping their progress a secret. Three independent judges as well as other guests were invited to our annual picnic. The teams were required to make a short presentation documenting their project before setting their robot to work. The judges scored on presentation, creativity and ingenuity.



Red Team enjoying their prize: spending the day visiting the Smithsonian Museums in Washington, D.C.

Terri's Notes... When Chris asked me to be a judge for “Challenge 06” I had no idea what was in store. She gave me a cool new embroidered shirt and a packet full of instructions. Having no scientific background whatsoever, I was wondering if I was in over my head. It was a bit intimidating, but also intriguing. The creativity involved in just the concept of the challenge was extraordinary (who thinks of these things??), how on earth could the challenge be successfully met? It seemed impossible.

The day of the event, I was nothing but amazed. Totally blown away, would be a better description. The thought, planning, engineering and execution of these robots was phenomenal. Watching them perform, everyone was caught up in the excitement of the moment(s). We all shared the disappointment when the Blue Team had difficulties, and the thrill of success for the Red team's triumph. **Kudos to both teams for an amazing accomplishment!**

I have no idea how they can top this, but I hope I am invited back again next year to find out.

Both teams had working, autonomous robots. The Blue team's robot took a wrong turn and spilt its water, wetting the electronics. The Red team's robot performed flawlessly until the very end. Theirs was also the lighter of the two, and carried more water. Their ingenious design incorporated optical encoders and front bumpers. To ensure the robot went straight even if the motors powering each side were going at different speeds, optical encoders were

used to compare the revolutions made by each motor and correct them so they were kept the same. To correct for any error still built up along the course, two bumper switches mounted on the front of the robot triggered upon contact with the bucket depending on whether the robot was facing the bucket or not. For instance, if only the left bumper switch was depressed then the robot knew it was too far to the right and corrected for this by backing up and turning left slightly, repeating



Blue Robot in action... filling a bucket (instead of overwatering the plant).



The winning Red Team (clockwise starting with back row) Cathy, Ken, Hanh, Ricardo, Eric and Russell (Captain).

until both bumper switches were triggered, indicating the robot was centered facing the bucket and ready to dispense its water.

Much fun was had by all who attended. Got any ideas for Challenge 07 or know of any engineers looking for employment? Email us at microwt@aol.com.



Judges: Terri, Charlie and Tom