

Microwave Telemetry, Inc.



Your success urges us on...

Dear Customers and Friends,

As we enter our next decade, our commitment to finding innovative solutions to your requirements urges us on. It is a daunting task to carry on Research and Development in parallel with manufacturing PTTs. However, our reward comes with your success in doing what was once impossible, including tracking the amazing journey of the Cory's Shearwater from the Selvagens to Brazil using our 18 g solar PTT. We thank Frank Zino, Manuel Biscoito and Ulrich Querner for a most interesting article.

In the last two years, we have also seen an increasing use of our Archival Pop-up tags on several shark species never tracked before. We thank Alex Antoniou and Marie Levine for a fascinating insight into the life of the Whale Shark; the photos included with their article are a treat for the eyes!

Last but not least, we proudly present to you the first in a series of articles submitted by the schools awarded free transmitters. We feel so privileged to be contributing something, however small, to the education of our children. We especially thank Jim Watson, Kent Woodruff and Mike Putnam for their article and their enthusiasm.

We wish you a good 2002 field season and we look forward to working with you.

*Sincerely,
Paul and the staff at MTI*



Our website has been updated.
Visit us at www.microwavetelemetry.com

New Products

70 gram Argos/GPS Parsing Software now available

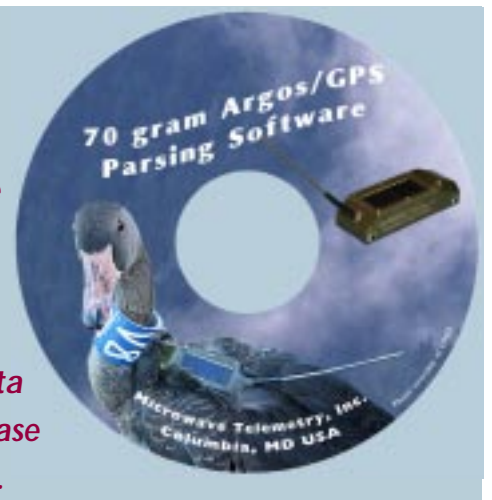
Our 70 gram Argos/GPS PTT has been deployed on Bald Eagles, pelicans and White-fronted Geese. The raw data collected from a GPS transmitter can be time consuming to interpret and manage. Some method of sifting through these reams of data is required to achieve the most effective use of the GPS technology. Users of our 70 gram Argos/GPS transmitter now have a program specially designed to extract data from DS files into a tab delimited format for each transmitter deployed. Use of this software will speed up the transfer of calculations and easily load the data into a database or into Excel. This software will be included at no extra charge with every shipment of GPS transmitters.

The software, a Perl script, takes the Argos sensor data and extracts the GPS information which includes: date and time, latitude and longitude, speed, course or direction, and altitude for each hourly reading.

Because the data is tab delimited, opening the file in a database or worksheet will organize the data into separate cells or columns. The data will be presented in a format for charting or further sorting according to your parameters. Additionally, when running the script, you can customize the organization of the data according to your needs.

Each CD will also include a PDF version of the 70 gram Argos/GPS Field Manual and a current copy of our website.

Use of this parsing software will speed up the transfer of calculations and easily load GPS data into a database or into Excel.



You Need to Know...

Two-page form— very important!

It is extremely important for our customers to fill out a two page form to initiate any work order. ***Until we receive a filled out two-page form, we cannot begin work on any transmitters!***

To make it easier for you to submit all the information we need, we have several new versions of the two-page form—for battery operated PTTs, solar powered PTTs, 70 gram Argos/GPS PTTs, SiV™ equipped PTTs and Archival Pop-up tags. We will gladly send one to you as a Word document or as a PDF.

Either version can be filled out and faxed back to us at 410-715-5295. However, the form in Word format can be filled in from your Word program and emailed back to us as an attachment.

Make sure that the form is completely filled in and returned to us in a timely manner, preferably six weeks before delivery of your PTTs. If the transmitters you are ordering are not standard devices, we may need more than six weeks lead time. Please contact us at microwt@aol.com if you have any questions.

PTTs with new 28 bit IDs

Many PTTs have been programmed with new 28 bit IDs issued by Service Argos, Inc. There are two ways that this may affect you:

1. If you are using a receiver that decodes the ID numbers, the receiver will probably decode only the root ID number. For a series of PTTs the root ID number will probably be the same for all of your PTTs.

Please consult your receiver manufacturer and Argos for an explanation of this—we have not programmed them all incorrectly with the same ID!

2. PTTs with 28 bit IDs transmit their sensor data differently. Ask Argos to set up your sensors for A1 processing of four sensors with 8 bits, 8 bits, 2 bits, and 6 bits, respectively. Otherwise you will probably only receive data from three sensors, which would not make sense.

Microwave Telemetry, Inc.

8835 Columbia 100 Parkway
Suites K and L

Columbia, MD 21045, USA

phone 410-715-5292

fax 410-715-5295

e-mail microwt@aol.com

web address www.microwavetelemetry.com



Feature Article, *Small is Beautiful*—Continued from page 3

In 2001 the Max Planck Institute provided us with Microwave Telemetry's lightweight solar powered PTTs. This released us from the battery duration factor and thus allowed us to attempt to follow the long annual migration to the south.

Two PTTs were attached on known birds returning to feed their chicks on Selvagem Grande on the night of 3 October, 2001. The method of attachment was of prime importance. Gluing to feathers would not have been practical, as the PTTs would have been moulted off. A Teflon harness, developed by Michael Kaatz from the MPI for use on Storks, was adapted.

The results have been astonishing. Both birds flew south almost in unison as far as the Cape Verde Islands. From there they crossed the Atlantic in the direction of Recife, Brazil. Here their routes diverged, one flying northwards up to Surinam where contact was lost after 85 days of excellent transmission. The other went down to the Argentine Basin, arriving there 64 days after leaving the Selvagens and only started on a northern migration on 12 April, 2002 (Fig. 3).

The results obtained were inconceivable until the advent of Microwave Telemetry's solar powered lightweight PTTs. After 193 days of regular and consistent transmission, one of the two birds is still being tracked and hopefully, by the time this article is published, we will have followed it home to its partner for the new breeding season.

Technology without day-to-day basic backup can fail. We must thank the Portuguese Navy and the Natural Park of Madeira for all their help provided in transportation and on the ground. Part of this success of this project is also due to them. ❖

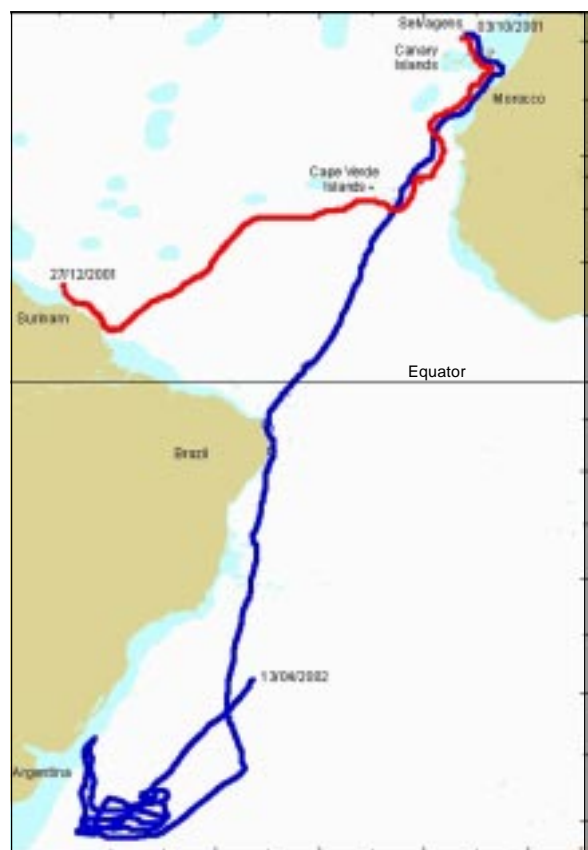


Figure 3: The routes of two Cory's Shearwaters fitted with 18 gram solar powered PTTs. One of the two birds is still being tracked.

Fifth in a series of *Feature Articles*

(Printed with permission)

Small is beautiful: The use of 18 gram solar powered PTTs on Cory's Shearwaters

Francis Zino¹, Manuel Biscoito¹, Ulrich Querner²¹Museu Municipal do Funchal (História Natural), Madeira, Portugal²Max Planck Research Centre for Ornithology, Vogelwarte Radolfzell, Germany

Cory's Shearwaters belong to the family *Procelariidae*, weighing on average 750–1100 grams. This species comes to nest in the NE Atlantic and from ring returns (over 40,000 in 33 years) we know that many birds migrate to South America and some to Africa. However, the major question of their migratory routes remained unanswered until the use of extra light satellite transmitters. PTTs small enough to be used on Cory's Shearwaters were only developed in the mid-nineties.

In 1997 a team from the National Natural History Museum in Paris, working with the Natural Park of Madeira and ourselves (project co-funded by EU-Life Project B4-3200/P/94765), made a first attempt to use Microwave Telemetry's 20 gram battery powered PTTs on incubating Cory's Shearwaters, on Selvagem Grande. The results, although promising, were inconclusive and all birds carrying PTTs were lost. The problem appears to have been the method of attachment.

During the breeding season of 1998, ten wooden replicas of the PTTs were put on birds for trial, from selected nests at Baía das Cagarras, Selvagem Grande. Instead of the harnesses used in the first attempt, replicas were glued to the back of the birds with fast drying epoxy-resin. In order to increase adherence, a small area between the wings was prepared by cutting some of the feathers away so that the replica would fit into a space where the feather stubs were only some 7 mm high. As soon as the glue dried, the birds were returned to their nest, where they quickly settled and continued to incubate. The application of the replicas was always carried out mid-morning when there was least bird activity in the area, thus diminishing the risk of the bird flying off after handling.

On 14, 15 and 16 June 1999, five real battery powered PTTs were put on some of the same birds, (Fig. 1) which had been fitted with the replicas in the previous year (three males and two females). The PTTs were programmed for continuous transmission. Birds were removed from the nest where they were incubating an egg and their weights and rings checked. Males weighed 870–1030 g and females 750–850 g. The transmitter's weight accounted for 2.9 percent of body weight of the lightest female.

The results were spectacular. All birds equipped with PTTs left for sea when relieved by their partner, and not before, and behaved normally. Of the five breeding pairs, only one failed, which was due to the incubating bird (with no PTT) breaking the egg.

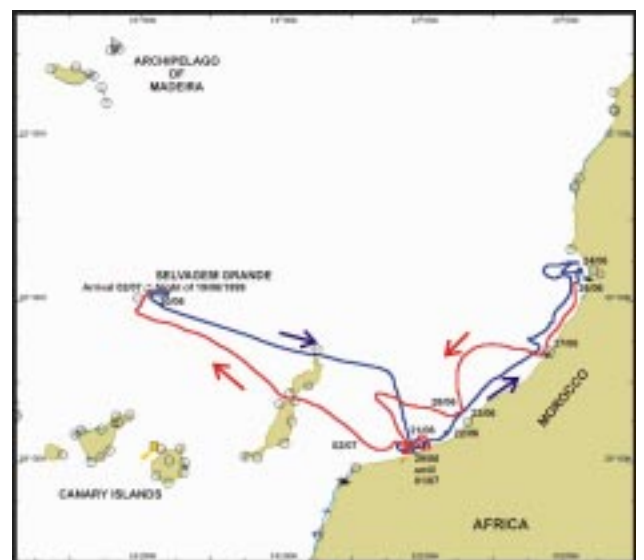
The route taken by two of the birds is shown in Figs. 2A and B. All birds flew southeast, passing by the eastern group of the Canary Islands towards the African coast. The number of days at sea ranged from 12 to 19, with distances covered ranging from 2,622 km to 4,252 km. No significant differences between males and females were found.



Figure 1: The major question of migratory routes of Cory's Shearwaters remained unanswered until the use of extra light PTTs.



Figure 2A and B: The routes of two Cory's Shearwaters fitted with a battery operated 20 gram PTTs, deployed in June 1999.



Continued on the right column of page 2

In the Winter 2000 issue of our newsletter, we invited readers to submit proposals for projects that involve school children in field research using our PTTs. Four school groups were awarded a total of eight transmitters for their research. Jim Watson of the Washington State Dept. of Fish and Wildlife, working with Liberty Bell Junior-Senior High School, is the first to report results back to us.

Taking the Classroom into the Field: Hawk Migration at Chelan Ridge, Washington

Submitted by Jim Watson, Kent Woodruff, and Mike Putnam

Liberty Bell Junior-Senior High School, located in north-central Washington near the town of Winthrop, lies in the shadow of a major hawk migration corridor along Chelan Ridge. Although over 2,000 hawks have been counted annually during the fall for a number of years, little is known about their long-range movements. Because the US Forest Service encourages public education and appreciation of hawk migration at the ridge, it was the ideal setting for seventh-grade students to participate in the field capture of hawks, learn about satellite telemetry, and track hawk movements on their own web page.



Chelan Ridge was the ideal setting for students to participate in the field capture of hawks and learn about satellite telemetry.



Students get hands on experience trapping and banding a Cooper's hawk.

Students had first hand experience in the capture, banding, and handling of raptors.

Telemetry

Two 18 gram solar PTTs were selected to deploy on adult Cooper's hawks, northern harriers, or northern goshawks. Migratory movements of these species are of interest at Chelan Ridge since they account for a high proportion of hawks that pass over the ridge. The recent advent of small PTTs made the possibility of following Cooper's hawks and harriers especially interesting, but required capturing birds of adequate weight. Late into the migration season, an adult female northern harrier and a juvenile northern goshawk were chosen for study. Migration of northern harriers



A telemetered adult northern harrier is ready for release.

Photos courtesy of Jim Watson and Kent Woodruff

Field Day

The project began with a school bus climb up the narrow mountain road to 1,800 meters. This was enough to get the students excited for an early October day in the field with snow already showing on the surrounding peaks. The hawks and eagles were moving when the students arrived. A golden eagle soared past on its way to winter areas right as the students got off the bus!

Students then got a close hand view of captured raptors, including one of the target species for the study, the Cooper's hawk. For most students this was the first time to see a raptor at close range, generating a great deal of interest and excitement over the prospect of monitoring the long-distance movements of a bird they had handled. Although on this day no Cooper's hawks of adequate weight were captured for telemetry, the stu-

dent migration of northern harriers has not been studied with satellite telemetry, but they are ideal subjects because of the high aspect ratio of the species (more efficient wing for continuous soaring and gliding and generous exposure to solar rays), and the associated very low wing loading (20 to 30 N/square meter) which makes them just about the most efficient raptor in terms of flight energetics. Northern goshawks are forest dwellers, but during migration they are exposed to adequate sunlight to operate the solar PTTs.

The Classroom

The enthusiasm generated in the field set the stage for classroom discussions. After demonstrating how to download and interpret Argos data and how to map geographic coordinates, students participated in a contest to pick the winter destination of the northern har-

Continued on page 6

Archival Pop-Up Satellite Tagging of Whale Sharks (*Rhincodon typus*) in Honduras and the Galapagos Islands

Alex Antoniou, Ph.D., and Marie Levine, Shark Research Institute

Whale sharks (*Rhincodon typus*) appear seasonally in the waters surrounding Utila, Bay Islands, Honduras and at Darwin Island in the Galapagos. In 2000 and 2001, the Shark Research Institute deployed archival pop-up tags on five whale sharks in Honduras and the Galapagos in an effort to gather data about their long-term and short-term movements. In addition to tracking data, behavioral data was also collected.

The whale shark, *Rhincodon typus*, is the largest fish in the sea, attaining a length of 12, possibly 18 meters. The first whale shark known to science was a specimen from Table Bay, South Africa, in 1838. By 1986, there had only been 320 recorded sightings of the shark in all of Western scientific literature, a measure of the rarity of the species. One of the objectives of this study has been to determine the annual movements of whale sharks in the Pacific Ocean and Caribbean Sea in order to concentrate our resources on securing government protection for the sharks in these areas.

SRI's goal is worldwide protection of whale sharks, including a global ban on trade in whale shark products. To achieve this objective it is necessary to accumulate baseline data. Scant data exists because the species was never considered commercially viable. However, in the mid-1990s whale sharks became a target species for the Asian market. For example, in 1999 three towns in India accounted for the slaughter of 1,000 whale sharks, all for the export market. Although whale sharks are slaughtered for their fins and flesh, they have far greater economic value as living resources for the dive tourism industry, and protection has been legislated for these ocean giants in the territorial waters of Australia, Honduras, India, the Maldiv Islands, the Philippine Islands, and the eastern seaboard of the United States.

The Shark Research Institute tracked three whale sharks using satellite telemetry along the coast of East Africa (1998-2000) and two whale sharks off the coast of Utila, Honduras, but none of the tags remained attached to the host animal for more than a month. The size and drag of the satellite tags resulted in their premature detachment from the host animals. The development of new pop-up archival tags manufactured by Microwave Telemetry has helped overcome this hurdle; their small size and minimal drag coefficient permits them to remain attached to the host animal for much longer time periods.

Attachment of satellite, ultrasonic, data recording (archival) or passive visual tags usually involves baiting a shark, capturing it by hook and line and restraining the shark either on or along the side of the support vessel. In the case of whale sharks, a species that feeds on zooplankton and reaches lengths of 40' and longer, this is not possible. In this study, free-swimming whale sharks were tagged by divers using modified spearguns.

Divers in this study attached the tags using a rubber-powered speargun (manufactured by JBL Enterprises, Inc.), modified with a plastic stop-ring 15 cm from the



The whale shark is the largest fish in the sea and can attain a length of up to 18 meters.



The small size and minimal drag coefficient of the new pop-up archival tags permits them to remain attached to the host animal for much longer time periods.



The whale shark is tagged with a modified speargun to prevent the tag anchor from penetrating the musculature of the shark.



Photos courtesy of Alex Antoniou

Continued on the bottom of page 8

Taking the Classroom into the Field—Continued from page 4

rier. Winning students received photos of the telemetered hawk. The highlight of the classroom sessions, however, was the construction of cardboard Microwave PTTs and their deployment on “balloon birds.” The most impressive birds had color-coordinated antennas—something Microwave Telemetry might consider as an option!

Results

After weeks of anxious anticipation, the students were provided Argos locations of hawks to begin plotting in the classroom and for web page mapping, and estimating rates of migration. Between 10/16/01 and 11/11/01, the northern harrier migrated 2,407 km from Chelan Ridge to Lake Mead, Nevada. The hawk migrated an average of 89 km/day during the 27 days. Maximum distance recorded during a 27 hour period was 253 km; a rate of 9 km/hr. Flight estimates for consecutive locations were analyzed for three diel movements between 3 and 7.5 hours; flight speed ranged from 14.7 to 32.5 km/hr. There was no evidence of night migration. During the period between 11/11 and 12/25, when the hawk became localized, she occupied a winter range of 36,031 square kilometers in southern Nevada and Arizona, based on 108 locations. The hawk made a quick visit to the Grand Canyon just before Christmas and returned to Nevada, about which time the activity sensor indicated the PTT became stationary. As of early February, biologists in Nevada have been unable to verify the status of the bird, but the PTT continues to function.



Student's balloon bird with cardboard PTT

The northern goshawk provided only a brief glimpse of migration. One location was received from the hawk within a week after she was telemetered, showing she had moved about 60 km northwest. After that time, a location was received in December, and another in January. These locations were of too low quality to reveal her location, but the temperature reading and activity sensor suggested she was still mobile. It is quite possible she damaged the antenna resulting in the poor-quality transmissions, but that could not be confirmed.

Although we anticipated being able to monitor hawk movements through spring migration, the two subjects we selected did not allow this aspect to work out. The main goal of enlightening students at an age where they can choose to pursue scientific endeavors was realized very successfully. Some of the students have indicated a desire to help with the project in coming years. Overall, this cooperative project has stimulated student thinking far beyond that achieved in only a classroom setting. Through hands-on experience students have learned how state-of-the-art technology (i.e., satellite telemetry) is used to answer biological questions, including: the unpredictable nature of biological field work; facts concerning hawk morphology and physiology, migration ecology, and survival; how the scientific process is conducted, from generating hypotheses or questions to be answered, to collecting the data, interpreting it, and reporting it; how to interpret and plot map information, and use of the internet for communicating that information; and a greater appreciation for the treasure of Chelan Ridge in their own backyard.

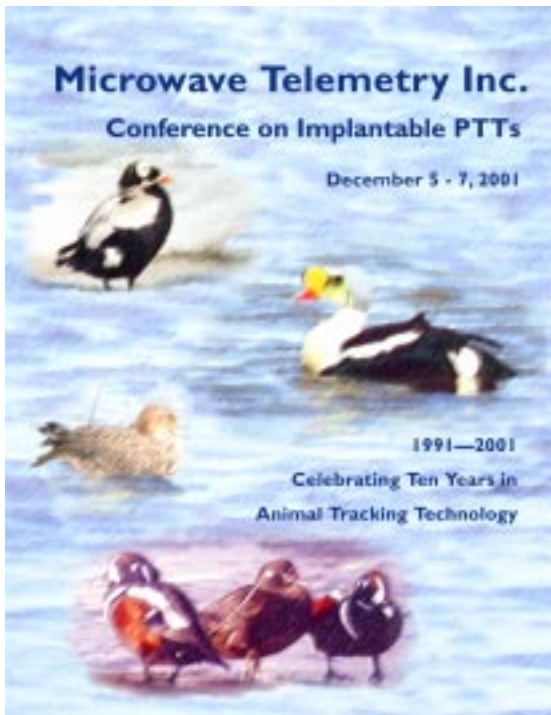


Migration of female northern harrier from Chelan Ridge, Washington to southern Nevada

Future

Students are preparing a web page of the study to be accessed by other students in and outside the school from the school web site (www.methow.org). The web page will provide an “ask the expert” section, where students will have the opportunity to ask questions that will be answered by the biologists on-line. Although it appears no further data will be provided from the study birds, Hawkwatch International is providing data from other telemetered birds from Chelan Ridge, so students can use real-time downloading and tracking of hawks on classroom maps. At the conclusion of the study students will provide comments to evaluate the project. This is important, because the success of the project has prompted the cooperators to look at how to continue the study in future years including the selection of student interns who will participate in upcoming hawk capture, banding, and telemetry studies. ❖

Implantable PTT Conference a Success!



The increasing use of implantable PTTs is revealing surprises in the study of migratory routes of endangered species.

Microwave Telemetry hosted a conference on Implantable PTTs in the first week of December 2001. The conference was designed for biologists who track waterfowl and seabirds and for the veterinarians who implant the PTTs. This relatively new technology was developed by Microwave Telemetry for Margaret Petersen in the early 1990's to track the wintering location of the Spectacled Eider.

The conference provided a rare chance for field biologists and veterinarians to meet and share experiences, ideas and suggestions with each other and with the manufacturer. Close to fifty attendees heard presentations from biologists and veterinarians and participated in a round table discussion led by Dan Mulcahy, a pioneer in implanting PTTs.

All agreed that the conference was a well-timed opportunity to relate successes and failures with surgical implantation of transmitters in many species of waterfowl and seabirds. It was also an occasion to trade tips on the capture and implantation of birds with as little stress to the animal as possible.

Tours of Microwave Telemetry gave everyone a chance to ask questions about the manufacturing process and to give Paul their input or "wish list" for future PTTs.

The last day of the conference, attendees toured the Patuxent Wildlife Refuge in Laurel, MD. They visited the veterinary hospital, where implant procedures are performed, the breeding area for whooping and sandhill cranes, as well as the educational center.



Participants at our Implantable PTT conference, December 2001.



Presentations, round table discussions, networking during breaks, and conversation over lunch gave biologists and veterinarians opportunities to talk shop and to trade ideas and methods.



PTTs Awarded at Holiday Party

To close out our tenth anniversary celebration, we offered our customers a chance to win either a 70 gram Argos/GPS PTT or an 18 gram Solar PTT. The drawing was held at our annual holiday party on December 7, 2001.

Congratulations to:

Peter Nye of the New York State Department of Environmental Conservation—winner of an 18 gram Solar PTT

Claire Mirande of the International Crane Foundation—winner of a 70 gram Argos/GPS PTT.



Employees, friends, supporters and colleagues gathered at the Columbia Sheraton for a luncheon and party to close out our tenth anniversary. There were so many people to thank for their support.

A chocolate covered raspberry filled cake slightly larger than our 95 gram PTT—suitable for tracking ostrich perhaps...



Tagging of Whale Sharks, Continued from page 5

end of the spear (tag applicator) which prevented the tag-anchor from penetrating the musculature of the shark, but leaving it securely fastened in the epidermis. The tag is attached to the tag-anchor by a 15-20 cm monofilament tether. Each tag was preprogrammed by the manufacturer to detach itself from the host animal on a specific date. When detached, the positively buoyant tag floated to the surface and transmitted archived data to the Argos Satellite System.

To date, five Microwave Telemetry archival pop-up satellite tags have been deployed on whale sharks: three in Honduran waters, and two in the Galapagos. In addition to locational data, water temperature and depths were recorded. The tags deployed in this study were programmed to remain attached to the host animals for periods ranging from twelve days to six months. Data received from these tags has provided a glimpse into the habitat use and day-to-day lives of the whale shark. For example, until recently, it was thought that whale sharks spent their adult lives close to the surface. Data accumulated in this study reveals that the sharks spend time at depths in excess of 2,000 feet in water temperatures colder than 10°C!

Deployment of additional tags in 2002 will provide important information on seasonal movements of whale sharks and we may find additional areas that the sharks visit. The lessons we have learned regarding the use of this new technology has potential application to the conservation of other threatened and endangered species. ❖



Above: Paul Howey from Microwave Telemetry, Inc. looks on as Debbie Shaw, from Service Argos, Inc., announces the winner of the 18g Solar PTT.

Santa surprised everyone when he arrived at the holiday party with a sack full of goodies. Santa must know someone on the inside—he really did know who had been naughty or nice!



Inside...

- You need to know... p. 2
- Feature Article—*Tracking Cory's Shearwaters* p. 3
- Taking the Classroom into the Field p. 4
- Tagging Whale Sharks p. 5
- Implant Conference p. 7