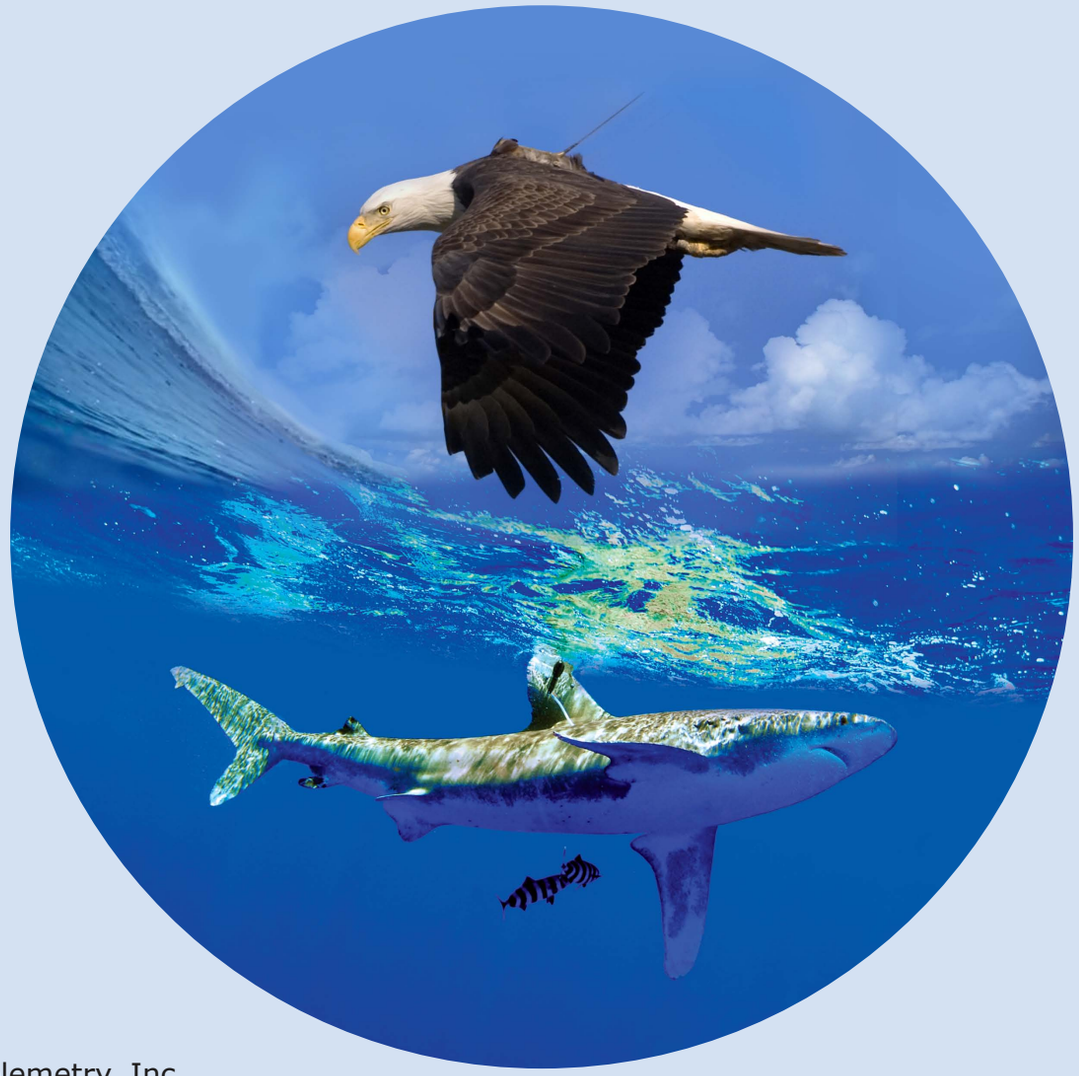
Microwave Telemetry, Inc.

2012 Avian & Marine Tracking Conference March 27-30



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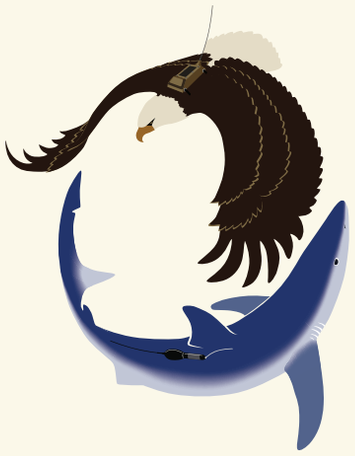
Taking Biotelemetry to New Horizons

Conference Schedule

Welcome to the Microwave Telemetry, Inc.
2012 Avian and Marine Tracking Conference

We thank you for joining us and we hope you enjoy your stay.

Paul & the staff at MTI



Tuesday, March 27, 2012

7:45 **Breakfast in Terrace C**

9:00 **Welcome in Terrace A and B**

9:05 Evolving with Telemetry: Personal Reflections from 40 Years of Raptor Research
Keynote Address – Jim Watson

9:35 Using Satellite Telemetry to Determine Survival and Movements of Juvenile Sea Ducks
Abby Powell *and Rebecca L. Bentzen*

9:55 Tracking Bald Eagles in the Chesapeake Bay: Nests, Roosts, and Concentration Areas
Elizabeth Mojica *and Bryan D. Watts*

10:15 **Break**

10:35 Peregrine Fund Aplomado Falcon 5g Solar PTT Study
William Heinrich

10:55 Moving Targets: Using Satellite Telemetry to Monitor Illegal Hunting of Great Bustards in Mongolia
Aimee Kessler, *Natsagdorj Tseveenmyadag, Batbayar Nyambayar, Batsuur' Dashnyam and Andrew Smith*

11:15 Habitat Selection by Mountain Hawk-Eagle, ***Nisaetus nipalensis***
Manabu Abe

11:35 Where Have You Been Birdie? Using Satellite Telemetry Information to Reduce Raptor-Human Conflicts
Brian Washburn

11:55 Leg Loops or Pelvic (Rappole) Harnesses – Does it Work with Solar Tags?
Lubomir Peske

Tuesday, March 27, 2012

12:15 **Atlantic and Great Lakes Sea Duck Migration Study**
Alicia Wells-Berlin, *Ronald E. Therrien, Matthew C. Perry, Timothy D. Bowman, Scott G. Gilliland, Jean-Pierre L. Savard, Christine Lepage, Taber D. Allison, Keith McAloney Kevin M. McBride, Lisa Vormwald and Peter C. Osenton*

12:35 **Lunch**

2:00 **Satellite Tracking of Peregrines in Arctic Russia: Usefulness of Argos Locations in Home Range Studies**
Vasiliy Sokolov, *Andrew Dixon, Alexander Sokolov and Nicolas Lecomte*

2:20 **Using Biotelemetry Tools to Assess the Effects of Augmented Feeding on Migration Patterns of Great White Pelicans through Israel**
Ohad Hatzofe, *Yoav Bartan, Nir Horvitz and Ran Nathan*

2:40 **Difficulties with Ducks**
Susan Sheaffer *and Richard A. Malecki*

3:00 **Following Migrating Introduced Whooping Cranes with Satellite Telemetry**
Glenn Olsen

3:20 **Break**

3:40 **Avian Attachment Workshop – Elizabeth Mojica**

4:20 **Visit to MTI Facility**

Wednesday, March 28, 2012

7:45 **Breakfast in Terrace C**

9:00 **Welcome in Terrace A and B**

9:05 **Dispersal and Migration Patterns of Atlantic Bluefin Tuna Challenge Management Paradigms and Provide New Information for Stock Assessment**
Keynote Address – Molly Lutcavage

9:35 **Preliminary Results on the Use of X-Tags To Delineate Critical Habitat of The Spotted Eagle Ray (*Aetobatus narinari*) in Florida Gulf Coastal Waters**
John Tyminski, *John Morris, Kim Bassos-Hull, Peter Hull, Dean Dougherty and Robert Hueter*

9:55 **The Importance of Remote Monitoring in the Effort to Re-Establish California Condors to Self-Sustaining Populations**
Mike Wallace

10:15 **Break**

10:35 **Use of PTTs to Evaluate Winter Site Fidelity Among Pacific Common Eiders**
Margaret Petersen, *David C. Douglas, Heather M. Wilson and Sarah E. McCloskey*

10:55 **Argos/GPS PTT Data Enable Finely Scaled Studies of Habitat Selection, Foraging Ecology, Toxicology, and Correlates of Mortality in Swallow-Tailed Kites and Snail Kites**
Kenneth Meyer, *Gina M. Kent, Jennifer O. Coulson, Dean W. Demarest, Philip C. Darby and Kristen M. Hart*

11:15 **PSAT Deployments in Coastal Fishes: Challenges and Opportunities**
John Graves *and Andrij Z. Horodysky*

11:35 ***Scolopax rusticola* without Frontiers: The Ural Mountains and Beyond**
Joseba Felix Tobar-Arbulu

11:55 **Using X-Tags to Unravel the American Eel's Mysterious Migration from the St-Lawrence Estuary to the Sargasso Sea**
Mélanie Béguer, *José Benchetrit, Martin Castonguay, Kim Aarestrup and Julian J. Dodson*

Wednesday, March 28, 2012

12:15 **Vertical and Horizontal Movement Patterns of Archival Satellite Tagged Spiny Dogfish, *Squalus acanthias* in the Northwestern Atlantic**
Amy Carlson *and James Sulikowski*

12:35 **Lunch**

2:00 **Navigation and Orientation in Migrating Ospreys: Insights from Satellite Telemetry**
Rob Bierregaard *and Mark Martell*

2:20 **Demographic Variation in Vertical Habitat Use and Deep Diving Behaviour in the Caribbean Reef Shark (*Carcharhinus perezi*)**
Edd Brooks, *Annabelle Brooks, Lance Jordan and Lucy Howey-Jordan*

2:40 **The Impact of Major Weather Events on Migrating Whimbrel (*Numenius phaeopus*)**
Fletcher Smith, *Bryan Watts, Elizabeth Mojica, Tim Keyes, Barry Truitt and Brad Winn*

3:00 **Post-Release Survival and Habitat Utilization of Juvenile Swordfish in the Florida Straits**
Jenny Fenton, *Arthur Mariano and David Kerstetter*

3:20 **Break**

3:40 **Movements and Habitats of Ducks in Argentina Based on Satellite Telemetry**
Matthew Perry, *Alicia M. Berlin and Glenn H. Olsen*

4:00 **Utilization of Bahamian Shark Sanctuary by the Oceanic Whitetip Shark – Refuge from What Lies beyond**
Lucy Howey-Jordan, *Edd Brooks, Annabelle Brooks, Debra Abercrombie, Sean Williams, Emily Gospodarczyk, Lance Jordan and Demian Chapman*

4:20 **The Post-Natal Dispersal Ecology of the Hen Harrier (*Circus cyaneus)* in England**
Stephen Murphy

4:40 **Migratory Movements of Long-Billed Curlews (*Numenius americanus*) from Three Breeding Populations**
Lee Tibbitts, *Gary W. Page and Nils Warnock*

6:00 **Cocktail and Dinner Reception in Terrace C and D**

Thursday, March 29, 2012

7:45 **Breakfast in Terrace C**

9:00 **Welcome in Terrace A and B**

9:05 The Argos System: Enabling Science
Bill Woodward *and Debbie Stakem*

9:35 Taking Biotelemetry to New Horizons
Paul Howey

10:35 **Break**

10:55 Getting the Most Out of Your Microwave Telemetry Experience
Cathy Bykowsky

11:10 The Power of the Parser – Accessing Your GPS Data
Ted Rollins

11:30 From Programming to Pop-Off: Understanding PSAT Data Reports and Recent Advances
Emily Gospodarczyk

12:00 The Argos System: Better than Ever
Michel Guigue

12:35 **Lunch**

2:00 Movebank: an Online Archive and Tool for Analysis and Sharing of Animal Tracking Data
Roland Kays *and Martin Wikelski*

2:20 Using GPS Telemetry Units to Study the Ecology of Nesting Golden Eagles in North Dakota
Anne Marguerite Coyle

2:40 Predation on Dovekies by Monkfish over Deep Water in the Northwest Atlantic Ocean
Matthew Perry, *Lance Jordan and R. Anne Richards*

Thursday, March 29, 2012

3:00 **Break**

3:20 **Small Solar Tags on Large Birds or Birds with Long Contour Feathers – How to Avoid Shielding?**
Lubomir Peske

3:40 **A Review of Pop-Up Satellite Archival Tag Attachment Methods for Teleost and Elasmobranch Fishes**
David Kerstetter *and Kristina A. Trotta*

4:00 **Natal Dispersal of Golden Eagles (*Aquila chrysaetos*) from Southern California 1988–2011**
Dave Bittner, *Chris Meador, Jim Hannan, Jeff Laws, James Newland, Renee Rivard, Katie Quint, Brittany Schlotfeldt and Jeff Wells*

4:40 **Visit To MTI Facility**

Friday, March 28, 2012

7:30 **Breakfast in Terrace C**

8:30 **Geolocation Workshop in Terrace C (lunch will be provided)**

Abstracts

Evolving with Telemetry: Personal Reflections from 40 Years of Raptor Research

James W. Watson

Washington Department of Fish and Wildlife, 600 Capitol Way N., Olympia, WA 98501-1091

Advancements in telemetry technology and the resulting growth in our understanding of ecological relationships have been mind-boggling for those who have been involved in avian research for several decades. Raptor movements are no longer assessed solely from band returns, VHF transmitters, and long searches from fixed-wing aircraft. Beginning in the early 1990s when light-weight satellite transmitters became available, our raptor research projects in the Pacific Northwest have provided an interesting history of the evolution of PTT technology and the increasing scope of what can be learned through satellite telemetry. In early years, we investigated Bald Eagle (*Haliaeetus leucocephalus*) migration (battery powered Argos PTTs) and then in the early 2000s tested utility of increasingly smaller (i.e., 20g!) PTTs on several raptor species while participating in MTI's School Projects. The advent of solar-powered GPS units in 2005 allowed us to document detailed range-wide migration characteristics and mortality factors of 120 of Ferruginous Hawks (*Buteo regalis*), and more recently have relied on the accuracy of GPS PTTs to determine home range characteristics and residency of Washington's Golden Eagle (*Aquila chrysaetos*) population. We are presently studying range use patterns, mortality factors, and survival of GPS-telemetered Buteos in relation to wind turbines, and plan to test the efficacy of the new micro, 5g PTTs on merlins in 2012. Although our studies are not unique, collectively they generate anticipation for benefits of further miniaturization of PTT components and high expectations for what we will be able to learn from the next generation of satellite transmitters (and biologists!).

Using Satellite Telemetry to Determine Survival and Movements of Juvenile Sea Ducks

Abby N. Powell and Rebecca L. Bentzen

Alaska Cooperative Fish and Wildlife Research Unit,
University of Alaska, Fairbanks Alaska

Little is known about the survival and dispersal of juveniles for most species of birds, particularly those species that spend much of their time at sea. King Eiders (*Somateria spectabilis*) spend most of their lifecycle in remote marine habitats, and young birds do not return to terrestrial habitats until they are old enough to breed (> 3yrs). Recent improvements to satellite transmitter technology allowed us to track juveniles (n = 61) from when they left their natal grounds in northern Alaska for up to two years. First-year survival was estimated as 65% (95% CI: 0.53–0.76), while second-year survival was close to 100% (95% CI: 0.94–1.00). Juveniles staged in the Beaufort Sea prior to their first fall migration up to 61 days. Individuals wintered in 3 discrete regions around the Bering Sea overlapping with adult wintering areas. Second-year birds had large winter home ranges and lack of fidelity to first year winter regions, suggesting that this is a period of exploration. During summer, first-year birds either remained on winter areas or moved north along the coast, whereas second-year birds returned to marine areas off the natal breeding grounds, likely prospecting for future reproduction. Five females visited terrestrial areas close to their natal sites in their second summer. Molt and molt migration were very synchronous among individuals, suggesting a strong selection pressure on the timing of wing molt. Locations and timing of use of at-sea areas are critical for determining areas of high conservation concern.

Tracking Bald Eagles in the Chesapeake Bay: Nests, Roosts, and Concentration Areas

Elizabeth K. Mojica and Bryan D. Watts

Center for Conservation Biology at the College of William and Mary
and Virginia Commonwealth University, Williamsburg, VA, USA

The Chesapeake Bay is an important convergence area for Bald Eagle (*Haliaeetus leucocephalus*) populations along the Atlantic Coast of North America. The tidal reaches of the Bay support approximately 1300 breeding pairs of Bald Eagles. In addition, non-breeding eagles from the northern US states and Canadian provinces migrate to the Bay in fall and winter and from the southern states in spring and summer. During 2007-2011, we captured 67 adult and subadult Bald Eagles in Maryland and Virginia. Capture dates were stratified to target both the resident population and northern and southern migrants. Birds were fitted with 70g solar powered GPS-PTTs or GPS-GSM transmitters using a backpack harness. Movements ranged throughout the lower and upper parts of the Bay with concentrations in the upper reaches of the major tributaries, Conowingo Dam, Aberdeen Proving Ground, and on the Delmarva Peninsula. Identification of communal roosts and concentration areas will assist in future conservation of these areas for eagles.

Peregrine Fund Aplomado Falcon 5g Solar PTT Study

William Heinrich

The Peregrine Fund, 5668 West Flying Hawk Lane, Boise, Idaho, USA

The Northern Aplomado Falcon was last seen in the American Southwest in the 1950s, leaving its niche in the grassland ecosystem unfilled for decades. The Peregrine Fund began raising the falcons in captivity and releasing them to the wild shortly before the falcon was added to the U.S. Endangered Species List in 1986. A self-sustaining population has been established in South Texas, but in the Chihuahuan desert part of their range the population of established pairs dropped dramatically in 2010. As a result, a telemetry study was launched during the 2011 release season. The results showed extremely high predation with the loss of 71% of the released falcons. Ten Microwave Telemetry 5g solar PTT units were placed on falcons. With the use of the Argos AL-1 PTT locater, we were able to recover five transmitters from dead falcons and place them on live ones. At the end of the season, five of the transmitters were eventually lost, four were recovered and in hand, and one is still sending out signals in Mexico. This year we plan to release falcons in South Texas where we already have an established population. Ten new PTT units will be placed on released falcons there. We suspect that a number of birds may be nesting to the south in Tamaulipas, Mexico, and possibly further north than where the core population is located.

Moving Targets: Using Satellite Telemetry to Monitor Illegal Hunting of Great Bustards in Mongolia

Aimee Kessler[1], Natsagdorj Tseveenmyadag, Batbayar Nyambayar, Batsuur' Dashnyam and Andrew Smith

[1]Arizona State University, Tempe, Arizona, USA

Only 2000 individuals of the Asian subspecies of Great Bustard (*Otis tarda dybowskii*) are estimated to remain. Despite this low number and reports of continued decrease, data are lacking on factors influencing this decline. Over the past six years we have used Argos/GPS solar-powered PTTs to monitor 14 adult Great Bustards captured on their breeding grounds in northern Mongolia. By longitudinally tracking individual birds we have been able to investigate mortalities with the goal of elucidating factors limiting population growth. Ten mortalities have been recorded so far, occurring an average of one year after monitoring on a bird was begun. By examining physical evidence at the site of last transmission and interviewing local people, we determined the cause of mortality for each bird. Causes of death thus far have included poaching, poisoning, and collision with power lines. Two deaths were determined to be due to natural causes. Poaching has caused 50-70% of recorded deaths. This high rate of mortality, coupled with Great Bustards' long maturation time and low reproductive rate, is likely a major driver of the decline of the Asian subspecies. All deaths occurred on varied stopovers across a 2000 km migratory path and on wintering grounds in China. Thus, conservation efforts across a broad swath of territory are urgently needed to slow declines of the small remnant populations of Asian subspecies of Great Bustard.

Habitat Selection by Mountain Hawk-Eagle, *Nisaetus nipalensis*

Manabu Abe

Raptor Japan

The Mountain Hawk-Eagle is a resident of tropical to temperate zones in Asia. Throughout Japan, the eagle is a non-migratory forest-dwelling raptor. It breeds in dense multilayered mountain forest and mixed forests of coniferous and broad-leaved trees on mountain slope. The eagle was considered to be a large, secretive raptor living in remote, mountainous thick forest areas. Therefore there is scarce biological information on this species. Though the hawk-eagle lays one egg without exception every year, it rarely lays two eggs. The parents produce a young at one or two-year intervals. I put a 70g Solar Argos/GPS PTT on an adult male hawk-eagle in Sept. 1, 2008 in Gifu Prefecture, central part of Japan. This PTT is still active (more than 3.5 years; 1,306 days). It was found that contrary to information it inhabits the mountainous hinterland, it had been living in the vicinity of the large Hida City. The eagle had his home range where surrounded the City, population size was 26,291. The eagle is depending mainly on man-made areas, such as paddy field, artificial plantation forest, road and river side and so on, where it found plenty of wildlife. Four hundred ninety-five location points were acquired in and around the City. These produce 156 quadrats in his habitat at random. Some quadrats in mountain area have no location point, and some have one point, some have two, and so on. Each quadrat has 3.17 location points on an average. As a result of habitat selection analysis revealed that the eagle selected significantly cultivated areas.

Where Have You Been Birdie? Using Satellite Telemetry Information to Reduce Raptor-Human Conflicts

Brian E. Washburn

USDA/APHIS/Wildlife Services National Wildlife Research Center, 6100 Columbus Avenue, Sandusky, OH 44870 USA; (419) 625-0242; brian.e.washburn@aphis.usda.gov

Conflict situations related to raptors and humans are becoming more frequent and diverse due to a variety of factors. Human populations are growing at exponential rates and urbanization is occurring worldwide. Conservation successes in North America have resulted in increasing populations of several raptor species, including Ospreys and Bald Eagles. Also, the adaptability of some raptors has allowed them to thrive in suburban/urban landscapes. The nature of raptor-human conflicts is complex, with situations of human activities negatively affecting raptor populations (e.g., environmental contaminants, wind energy development), raptors negatively affecting humans (e.g., raptor-aircraft collisions), and raptors affecting other species of wildlife (with associated human values). Concurrently, there is widespread public interest in raptors with a strong concern that raptor populations be protected. Effective, publically accepted methods to alleviate raptor-human conflict situations are needed. Information obtained from GPS-capable satellite telemetry technologies deployed on free-ranging raptors has the potential to provide a greater understanding of the breeding, migration, and wintering ecology of raptors, in addition to providing data critical to understanding the spatial and temporal dynamics of raptor-human conflict situations. As one example, information collected from migrating satellite-tagged Ospreys was evaluated to assess the risk they pose to military aircraft operations along the Eastern seaboard. Incorporation and integration of Osprey movement information (e.g., timing, travel routes) into military flight mission planning systems increases pilot awareness of potential Osprey-aircraft collisions during critical time periods and allows for military flight operations to occur at times and locations that minimize the risk of these collisions.

Leg Loops or Pelvic (Rappole) Harnesses: Does it Work with Solar Tags?

Lubomir Peske

Czech Society for Ornithology, Prague, Czech Republic

In last 17 years I installed 233 tags (PTTs, VHFs, dataloggers not included) on 19 mostly medium and large species of birds and made extensive tests of different types of attachments in Zoos and breeding centers. Whereas at the beginning the standard backpacking was preferred the leg loops (Rappole harnesses) we mostly used even on extra large birds in last decade. Recapture and removal/replacement of tags is a standard part of projects rather than different untestable weak links for a natural tag shed (recovery rate depends on species, money and activity, above 50% in some periods but still above 1/3 on average). Standard Teflon ribbon works well in all cases (except geese) even on large birds of prey (Golden Eagle, vultures, storks). Leg loops are very effective in many ways: fast installed, less ribbon, safe shed, not visible except in flight, well tolerated, etc. In total it forms 50% of harnesses recently especially on young birds without final size. I did not record failure except one when tag was lost. Tags should be as long as possible with a "noose" and there are some other modifications recommended to avoid tag reversal. Rubber loops are dangerous in this aspect. However, it was unsure whether it can be used for solar tags at all. All depends on location, bird species and its behavior. Examples of very efficient solar tags on leg loops (Bald Ibis) are discussed.

Atlantic and Great Lakes Sea Duck Migration Study

Alicia M. Wells-Berlin[1], Ronald E. Therrien[1], Matthew C. Perry[1], Timothy D. Bowman[2], Scott G. Gilliland[3], Jean-Pierre L. Savard[4], Christine Lepage[4], Taber D. Allison[5], Keith McAloney[6], Kevin M. McBride[1], Lisa Vormwald[1] and Peter C. Osenton[1]

[1]U.S. Geological Survey, Patuxent Wildlife Research Center, 12100 Beech Forest Road, Laurel, Maryland 20708, U.S.A.
[2]U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503, U.S.A.
[3]Environment Canada, Canadian Wildlife Service, 6 Bruce Street, Mount Pearl, Newfoundland A1N 4T3, Canada
[4]Environment Canada, Science and Technology, Wildlife Research, 1141 Route de l'Église, P.O. Box 10 100, Québec, Québec G1V 3W5, Canada
[5]American Wind Wildlife Institute, 208 South Great Road, Lincoln, Massachusetts 01773, U.S.A.
[6]Environment Canada, Canadian Wildlife Service, 17 Waterfowl Lane, Sackville, New Brunswick E4L 1G6, Canada

In 2009, the Sea Duck Joint Venture (SDJV) partnership launched an ambitious, large-scale satellite telemetry study of sea ducks in the Atlantic Flyway to document sea duck distribution, migration patterns, and seasonal habitats used. The study is designed to: 1) identify important wintering, breeding, and staging areas, 2) identify important habitats within these areas, 3) investigate annual variability in migration patterns, 4) investigate site fidelity to seasonal habitats, and 5) investigate wintering ground movement patterns and variability of habitat use. Black Scoters staging in Baie des Chaleurs in spring bred from Northern Québec to the Northwest Territories, molted in James Bay, staged near Cape Cod in fall, wintered from Chesapeake Bay to South Carolina, and used different migration routes in spring and fall (~1000 km shorter in fall). Surf Scoters molting along the Labrador coast migrated over or around the Gaspé Peninsula (Québec), wintered from Cape Cod to North Carolina and staged in the St. Lawrence and near Cape Cod in fall. White-winged Scoters molting in the St. Lawrence Estuary, staged there and near Prince Edward Island in fall, wintered in Lake Ontario, Newfoundland, Gulf of St. Lawrence (Québec), Cape Cod (Massachusetts) and Long Island (New York) suggesting that molting locations are selected independently of wintering areas. Long-tailed Ducks traveled from wintering areas in Nantucket Sound, through eastern Hudson Bay area to breeding areas in the arctic, and returned via a similar route. Long-tailed Ducks instrumented on wintering areas in Chesapeake Bay apparently bred in arctic habitats but, unlike ducks marked at Nantucket, migrated through the Great Lakes and western Hudson Bay. Maps illustrating migration patterns of marked birds and other information about this study can be found at http://seaduckjv.org/atlantic_migration_study.html.

Satellite Tracking of Peregrines in Arctic Russia: Usefulness of Argos Locations in Home Range Studies

Vasiliy Sokolov[1], Andrew Dixon, Alexander Sokolov and Nicolas Lecomte

[1]Institute for Plant and Animal Ecology, Ural Division, Russian Academy of Sciences

Peregrine home range movements were studied in 2009-11 on the Yamal Peninsula, Russia. In 2009, we fitted Argos satellite transmitters (PTT-100 18 g Solar, Microwave Telemetry, Inc., USA) to 10 breeding peregrines (9 females and 1 male). We used satellite telemetry to investigate movements, home range size and overlap in neighbouring adult birds at different stages of the breeding cycle and discuss our findings in relation to prey availability and the constraints imposed by parental care. The polar orbit of the Argos satellites means that we received a large proportion of high quality signals, providing accuracy for determining range use. The number of high quality signals (LC 2 & 3) was 4,389 from a total of ca. 6,700 signals. The average home range size on the Yamal Peninsula was 115 km² (MCP 95%) over the whole breeding season. Over the breeding season, female home range quadrupled after the early brooding period and then tripled again after the chicks fledged. With such expansion, home range boundaries increasingly overlapped between neighbouring females, while prey availability increased, first with the fledgings of passerine followed by hatching of waterfowl and waders. The seasonal pattern of home range variation throughout the breeding cycle enables breeding activity to be monitored remotely using satellite telemetry in inaccessible regions such as the Russian Arctic.

Using Biotelemetry Tools to Assess the Effects of Augmented Feeding on Migration Patterns of Great White Pelicans Through Israel

Ohad Hatzofe[1], Yoav Bartan[2], Nir Horvitz[2] and Ran Nathan[2]

[1]Science and Conservation Division, Nature and Parks Authority, Jerusalem, Israel
[2]Movement Ecology Lab, The Hebrew University of Jerusalem, Jerusalem, Israel

The entire western Palearctic population of roughly 40,000 Great White Pelicans (*Pelecanus onocrotalus*, hereafter GWP) migrates through Israel to/from the African wintering grounds twice a year. The drainage of the Hula lake in 1957 and the Amiq lake in 1975 have strongly constrained the stopover opportunities of such a large number of GWPs migrating across the Rift Valley. In Israel, in particular, where appropriate wetlands are no longer available and intensive inland fish farms are well developed, migrating GWPs depend mostly on the commercial fish stock. To mitigate the conflict and to enable the GWPs to complete their migration, the Israeli Nature and Park Authority (NPA) is supplementing each year approximately 110 tons of non-commercial fish for the GWP. This unique management measure is, however, costly and controversial. It raises several questions if this practice might trigger GWPs to winter rather than to migrate (as has happened to Eurasian cranes in Israel over the last two decades), or whether GWPs that fed ad lib would indeed shorten their stay in Israel and lessen the pressure on the fish farms? To address these questions, we trapped 160 GWPs and fitted 16 units of GPS transmitters over the last two years. Because addressing these questions requires quantifying and understanding GWP movements at different levels of resolution across multiple spatial and temporal scales, we applied three different GPS-telemetry devices, including six GPS PTTs combined with GPS dataloggers (with a download capacity via UHF) and ten GPS GSM (with a download capacity via VHF). Our tracking project has enabled detecting an unknown breeding colony of the species in central Turkey, and revealed multiple mortality events that can be attributed to different human-related factors. We shall present preliminary analysis of the pros and cons of addressing this management problem by using different tracking devices and different sampling frequencies.

Difficulties with Ducks

Susan E. Sheaffer and Richard A. Malecki

Livingston Ripley Waterfowl Conservancy, P.O. Box 210, Litchfield, Connecticut, 06759, USA

The pairing of GPS capability with satellite transmitters has revolutionized our ability to learn about the habitats used by animals. However, like many new technological developments, researchers are often quick to apply this technology without knowledge about potential limitations of transmitter performance relative to a specific species. During 2009-2011, we conducted a series of experiments using both 22 g and 30 g solar GPS satellite transmitters on captive ducks at the Livingston Ripley Waterfowl Conservancy. Our objectives were to identify the causes of missed GPS locations from transmitters on live ducks, to evaluate the impact of seasonal changes in duck weights on harness fit and transmitter performance, and to compare two different harness designs. The performance of an individual transmitter depended on a number of factors, which varied greatly among individual birds. The bird's behavior, its location and the time of year all played a role in the realized success of a transmitter. The relatively close proximity of the front of the transmitter to the head and neck of a duck sometimes affected the ability of the transmitters to obtain their GPS locations. In addition, GPS success rates of 30 g transmitters were higher than that of 22 g units. Ducks readily adjusted to a Teflon ribbon harness; however, harnesses with elastic caused significant skin deterioration under the transmitter. Our studies identified potential limitations to GPS satellite transmitters on ducks, but this knowledge will improve our ability to design effective habitat assessment studies for ducks using this technology.

Following Migrating Introduced Whooping Cranes with Satellite Telemetry

Glenn H. Olsen

USGS Patuxent Wildlife Research Center, Laurel, Maryland USA

Starting in 2001, whooping cranes (*Grus americana*) have been introduced into eastern North America. The first 4 years, reintroductions were all done by training whooping cranes to follow costumed people, and some of these people would lead the cranes using ultralight aircraft. The whooping cranes are led south in the fall to two wildlife refuges in Florida. Once the whooping cranes spend the winter in Florida they migrate back north to Wisconsin on their own, but are tracked by members of the monitoring team. All whooping cranes on their first migration have VHF legband transmitters, and a third of the cranes have Microwave Telemetry PTTs mounted on legbands. In 2005 an additional method to reintroduce whooping cranes was developed, called the direct autumn release. In this method, the whooping cranes were again reared by costumed humans, but were not led south by them but rather were released in close proximity to some of the previously introduced whooping cranes who would then lead the new releases on their first migration. In 2011 our ultralight-led migration was shut down by the Federal Aviation Administration (FAA) when the cranes were only half way through the route. The birds were trucked to Wheeler National Wildlife Refuge in northern Alabama where they received their legbands with radio transmitters and were released in early February of 2012. We will be reporting on their progress north at the meeting.

Dispersal and Migration Patterns of Atlantic Bluefin Tuna Challenge Management Paradigms and Provide New Information for Stock Assessment

Molly Lutcavage

Large Pelagics Research Center, Dept. of Environmental Conservation, UMass Amherst,
PO Box 3188, Marine Station, Gloucester, MA 01931

Migrations of Atlantic bluefin tuna (ABFT) from specific western Atlantic foraging grounds are not well described and the extent of their spawning areas is mainly surmised. Current ABFT management is based on a two stock structure, east and west, with assumptions of separate spawning grounds, spawning site fidelity and low mixing rates. Western ABFT are believed to spawn annually in the Gulf of Mexico, and Eastern ABFT in the Mediterranean Sea, and are assumed to have different size/age at maturity. However, since 1997, "giant" ABFT that we released with pop-up archival satellite tags (n > 520) on the NW Atlantic shelf displayed multiple, distinct dispersal patterns. Most fish with PSAT tags remaining on until the following summer and fall did not enter a known spawning area during their presumed spawning period, and returned to their tagging locations the following year, even after dispersing to different regions of the North Atlantic. The assumption that fish that don't visit known spawning areas are sexually immature is not supported by maturity evaluation of fish sampled over the same time period and geographic region. Integrated findings on ABFT movements and ecological status provide evidence that current management paradigms may be incorrect, and call for the development of new approaches utilizing spatially explicit, fishery independent information from electronic tags in stock assessment.

Preliminary Results on the Use of X-Tags to Delineate Critical Habitat of the Spotted Eagle Ray (*Aetobatus narinari*) in Florida Gulf Coastal Waters

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The spotted eagle ray (*Aetobatus narinari*) is a large marine ray with a widespread distribution and is listed by the IUCN as Near Threatened with a decreasing population trend. In the Gulf of Mexico, this species is protected in Florida waters but is not protected by other states, in U.S. federal waters, or in Mexico, where a specialty fishery harvests more than 7,000 individuals every year. In 2010, we deployed four Microwave Telemetry X-Tags on spotted eagle rays captured off Sarasota, Florida to investigate their long-term migratory patterns. The rays (3 females, 1 male), ranging in size from 150-168 cm disc width, were outfitted with tags programmed to pop-up after 120-270 days. X-Tags were secured with one of two attachment methods ("through-wing" or "tail-band" method), which were both tested in captive trials at Mote Marine Laboratory. Of the four deployed X-Tags, two failed to report at all, one failed to report but was recovered, and one reported early. The two tags that provided data apparently remained attached to the live, free-swimming rays for periods of four days for one and four hours for the other. The depth profiles during these short deployments revealed regular vertical movements from the surface to depths of as much as14 m. The reasons for the early detachments are unclear but there is evidence of possible post-release mortality/predation for one of the rays. We are testing a new "through-tail" attachment method and plan on new deployments on spotted eagle rays in the coming year.

The Importance of Remote Monitoring in the Effort to Re-establish California Condors to Self-Sustaining Populations

Mike Wallace

San Diego Zoo's Institute for Conservation Research

California Condors once ranged from British Columbia to Northern Baja Mexico. Human pressures caused their near extinction with 20 birds alive by the early 1980s. After much discussion and controversy the last bird was removed from the wild in 1987 to form a captive flock of 27 birds evenly distributed between the Los Angeles and San Diego Zoos according to sex and genetic line. The first breeding was in 1988; by 1992 sufficient offspring allowed the first releases in southern California of two yearling birds to the wild. Since then, more production and release sites have increased the population to almost 400 birds; 180 in captivity and 209 in the wild. Telemetry is critical in allowing us to study mortality, the successes and failures of nesting attempts as well as mortality factors such shooting, collisions and electrocutions with power lines and lead poisoning from hunter shot animals in their environment. VHF and GPS transmitters were first tested on Andean condors in Peru and Argentina to develop the most efficient patagial attachment technique with the first GPS transmitters tested on wild Andean condors in the mid 1990s. Each released condor carries a VHF transmitter and many have a GPS transmitter attached to the opposite wing as well. These help us track their movements to assist with management of food placement as we teach inexperienced birds how to forage. We also scientifically study their behavior and movements as they explore and learn to adapt to their new environment.

Use of PTTs to Evaluate Winter Site Fidelity among Pacific Common Eiders

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A challenge in managing populations of wide-ranging seabirds is locating them when away from their breeding grounds. It is then possible to evaluate distribution and movement patterns to provide insight into the natural history of a species and aid in its conservation and management. In northern marine habitats, sea ice plays an important role in variability in the distribution and movement patterns of many species and the quality and availability of winter habitat. To understand the influence of ice on a northern sea duck, we marked 25 adult Pacific common eiders (*Somateria mollissima v-nigrum*) at Cape Espenberg, Alaska, with implanted satellite transmitters and followed them for a two-year period to their wintering areas in the northern Bering Sea. We examined changes in winter site fidelity in relationship to home range characteristics and ice. Ninety-five percent of individuals were found within the 95%UD of the previous year, and 90% were found within their 50%UD. Spatial distributions of winter locations between years changed for 32% of the individuals. Characteristics of polynyas varied substantially and likely had an effect on the size of winter ranges and movements within polynyas. These movements were correlated with changes in weather which in turn affected ice conditions. Although ice conditions varied substantially between polynya, and within and among years, the common eiders monitored in this study showed a high degree of fidelity to their winter areas over two consecutive years.

Argos/GPS PTT Data Enable Finely Scaled Studies of Habitat Selection, Foraging Ecology, Toxicology, and Correlates of Mortality in Swallow-Tailed Kites and Snail Kites

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Microwave Telemetry's small Argos/GPS PTTs make it possible to resolve critical questions about the conservation ecology of rare species of great conservation concern. By discovering large pre-migration communal roosts and estimating detectability and turn-over rates of tagged Swallow-tailed Kites from the U.S. breeding population, we are identifying vitally important habitat features and land parcels, refining survey methods, and improving population size and trend estimates. On the South American winter range, where previous tracking revealed higher than expected mortality, GPS locations will improve our chances of recovering dead kites to determine likely causes of death. Foraging sites for Snail Kites of the resident U.S. population carrying the same model Argos/GPS PTT will be the focus of snail, vegetation, and hydrologic sampling. These prey and habitat data will be analyzed in relation to arrivals and departures of the tagged Snail Kites (i.e., what factors influence movements?). Copper concentrations determined from successive tissue sampling of the tagged kites will be analyzed with regard to copper levels in snails at successive kite foraging locations to determine whether this metal, long used as a fungicide in citrus groves and detrimental to bird reproduction, is being acquired by the kites. Copper levels in snails are extremely high at some planned water storage sites essential to Everglades restoration. These reservoirs are expected to draw large numbers of foraging Snail Kites, which are federally listed as endangered. Such study designs would be impossible without bird-borne GPS tracking devices.

PSAT Deployments in Coastal Fishes: Challenges and Opportunities

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The development of the Microwave Telemetry X-Tag provides opportunities to tag schooling coastal fishes that were too small to carry the larger PTT-100 tags. However, smaller schooling fishes and their coastal and estuarine environments present a suite of different challenges than those we experienced in our previous tagging studies of large pelagic fishes. In particular, we were concerned with the potential for premature release of tags because of entanglement in physical structure, fish-tag interactions that would result in premature release or tag damage (tag predation), and the likelihood that tags would effectively transmit the archived data from nearshore waters. To evaluate movements, habitat utilization and post-release survival of coastal fishes, we deployed 10 X-Tags programmed to release in 30 days on striped bass (*Morone saxatilis*), and 17 tags with release times ranging from 30 days to six months on red drum (*Sciaenops ocellatus*). We received transmissions from 9 of 10 striped bass tags and 16 of 17 red drum tags. The one non-reporting striped bass tag was subsequently recovered (with the fish) two and a half years after deployment. No striped bass tags released prematurely, but three red drum tags did so within a few weeks of each other, suggesting possible tag predation. Tag reporting rates varied widely as some tags washed ashore shortly after surfacing while others floated upright for the entire data transmission period. However, the low transmission recoveries from beached tags were offset by the high likelihood of physically recovering the tag which allowed 100% data collection.

Scolopax rusticola without Frontiers: the Ural Mountains and Beyond

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One of the main preoccupations we have had since we started our experiments in 2006 has been the following: Do the woodcocks cross the Ural Mountains? Where do the woodcocks which are in the other side of the Ural Mountains go in their migration? In what direction do they travel? How far? In February 2010 with the prototype that MTI gave us in 2008 and after its recovery in Karelia in 2009, the woodcock Karelia was released in Cantabria. During a long period of time, according to some woodcocks' literature, the Ural Mountains have been considered the boundary between two kinds of Eurasian woodcocks: the ones of the West of the Urals and the ones of the East. Karelia has proved that at least some of them are able to cross these mythical mountains. In fact, here a couple of new records for the annals of woodcock's research: a) Karelia has traveled around 6,380 km from Cantabria (Spain) up to the surroundings of Tayga, in the Kemerovo Oblast, Russia and b) Karelia has not only crossed the Ural Mountains, but has also gone far beyond the Urals.

Using X-Tags to Unravel the American Eel's Mysterious Migration from the St-Lawrence Estuary to the Sargasso Sea

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Anguillid eels are notorious for the remarkable migrations they undertake to oceanic spawning grounds after the onset of reproductive maturation in continental waters. Without a doubt, these are some of the most impressive examples of migration and navigation in the animal kingdom. Yet after over a century of research, most information surrounding their migration remains a complete mystery. The recent advent of miniaturized pop-up archival transmitter tags has enabled researchers to acquire novel information for several eel species but many questions remain unanswered. The American eel, *Anguilla rostrata*, inhabits continental waters from southern Greenland to northeastern South America. Adults undertake a migration toward a singular spawning site in the Sargasso Sea. Neither the exact location of the spawning ground, nor the migration routes and the predominant environmental conditions along these routes, are known. In this study, 8 American eels were, for the first time, fitted with archival-tags (X-Tags). All eels were released in the St-Lawrence estuary in October 2011. All tags popped prematurely (after 20 to 68 days) as a consequence of an unexpectedly high predation rate by larger fishes. Our efforts, nevertheless, provide the first significant pieces of information regarding the behavior of American eels in the Gulf of Saint Lawrence. As observed for other anguillids, tagged eels exhibited daily vertical migrations. Furthermore, according to depth and temperature data recorded by the tags, eels appear to follow the deep Laurentian Channel while in the Gulf. This year, a further 10 eels are set to be tagged.

Vertical and Horizontal Movement Patterns of Archival Satellite Tagged Spiny Dogfish (*Squalus acanthias*) in the Northwestern Atlantic

Amy Carlson and James Sulikowski

University of New England

Over the last several years, the spiny dogfish (*Squalus acanthias*) stock abundance in the Northwest Atlantic Ocean has been of concern due to anomalous population, as quantified by spring and fall National Marine Fisheries Service bottom trawl surveys. To obtain a better understanding of the movement dynamics of this species, X-Tags have been attached to spiny dogfish at a northern and southern point at opposite ends of their geographic range. Ten adult male and 13 adult female dogfish fixed with tags were deployed in the Gulf of Maine, off the coast of Portland, Maine. In addition, 19 adult female and one adult male were released off the Outer Banks, North Carolina. So far, 31 of the tags have popped and transmitted data. Approximate geolocations and vertical movements within the water column were derived from light level, pressure, and temperature records and have been filtered and corrected using bathymetric and sea surface temperature data using derivations of kftrack and ukfsst modeling packages in R, Matlab, and ArcGIS. Reconstructed tracks ranging in durations from 2 to 12 months are being used to elucidate the seasonal migration paradigms, which show to be more localized than previously published. In addition, vertical movements show distinct, dynamic diel patterns with deepest recorded depths ranging from 70 to over 600 meters, and temperature profiles suggest distinct temperature preferences. Based on this preliminary data, it appears that dogfish populations and migration patterns estimated from NMFS surveys may not be as indicative to these old archetypes as once thought.

Navigation and Orientation in Migrating Ospreys: Insights from Satellite Telemetry

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How birds navigate between breeding and wintering areas, often thousands of kilometers apart, remains one of Ornithology's most puzzling mysteries. Decades of experiments with a host of bird species have demonstrated that the many cues birds use for simple orientation and astonishing navigation include landmarks, the position of the sun and stars in the sky, polarized light at dusk and dawn, the Earth's electromagnetic field, and even perhaps smell. Since 1998 we have tagged 42 juvenile Ospreys (*Pandion haliaetus*) in Minnesota (7) and the eastern US (35). Comparisons of the tracks of naïve Ospreys with those of adults provide insights into how juvenile Ospreys learn the route to their wintering grounds that they will use as adults. Eastern adult Ospreys move south in the fall over a fairly narrow front from the coast inland, funneling to Florida and then on to Cuba, Hispaniola, and thence across the Caribbean to South America. In marked contrast, roughly 1/3 of all eastern young we tagged migrated over the Atlantic Ocean in non-stop flights of up to 50-60 hours, covering as much as 1,700 km of open water. We argue in this presentation that it is on the first trip north that the Ospreys that crossed the Atlantic in their first fall migration learn the migration routes they will follow as adults. Two juveniles that wandered roughly 1,000 km west of the "normal" route for eastern birds corrected for the displacement, indicating that they had either an innate or an acquired sense of east vs. west. In addition, the tracks of two juveniles that wandered far west of the "normal" path for east coast Ospreys demonstrate that they can somehow sense east vs. west.

Demographic Variation in Vertical Habitat Use and Deep Diving Behaviour in the Caribbean Reef Shark (*Carcharhinus perezi*)

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The Caribbean reef shark (*Carcharhinus perezi*) is the most economically and ecologically significant species of shark in The Bahamas, yet despite its significance, its fundamental biology and ecology remains minimally understood. The primary objective of this study was to characterise the short term vertical habitat use of the Caribbean reef shark in the north-east Exuma Sound, The Bahamas. High rate (30-day) X-Tags were deployed on five mature Caribbean reef sharks(M = 2, F = 3). All five tags remained attached for the full 30 days and reported on time. Complete data recovery (90%-100%) was achieved for four tags and 35% recovery for one, yielding a total of 38,274 data points. Caribbean reef sharks spent 77.8% of the time in water <40 m but regularly made dives >200 m. Shallower mean depths were maintained during crepuscular periods and marginally deeper mean depths during the daylight hours ($X^2 = 1561.42$, $p < 0.001$). Females maintained deeper mean depths than males ($X^2 = 14.71$, $p < 0.001$). Logistical modeling indicates that depth records in excess of 80 meters were more common in females than males ($X^2 = 1293.34$, $p < 0.001$), and more likely to occur during daylight hours ($X^2 = 40.25$, $p < 0.001$). This suggests that deep diving behaviour, rather than sustained variation in vertical habitat use, is the primary factor influencing the observed sexual and diurnal differences in depth association. Further investigation into the long term movement patterns and vertical habitat of this species using PSAT technology is recommended.

The Impact of Major Weather Events on Migrating Whimbrel (*Numenius phaeopus*)

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Many shorebird species that breed in eastern Canada have experienced precipitous declines in recent decades. However, the details of their migration and what factors they encounter during migratory flights are poorly understood. The Western Atlantic Coast population of Whimbrel (*Numenius phaeopus*) has declined in recent years and migrates between breeding grounds within the high latitudes of Canada and northern South America. From 2008 to 2011 we outfitted 19 migrating Whimbrel with Microwave Telemetry 9.5g PTT satellite transmitters. Our objectives were to connect breeding grounds to winter areas, delineate migration routes, identify key stopover areas, and investigate factors confronting Whimbrels en route. During this long-term tracking study we documented encounters between migrating Whimbrel and major storm systems including 7 with hurricanes, 6 with tropical storms, and 6 with large fronts. Many of these encounters have been within the Caribbean Basin, a major corridor for the development of tropical systems and an area that represents a significant flyway for many shorebirds during fall migration. Two examples from 2011 include one Whimbrel that flew into the eye of Hurricane Irene, averaging 48kph throughout, and another that flew through Tropical Storm Gert, flying 400km in 27 hours before averaging 144kph for several hours after encountering tailwinds of that storm. Secondary factors such as hunting affect the survivorship of migrating shorebirds as they encounter storm systems. The movement of large numbers of birds through the Caribbean coincides with peak hurricane season. Encounters documented between transmittered Whimbrels and tropical storms may have implications for other Caribbean migrants.

Post-Release Survival and Habitat Utilization of Juvenile Swordfish in the Florida Straits

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The use of pop-up satellite archival tags (PSATs) allows a researcher to overcome limitations associated with acoustic, conventional, or archival type tags. Previous research techniques have provided information on short-term movements, migrations, and behavior patterns, but there is still a need for additional tagging studies with "second generation" tags with depth and light data and increased memory that will further define the activity patterns and migratory behavior of swordfish in the North Atlantic. PSATs have been successfully used on other large pelagic fishes, but have yet to be used on juvenile swordfish. This project investigates two topics: the post-release survival rates of 20 juvenile swordfish after being released from the recreational rod-and-reel fishery or buoy fishery in the Florida Straits, and habitat utilization following release. High-resolution PSAT technology is being used to estimate post-release survival; analysis will be done using the "Release Mortality" program. Data gathered by the PSATs will also be used to analyze behavioral interactions with the fishing gear, such as habitat utilization patterns, and compared with other descriptions of swordfish behavior. A deterministic, periodic model is being developed to fit to the data and describe the fish's habitat utilization. It has four amplitude parameters, two each for the daily and lunar cycle, and a mean depth value. This model will aid in identifying any diurnal and lunar signals in the data as well as any patterns in the residual data. This study is a collaborative effort, utilizing local fishermen to conduct the field work.

Movements and Habitats of Ducks in Argentina Based on Satellite Telemetry

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During August, 2008, 2009, and 2010, 100 ducks were instrumented in Corrientes Province, Argentina. Instrumentation was done with use of an improvised indoor surgery and holding facility. All transmitters used were 26-gram PTT-100 implantable (Microwave Telemetry, Inc.) with an external antenna (percutaneous). Surgery techniques were similar to those developed for seaducks in North America. Each duck transmitted with a duty cycle of 4 hours on and 60 hours off. The white-faced whistling ducks were most commonly caught in all three years of the study, but an attempt was made to have equal numbers of instrumented rosy-billed pochards and three species of whistling ducks (black-bellied, fulvous, and white-faced). Transmission time in days varied from a mean of 250 days to 474 days. The average distance traveled by the ducks from the ranch was greatest (350.2 km) for rosy-billed pochard and shortest (146.3 km) for fulvous whistling ducks. The greatest mean distance traveled for instrumented white-faced whistling ducks was during the month of April when movements exceeded 300 kilometers. The rosy-billed pochard seemed to have the most dispersed distribution, and was not associated with the estuarine lagoons of the coast. Rosy-billed pochards were recorded in four South American countries. Although there was a slight tendency for the ducks to move south, there was not the clear north/south movement that is seen with ducks in North America every spring and winter. Main habitat types used by ducks were natural wetlands and cultivated areas. Rice fields were the predominant areas used among cultivated fields.

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Utilization of Bahamian Shark Sanctuary by the Oceanic Whitetip Shark – Refuge from What Lies beyond

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Once considered among the most abundant pelagic predators, the oceanic whitetip shark (*Carcharhinus longimanus*) has drastically declined in the last 25 years due to overexploitation. This species is especially impacted in the western Atlantic Ocean, where it is currently listed as "Critically Endangered" by the International Union for the Conservation of Nature (IUCN). After banning longline fishing in the mid-1990s, The Commonwealth of The Bahamas recently prohibited commercial shark fishing in its 630,000 km² Exclusive Economic Zone (EEZ). Given that this area may provide a fishing refuge for this species, the goals of our study were to: 1) quantify the time sharks spend within this EEZ, 2) determine long-term movements of individuals as they moved away from aggregation sites in The Bahamas, and 3) characterize the vertical and thermal habitat use of this understudied pelagic species. We deployed pop-up satellite archival tags on 11 adult female sharks at an aggregation site near Cat Island, The Bahamas in May 2011 as a pilot effort to achieve these goals. Another female shark was opportunistically tagged 420 km south of Cape Hatteras, USA. Eleven tags reported, collecting a total of 1,563 days of tracking data. Four tags were physically recovered, adding greater resolution to an already robust dataset – 1,146,959 depth and temperature records combined. Mean depth utilized by tracked sharks was 43.9 m (± 10.34 SD) and the mean temperature encountered was 26.1 °C (± 0.55 SD). The deepest dive observed was 1081.9 m and the coolest temperature was 7.75 °C. Preliminary reconstructed tracks revealed that tagged individuals spent substantial amounts of time (approximately 58 % of days tracked) within the Bahamian EEZ. It therefore appears likely that the Bahamas longline ban and newly implemented shark sanctuary could provide a significant refuge from fishing pressure the oceanic whitetip shark is exposed to outside of this area.

The Post-Natal Dispersal Ecology of the Hen Harrier (*Circus cyaneus*) in England

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Productivity in the small study population was high enough to expect consolidation and subsequent range expansion although the population has remained static. This study has found that illegal persecution is the main factor limiting the population. Birds are persecuted because they prey on game birds, particularly red grouse, and at high densities can limit gamebird populations to levels where shooting is not economically viable. In order to formulate prescriptive management options to try to restore its conservation status we had to know crucially where the birds went outside of the breeding season. Between 2002 and 2010 we satellite tagged 34 juvenile hen harriers and followed them from fledging for up to 3 years to increase our knowledge of their dispersal ecology. It was found that the species has complex dispersal strategies which vary between individuals and sexes. The majority of females travel between 40 and 80km from the natal area to winter, whereas males are more nomadic in their first year and may travel up to 1500 kilometres to reach wintering grounds as far away as Spain. High overwinter mortality was found to be a key factor, reducing the potential for population increase. Important areas for wintering birds have been identified and information on timings, habitat use and site fidelity have been gathered. The results show that the existing information on hen harrier dispersal, and to a degree, studies based on wing-tagging and radio-tracking, have been unduly influenced by observer bias.

Migratory Movements of Long-Billed Curlews (*Numenius americanus*) from Three Breeding Populations

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We used 18 g solar PTTs from Microwave Telemetry, Inc. to track the migrations of 28 Long-billed Curlews between breeding areas in Oregon, Nevada, and Montana and their stopover and wintering areas. Some individuals were tracked for 4-5 years. Nine curlews from Oregon wintered in agricultural areas of the Central Valley of California and five Nevada birds wintered from the Central Valley to the northern Gulf of California or the west coast of Baja California, Mexico. The 14 curlews from Montana wintered inland, from the Texas Panhandle south to the Mexican plateau or along the coast of the Gulf of Mexico. Montana curlews travelled over twice the distance to their wintering grounds as Oregon and Nevada birds. Montana birds interrupted migrations with more and longer stopovers than birds from the other two areas in spring and those from Oregon in fall. Mean arrival dates on the breeding grounds ranged from 24 March (Oregon males) to 21 April (Montana females) with both sexes arriving earlier in Oregon than their counterparts in Montana. Also, males arrived earlier than females in Montana and possibly in Oregon. Mean departures from the breeding grounds varied from 17 June (Oregon males) to 1 July (Montana males). Within pairs, male curlews departed the breeding grounds later than females. Individuals exhibited strong fidelity to both breeding and wintering sites. Results from the satellite tracking point to the importance of agricultural regions to wintering Long-billed Curlews.

The Argos System: Enabling Science

Bill Woodward and Debbie Stakem

CLS America, Inc.

The Argos System is the satellite telemetry system of choice for biologists worldwide. Although Argos focused initially on providing in-situ data from the Earth's oceans and atmosphere, this now 30-year-old system was discovered by the biological community in the early to mid-1980s. In fact, species monitoring and Argos technology have grown together. The demands of collecting sensor data and locating birds and animals in wide-ranging, and remote and hostile environments have continuously pushed Argos to improve the on-board and ground based systems to satisfy these needs. Today, biology applications are the fastest growing of all the monitoring and protection programs in the Argos System. System enhancements have provided a number of advantages to biologists, such as increased sensitivity, improved location calculation, new low-power modulation, and broadening of the bandwidth. Future enhancements will include further increased sensitivity, even more bandwidth, as well as specifying a dedicated area of the spectrum for low-power transmitters. A downlink capability has also been added to allow users to turn transmitters on/off, download orbital parameters, or modify the characteristics of the sensors or transmitter. All of these improvements can benefit those involved in wildlife tracking and management. This presentation will provide a brief system overview, identify important system features and capabilities and review the methods available for the scientist to access their data.

Taking Biotelemetry to New Horizons

Paul W. Howey

Microwave Telemetry, Inc.

Over the last 20 years our Argos PTTs have literally flown over new horizons on the backs of many species of birds, often revealing for the first time the mysteries of their travels. Since the company's inception, we have continuously refined our designs using the latest components enabling us to develop smaller and lighter units. Our present 5g PTT is state of the art. In the course of the next few years, as we continue this mission towards a 2g device, the study of many thousands of new species will become possible using the Argos system. The miniaturization techniques we have developed to produce the 5g PTT are now being transferred to our GPS enhanced PTTs and pop-up fish tags in the 17g GPS PTT and E-Tag, respectively; both of which will be available soon. Whereas Argos PTTs have revealed the global travels of many species, GPS enhanced Argos PTTs have revolutionized habitat-use studies, providing inherently greater spatial resolution. Such studies are now demanding even tighter temporal resolution and hence generating larger datasets. With modern high-efficiency solar cells and low-power GPS receivers, we can collect enormous amounts of data. However, we have gotten to the point where the practical data transfer limits of Argos are exceeded, especially in areas of high RF interference with the satellites. During the last three years, we have been developing transmitters based on GSM (Global System for Mobile Communications) technology, with the capability to handle much larger datasets, as an alternative to Argos. In order to achieve a practical system based on GSM, we have designed and implemented an "end-to-end" service that provides delivery of user-friendly data from your bird located anywhere on the planet with GSM coverage directly to you, the scientist. GSM based transmitters similar in shape and form to our 22g through 70g Argos models will be available in the coming months. We expect that these will open up new fields of fine-scale study and also fill in the gaps of Argos coverage where RF interference precludes its use. New technology is truly taking us to new horizons.

Getting the Most from Your MTI Experience

Cathy Bykowsky

Microwave Telemetry, Inc.

Our mission at Microwave Telemetry, Inc. is to provide state-of-the-art satellite transmitters to researchers worldwide and to give the finest service we can. It is important to us that users get the best possible results from their PTTs, so we would like to give you some simple steps to take when ordering and deploying PTTs to make the most of this technology. This talk will review the process from initial inquiry through ordering, and post-deployment data retrieval, to ensure users have the information they need to achieve the best possible results for their research. Emphasis will be placed on planning well in advance, communicating needs and expectations, selecting the appropriate device, and following the user manual's instructions. Our hope is that these simple tips will make it easier for users to get the most from their PTTs, for the benefit of their research. Ultimately your success is our success.

The Power of the Parser – Accessing Your GPS Data

Ted Rollins

Microwave Telemetry, Inc.

Before the development of our GPS PTTs, the amount of data transmitted from a PTT was much more manageable than today. While data retrieval methods were somewhat difficult, sorting and organizing of the data could be handled with minimal effort. With the introduction of the GPS PTT, the ability to process the much larger quantities of data became overwhelming for all but the most computer savvy. We created our GPS parser as a simple-to-use tool to aid in this task. The parser extracts and sorts the GPS locations and engineering data from the downloaded files and presents them in an easily manageable format. We will explain the techniques and settings to get the most out of the parser. The Argos website has made data retrieval much easier than in the past, but the technical issues can cause difficulties for many users. We will go over the use of the website and its interaction with the parser. We will also discuss the pros and cons of the different Argos data formats. The easy availability of Google Earth© has made plotting and displaying location data much simpler. We will review the capabilities of that program and its use with the parser.

From Programming to Pop-Off: Understanding PSAT Data Reports and Recent Advances

Emily Gospodarczyk

Microwave Telemetry, Inc.

All over the world, marine biologists use pop-up satellite archival tags to collect data and track the migration of fishes. These data have revealed an abundance of new information for the purpose of marine conservation. Archival tags are deployed on pelagic species for up to a year to take temperature, depth, and light measurements before transmitting the data through the Argos system. The tags' software has been carefully designed to compress and transmit data under the constraints of the allowed Argos message size and tag battery life. Understanding the fundamentals of data collection, compression, and calculations is the foundation to successfully interpreting transmitted datasets. One method of data compression includes transmitting "delta values" or the relative change between measurements with a scaling factor called gain. When delta values are implemented, some values may become "delta limited" and not accurately represent the real measurement. The tags' software has been improved to decrease the quantity of delta limited dives as a result of adjusting the gain to a lower spatial resolution. Furthermore, recent software advances provide more accurate sunrise times, and consequently, the light-based geolocations have been improved.

The Argos System: Better than Ever

Michel Guigue

CLS France

From the very beginning of Argos 30+ years ago wildlife tracking has been a priority application of the Argos data collection and location system. The evolution of the Argos technology has kept pace with the increasing needs of the wildlife community over the years. This presentation by CLS will showcase examples of current and new solutions developed to improve the Argos tracking performance when used in the typically harsh conditions experienced when tracking animals in the field. These include new coding implementations, new location processing using Kalman filterering, new Argos frequency bands, new Argos modulations, cross correlation between Doppler and GPS fixes, Argos-3 downlink and more…….

Movebank: an Online Archive and Tool for Analysis and Sharing of Animal Tracking Data

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[2] Max Plank Institute for Ornithology, Radolfzell, Germany

The increasing popularity in animal tracking as a research tool has led to an explosion of animal tracking studies. Scientists need new tools not only to manage these larger data sets, but also to make them available to collaborators, advisors, and the public that funds most studies. We have created an online tool to archive tracking data and provide a platform for sharing, analysis, and visualization at www.Movebank.org. Sharing data is not required - users retain complete control over their data, setting who has access to data (3 rolls: public, collaborators, data managers) as well as the terms of use. Movebank can stream live data through Argos satellites, automatically implement sophisticated filters, and send users daily e-mail updates. GPS and VHF tracking data can also be manually uploaded; any data with the location and date of individually known animals is suitable for the Movebank data model, which presently manages over 5 million data points from 12875 individually tracked animals representing 262 species contributed by 278 studies. Data can be mapped online, animated with Google Earth©, and exported in a variety of formats. Data can also be annotated with weather data and landscape data for each animal location in space and time, and we will be adding additional satellite derived annotations and analyses. Movebank is also adding new analysis tools for mining movement data and for integrating sensor data from tracking tags. Movebank has long-term support from the Max Plank Institute and is establishing new linkages with other tracking databases.

Using GPS Telemetry Units to Study the Ecology of Nesting Golden Eagles in North Dakota

Anne Marguerite Coyle

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Territory size, mortality, and juvenile movements of nesting golden eagles in North Dakota were studied. Aerial and ground surveys were used to gather nest site and mortality information. Using GPS satellite telemetry units, we tagged 18 fledglings from 8 nest sites: 2 in 2004 (2 nest sites), 8 in 2005 (5 nest sites), and 8 in 2006 (5 nest sites). The mean territory area was 8.95 km^2 (SD = 4.25 km^2, min = 3.09 km^2, max 26.65 km^2). Some causes of mortality included undiagnosed disease, West Nile virus, electrocution, injuries from wind storms, lead ingestion, and poaching. Of the 18 tagged juveniles, 9 lived long enough to collect movement data and only one survived to 2011. Most juveniles maintained a range close to the natal nest site after the first flight from the nest. The fledglings gradually moved away from the nest site with successively longer flights using alternate nests within the territory. The entire range of all juvenile movements extended from Saskatchewan Canada through western North Dakota to the southern border of South Dakota. The juveniles varied in their post fledging movements: some migrated to South Dakota or the southern portions of North Dakota, and some maintained residency near their natal area. One juvenile was a resident the first year then migrated the second year. All migration or movement beyond territories began in late fall. Analysis of this data is still in progress.

Predation on Dovekies by Monkfish over Deep Water in the Northwest Atlantic Ocean

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Fourteen dovekies, a small marine bird, were recovered from the stomachs of 14 monkfish caught during three winters 2007-2010. All fish were caught by commercial fishermen in gillnets set at depths of 85-151 m and 104-150 km south of Chatham, MA. Capture of birds by fish so far from shore and in deep water leads to speculation that birds were preyed on by monkfish at or near the water surface. Previous studies by other researchers have found monkfish at the surface over deep water and one monkfish tagged with a data storage tag exhibited maximum vertical movements of approximately 200 m. Vertical movements by the monkfish were primarily (81%) between 0000 h and 1200 h and peaked at 0300 h and 1000 h. The night period is a time when dovekies would most likely be sleeping on the water surface and vulnerable to predation. Future tagging of monkfish with pop-up satellite tags could provide more information on vertical movements of monkfish in regard to possible surface feeding, including predation on dovekies. In 2012, five monkfish will be captured in gillnets and instrumented with pop-up satellite archival tags (Microwave Telemetry, Inc.) for this purpose. We speculate that predation by fish on birds in the ocean could be an ultimate cause for the long daily commute (approx. 48-80 km) of some ducks that feed diurnally in the ocean and return to nearshore waters to sleep at night.

Small Solar Tags on Large Birds or Birds with Long Contour Feathers: How to Avoid Shielding?

Lubomir Peske

Czech Society for Ornithology, Prague, Czech Republic

Solar tags often suffer from low charge. It is a limiting factor for some species and areas. Different modifications of tags are used by researchers. Mostly it is a higher pad. We successfully used modification of frontal part, sides and enlarge basement to sides. There are few problems with thicker pad: it is highly visible and birds can be targeted by hunters (proved, especially when on shoulders) and certainly more negatively changing aerodynamics. Even if high it is too low for some birds with extra long back feathers (e.g. Bald Ibis), I prefer larger and wider padding rather than higher. Feathers anterior to tags create the main problem. In order to keep them off, a short (e.g. 2 cm) plastic tube is attached to a frontal part of the tag and harnesses go through. We always combine each PTT with a small independent VHF tag that enlarges the PTT body to the side and on the opposite side it is secured by a solid foam or other light plastic. Large neoprene padding of pentagonal shape is also attached to harnesses and strengthens the whole construction. This modification can effectively divert even large back contour feathers at least in some periods. However, there are other interesting results like migration of different Eurasian populations of Black Storks - Europe-Siberia-Mongolia-China or repeated year-round movements (6 yr) of critically endangered last 3 specimens of migratory Bald Ibises but there will be many presentations of this kind.

A Review of Pop-Up Satellite Archival Tag Attachment Methods for Teleost and Elasmobranch Fishes

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Self-detaching pop-up satellite archival tags (PSATs) have been used for pelagic fishes for almost 15 years, with a variety of methods used to paradoxically firmly anchor the tag to the fish body while still permitting easy release when the deployment time ends and the on-board programming initiates release. A number of tag attachment methods have been used for elasmobranch fishes, although the trans-dorsal harness for medium-sized sharks remains dominant in the literature. PSATs on large sharks (e.g., whale sharks *Rhincodon typus*) have also been anchored intramuscularly using a metal or nylon dart head. Skates and rays present additional challenges due to their body shape, although a technique using a trans-basal harness on the tail was successful in two recent stingray studies. Similarly, a number of attachment methods have been used on teleost fishes, most of which have been pelagic species such as istiophorid billfishes and thunnid tunas. The most common method for these fishes was the trans-pterygiophore placement of a metal blade or multi-prong nylon dart head, which presumably provided additional anchorage than an intramuscular placement. Many studies in recent years for all taxa have incorporated a small ball-bearing swivel in the tether connecting the dart head and the PSAT to minimize rotational torque around the attachment site, even with smaller model tags. Although the tags themselves will continue to decrease in size, a suite of factors ranging from structure dependence to likely range of vertical movement should be considered prior to the development of any project-specific PSAT attachment methodology.

Natal Dispersal of Golden Eagles (*Aquila chrysaetos*) from Southern California 1988–2011

Dave Bittner*[1] Chris Meador[1], Jim Hannan[1], Jeff Laws[1], James Newland[1], Renee Rivard[1], Katie Quint[1], Brittany Schlotfeldt[1] and Jeff Wells[2]

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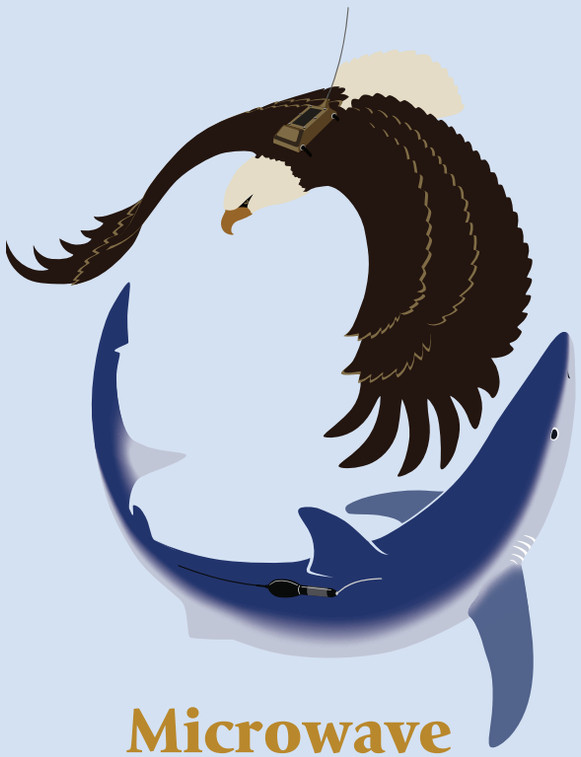
The Wildlife Research Institute, Inc. has been studying Golden Eagles since 1988 and has banded and tagged 521 Golden Eagles to study their movements, migration, life history, territory usage, and causes of mortality. From 1991-96, we placed 38 US Fish & Wildlife Service (USFWS) bands on nestling Golden Eagles. Beginning in 1997 and continuing through 2011, we attached 508 patagial tags on Golden Eagles in California, New Mexico, Nevada and Montana along with USFWS leg bands. Of these 508 patagial-tagged Golden Eagles, 110 also received VHF transmitters and 55 received PTT satellite transmitters. This report is a current summary of the results of the returns, mortalities and travels of these birds across the landscape of Western North America from 1991-2011. The project is ongoing and we continue to band 40-50 eagles each year. Seventeen satellite transmitters are currently active and transmitting data while approximately 50 of the VHF transmitters are on living eagles and still transmitting. Golden Eagles with natal areas in Southern California have been tracked south to La Paz, Baja California and Guadalajara, Mexico, east to Arizona and Colorado, and north to Nevada, Utah, and Wyoming and many points in between.

Geolocation Workshop in Terrace A
8:30am - 3:00pm

This workshop is for pop-up archival tag users and will be focused on the use of several R libraries used for estimation and correction of light-based geolocations from fish tags. Benjamin Galuardi and Tim Lam (from the Large Pelagics Research Center, UMass Amherst) will be hosting this workshop. Attendees will walk through light-based geolocation, state space models (Kalman filters) and will build R scripts for import, analysis and display of fish tag data. Use of sea surface temperature and bathymetry for track correction will be explored. Finally, Tim will present an overview of Tagbase; a relational database for management, visualization and data portal of electronic tag data. This workshop requires some prior knowledge of R, and will require the download of several open source software packages. The Tagbase portion requires Microsoft Access© (part of Microsoft Office©, any versions from 2000 or above).



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