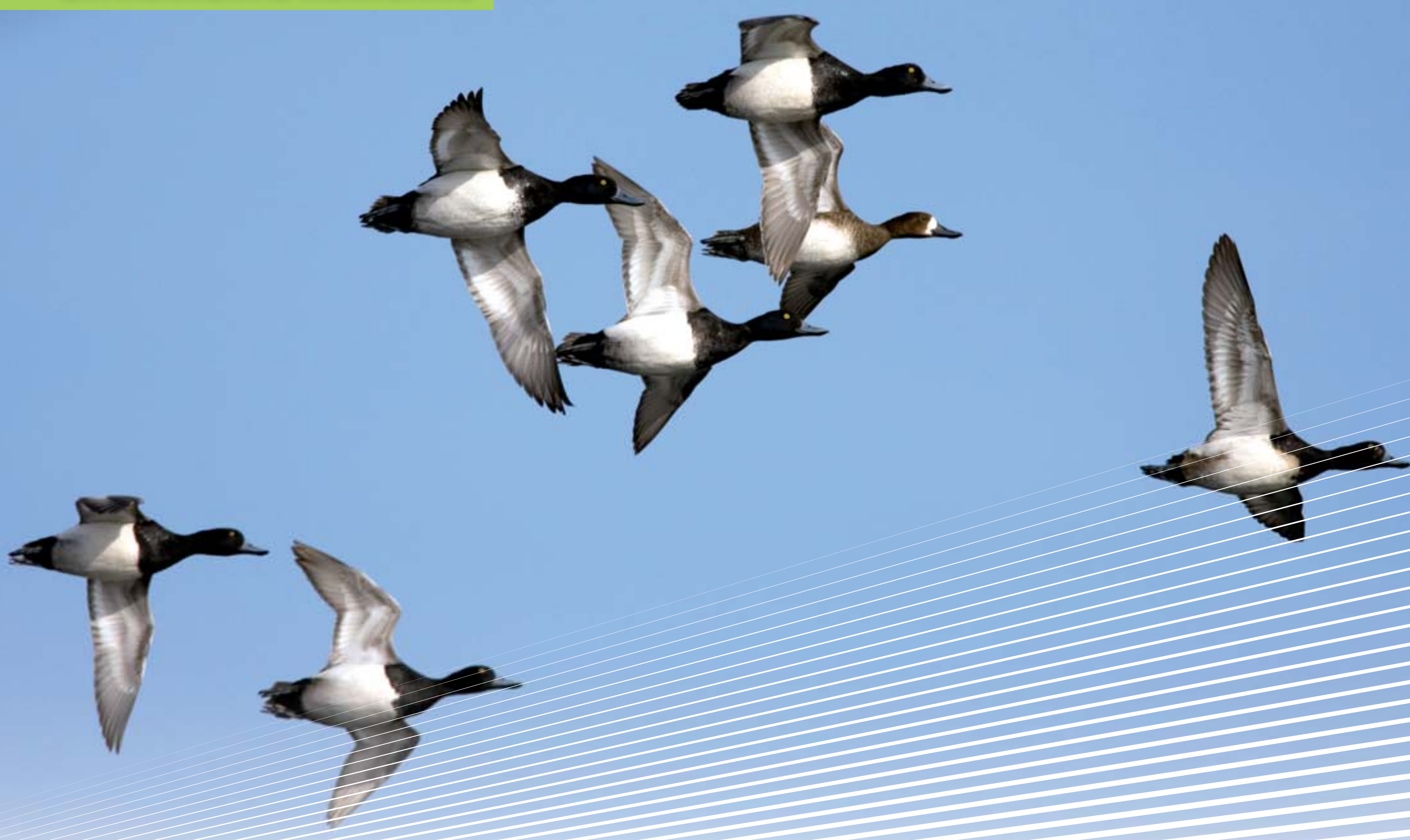
ARGOS FORUM

71

11/2010

WHERE WILDLIFE AND HUMANS **INTERSECT**

ENVIRONMENTAL MONITORING



CLS
COLLECTE LOCALISATION SATELLITES

CONTENTS

WHERE WILDLIFE AND HUMANS **INTERSECT**


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Photo courtesy of Brian Washburn


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EDITORIAL

By
Scott Newman, Animal Health Officer and EMPRES Wildlife Unit Coordinator in the Animal Production and Health Division at the Food & Agriculture Organisation of the United Nations in Rome, Italy

Every year billions of animals ranging from butterflies, dragonflies, and bees to bats, birds, wildebeest and whales migrate across the globe. Movements of migratory animals typically correspond with seasonal changes and the underlying objective of migration is usually to find abundant food, and appropriate habitat to accommodate life cycle needs such as breeding, molt, or over-wintering. Flighted species can cross continents or oceans, terrestrial species cross mountains and rivers, while aquatic species can travel upstream or move almost half way across the world underwater to accomplish this evolutionary behavior that is often similar year after year, and across generations.

While migration helps ensure survival of individuals and thus also species and also provides valuable ecological services, it is also recognized that when animals move across large spatial expanses, they also travel with any potential pathogens including bacteria, viruses, fungi, or prions. These pathogens are usually not of concern to the species making long distance movements as they are often commensal agents, coexisting with their host but not resulting in disease. However, changes in habitat use and migration patterns associated with landscape changes, expansion of farming systems, or climate change can lead to trans-located pathogens (and vectors), contacting new potential hosts (including humans), where the implications can be more significant.

Furthermore, as the global human population continues to increase, farming intensifies, cities expand, and as air, rail, road, and sea transportation increase, disease transmission is more likely to occur and wildlife migration will come at a cost. Conflict between migratory species movements and these transportation modes is well described to date, and in the future, one would expect greater conflict to occur unless precautionary measures are taken.

Additional anthropogenic environmental contamination in the form of petroleum or chemical spills, agricultural run-off, industrial pollutants, and ecosystem alterations and deterioration all may contribute to threatening or destroying animal habitats, foraging or breeding grounds, and migratory pathways.

For these reasons, studying seasonal habitat use and longer distance wildlife movements is of critical importance to minimizing potential disease transmission among livestock, wildlife and people, and human-wildlife conflict. In this context, Argos-derived data and other tracking and movement data, contribute significantly to our understanding of these important issues and how to best develop strategies that minimize impacts and conflict among people, livestock and wildlife.■

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Understanding the potential dispersal of HPAI H5N1 virus by migratory wildfowl

By
NICOLAS GAIDET, JULIEN CAPPELLE, JOHN Y. TAKEKAWA, DIANN J. PROSSER, SAMUEL A. IVERSON, DAVID C. DOUGLAS, WILLIAM M. PERRY, TAEJ MUNDKUR, and SCOTT H. NEWMAN

Reprinted article used with permission from the authors, Potential spread of highly pathogenic avian influenza H5N1 by wildfowl: dispersal ranges and rates determined from large scale satellite telemetry, Journal of Applied Ecology, Wiley & Sons. Copyright Wiley & Sons.

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Keawcharoen, J., van Riel, D., van Amerongen, G., Bestebroer, T., Beyer, W.E., van Lavieren, R., Osterhaus, A.D., Fouchier, R.A. & Kuiken, T. (2008) Wild ducks as long-distance vectors of highly pathogenic avian influenza virus (H5N1). Emerging InfectiousDiseases, 14, 600–607.

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Migratory birds are major candidates for long-distance dispersal of zoonotic pathogens. Yet just how responsible are migratory wildfowl for spreading disease? In a study coordinated by the Food and Agriculture Organisation (FAO) of the United Nations, a consortium of scientists led by Nicolas Gaidet explore the issue, in this article adapted from the Journal of Applied Ecology and reprinted with permission.

In recent years, wildfowl have been suspected of contributing to the rapid geographic spread of the highly pathogenic avian influenza HPAI H5N1 virus. Experimental infection studies reveal that some wild ducks, geese and swans shed this virus asymptomatically and hence have the potential to spread it as they move.

We evaluate the dispersive potential of HPAI H5N1 viruses by wildfowl through an analysis of the movement range and movement rate of birds monitored by satellite telemetry and the Argos satellite tracking system in relation to the apparent asymptomatic infection duration (AID) measured in experimental studies.

MIGRATION AND DISEASE

We analysed wildfowl movements between 2006-2009, including 228 birds from 19 species, part of a larger international programme (see Figure 1) coordinated by the Food and Agricultural Organisation (FAO) of the United Nations aimed at understanding if there are temporal or spatial relationships between HPAI H5N1 outbreaks and movements of migratory wildfowl, the first large scale data set available for such an analysis.

Satellite-based telemetry is increasingly used to monitor free-ranging animal movements over extensive and remote regions. It provides a direct measurement of individual movements over relatively long periods and at an intercontinental scale, including over the most remote areas of the world. In addition, location data obtained every 2–4 days allows for analysis of individual movements with a high temporal resolution compatible with the duration of viral infection.

IDENTIFYING POTENTIAL VECTORS

Species monitored in the FAO coordinated programme are some of the main candidates identified as potential long-distance vectors of HPAI H5N1 virus (e.g. mallard *Anas platyrhynchos*, bar-headed goose *Anser indicus*, whooper swan *Cygnus cygnus*; Brown, Stallknecht & Swayne 2008; Keawcharoen et al. 2008). Species monitored are also amongst the most abundant wildfowl species across Eurasia and / or Africa, representing 9 of the 16 species estimated to each have populations in excess of one million birds (Wetlands International 2006). This is the reason that the analyses conducted by CIRAD (A French research centre working with developing countries to tackle international agricultural and development issues) focused on these species.

Results indicate that individual migratory wildfowl have the potential to disperse HPAI H5N1 over extensive distances, being able to perform movements of up to 2900 km within timeframes compatible with the duration of asymptomatic infection.

Photo courtesy of Dr. S. Balachandran, BNHS

Chilika Lake, India. Taej Mundkur with a marked Ruddy Shelduck.

GLOBAL MIGRATION & HPAI DISEASE ECOLOGY PROGRAM

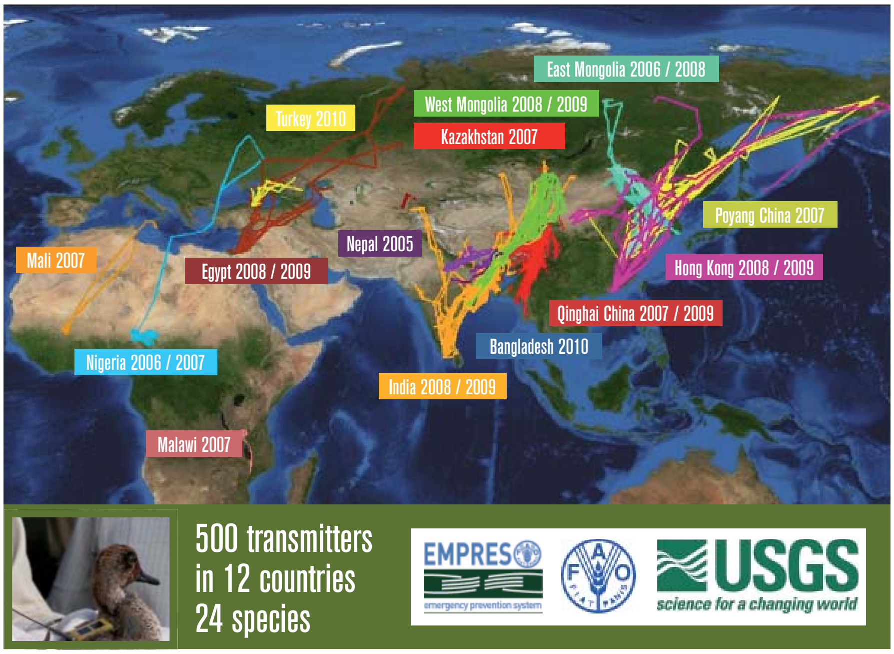


Figure 1: A map of the massive tagging campaign coordinated by the UN FAO and the USGS from 2007-2010.

LOW RISK VIRUS TRANSMISSION

However, the likelihood of such virus dispersal over long distances by individual wildfowl is low: we estimate that for an individual migratory bird there are, on average, only 5–15 days per year when infection could result in the dispersal of HPAI H5N1 virus over 500 km.

Staging at stopover sites during migration is typically longer than the period of infection and viral shedding, preventing individual birds from dispersing a virus over long distances in single flights. Intercontinental virus dispersion therefore probably requires relay transmission between a series of successively infected migratory bird movements.

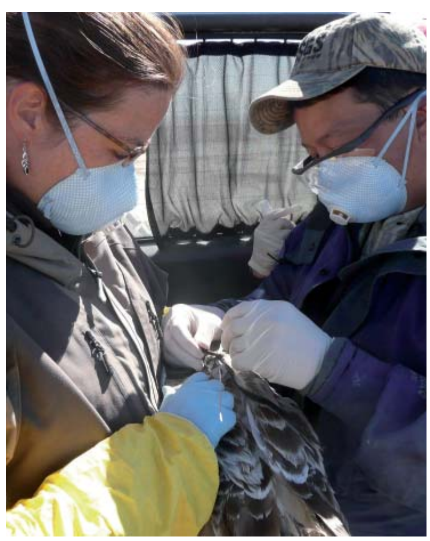
Our results provide a detailed quantitative assessment of the dispersive potential of HPAI H5N1 virus by selected migratory birds. Such dispersive potential rests on the assumption that free-living wildfowl will respond analogously to captive, experimentally infected birds, and that asymptomatic infection will not alter their movement abilities.

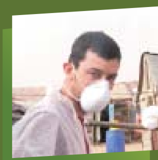
CONCLUSIONS

Our approach of combining experimental exposure data and telemetry information provides an analytical framework for quantifying the risk of spread of avian-borne diseases.

Niger Delta, Mali. A Garganey is released with an Argos transmitter on its back.

Qinghai Lake, China.: John Y. Takekawa and Diann J. Prosser marking a Pallas's Gull.





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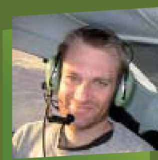

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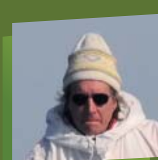

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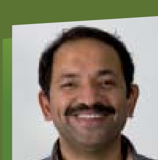

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Photo courtesy of Brian Washburn

Reducing risk of osprey collisions with aircraft

By
DR. BRIAN WASHBURN

A true conservation success story, osprey (*Pandion haliaetus*) populations in North America have staged a dramatic recovery during the past few decades. Expanding osprey populations are the direct result of the banning of harmful pesticides (most notably DDT), conservation efforts that provided suitable nesting structures, and the implementation of successful translocation and hacking programs. However, with conservation success comes new challenges, as Dr. Brian Washburn explains.

Osprey exhibit a remarkable tolerance to humans and adapt well to urban environments. Yet, breeding populations of osprey adjacent to civil airports and military airbases increase the risk of collisions between osprey and aircraft. As North American osprey migrate to their wintering areas in central and South America, they traverse numerous civil and military airspace use areas. The risks to human safety and damage to aircraft associated with osprey-aircraft collisions are a serious flight safety concern, highlighting the need for research and management efforts designed to mitigate such risk.

Supported by the U. S. Department of Defense's Legacy Natural Resources Management Program, a collaborative multi-agency research effort was initiated in 2006. The goal of this research project is to incorporate satellite telemetry technologies and geo-spatial referencing to quantify bird-strike risk of migrating and breeding osprey from the Mid-Atlantic Chesapeake Bay Region.

MONITORING OSPREY BY SATELLITE

The study area is located in the Back River of the Chesapeake Bay adjacent to Langley Air Force Base (AFB) in Virginia. During the 2006 and 2007 nesting seasons, we captured 13 adult Osprey (including 5 males and 8 females) using carpet-noose traps at their nests. Amongst this group, we successfully captured and satellite-tagged three breeding pairs (i.e., both the male and female).

Each osprey was fitted with unique color and U.S. Fish and Wildlife Service leg bands, tagged with a GPS-capable solar-powered satellite transmitter, and released at the nest site. The satellite tags were 30-gram Argos/GPS PTT-100 platform transmitter terminals (PTTs) from Microwave Telemetry Inc. (Columbia, MD). We attached the transmitters in a backpack configuration using a Teflon tape harness. The satellite transmitters were programmed to collect location and movement information 10 times each day (at 2-hour intervals). The data is transmitted from the PTT to the Argos satellite network and then relayed to the researchers through the Argos system.

An F-15 Eagle at Langley Airforce Base. Photo courtesy of Brian Washburn

BREEDING SEASON ECOLOGY

Using the location and movement information provided by the satellite-tagged osprey, we are gaining new insights into osprey breeding ecology. This information will provide us with a better understanding of the movements, activity patterns, and habitat use of male and female adult osprey during their breeding season. We have learned that adult osprey are active relatively equally throughout during daylight hours. In addition, we are gaining an understanding of osprey space use and selection of resources within their breeding territories.

DOCUMENTING MIGRATION PATTERNS

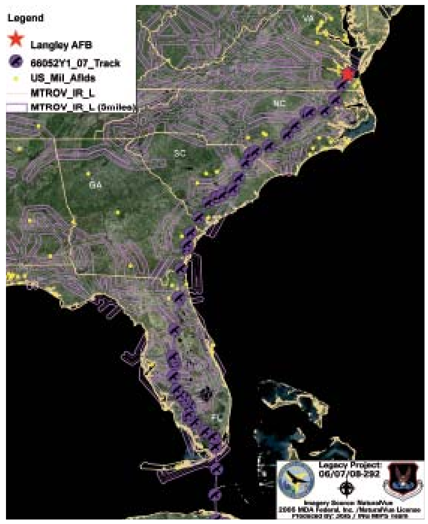
Recent advances in satellite tracking technologies allow for an unprecedented level of understanding and study of birds that migrate long distances. We found that female Osprey that breed in Virginia began their fall migrations in August, whereas males typically began migrating in September. Breeding pairs of osprey do not migrate or winter together. Osprey migrated during daylight hours and roosted at night, potentially foraging on fish during the morning or evening hours. Seven osprey completed their fall migration to their wintering grounds in the Caribbean or in South America, traveling an average distance of 4,600 km.

We lost contact with six osprey during their fall migration; the fate of these birds in unknown. All 13 adult osprey utilized similar migration routes along the eastern coast of the United States and traveled from Florida to Cuba. Future analyses of collected osprey location and movement data will help identify stopover habitats important to migrating osprey. With a better understanding of osprey migration patterns, conservation and management efforts for this species can be enhanced.

SAFER FLYING ENVIRONMENTS

Using data provided by the satellite-tagged ospreys during the breeding season, we are constructing spatial and temporal models of how breeding Osprey utilize areas within their nesting territories. These models will be analyzed to determine whether predictive relationships exist among osprey movement patterns, the occurrence of ospreys on Langley AFB, and the critical airspaces used by military aircraft during flight operations. In addition, movement and activity patterns of breeding Osprey will be used to identify locations where nesting Osprey present the greatest risk to aircraft operations.

Spatially and temporally patterns of osprey migration, including specific migratory routes, will be mapped and summarized using information provided by the satellite-tagged osprey. Flight characteristics and geographic routes of migrating osprey will be compared with U.S. Department of Defense airfields and military flight operations areas along the Atlantic seaboard to determine periods of increased risk of osprey-military aircraft collisions. Ultimately, using information provided by this research effort, the timing and routing of military training flights might be scheduled to reduce the risk of osprey-aircraft collisions.



Fall migration route of M52, an adult male osprey, from Langley Air Force Base, Virginia through the southeastern United States in 2007. On his journey he passed by several military airfields (represented by yellow dots) and through numerous military training routes (presented by lines and 5-mile buffers).

An adult female osprey with her 30-gram Argos/GPS PTT-100 platform transmitter terminals (PTTs) from Microwave Telemetry Inc.

Photo courtesy of Brian Washburn

DR. BRIAN WASHBURN

Dr. Brian Washburn is a research wildlife biologist with the United States Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center in Sandusky, Ohio and is an adjunct assistant professor with Michigan State University, North Carolina State University, and the University of Missouri. His research program involves finding science-based solutions to wildlife-aviation conflicts, stress and reproductive physiology of wildlife, and habitat management of grassland ecosystems.

In addition to the work presented here, Dr. Washburn and his colleagues are using satellite telemetry to track resident Canada geese in urban areas and bald eagles translocated from airport environments to reduce the risk of bird-aircraft collisions by these species.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How female Lesser scaup are affected by pollution in the Great Lakes

By
SHANNON S. BADZINSKI, SCOTT A. PETRIE
and GLENN H. OLSEN

The Lesser Scaup is a diving duck with an impressive migration range. The birds fly as far north as the northern boreal forest and tundra of Northern Canada in Spring, and they fly as far south as Florida or the Caribbean for the winter. The birds are quite common in North America, although their population has been in decline since the mid-1980s. The birds are increasingly exposed to pollution and other environmental hazards as they migrate. Is there a link between population decline and pollution in their spring migration staging ground? Shannon S. Badzinski (Long Point Waterfowl), Scott A. Petrie (Long Point Waterfowl) and Glenn H. Olsen (Patuxent Wildlife Research Center) report.

Lesser scaup use the Lower Great Lakes as a staging ground during both spring and fall migration, where they feed on zebra and quagga mussels and other prey that can contain high levels of selenium (Se). Selenium is a naturally-occurring and essential trace element for birds but can become toxic when injested in large amounts. Also, Se tends to bioaccumulate up the food chain. Although naturally occurring, Se enters the Great Lakes from fossil fuel burning as well as from urban and agricultural runoff.

Our concern is whether or not Selenium exposure in the Lower Great lakes staging ground has an impact on the reproduction of female Lesser Scaup. It is known that some ducks leave for breeding areas with hepatic Selenium levels that may impact reproduction. However, we know selenium has a half-life of approximately 19 days in ducks, and that depuration begins as soon as exposure ends.

But how many days do females spend in migration after departing the Great Lakes? Is it long enough for elevated levels of Se to be eliminated from their systems?

TRACKING LESSER SCAUP DURING THEIR VAST MIGRATION

In Spring 2005, 2006 and 2007, we captured a total of thirty females at two major stopover sites in the Lower Great Lake region of Ontario, Canada: Long Point Bay, Lake Erie and Hamilton Harbor, Lake Ontario. Argos satellite transmitters (38-g PTT-100, Microwave Telemetry Inc.) were surgically implanted into the birds and programmed to activate every 3 days during spring and every 10 days the remainder of the year. We used the most reliable location classes (3 - 0) to determine locations, migration routes, and regional use.

STOPPING OFF IN THE GREAT LAKES

We found that female Lesser Scaup that migrated through the Great Lake region during spring dispersed to breed throughout North America (Figure 1). Thirty-eight percent (9 of 24) of females migrated to eastern North America where 89% and 11% of those birds, respectively, spent the breeding season in the Taiga. Sixty-two percent (15 of 24) of Lesser Scaup we tracked

Migration paths for female lesser scaup in North America

migrated to western North America where 47%, 33%, 13% of those females, respectively, spent the breeding season in Taiga, Boreal, and Hudson Plains Ecozones; only one female (7%) migrated to the Prairies and Parklands Region.
Overall, the female Lesser scaup we studied spent an average of 28 days (range: 15 – 45) outside of the Great Lakes before arriving at breeding sites.

ELIMINATING SELENIUM DURING FLIGHT

Calculations using these values and others for Se half-life, hepatic Se levels in spring-migrants from the Lower Great Lakes, and days preceding egg laying at breeding sites suggest most birds have enough time to depurate much of their Se prior to egg formation. However, some females with high Se burdens, rapid migrants, or birds nesting near the Great Lakes (e.g., eastern Boreal) may retain elevated levels and transfer Se to some eggs, possibly affecting their reproduction.

Our conclusions, based on satellite tracking and other field and captive studies is that Se is not a major factor limiting scaup productivity or survival. Satellite tracking remains a useful tool to study movement patterns throughout the annual cycle which provides answers to key questions pertaining to habitat requirements and conservation goals.

From left to right: Shannon S. Badzinski, Glenn H. Olsen and Scott Petrie,
Photo: Theodore Smith

Shannon S. Badzinski, Ph.D. currently is a Senior Population Management Biologist with the Canadian Wildlife Service - Ontario Region specializing in waterfowl research, management and conservation. Prior to this position, he was the Scientist at Long Point Waterfowl where he conducted research on various aspects of the staging ecology of waterfowl and other waterbirds in the Lower Great Lakes Region of Canada.

Dr. Scott Petrie, PhD is the is the Executive Director of Long Point Waterfowl and is an Adjunct Professor at the University of Western Ontario where he teaches Wildlife Ecology and Management. Scott and his graduate students are presently studying various ecological aspects of waterfowl that stage and winter on the lower Great Lakes. Scott received a B.Sc. from the University of Guelph in 1990 and a PhD from the University of the Witwatersrand, South Africa in 1998.

Glenn H. Olsen, DVM, PhD is the veterinary medical officer at Patuxent Wildlife Research Center, part of the US Geological Survey. Prior to this position, he worked as a research biologist in the National Biological Survey, in refuge management in the US Fish and Wildlife Service, and as an assistant professor at Louisiana State University. In addition to working with ducks, Dr. Olsen also does research on whooping crane reintroductions.

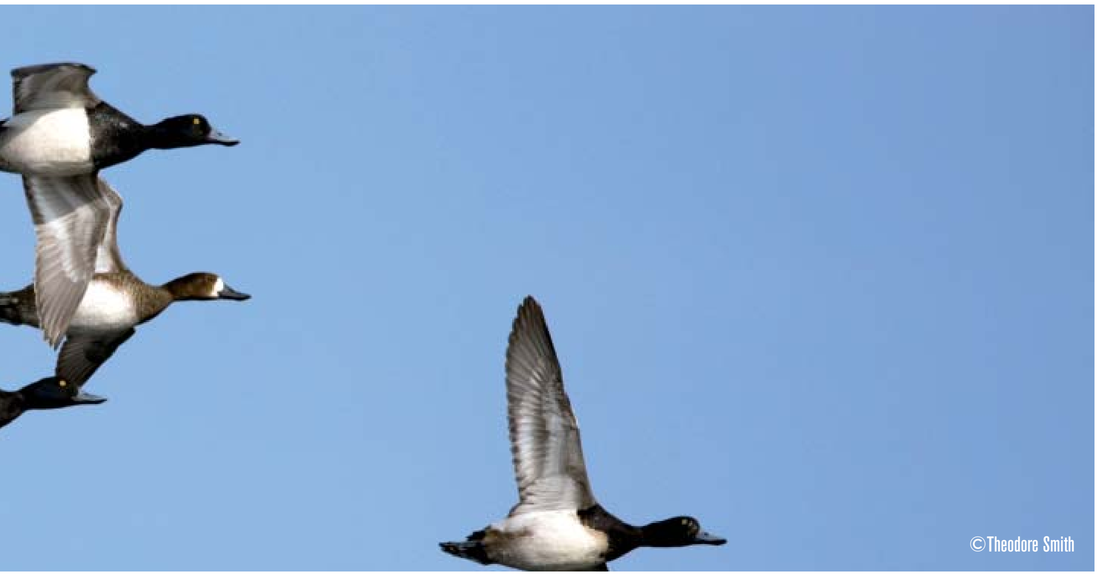



Photo courtesy of Carlos Barrera

ARGOS-3 in the Canary Islands:

Real-Time Data Series Telemetry from a multidisciplinary, deep-ocean mooring

By
DR. MARIA JOSE RUEDA,
Research scientist and head of the Oceanography department at Canaries Institute of Marine Sciences (ICCM)
CARLOS BARRERA,
Research scientist at Canary Island Oceanic Platform (PLOCAN) and head for the area of VIMAS (underwater vehicles, instruments and machines)

The Oceanography Department of the Canaries Institute of Marine Sciences (ICCM) is the first European research institute to integrate a high-speed, bidirectional data link system (Argos-3 PMT) into its own custom observing system (moored buoy) for real-time met-ocean monitoring. Dr. Maria Jose Rueda and Carlos Barrera explain how the Argos-3 system provides the stable and powerful satellite link telemetry required for their work.

In March 2010, we deployed our deep-ocean multidisciplinary mooring on board the RV Vizcone de Eza and put into operation at the ESTOC site (European Station for Time-series in the Ocean Canaries, 60 Nm North of the archipelago at 29°10'N – 015° 30'W and over 3670 meters depth). The area has deep oligotrophic waters that include the main water masses encountered in the Eastern North Atlantic.

HIGH-DATA RATE DATA EXCHANGE

The deployed monitoring system contains a complex sensor and telemetry configuration used both on the surface buoy and on the mooring line. This configuration allows real-time monitoring of meteorological and oceanographic parameters such as wind speed and direction, solar radiation, air temperature and humidity, barometric pressure, water temperature, conductivity, dissolved oxygen, turbidity, chlorophyll, current speed and direction, pH, pC02, nutrients and hydrocarbons.

Due to the complexity of the integrated sensor configuration, two main parallel board electronics were required, and in both cases, the Argos-3 PMT system provided the required stable and powerful satellite link telemetry.

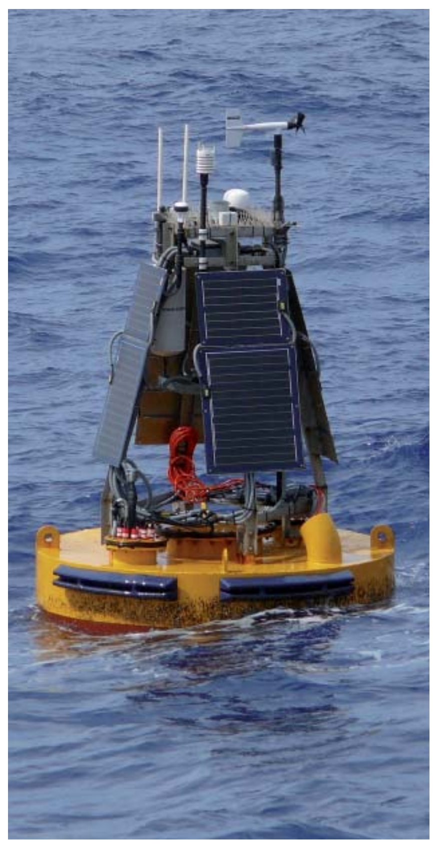
The Argos-3 PMT provides two-way communication and a high data-rate link between the off-shore mooring site and the land-based control center enabling a large data transfer. The Argos-3 PMT ESTOC buoy is significantly more efficient in terms of data collection and energy consumption than the previous Argos transmitter.

A STATE-OF-THE ART MOORED BUOY

In parallel, the ICCM has developed a new and specific surface mooring buoy system under the framework of EuroSITES project (www.eurosites.info), also using Argos-3, to enhance real-time observations in the Central North-Atlantic Ocean. This buoy has been fitted with state-of-the art sensors and loggers. The Argos-3 PMT bi-directional communication system enables tangible energy and cost savings.

CONSISTENT RECORDS FOR CLIMATE AND ENVIRONMENTAL QUALITY

The detailed time-series obtained over the past 15 years at ESTOC make it possible to comprehend and to monitor the conditions and long-term variability of the subtropical gyre in the eastern region of the North Atlantic. This station, along with HOT, BATS and the Hydrostation S, are the sole fixed stations in the subtropical areas where the current tendencies related to ocean biogeochemical processes can be studied due to time-homogeneity. Up to now, the results are very promising, in terms of providing very effective high data collection and transmission. Such enhancements are expected to lead to a wider and more effective use of data buoys, offering a new working horizon for different marine science fields, including processes and phenomena in both coastal and open-ocean areas related to climate change.


The ICCM's custom observing system that integrates a high-speed bidirectional data link system (Argos-3 PMT) for real-time met-ocean monitoring. Photo courtesy of Carlos Barrera

NEWS

Photo: Vladimir Bologov

Ultra-robust Argos collars for Russia

By
ALEXANDRE SALMAN,
General Manager of the Russian company ES-PAS

In Russia, Argos satellite tracking is essential for the study and protection of a wide variety of wildlife, which is scattered over a vast area. However, it is a formidable challenge, given the difficult terrain, the dense vegetation and the fact that the tracked species quickly damage their collars. This presents Russian researchers with a dual challenge: how to develop transmitters with integrated antennas that resist friction from the animal and allow it to be tracked despite the difficult topography and vegetation. We take a look at the development of a device that is continually being improved.

The richness and diversity of Russian wildlife are on a scale with the size of the territory: gigantic (tigers, leopards, bears, deer, seals, walruses, belugas, whales and even wolves in some areas). Despite this abundance, many species are threatened by climate change, poaching or pollution.

WEAKNESS OF CONVENTIONAL COLLARS

The first terrestrial animal tracking projects, using Argos transmitters developed by our company ES-PAS, were conducted on wolves, deer and bear cubs. This tracking demonstrated the weakness of the conventional Argos antenna collars (which had external antennas). Statistically, we encountered too many operating problems with this kind of collar, due to animals damaging the antenna through fighting and rubbing against trees. This problem is not unique to Russia but affects all types of collar!

In addition, the preferred habitat of some species is rugged, with areas that are often hemmed in by steep slopes. This unfavourable topography and dense vegetation significantly disrupt data transmission.

To overcome this obstacle and improve Argos tracking quality, we have developed a new type of Argos collar with integrated antenna.

GOOD RESULTS FROM COLLARS WITH INTEGRATED ANTENNAS

The first 11 collars of this type have been used in a reindeer tracking project in Yakutia, conducted by the Institute for Biological Problems of the Cryolithozone, at the Russian Academy of Sciences. The 11 transmitters were fitted and the animals released into the wild between 13 and 22 August 2010. The results have been excellent. The 11 transmitters are working correctly and have been relaying a considerable number of Class 2 and 3 locations. The reindeer have begun their migration and scientists can follow them every step of the way.

As part of our effort to continually improve the equipment, we are now developing Argos/GPS collars, again with integrated antennas. These newest transmitters will initially be used to track tigers and bears in Russia's far east.

Right : The first Argos collars used in Russia were easily damaged by the animals wearing them.

Left: The collar with integrated antenna developed and manufactured by the Russians for the study of wildlife in difficult conditions.

Photos: Sergey Ganusevich

Below: A wild reindeer fitted with a new Argos collar with integrated antenna. It allows the animal to be tracked with highly satisfactory results.

Photo: Egor Kirillin

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