ARGOS FORUM

71

Health, Safety and Environment

Environmental monitoring

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CONTENTS

Health, Safety and Environment

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Editorial

By Scott Newman, DVM, PhD
Deputy Wildlife Coordinator,
UN Food and Agriculture Organization

Every year billions of animals migrate across the globe. Migration is an essential part of the Earth's balance and contributes to its biodiversity. Migration is mysterious and beautiful, but not without consequences on human health and safety. While in most cases animal migration and human activity coexist harmoniously, in some cases, migratory animals are believed to transport diseases or even threaten human safety.

But just as human health and safety can be affected by animal movements, animals increasingly suffer from human activity. Oil spills, agricultural and industrial pollution, change of land use, general degradation of environmental quality, all threaten animal habitats, well-being and migration habits.

Studying large-scale animal movement is of critical importance to addressing environmental challenges including infectious diseases, safety, climate and environmental change. Now more than ever, Argos is an essential tool, at the intersection of animal welfare and human welfare. Ever smaller and more robust Argos transmitters open new windows of opportunity, making it possible to understand animal movements on a global scale.

All ARGOS publications are available at:
www.argos-system.org

Understanding the potential dispersal of H5N1 HPAI 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."

Migratory birds are major candidates for long-distance dispersal of zoonotic pathogens. Yet just how responsible migratory wildfowl are for spreading disease? In a study coordinated by the United Nation's Food and Agriculture Orgnaization (FAO), 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 map below) 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.

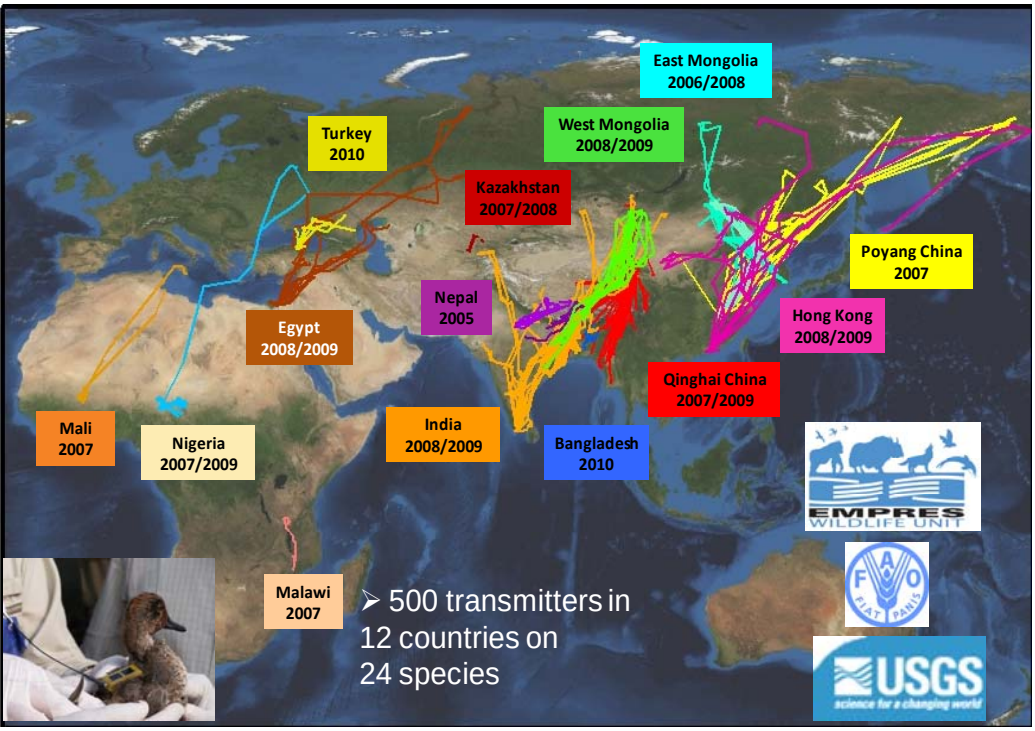
Satellite-based telemetry is increasingly used to monitor free-ranging animal movements over extensive and remote regions. It provides a direct measurement of individual movements over relatively long periods and at an intercontinental scale, including over the most remote areas of the world. In addition, 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.

Global Migration & HPAI Disease Ecology Programme



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 beacon on its back.

Qinghai Lake, China.: John Y. Takekawa and Diann J. Prosser marking a pallus gull .

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Reducing risk of osprey collisions with aircraft

By

Dr. Brian Washburn, United States Department of Agriculture, Animal Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center

Photo courtesy of 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 and civil airports 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. more specimens.

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.

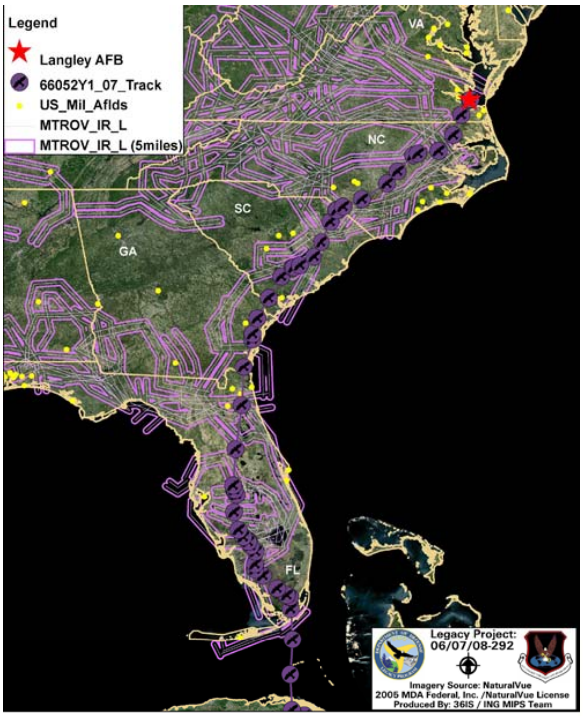
Documenting migration patterns

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.

Afigure 1: n F-15 Eagle at Langley Airforce Base. Photo courtesy of Brian Washburn

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.

Figure 2: 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 airfield (represented by yellow dots) and through numerous military training routes (presented by lines and 5-mile buffers).



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.

Figure 3: 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.

How female Lesser scaup are affected by pollution in the Great Lakes

By
Shannon S. Badzinski,
Scott A. Petrie
and Glenn H. Olsen

Photo copyright Theodore Smith

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 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.

Figure 1: Migration paths for female lesser scaup in North America

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 (9 of 24) percent of females migrated to eastern North America where 89% and 11% of those birds, respectively, spent the breeding season in the Taiga. Sixty-two (15 of 24) percent of Lesser Scaup we tracked 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 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, Scott Petrie and Glenn H. Olsen, Photo: Theodore Smith

Dr. Scott Petrie 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.

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.

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.

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, pCO2, 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.

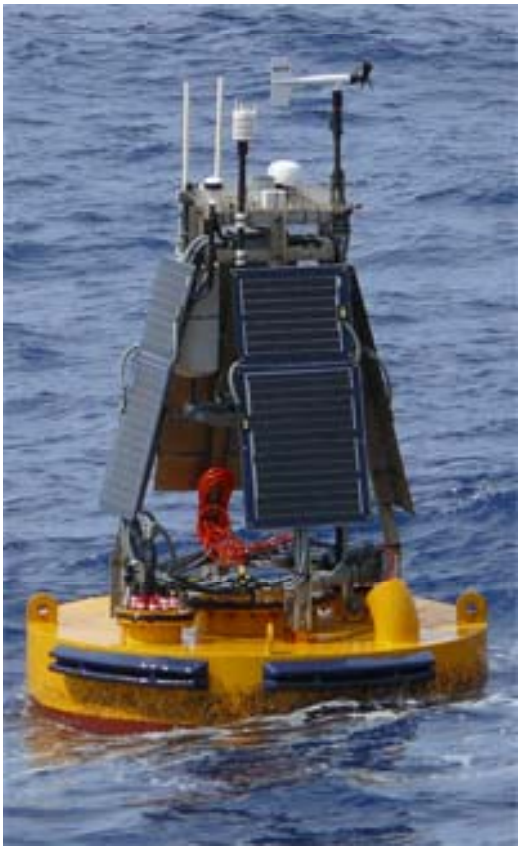
The Argos-3 PMT provides two-way communication and a high data-rate link between the off-shore mooring site and the land-based control center enabling a large data transfer. The Argos-3 PMT ESTOC buoy is significantly more efficient in terms of data collection and energy consumption than the previous 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) to enhance real-time observations in the Central North-Atlantic Ocean. This buoy has been fitted with state-of-the art sensors, loggers and a bi-directional communication system enabling 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 of 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 world 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 a 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

Photo courtesy of Alexandre Salman, ES-PAS

Ultra-robust Argos collars for Russia

By Alexandre Salman, Directeur General de la société russe ES-PAS

En Russie, le suivi satellitaire Argos est indispensable à l'étude et à la protection d'une faune très diverse et disséminée sur un immense territoire . Mais le défi s'avère de taille, compte tenu de la difficulté du terrain (relief), de la richesse de la végétation et du fait que les espèces suivies endommagent leurs colliers rapidement. Double challenge donc pour les russes : développer des balises à antenne intégrée qui résistent aux frottements des animaux et permettent le suivi de cette faune malgré une topographie et une végétation difficiles. Retour sur le développement d'un nouvel équipement toujours plus performant.

La richesse et la diversité de la faune russe sont à l'échelle de l'étendue du territoire : gigantesques (tigres, léopards, ours, cerfs, phoques, morses, bélugas, baleines voire loups dans certaines régions). Malgré cette abondance, de nombreuses espèces animales restent menacées, victime des changements climatiques, du braconnage ou encore de la pollution.

Faiblesse des colliers traditionnels

Les premiers projets de suivi d'animaux terrestres, réalisés grâce à des émetteurs Argos développés par notre société ES-PAS, ont été menés sur des loups, des cerfs et des oursons. Ces suivis nous ont démontré la faiblesse des colliers à antenne Argos traditionnelle (antenne externe). Statistiquement, nous rencontrons trop souvent des problèmes de fonctionnement avec ce genre de colliers. En effet, les animaux endommagent l'antenne, en se battant, en se frottant aux arbres. Ce problème n'est pas une spécificité russe mais s'applique à tous les types de balises du marché !

En outre, le terrain de prédilection de certaines espèces est accidenté et les zones où elles évoluent sont souvent encaissées. Cette topographie défavorable et la végétation très dense perturbent de façon significative la transmission des données.

Afin de résoudre ce handicap et d'améliorer la qualité du suivi ARGOS, nous venons de terminer le développement d'un nouveau type de collier Argos à antenne incorporée.

Bons résultats grâce aux colliers aux antennes intégrés

Les 11 premiers colliers de ce type ontutilisés dans le cadre d'un projet de suivi des rennes en Yakoutie réalisé par l'Institut des Problèmes Biologiques de Cryolithozone de l'Académie des Sciences de la Russie. Les 11 balises ont été posées et les animaux relâchés dans leur milieu naturel entre le 13 et le 22 Août 2010. Les résultats sont excellents. Les 11 balises fonctionnent correctement et délivrent un nombre important de localisations de deuxième et de troisième classes. Les rennes ont commencé leur migration et les scientifiques peuvent les suivre pas à pas.

Afin de leur fournir du matériel toujours plus performant, nous sommes en train de développer des colliers Argos/GPS toujours à antennes incorporées. Ces dernières balises seront destinées dans un premier temps au suivi de tigres et des ours en Extrême-Orient.

Les premiers colliers Argos utilisés en Russie étaient facilement abimés par les animaux équippés. Photo: Alexandre Salman

A gauche: Le collier à antenne intégré développé et manufacturé par les Russes pour l'étude de la faune en conditions difficiles. Photo: Alexandre Salman

A droite: Une renne sauvage équipée d'un nouveau collier Argos avec l'antenne intégré. Ce collier permet son suivi avec des résultats très satisfaisants. Photo: Alexandre Salman

Photo courtesy of Alexandre Salman

We welcome your contributions!

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