

Title: Satellite Mallard Tracking Using ArcIMS- Paper #2170

Authors: Hanna Ford, Arkansas Game and Fish Commission; Brian Culpepper, Center for Advanced Spatial Technologies; Andrew James, Arkansas Game and Fish Commission

Abstract

The Arkansas Game and Fish Commission (AGFC) Satellite Mallard Tracking program will allow biologist to collect valuable information relating to migration routes and breeding locations of mallards in the Mississippi Flyway, while also providing a new, exciting way for the public to be involved in waterfowl management. Mallard ducks are captured in Arkansas during February and March and are fitted with a Platform Type Transmitter (PTT). These PTTs acquire and transmit locations according to pre-programmed intervals. These location transmissions are processed and reliable locations are automatically posted to an IMS site where users may track the ducks as they migrate. This paper will disseminate the paths taken to get the AGFC Satellite Mallards off the ground.

Introduction

Using an Internet Map Server (IMS) site to track mallard migrations has allowed for AGFC biologists and the public to witness mallard migration in near "real-time." Providing an answer to the much begged, "Where are all the ducks?" This idea of tracking mallard migrations via the Internet has become increasingly popular with sportsmen throughout the Mississippi Flyway and AGFC biologist since it was first made available in late November 2004.

Why track mallard migrations?

Mallard migrations, from the breeding grounds of the north central United States and south-central Canada, to the wintering grounds of the south central United States, have been well document in scientific literature over the years. Through band recovery data, researchers have been able to piece together the common breeding grounds and wintering areas used by many populations of mallards. However band recovery data are only useful in identifying the banding and recovery locations of a duck, with no information on the movements the duck made while in-between those points. Although this information has been useful in determining areas that need habitat conservation attention on both the breeding grounds and wintering grounds we have very little information on areas used as stopovers during migration. These areas are used by mallards to rest and take in the needed energy to complete their migrations and are just as critical to waterfowl populations as wintering and breeding habitat. Through the recent advancements in satellite telemetry, we are now able to fill in the gaps in our band recovery data. This project will allow us to pinpoint the stopover areas of greatest importance to mallards known to winter in Arkansas and allow us to focus our limited habitat management funds on these areas.

Satellite Transmitters and IMS

Tracking the mallard migrations is a costly process requiring the cooperation of many people and the cooperation of the sometimes-difficult mallards. There are two main components to tracking the mallards, the satellite transmitters worn by the mallards and the IMS site used to track the mallards.

The satellite transmitters presently being used are 30-gram platform type transmitters (PTTs). These lightweight units are fitted around the bird similar to a backpack with straps constructed of Teflon ribbon, the same material used in bulletproof vests. This attachment method has proven to be very effective and of low impact to the birds. Once the transmitters are attached the bird is released. After initialization, the transmitter operates according to a schedule. The schedule varies depending on the time of year to conserve the battery for use during periods of migration. During the spring migrations northward the transmitter is active for 6 hours every three days. During the summer months when birds are on the breeding/nesting grounds the transmitter is active for 6 hours every 10 days. And, during the fall and winter months when the birds are making their southerly migration the transmitter is active for 6 hours every 48 hours. The transmitters use National Oceanic and Atmospheric Administration (NOAA) satellites to establish a location of a PTT. The data collected is then transmitted via a third party data service to a database where all location data are stored. In addition to the location data, information is received about the quality of the location data, activity sensor data, battery information and temperature. These data are also stored in the database. Activity sensor data can be analyzed to determine if the PTT is still active or not. Inactivity can be as a result of mortality or detachment from the bird.

Upon deciding to create an IMS site for the tracking of the mallards the Center for Advanced Spatial Technologies (CAST) was contracted to design and develop an automated IMS site that would require little manual interaction. CAST and AGFC set forth to design the website portion of the IMS site. Beginning with a hand drawing of the site as depicted below. This drawing gave a starting place for beginning development on the site.



Comparison of hand drawn design for site and the actual Satellite Mallard Tracking site.

Development continued and changes were made to make the IMS site begin to resemble and be more consistent with the design of the AGFC website. Special attention was given to the user. Most of our users are waterfowl hunters and what seems intuitive to a GIS user does not always seem quite as apparent to a person with no knowledge of GIS, therefore we opted for simplicity. We eliminated the option of turning on/off layers, and set all layer visibility to be controlled by scale. A static legend was used to provide identification for the symbols, political boundaries and rivers. Although there are more features that could be listed in the legend, for the purposes of this site they were not needed. A scrolling commentary was added to provide explanations as to why the ducks were in a certain area or give information on the project. The buttons for the tools that appear so intuitive to a GIS user proved to be a mystery for many of our users. The zoom tool seemed to be an enigma; the concept of drawing a box to zoom was so foreign to so many. The zoom tool was altered to zoom on a click, while it may still also zoom when drawing a box for the GIS users. The mystery was solved. After the design for the site was completed and the tools had all found their respective symbols it was time to put some mallards on the map.

CAST was able to establish a direct connection with the third party data service, Service Argos, Incorporated. This allowed for automated updates to the database. The most recently acquired locations are queried from the database and posted to the IMS site. This gives the user the initial view of the "current" positions of the birds. The mallards are identified as males and females by their symbology. Each duck also has a name that appears on the map beside the symbol. If the user is interested they may also view the entire flight path of the bird, or all of the locations collected by one PTT. The user may also query a mallard to find out when the location was acquired, where it was banded, what the band number is, the date of banding, age of the bird and the latitude and longitude of the location.

To keep track of our users we created a login page where users enter their email address and zip code to enter the site. If they are a new user they are prompted with the optional user survey. Results from the survey are to help us further identify our user group. Also part of the survey, users are invited to suggest a name for a satellite mallard. The Satellite Mallard tracking IMS site has provided for public involvement and a good resource to show "where the ducks are," many hunters have become enthusiastic about the site and continually check it to see what progress the mallards have made. The site has also become a source of revenue for the AGFC. The naming rights to each mallard banded in February 2005 were up for sponsorship. Giving the AGFC an opportunity to gain additional funds to put into the project.

The site has been a success so far and we hope to continue this site for the duration of the project. There have been approximately 35,000 users login to the site since November 2004. Users from each state and more than 50 countries have logged on to see where the ducks are. At the peak of activity, which coincided with duck season in Arkansas, there were 1.9 images being generated per second.

Future plans for the Satellite Mallard Tracking program are to add more detailed data such as topographic maps and aerial photographs. As the program continues to place transmitters on additional mallards they will also appear on the site.

Hanna L. Ford
Programs Support
Wildlife Management Division
Arkansas Game and Fish Commission
2 Natural Resources Drive
Little Rock, AR 72205
hlford@agfc.state.ar.us
(501) 223-6366 Office
(501) 223-6452 Fax

R. Brian Culpepper
Research Specialist
Center for Advanced Spatial Technologies (CAST)
12 Ozark Hall, University of Arkansas
Fayetteville, AR 72701
brian@cast.uark.edu
(479) 575-8745 Office
(479) 575-5218 Fax

R. Andrew James
Waterfowl Program Coordinator
Wildlife Management Division
Arkansas Game and Fish Commission
2 Natural Resources Drive
Little Rock, AR 72205
rajames@agfc.state.ar.us
(501) 972-7318
(501) 223-6452
