Circle *of* Life

THE LONGSTANDING PRACTICE OF ***banding birds*** PROVIDES INVALUABLE INFORMATION ON THE ***life history*** AND ***migratory*** HABITS OF A WIDE RANGE OF SPECIES. ***Written by Eric G. Bolen***

John James Audubon pondered the brood of Eastern phoebes in a nest at a shallow cave in eastern Pennsylvania. It was 1804, and Thomas Jefferson was sending his Corps of Discovery westward in part to describe the natural resources of the Louisiana Purchase. Audubon, just 19, likewise was discovering nature's wonders in America. The strapping youth had left France the year before to oversee property owned by his father near Philadelphia. Audubon was still years away from publishing his remarkable paintings of North American birds, but his keen interest in the lives of birds was already in motion.

The small phoebes in the nest were just days away from fledging, and Audubon had a thought. Would the nestlings return as adults to the same area where they were reared? To answer the question, he tied — loosely, to prevent injury and to allow for growth — a "silver wire" around the leg of each nestling in hope of finding some of the same birds the following year. At the time, the winter quarters of phoebes, like most other migratory birds, lay somewhere yet unknown to the south. To his delight, Audubon located two of the now-grown phoebes a year later in the same locale where he had marked them the previous nesting season. With his loops of silver wire, John James Audubon became the pioneer of bird banding in North America.

In Europe, others had attached bands of one kind or another for centuries, but it's unclear if Audubon knew of those efforts when he banded the young phoebes. Some of the early markings likely were for no other purpose than to establish ownership, as when Henry IV, King of France, placed bands on falcons he used for hunting. In 1595, one of his falcons escaped and showed up 24 hours later on Malta, an island about 1,350 miles away in the Mediterranean Sea. The wayward bird's flight averaged 56 miles an hour. In 1669, another royal figure, Duke Ferdinand, banded a heron that his grandson recovered in 1728, thereby indicating the birds could live at least 60 years. Little changed until 1890 or so, when a Danish ornithologist,

Biologists can learn much from a tiny piece of aluminum fastened to a bird's leg.

TODD PUSSER

1804
John James Audubon begins banding birds

Paul Bartsch adds serial numbers to bands
1902

1909
Formation of the American Bird Banding Association

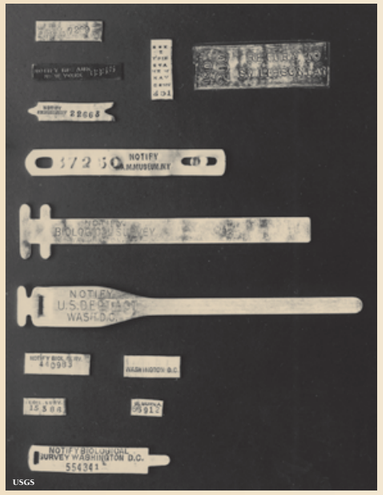
Migratory Bird Treaty
1916

1920
Frederick C. Lincoln organizes the federal bird banding program

1935
Publication of *The Waterfowl Flyways of North America* and *The Migration of North American Birds*

USGS

Frederick Lincoln (below) is considered the originator of the modern banding program and the father of the flyway concept for waterfowl in North America.



Hans Christian C. Mortensen, attached zinc rings—he later switched to aluminum, still used for most bird bands—bearing the name of the banding site and the year to the legs of European starlings.

Back in North America, Paul Bartsch earned the honor as the first person to undertake a truly scientific approach to bird banding when, in 1902, he banded black-crowned night herons in the District of Columbia. The bands were etched with a serial number, the year and "Return to Smithsonian Institution." His efforts continued sporadically until 1910 and yielded recoveries from as far away as Canada and Cuba. Meanwhile, Jack Miner began banding large numbers of ducks and geese at a private waterfowl sanctuary he established near Kingsville, Ontario. Miner's bands bore his address and, often, a short verse of scripture such as "God is able," but they were not numbered. Because of the scriptures, Inuit and other native peoples in northern Canada often brought the bands to missionaries for interpretation. The first of his banded ducks was recovered in South Carolina in 1910, and in 1915, the first of some 20,000 geese he banded between 1909 and 1939 was recovered in northern Ontario.

Such activities led to the formation of the American Bird Banding Association in 1909, but the growing data lacked coordination and standardization, and in 1920 banding became the jurisdiction of the Bureau of Biological Survey (predecessor of the U.S. Fish and Wildlife Service) and the Canadian Wildlife Service. Because of the Migratory Bird Treaty (1916) and the Migratory Bird Treaty Act (1918), the federal government gained jurisdiction over the management, including banding, of migratory birds. (Except for endangered species, nonmigrant birds are banded under state authority.)

In 1920, Frederick C. Lincoln assumed responsibilities for organizing the federal bird banding program, which he directed until 1946. The task was daunting, but he nonetheless designed a uniform system for handling the growing mountain of banding data in an era predating computers. He wrote nearly 250 publications, including descriptions of traps to catch birds for banding, and most concerned what had been learned from the banding program. In 1935, he published two landmarks, "The Waterfowl Flyways of North America" and "The Migration of North American Birds," the latter expanded into book length in 1939. Lincoln is honored as the originator of the modern banding program and as the father of the flyway concept for waterfowl in North America.

ABOUT BANDS

Federal permits and bands are issued by the Bird Banding Laboratory housed at Patuxent Wildlife Research Center in Laurel, Md., which is also the depository and clearinghouse for all banding data and activities, including those in Canada. To date, more than 58 million birds have been banded, of which some 3.5 million were later recovered.

In addition to a serial number, each band once carried the notation "Avise Bird Band, Washington, D.C., USA." The Spanish "avise" is close enough to its English counterpart, advise, to be useful in all of the languages used in North and South America. Remarkably, this simple direction and brief address produced responses mailed from even the remotest locations in far-off lands. In 1995, the message was changed to "Call 1-800-327 BAND" and "Write Bird Band, Laurel, MD 20708 USA." Many years ago, a misprint on one lot of bands transposed the "i" and "o" in the abbreviation for Biological, and the resulting address on the band thus read "Avise Boil. Surv., Wash." Hence, the story goes that at least one respondent indignantly challenged the "advice to wash, boil and serve." The bird, he claimed, was the toughest he'd ever eaten!

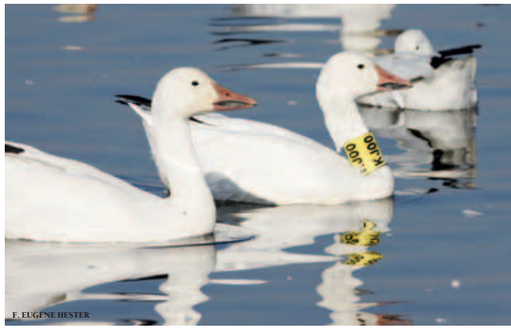
Bands are available in 23 standard sizes, along with five special sizes, that fit the full range of birds—hummers to swans. Butt-end bands are used on most birds, but birds with strong bills like hawks and owls require lock-on bands, and those placed on eagles are attached with rivets. In some cases, bands made of stainless steel, Monel or other hard metals are used on birds that outlive the durability of aluminum or on birds that live in harsh environments. At times, a bird carrying an aluminum band may survive long enough that the serial number erodes, leaving no more than an apparently smooth surface. With chemical treatment, however, biologists usually can determine enough digits to identify the original number.

WHAT DO WE LEARN FROM BANDING BIRDS?

All birds are not recovered in equal proportion to the number banded. As might be expected, migratory game birds head the list of recoveries. In a given year, about half of the banded swans are recovered, 30 percent of the banded geese, and up to 20 percent of the ducks, trailed by woodcocks (10 percent) and doves (4 percent). In contrast, no more than 1 percent of banded songbirds are recovered. Of some 131,000 vireos and warblers banded, for example, only 89 were recovered by 2001. Information derived from band recoveries thus is more robust for some species than others. Nonetheless, much has been learned over the years. Banding information provides

MELISSA McGAW/NCWRC

Data gleaned from banding helps biologists in setting seasons for waterfowl in North America's four flyways.



F. EUGENE HESTER

MELISSA McGAW/NCWRC

BANDS ARE AVAILABLE IN 23 STANDARD SIZES, ALONG WITH FIVE SPECIAL SIZES, THAT FIT THE FULL RANGE OF BIRDS — ***hummers to swans.***


USGS

insight into the basic biology of birds as well as guidance for their management.

Migratory movements, in both time and space, are the most obvious type of information gleaned from band recoveries. Based on thousands of banded birds, especially waterfowl, Frederick C. Lincoln described four major flyways crossing North America on a north-south axis: Atlantic, Mississippi, Central and Pacific. The flyways resemble immense funnels, widest in the North where they overlap, then progressively narrower southward. Because of the overlap, birds of the same species may travel in either one of two or more flyways, but these nonetheless represent discrete subpopulations whose migratory traditions persist for generations.

Pintails and other ducks nesting in the Prairie Pothole region, for example, may end up in the Central, Mississippi or Atlantic Flyway, but they typically maintain their migratory faithfulness to just one of these year after year. In Utah, ducks nesting in the marshes on the eastern edge of Great Salt Lake move in either the Central or Pacific Flyway, and some of the redhead ducks nesting there also move eastward to the Atlantic Flyway. Tundra swans wintering in North Carolina follow a primary migratory route that begins in Alaska, thus crossing all four flyways as they traverse North America.

The flyways revealed by band recoveries are biological pathways that evolved over hundreds of millennia and understandably do not always coincide with the geopolitical boundaries of the modern world. Thus North Carolina lies fully within the Atlantic Flyway, but Louisiana overwinters birds from both the Mississippi and Central flyways and, as already mentioned, Utah is a crossroads for redhead ducks migrating in three flyways.

Nonetheless, the biological flyways provided a useful administrative template for managing most migratory birds, and in 1948, the U.S. Fish and Wildlife Service formally adopted Lincoln's flyways as administrative units for managing waterfowl. Paramount among these activities is the annual promulgation of hunting regulations for waterfowl that are tailored to conditions peculiar to each unit. Accordingly, if drought in one flyway precludes good nesting success, bag limits and season lengths within that flyway can be more restrictive than in other units where production might be better because of normal precipitation.

SETTING SEASONS

Some flyways at times authorize special seasons or bag limits for waterfowl. The most notable of these is the special season for blue-winged teal. Because bluewings begin migrating southward by the end of August, well before the regular season begins, large numbers of the species escaped hunting pressure in most states. Bluewings in fact begin arriving on their primary wintering areas in Mexico, Central America and northern South America by September. (One bluewing banded in southern Canada in mid-August was killed in Colombia just 16 days later.) In response, a September teal season of up to nine days in length was inaugurated experimentally in the Mississippi and Central flyways in 1965 and later became a regular feature. Diminished waterfowl populations led to a temporary halt of the special season in 1988, but it was reinstated in 1998 in the Atlantic Flyway and thereafter in both the Mississippi and Central flyways.

In general, the teal season lasts for 16 days in September and permits a daily bag limit of four birds, which may include cinnamon and green-winged teal as well. Similarly, a lightly harvested mallard population in the Central Flyway prompted biologists to initiate a High Plains Mallard Management Unit in 1968 that permits a special 23-day season for the exclusive harvest of male mallards. As with all season and bag limits for waterfowl, each state within a flyway may opt for stricter regulations than those otherwise authorized for each flyway (e.g., a shorter, but not longer, season length). In sum, banding revealed the somewhat fuzzy biological boundaries for the areas traversed by migrating birds that biologists thereafter hardened into useful administrative units.

Banding likewise helps determine some of the fundamental aspects in the life history of birds. Audubon's simple experiment with phoebes, for example, determined that the young of this species return to breed in the same area in subsequent nesting seasons — a phenomenon now known as homing behavior or philopatry. Modern-day banding has determined that this pattern varies by species. In most ducks, for example, the female exhibits strong philopatry, returning to the same marsh to nest year after year, whereas this attachment in males usually is much less developed. This information emphasizes the importance of protecting breeding areas to assure returning females the availability of suitable nesting habitat where they have previous experience. The sex-specific nature of philopatry in many species of ducks also means that females each year mate with a male from another area, thereby constantly mixing the gene pool and precluding the development of distinct races. Banding provides a measure of dispersal for birds banded at a given location.

Banding also reveals the tenure of pair bonds. If a pair of birds is banded while nesting and the same two birds are nesting together in following years, a lifelong pair bond is indicated, as is the case for geese and swans. A lifetime pair bond also means that both sexes, along with their offspring, return each spring to the same breeding area, leading to genetic isolation and distinctive subspecies (e.g., dusky Canada goose). Also because of banding, we know that if a bird's mate should die, the survivor will find another mate and establish a new lifelong pair bond with that bird.

Banding determines life spans (recall Duke Ferdinand's well-aged heron). Records at the Bird Banding Laboratory include a 12-year-old hummingbird. The longevity record for our state bird, the Northern cardinal, is 15 years 9 months. Records for some other common species include: Canada goose, 24 years 4 months; wood duck, 22 years 6 months; and red-tailed hawk, 21 years 6 months. Additionally, biologists have learned much about the social structure of birds (e.g., pecking order and territorial behavior) by supplementing the numbered aluminum bands with color markers that improve visual identification of individuals.

Finally, banding provides the foundation for understanding the dynamics of bird populations. Recall that the first question typically asked by life insurance agents is "How old are you?" Similarly, biologists use banding records to determine the proportion of birds dying in their first year of life, second year and subsequent age classes. With enough band recoveries at hand, complex computer programs yield estimates of annual mortality rates, from both hunting and natural causes such as disease and predation.

This information, of course, is especially important for managing game birds. Of particular interest is whether hunting significantly increases natural mortality (a situation known as additive mortality) or replaces deaths from predation and other natural causes so that the overall loss of birds each year is essentially unchanged (compensatory mortality). Arguments continue, and some environmental conditions affecting survival may change yearly, but it now seems that hunting is compensatory in nature, at least until a point is reached where hunting increases the death rate and thus becomes additive. Hence, bag limits and season lengths ideally keep hunting mortality from becoming additive. Banding information also can measure the vulnerability of each sex and age class to hunting pressure. It likewise determines survival rates for bird populations that are exposed to oil spills or disease for comparisons with those that are not.

Thanks to banding, we know a great deal about ecology and population dynamics of birds. But the system works only when hunters and others who recover banded birds report the serial number, date and location to the Bird Banding Laboratory. This small effort melds hunters and scientists into a team dedicated to the sound management of migratory birds. Audubon, I'm sure, would be quite pleased. ⬘

Eric G. Bolen, formerly dean of the graduate school, is now professor emeritus at UNC Wilmington and contributes occasionally to Wildlife In North Carolina.


MELISSA McGAW/NCWRC

Biologists gather several pieces of information from captured birds prior to banding, including the bird's weight and wing measurements.


TODD PUSSER


MELISSA McGAW/NCWRC


MELISSA McGAW/NCWRC