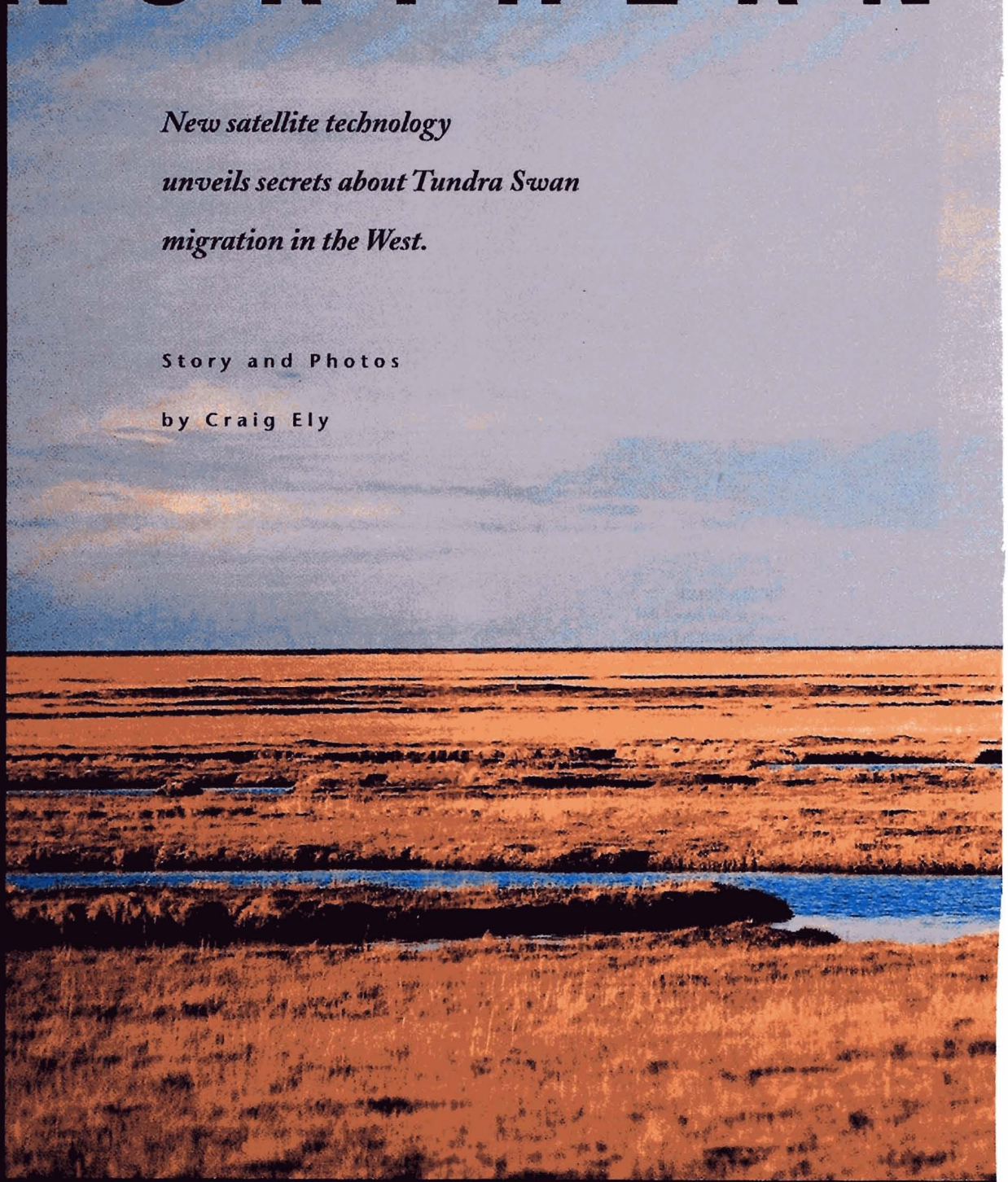
NORTHERN

New satellite technology unveils secrets about Tundra Swan migration in the West.

Story and Photos

by Craig Ely



EXPOSURE

The study of avian migration has held the interest of mankind almost since the beginning of recorded history. Indeed, it was Aristotle who speculated that birds that disappeared each spring and reappeared each autumn either transmutated into another species or entered hibernation. Our abilities to explain why birds migrate have improved modestly since Aristotle's time (384-322 B.C.), but thanks to recent advancements in microelectronics, we have greatly enhanced our capacity to determine where birds migrate. Miniaturization of satellite transmitters in particular has lead to a resurgence of investigations into avian migration, and scientists now can track individual birds virtually all over the globe.

Tracking Tundra Swans

Tundra Swans (formerly called Whistling Swans) are among the largest and most noticeable long-distance avian migrants. They nest on tundra habitat throughout much of Alaska and northern Canada. Their counterparts in the Old World, Bewick's Swans, breed across Asia and winter mainly in Europe. Tundra Swans are comprised of an eastern population and a western population, based primarily on their winter distribution. The eastern population winters along the eastern seaboard and nests from Baffin Island, across northern Canada to as far west as the Seward Peninsula in northwestern Alaska.

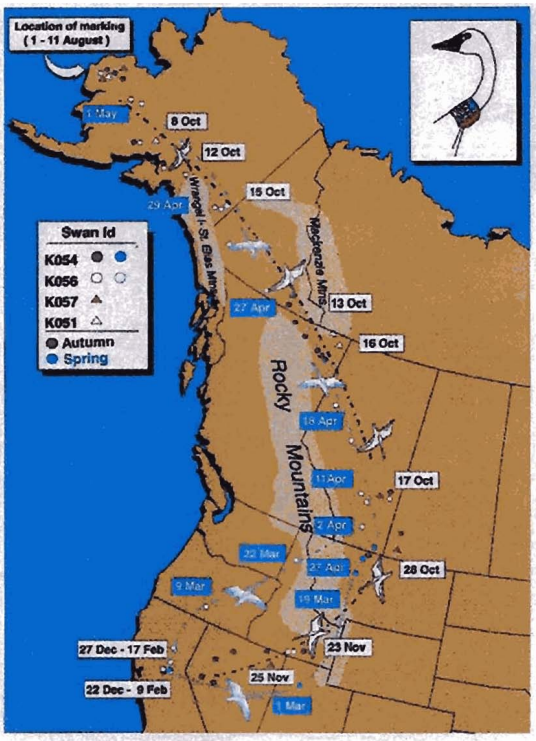
The western population winters primarily in Pacific Coast states and intermountain valleys in the West, and it breeds throughout tundra regions of western and southwestern Alaska, south of the Seward Peninsula. Most swans from the western population nest on the Yukon-Kuskokwim Delta in western Alaska, the single most important breeding area for the species in North America.

Tundra Swans are easily observed on wintering areas where their white plumage and large size make them easy to spot on estuaries and inland waters. Despite their conspicuousness, we have a rather poor understanding of their migration pathways, especially at northern latitudes, where the wetland habitats that they prefer are inaccessible and difficult to monitor.

Until very recently, we could not answer such simple questions as: "How long does it take swans to migrate from Alaska to California?" or "Where do swans stop and rest when flying across remote areas of Alaska and northern Canada?"

To answer some of these questions, we fitted Tundra Swans nesting on the Yukon-Kuskokwim Delta with satellite transmitters to study their autumn and spring migration.

We captured adult pairs with cygnets in late summer using dip-nets. This proved no simple task. Although Tundra Swans, like other northern waterfowl, become flightless each summer when they molt their flight feathers, they are excellent runners. Their large webbed feet give them a decided advantage over biologists trying to negotiate soggy tundra in hip boots. One-on-one, we didn't stand a chance, so we relied on our superior numbers to eventually contain them.



Upon capture, adult females were fitted with satellite transmitters attached to neck collars. Transmitters were programmed to turn on for four to five hours every other day and were expected to function for six months. Receivers collected the transmitter signals on National Oceanographic and Atmospheric Administration polar-orbiting environmental satellites. Location information was transmitted from the satellite to a ground station in France and sent electronically to our computers in Alaska.

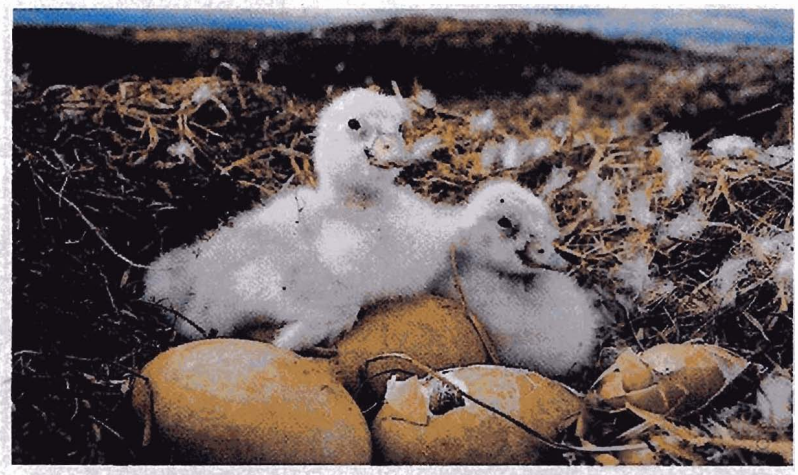
Our marked swans, all of which were with young, remained near where we captured them until early October, which is not surprising. Tundra Swans on the Yukon-Kuskokwim Delta generally do not fledge until September or October. Radio-marked swans initially joined other swans near the Bering Sea coast or along major rivers before continuing eastward across the Yukon-Kuskokwim Delta.

Swan Stopovers

After departing the delta, satellite-marked swans stopped at wetlands on the upper Kuskokwim River before crossing the Alaska Range and alighting on the Susitna Flats of Upper Cook Inlet. From Cook Inlet, they flew eastward and, despite relatively mild autumn weather, stopped only briefly at staging areas in eastern Alaska and the Yukon Territory. They turned southward, flying through the interior of the Yukon into northeastern British Columbia. From British Columbia, the swans stopped in central Alberta and southwest Saskatchewan, where they remained for up to three weeks during late October and early November before flying across Montana to southeastern Idaho. Our swans remained near the Snake River from mid-November until early December when they migrated across the deserts of Nevada to the Sacramento-San Joaquin Delta of California.

Two of the satellite transmitters functioned longer than expected and provided location information throughout winter and during spring migration. One swan wintered in both the Sacramento-San Joaquin Delta and the Sacramento Valley, moving between the two areas several times from December to February. The other swan remained in the Sacramento-San Joaquin Delta. The two swans took different spring migration routes: One migrated north through Oregon and Idaho on the way to Alberta, while the other flew east to Utah before continuing north into Montana. We were able to monitor the movements of one bird through Alberta and back to the Yukon-Kuskokwim Delta, along the same route it took during autumn.

The swans' migration route was corroborated by regional observers, who noted flocks of swans in many of the geographic areas documented in our study. Observers also occasionally sighted a



Tundra Swan cygnets hatch in late June to early July, but don't fledge until September. By that time, freezing temperatures may prevent them from flying south.

Costly or Cost-Effective?

Leading-edge technology is generally quite expensive. Miniaturized satellite transmitters for animals are no exception, especially because there is not a high demand for them, which means they are not mass-produced. Each transmitter costs $2,500 to $3,500, and satellite time can run as high as $300 per month for each transmitter.

Yupik eskimo youths from the village of Chevak helped catch and mark swans.

Our project was made possible only through a special program to test and assess microsatellite technology for wildlife applications. The use of satellite transmitters may seem prohibitively expensive for most wildlife applications, but use of such devices can actually be cost-effective.

This is especially true when tracking animals in remote areas where a lot of aircraft time is required to track birds with conventional VHF radio transmitters (whose range of detection is generally less than 19 miles). Tracking animals via satellite is much safer than trying to fly in a small plane over remote areas, especially during spring and autumn when stormy weather can make flying hazardous. — *Craig Ely*

radio-marked bird. The geographical distribution of leg-banded swans that were recaptured as well as observations of swans from the Yukon-Kuskokwim Delta on southern staging and wintering areas provided additional verification of the importance of habitats used by our radio-marked birds. Birders are well aware of the concentrations of Tundra Swans in eastern Oregon, Idaho and Utah during autumn and spring migration.

Satellite Tracking

The Tundra Swan is one of the largest species of flying birds and, because of this, one of the first avian species to be fitted with satellite transmitters. Satellite transmitters have been successfully used to track Bewick's Swan during spring migration in Europe and Asia, where the main objectives were to locate the breeding areas of birds marked during winter.

Satellite transmitters designed for birds are generally smaller, have less battery capacity and transmit with less signal strength than satellite transmitters typically used on large mammals. As a result, location information obtained from small avian transmitters is often accurate only to within a couple of miles. Fortunately for studies of species undergoing long migrations, the magnitude of location error is generally negligible relative to the length of the migration route.

Tundra Swan cygnets are among the slowest-growing of northern waterfowl. They are weaker and developmentally less mature at fledging than ducks and geese. On the Yukon-Kuskokwim Delta, cygnets first gain flight nearly three weeks after sympatric-nesting Cackling Canada and Greater White-fronted Geese, but all three species generally begin autumn migration at the same time. It was not unexpected that swans made many stops to rest and replenish body reserves during autumn migration, as they were likely unable to sustain long, uninterrupted flights. I was surprised, however, that swans remained so briefly at northern areas and did not stop to stage at any given location for more than a few days until they reached central Alberta. Swans have generally been reported to be able to remain longer than geese at northern breeding and staging areas due to the thermoregulatory benefits of their large body size and the greater availability of aquatic compared to terrestrial foods after autumn snowfall.

Migration areas are critical to all migratory waterfowl, and those areas at northern latitudes are especially important to Tundra Swans. Many northern marshes are relatively pristine, but others have been contaminated by heavy metals and siltation from industries associated with the extraction of natural resources, such as timber, hydrocarbons and minerals. It is imperative that we document the importance of key migration areas and make sure these sites receive the public exposure they need for protection. WB

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