BIRD WORK

The Center for Conservation Biology

Annual Report 2019

CCB's

ONGOING MISSION

The mission of The Center for Conservation Biology, through all of its diverse programs, is to provide the global community with the information needed to drive thoughtful, science-based conservation, to educate and train the next generation of conservation scientists, and to make lasting contributions to the natural world through critical thinking, innovation, and ground-breaking research.

The Center for Conservation Biology is a research unit shared by William & Mary and Virginia Commonwealth University. The Center is a part of the VCU Rice Rivers Center. Rice Center scientists conduct cutting-edge environmental research on the James River and around the world.

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ON THE COVER:

Field crew sets up mist nets in the dunes on Assateague Island to capture Ipswich sparrows as part of a habitat, winter survival and home range study. Working a multi-dimensional study requires the mastery of several field techniques. *Photo by Bryan Watts*

A MESSAGE FROM THE DIRECTOR

The nest was off-center on the outer crown of a huge oak, forcing me to limb walk away from the trunk and throw a line over a supporting branch. As I ascended to the base of the nest the rope jammed, leaving me stranded with no way up or down. Hanging eighty feet up and feeling my energy ebbing, I reached for the long lanyard on my harness, threw it over a limb above, flipped upside down, put my knees on the edge of the nest, and pulled myself hand over hand upright into the nest. Time is the enemy in fieldwork, there is only seizing the moment and moving forward. Some days we are winners and some days we are losers, but we are never sitting in the bleachers watching the game.

The Center for Conservation Biology exists on the front line. We live knee-deep in the blood and guts business of fieldwork. Bone-jarring truck rides, white-knuckle boat rides, standing in waist-deep swamp water for hours, hanging from a rope over a gorge — this is the glorious essence of a life working with species where they live. It is the being there in full awareness that allows us to constantly reassess, adapt, and overcome. Confronted with complex problems, we frame the questions and employ the combination of field techniques to collect appropriate data to address them. Triumphs come project by project by deliberately pushing forward.

Fieldwork is a craft performed by artisans. Some of the techniques may be learned in an afternoon while others may take a lifetime to master. To execute the wide diversity of projects conducted by The Center requires the mastery of hundreds of field techniques. Within this annual report I have attempted to highlight a few of them.

Conservation is a team sport. Join with us to make a difference.

Sincerely,

Bryan Watts

Bryan D. Watts
Mitchell A. Byrd Professor of Conservation Biology
Director, The Center for Conservation Biology

Bryan Watts walks back to a boat on the Rappahannock River after conducting a marsh-bird survey. The Center specializes on surveys designed to estimate bird populations. *Photo by Marian Watts*

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Fletcher Smith at the end of a long day trapping whimbrels on the lower Delmarva Peninsula. Many waterbirds nest and forage in habitats that require boats to access. Good boat skills and experience during all types of weather and often during the night are essential. *Photo by Bart Paxton*

BEING THERE

From our armchairs tucked away in an office it is easy to lead ourselves down the garden path of believing that we know how the natural world works. Isolated in our offices we become blind, struggling to imagine a flame-colored sunset. The complexity of nature is so much more than our most fantastical dreams. There is no substitute for being there – to feel the elements that have shaped a place, to see the species compete on the battlefield, to watch the drama unfold on the stage where it was meant to be performed. Life reflects context.

Somewhere at the end of the last single-track road there is a skiff waiting where we will leave the endless meetings and phone calls behind. We will join a world where time is measured by the sun, where eagles cut a clean line across the sky, and laughing gulls settling down on a distant bay have the last word. As field biologists we enter this place like a cathedral with a sacred text laid out before us. We come not as passive observers but as students and explorers.

Gina Kent (r) and Libby Mojica (l) use a log as a dry table to process a swallow-tailed kite in a Georgia swamp. Adaptation and perseverance is the key to completing fieldwork within some habitats. Experiencing these habitats first hand provides insights that simply cannot be gained any other way.
Photo by Bryan Watts

POPULATION ESTIMATION

Populations are groups of potentially interbreeding organisms. They may be confined to small, isolated locations or extend over vast areas depending on the species. Populations are the biological units of conservation and population size is often the metric we use against a reference benchmark to assess the state of recovery or endangerment.

The Center for Conservation Biology specializes in systematic, benchmark population surveys. We have assessed hundreds of populations using a variety of field methods, from density estimation and habitat projects to mark-resight techniques. Many of these efforts have been part of long-term survey series that The Center has maintained to assess population trends across decades. The trends have been used to inform conservation planning and adaptive management.

White ibis in a colony near Chincoteague Virginia. White-colored birds like the ibis are effectively surveyed from the air because they are easily detected. *Photo by Bryan Watts*

AERIAL SURVEYS

Populations may be distributed over tens of thousands of kilometers. Even if a large army was available to conduct surveys, accessing remote or restricted areas from the ground is often not possible. In settings where the species is out in the open and visible from the air, surveying from an aircraft is the most effective approach. Aerial surveys allow biologists to systematically cover large areas including remote locations effectively and efficiently. Depending on the terrain and wind conditions, surveys may be conducted from fixed-wing aircraft or helicopters.

FIELD TECHNIQUES

The Center has conducted more than 5,000 hours of aerial surveys to assess dozens of populations throughout the Western Hemisphere. Surveys have included complete counts, transects, and grids, to estimate populations during the breeding season, as birds stopover during migration, or within the wintering grounds.

Conducting a helicopter survey for peregrine falcon cliffs within the southern Appalachians. Helicopters are preferred over fixed-wing aircraft in terrain that creates a great deal of air turbulence. *Photo by Bryan Watts*

(Opposite page) Captain Fuzzzo Shermer (l) and Mitchell Byrd (r) flying an eagle nest survey along the James River. Surveying from the air is the only effective approach to mapping eagle nests within the Chesapeake Bay. The team of Byrd, Watts and Shermer have worked together surveying eagles and other species since 1992. *Photo by Bryan Watts*

LINE TRANSECTS

Many bird species are cryptic, particularly during the winter period when they are less vocal or occur within extensive, uniform habitat. Sampling birds along transect lines is a common approach to estimate the density of cryptic species or to subsample extensive habitats. Transects may be established within a single habitat or may be stratified across several habitats to estimate densities. Permanent, repeatable transects may be established to assess changes in density over time.

FIELD TECHNIQUES

The Center has employed band or variable-width transect techniques in dozens of studies to estimate populations. Surveys of band transects record all individuals within a fixed distance from the transect line. Variable-width transects record both individuals and their distance off the transect line and then employ distance-sampling techniques to estimate densities. Habitat-specific densities produced from transect surveys along with habitat availability may be used to extrapolate population estimates. The Center has used line transects to estimate densities from the ground, from boats, or from the air.

Swamp sparrow in the hand. This species and a wide range of others that are cryptic during the winter months is often best surveyed using line transects. *Photo by Bryan Watts*

Chance Hines (l) and Zak Poulton (r) drag a rope through a salt marsh to survey saltmarsh and Nelson's sparrows. The result is a band-transect count. Some species are so cryptic and secretive during specific seasons that specialized approaches must be used to survey them. Rope dragging is very effective for these species during winter. *Photo by Bryan Watts*

POINT COUNTS

The point count is the most widely used technique for estimating bird density. Since the 1960s, this technique has evolved and become a true work horse of the industry. Although they may be used in a number of different settings, point counts are an extremely efficient technique for surveying birds during the breeding season when singing frequency peaks. Flexibility is one of the great strengths of this approach and points may be structured in space and time to reveal influences of a wide range of factors on bird density.

FIELD TECHNIQUES

The Center has conducted hundreds of thousands of point counts focused on a large number of species. An observer stands on a point and records all birds heard singing. Similar to line transects, point counts may be fixed radius but are more often variable radius counts where distances to singing birds are estimated. Habitat-specific densities may be used with habitat availability to estimate population size. Over time, this may be repeated to estimate population trends.

(Opposite page) Laura Duval listens for nightjars while conducting a point count as part of The Center's Nightjar Network. The network has routes of point counts distributed across North America that are surveyed by volunteers to determine the distribution and population trends for several species of nightjars. *Photo by Bart Paxton*

Green heron forages in marsh. Due to their calls that carry for long distances, green herons are frequently recorded on point counts in marsh habitats or around water. *Photo by Bryan Watts*

DEMOGRAPHY

Demography is the science of populations. We may count individuals within a population but in order to understand the internal workings of the population we must also study births and deaths. Demographics provide a baseline for monitoring population health and offer insights into the mechanisms driving population declines. The relationship between birth and death rates determines the age structure and whether a population is increasing, decreasing, or stable in the absence of immigration.

Demographic investigations are often time and resource intensive. The Center has focused its demographic studies on several species of high conservation concern when having such information may lead to better conservation outcomes. Some investigations of births or fecundity have spanned decades and included tens of thousands of breeding attempts. Some investigations of mortality have included marking thousands of individuals.

A young brood of peregrine falcons in Virginia. The reproductive performance of this recovering population has been monitored closely since the early 1980s. All individuals are marked as nestlings and monitored to assess survival. Demographic studies require long-term commitments. *Photo by Bryan Watts*

REPRODUCTIVE RATE

Reproductive rate is the number of offspring an individual or population produces in a given period of time. This is the debit side of the population ledger. In birds, we typically express this metric as the number of offspring produced per pair or female per year. Fecundity varies widely across bird species. Some long-lived seabirds never produce more than one young per year, while shorter lived waterfowl or gallinaceous birds may have single broods of ten or more and some passerines may produce several broods per year.

FIELD TECHNIQUES

The Center has invested significant time and resources to monitor reproductive outputs of several species of conservation concern. This includes more than 25,000 bald eagle nest checks, more than 20,000 osprey nest checks, and following virtually all peregrine falcon and red-cockaded woodpecker nest outcomes over the past few decades. These efforts have investigated factors that may influence productivity such as contaminants, human disturbance, predation, and site quality. We have employed aerial surveys and various other specialized techniques such as mirror poles, game cameras, and peeper scopes to observe nests.

Standing on Swedish climbing ladders near a woodpecker cavity. Using Swedish climbing ladders is a critical skill that must be mastered in order to work with red-cockaded woodpeckers. The ladders are used to access roost and nest cavities for management activities. *Photo by Bryan Watts*

Just hatched American oystercatchers. A large portion of the Virginia breeding population has been monitored since the early 2000s to estimate reproductive rates that have been used to compare to other populations and to evaluate the effectiveness of ongoing management.
Photo by Alex Wilke

A brood of yellow-crowned night herons in Tidewater Virginia. The Center has monitored reproductive rates in this species for many years but have not been able to assess adult survival.
Photo by Bryan Watts

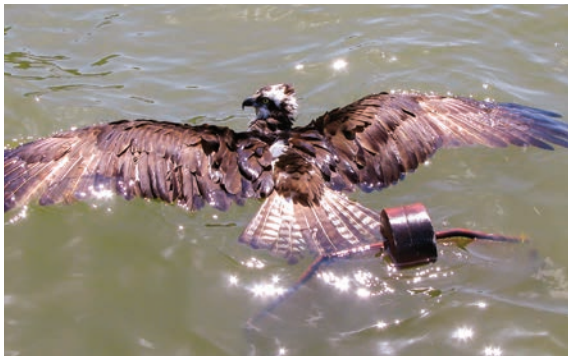
MORTALITY RATE

Mortality rate is the number of individuals dying within a specific period of time and is the counterweight to reproduction. For most long-lived bird species, population trends are more sensitive to changes in mortality rates rather than reproductive rates. Unfortunately, of the two metrics, mortality is often much more resource-intensive to measure. Mortality tends to be high in the first year and then flattens out in subsequent years such that of the many young that are produced, few survive to breed. Understanding the causes of adult mortality is often an important step in successful conservation.

FIELD TECHNIQUES

Discovering how and where birds die is a critical step in the conservation process. The Center has used two approaches to estimate mortality rates including conventional mark-resight techniques and various tracking technologies. To estimate mortality for local populations, young birds are marked and periodic surveys are conducted over time to resight marked individuals. The Center has used this approach with red-cockaded woodpeckers, peregrine falcons, osprey, bald eagles, and American oystercatchers over decades and with other species over shorter time periods. The Center has also deployed tracking devices on several species and followed cohorts through to mortality events.

Chance Hines weighs a nestling red-cockaded woodpecker within the Piney Grove Preserve. Assessing nestling condition allows The Center to evaluate relationships between condition in early age to other benchmarks such as fledging, attaining breeding territories and survival. *Photo by Bryan Watts*



Adult osprey captured by a dome trap floats on the James River waiting to be retrieved. Osprey have been trapped this way in the Chesapeake Bay for decades. Banding adults along with follow-up monitoring allows researchers to estimate survival. *Photo by Bryan Watts*

Bryan Watts holds a nestling red-cockaded woodpecker after banding within the Piney Grove Preserve. The ability to identify individuals is key to assessing survivorship. All of the individuals within the Virginia population are uniquely banded allowing The Center to follow individuals throughout their life. *Photo by Bobby Clontz*

MOVEMENT ECOLOGY

Among the traits shared by humans and other animals is the intentional movement through space to perform activities. Understanding the pattern of purposeful movements is fundamental to knowing how ecosystems function and is the focus of the rapidly-expanding field of movement ecology. Investigations typically focus on four areas including 1) internal state and motivation for moving, 2) capacities for navigation, 3) when and where to move, and 4) an animal's physical ability to move. Birds are among the most mobile animals on earth and movement is one of the most fascinating aspects of their ecology. The study of bird movement has come into its own in recent years with the rapid development of location-aware technologies such as GPS-enabled transmitters.

The Center has been interested in the movement of birds for decades. Much of this interest has focused on the ecology of migration, but other work has included characterizing dispersal and local movements related to hazard mitigation. To answer specific questions, we have employed conventional mark-resight techniques and deployed a wide range of tracking technologies.

An Ipswich sparrow fitted with a nanotag during the winter on Assateague Island. Nanotags communicate with a network of receiving stations along the Atlantic coast. This technology is being used to investigate migration pathways in this unique passerine. *Photo by Bryan Watts*

MIGRATION

Migration is the directed movement of an individual between two “ranges.” The most common form of migration in birds is the movement between breeding and winter home ranges. These movements allow birds to exploit resources that are only available during a given season. The movement of billons of birds annually from the extreme latitudes of the northern or southern hemispheres toward the tropics and back are grand examples of this form of movement.

FIELD TECHNIQUES

Migration ecology has been one of the most enduring research themes for The Center. We have been interested in migration pathways, the timing of migration, identification of stopover areas, foraging and stopover duration, and the condition of migrants along their route for decades. We have employed direct observation and a wide range of survey techniques to document movement timing. We have used mark-recapture or resighting techniques to examine stopover duration. We have used several tracking technologies to document migration pathways and flight speeds.

(Opposite page) A fourth-year eagle fitted with a transmitter in the upper Chesapeake Bay. By tracking a large cohort of wintering birds The Center was able to delineate migration pathways between the Bay and eastern Canada. *Photo by Bryan Watts*

(Left) Marian Urbi Watts (above) and Melissa Urbi Shaw (below) count whimbrels leaving the lower Delmarva for arctic breeding grounds. Strategic counts executed over years provide information about population trends. *Photo by Bryan Watts*

(Above) Marian Watts holds a young peregrine after banding with field readable bands. The use of these bands along with an intensive monitoring program has allowed The Center to determine dispersal distances for both male and female peregrines. *Photo by Bryan Watts*

(Right) Bart Paxton holds a catfish fitted with monofilament nooses linked to a bungee cord and a drag line used to capture eagles in the Chesapeake Bay. This capture technique along with others has allowed The Center to mark and deploy transmitters to investigate movement patterns and survival. *Photo by Bryan Watts*

DISPERSAL

Natal dispersal is the movement of an animal from the place of birth to the location where it will ultimately breed. For the majority of bird species, dispersal progresses through three phases including 1) a decision to leave the natal territory, 2) a transition period of exploration or prospecting and 3) a decision to settle or establish their own breeding territory. Of these three phases, we know the most about when young birds leave their natal territories. We know far less about prospecting and, for many species, even less about where young birds ultimately settle. Achieving an understanding of dispersal distances, gender differences, and seasonality provides insights about the spatial structure of populations, potential rates of range shifts, and possible interaction with hazards.

FIELD TECHNIQUES

We employ different techniques to assess the various stages of dispersal. For most species, movements away from the natal territory and prospecting movements are best assessed using tracking technologies. However, due to the long recruitment period, tracking is less effective for documenting settlement. Collecting data on settlement typically requires an intensive program to mark nestlings paired with an intensive monitoring program to detect settlement. Development of such a data set requires years of commitment.

(Opposite page) Peregrine falcon female from the Mills Godwin Bridge. This bird was hatched on Mockhorn Island and dispersed sixty-five kilometers to this breeding territory. The use of field readable bands allows The Center to follow the history of each bird. *Photo by Bryan Watts*

HABITAT USE

The revolutionary Princeton ecologist Robert MacArthur was noted for stating that any experienced bird watcher could walk into a habitat and tell you what birds would be found living there, but if we did not quantify, analyze, and interpret their distribution, the patterns would continue to be sensed without ever being communicated effectively to future generations. Determining the essential conditions that a species requires is a vital first step toward protecting the species by providing those conditions.

Over many years we have conducted dozens of investigations to isolate the factors that appear to be essential in driving the distribution of specific species. In concept, these investigations are similar to screening chemical compounds to find the few that provide medicinal benefits. We evaluate a set of features and the occurrence of a species in order to assess the strength of a predictive relationship. Less frequently, we manipulate features and measure the response of a species. Central to these assessments is our ability to monitor the use of space by the target species and to quantify habitat features.

Richard Ward (l) and Katy Rubis (r) venture out on the mudflats in Panama to collect mud samples used to investigate shorebird prey availability. For migrant shorebirds, prey availability is the key to site quality. *Photo by Bryan Watts*

HOME RANGE

A home range is the area over which an individual regularly travels during a specified period of time. A territory is the portion of a home range that is actively defended from other individuals. The home range has been a significant tool in understanding habitat requirements since the space that confines an individual contains the essential resources needed to survive. Once we delineate the range, we may quantify resources within this area and then compare their densities to random locations throughout the landscape in order to assess their predictive value. We may also evaluate the relationship between activities and the distribution of resources within the home range.

FIELD TECHNIQUES

Delineating a home range requires that an individual be tracked through space and time. This may be done by 1) following a known individual and mapping their location periodically, 2) tracking individuals using conventional radio transmitters and triangulating their locations using antennas or 3) tracking them with modern satellite or GPS transmitters. All of these techniques result in a cloud of points that may be assessed using analytical techniques to determine the likelihood of an individual being found in a given location.

Libby Mojica attaches a transmitter to a second-year bald eagle. Tracking eagles with satellite transmitters has allowed The Center to effectively assess winter home ranges. *Photo by Bryan Watts*

Peregrine falcon fitted with satellite transmitter. Tracking a cohort of peregrine falcons with transmitters has allowed The Center to effectively assess winter home ranges. *Photo by Bryan Watts*

Chance Hines (l) and Laura Duval (r) band Ipswich sparrows in the dunes as part of a winter home range study. This study requires several field techniques including capturing birds using mist nets, aging and banding birds, fitting birds with transmitters and following birds through the winter to map locations. *Photo by Bryan Watts*

SITE QUALITY

Not all home ranges, territories, and migratory staging areas are the same. Critical resources are not evenly distributed across the landscape and differences in resource densities may lead to differences in site quality. Some individuals live in abundance while others barely scrape by. Site quality is the attractiveness of a location to a species, reflecting the concentration of critical resources, protection from the elements, or possibly the density of potential predators. Site quality is one of the key criteria we use to identify areas with high conservation priority.

FIELD TECHNIQUES

In order to assess site quality, we either measure critical resources directly or we measure species "outcomes." Critical resources depend on the species and circumstances such as the availability of dead snags for breeding woodpeckers or the density of bivalves for staging shorebirds. Field techniques are tailored to the specific resource being measured. Outcomes are often more easily quantified and include how a species behaves or performs such as reproductive output, home range size, foraging rates, or the density of migrants.

Adult osprey carrying a gizzard shad to a nest on the James River. Prey delivery rates are often a good measure of site quality. *Photo by Bryan Watts*

Catherine Markham picks up an eaglet along the Mattaponi River during a study of nestling growth rates across several rivers in Virginia. Growth rates give a good indication of site quality. *Photo by John DiGiorgio*

Bart Paxton (l) and Marie Pitts (r) collect blood samples from a bald eagle nestling along the James River. Contaminant loads are an important dimension of site quality for sensitive species. *Photo by Bryan Watts*

INSTITUTIONAL PARTNERS 2019

Acadia University
Advanced Conservation Strategies
Aluminum Company of America
American Bird Conservancy
American Eagle Foundation
American Wind Wildlife Institute
Arborscapes, LLC
Arizona Bird Conservation Initiative
Atlantic Coast Joint Venture
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Georgia Ornithological Society
Georgian Bay Osprey Society
Gomez and Sullivan Engineers
Good Shepherd Fund
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Hanover Aviation
Idaho Bird Observatory
Illinois Natural History Survey
Institute for Integrative Bird Behavior Studies
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Michigan Dept of Natural Resources
Michigan Natural Features Inventory
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Midstream Technology, LLC
Midwest Coordinated Bird Monitoring Partnership
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Mount Allison University
Movebank
MPJ Wildlife Consulting, LLC
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National Fish and Wildlife Foundation
National Park Service
New Hampshire Audubon
New Jersey Audubon
New Jersey Conservation Foundation
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Northern Neck Audubon Society
Northern Virginia Conservation Trust
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Wisconsin Bird Conservation Initiative
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ON THE BACK COVER:

View of a Forster's tern colony from the air. Colonial waterbird populations have been surveyed from the air in the Chesapeake Bay since the 1970s. Aerial surveys are the most efficient and effective approach to surveying for bird colonies within this landscape. *Photo by Bryan Watts*

CCB

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