THE ARC OF CONSERVATION

THE CENTER FOR CONSERVATION BIOLOGY

Annual Report 2024

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

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Annual Report 2024
Content by Bryan Watts
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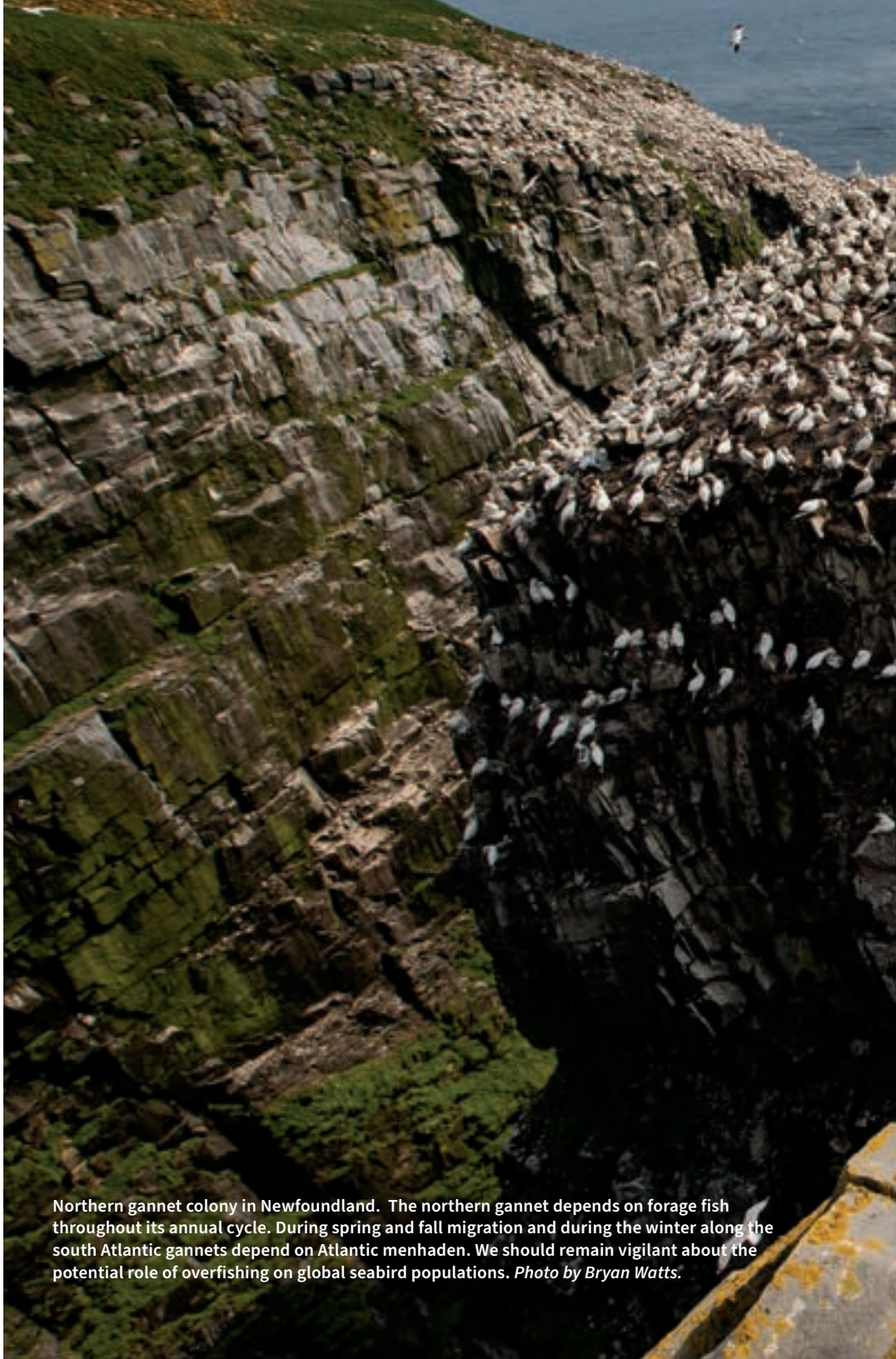
(Front cover) Adult osprey in Chesapeake Bay. Osprey represent the arc of conservation having declined throughout their range due to DDT and then recovered throughout their range with the help of management. We continue to be vigilant to guard against new threats.



Northern gannet colony in Newfoundland. The northern gannet depends on forage fish throughout its annual cycle. During spring and fall migration and during the winter along the south Atlantic gannets depend on Atlantic menhaden. We should remain vigilant about the potential role of overfishing on global seabird populations. ***Photo by Bryan Watts.***

A MESSAGE FROM THE DIRECTOR

Working on the front lines of conservation is like being an emergency room doctor. The long hours and relentless pace are exhausting. The clock is ticking, and the stakes are real. The right decisions have to be made now or bad things can happen. You use all of the information available and all of the experience you have to diagnose the problem and find a treatment. Time is always limited. You live with the internal struggle of whether or not to succumb to the constant request for meetings where people talk about doing something or spending that time actually doing something. Every day is different. Every day is consequential. Every day is full of the exhilaration of expending your life for something you value.

From the outside, conservation may seem like chaos. It is not. Like the narrative arc of a good novel, conservation moves through a sequence of ordered stages. These include identification of species in need, diagnosis of factors causing imperilment, consideration of potential remedies and development of a treatment plan, implementation of treatment with adaptive management, and resolution or recovery.

The Center specializes on the intense, heady first three phases in the arc. We have decades of benchmarks for dozens of species. We are constantly assessing these species and the threats they face. The urgent diagnosis of why a species is declining requires moving in all directions at once, turning over rocks, and driving toward answers. Developing remedies requires creativity, innovation, and thinking outside the box. The Center thrives in these fast-paced spaces where innovation wins the day.

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

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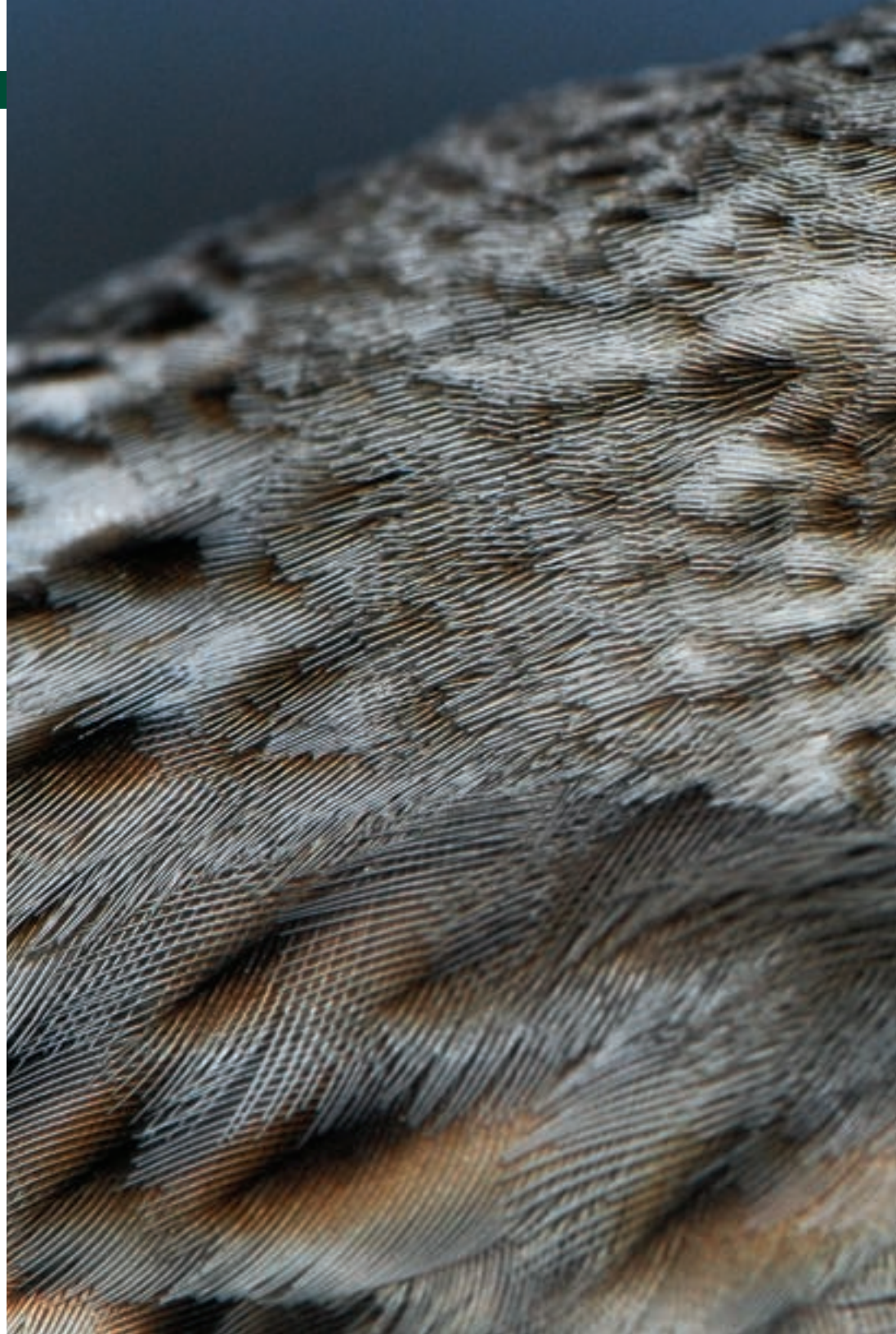

Ipswich sparrow in winter. The Ipswich sparrow is a dune specialist threatened by winter habitat loss along the mid-Atlantic coast. CCB continues to investigate requirements in order to understand how to mitigate threats. ***Photo by Bryan Watts.***

Wayne's warbler is a unique, isolated form of the black-throated green warbler that appears to have been declining for several decades. We are desperately working to measure this populations' vital signs and document requirements in order to develop a management strategy. ***Photo by Bryan Watts.***

(Top) Barry Truitt in back of survey plane during ferry out to the Virginia barrier islands to survey migratory shorebirds. We conducted spring surveys for more than twenty years to assess status, distribution and trends for a dozen shorebird species. *Photo by Bryan Watts.*

VITAL SIGNS AND CRISIS DETECTION

The arc of conservation begins with the identification of a species that is in need of management action. Of the millions of species on earth, how do we identify those species that are in trouble and in greatest need of our help? Similar to a patient who walks into an emergency room, we take their vital signs. For us, vital signs are measurements of our body's critical functions such as breathing rate, temperature, blood pressure, and pulse rate. Compared back to norms or baselines, these simple measures allow a doctor to evaluate a patient's status. For wild populations, we use a set of measurements including population size, demographic rates, and distribution that when compared to previous benchmarks give us insight about the condition of the population. Like risk factors in humans, many assessments of wild populations also include an evaluation of ongoing or future risks that the population is encountering. These collective vital signs or assessments are commonly referred to as a species' conservation status. Conservation status generally reflects a species' risk of extinction and provides a common metric that allows us to prioritize species for action.

One of the great strengths of The Center for Conservation Biology is identifying bird populations that are most in need of conservation. We have collected population metrics for scores of species over decades and have a unique perspective on the problems they face. Our information along with careful analysis has led to the identification of many imperiled species and the subsequent establishment of conservation programs focused on their recovery.

(Bottom) Clutch of the clapper rail in a Chesapeake Bay salt marsh. We have surveyed clappers and other marsh obligates in reference marshes over a 30-year span to document breeding densities and population trends. *Photo by Bryan Watts.*

POPULATION TREND

Like running a fever, a sharp downturn in a population is usually the first sign of a problem. The trend in population size is the most widespread vital sign used by the conservation community to flag a species for additional assessment. Just like how high a temperature is above normal matters, the slope of a population decline matters. While an annual decline of one to two percent may lead to highlighting the species for additional observation, an annual decline of 10% would be cause for immediate concern and action.

Trends in population size are determined by systematically measuring size over time and establishing points of reference. We use these reference points to evaluate the rise and fall of populations over time and to estimate rates of change. The Center for Conservation Biology specializes in systematic population surveys. We have established hundreds of reference points involving more than one hundred bird species. Some of these survey series span several decades and give a detailed account of population history.

(Top) Young tricolored herons in Chincoteague colony. This species has declined by 86% in Virginia over the past 50 years and its distribution has contracted dramatically. Regular, systematic surveys have allowed us to track population changes. *Photo by Bryan Watts.*

(Bottom) Captain Fuzzzo Shermer (lft) and Mitchell Byrd (rt) survey breeding bald eagles along the James River. Eagle population size, distribution and demography have been monitored by aerial survey for 60 years to inform management and to measure outcomes. *Photo by Bryan Watts.*

Ipswich crew heading out to survey Metompkin Island. Although for many species we have in place programs for regular, systematic surveys that establish benchmarks some species we may kick the tires and do ad hoc surveys to get an initial sense of where we are or how we may best approach surveys. *Photo by Bryan Watts.*

Chance Hines color bands a Wayne's warbler in the Great Dismal Swamp. CCB uses unique combinations of color bands on passerines and field readable bands on larger birds to identify individuals and allow us to estimate survivorship. ***Photo by Bryan Watts.***

DEMOGRAPHY

Demographic rates are essential vital signs that provide researchers clues about why a population is changing. Just as cash flow resulting from debits and credits determines the viability of a business, the flow of individuals through births and deaths determines the viability of a natural population. 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. Comparison of current rates back to norms or previous benchmarks allows us to sort out which metrics may be causing populations to decline such as a spike in adult mortality or a dip in reproductive rates that changes the balance sheet.

Demographic rates are particularly diagnostic. The Center collects demographic rates for many species of high conservation concern so that we can monitor what factors may be causing population change. Our monitoring efforts typically focus on reproductive rates, survival of young to recruitment into the breeding population, and adult survival. Recognition that one of these rates is off kilter allows us to quickly focus in on possible causes of population change.

(Top) Nestling yellow-crowned night heron. Reproductive rate is a key demographic metric. CCB has monitored reproductive rates for dozens of imperiled species to help diagnose underlying problems. *Photo by Bryan Watts.*

(Bottom) Second-year peregrine falcon on territory in the lower Chesapeake Bay. Age to first reproduction is an important demographic parameter. Peregrines typically recruit into the breeding population during their third year. A spike in second-year recruits may indicate a concern with age structure. *Photo by Bryan Watts.*

DISTRIBUTION

Within their geographic range, species often shift their distribution over time. The basic distribution of a species and how distribution changes over time is a vital sign that may give researchers unique insight into why a species is imperiled. Shifts in distribution may coincide with changes in demographic rates, reflecting spatial variation in population viability. Shifts may also reflect losses or gains in preferred habitats. Whatever the underlying cause, a change in distribution provides a sign that conditions have changed and may provide clues about potential management options.

Because distribution is such a basic characteristic of a population, researchers within The Center have had an ongoing interest in tracking the distribution of concern species for decades. Tracking changes in distribution has been accomplished by conducting systematic, large-scale surveys and repeating the surveys over time to reveal shifts in distribution. Changes in distribution are investigated to better understand what factors may be contributing to population change.

(Top) An anhinga swims through a shallow swamp. This species is rapidly expanding its range northward with climate change. CCB is always interested in distribution changes since distribution is fundamental to management. *Photo by Bryan Watts.*

(Bottom) Recently fledged seaside sparrow (front) with adult (back) in black needlerush. Sea-level rise is having an impact on the structure of salt marshes, and this is having an impact on the sparrow population. Occupancy of isolated patches is declining and may foreshadow distribution changes. *Photo by Bryan Watts.*

The saltmarsh sparrow depends on the salt marsh for its entire life cycle and is highly vulnerable to ongoing sea-level rise. In recent decades we have seen a contraction of the breeding distribution along the southern range limit in Virginia presumably related to rising tides. A great deal of work is ongoing to develop management options.
Photo by Bryan Watts.

Maxi Galmes (above) accesses a young Chaco eagle in nest within a dead calden tree while Manu Grande (below) looks on. This globally endangered species has a very low reproductive rate and within Argentina depends on the calden forest. Shooting by ranchers has reduced survivorship and both fires and clearing have reduced available forest. ***Photo by Bryan Watts.***

THREATS AND RISKS

A threat is the potential for harm while risk is the chance or likelihood of the harm occurring. When assessing the conservation status of a species, we often make lists of plausible threats and evaluate the risks that a population will experience these threats. In some instances, our assessment of risk is so high that we may consider a species to be imperiled even though the harm has yet to be realized. For example, salt marsh obligates such as the saltmarsh sparrow, that are entirely dependent on saltmarshes for their life cycle, are completely vulnerable to ongoing sea-level rise. The likelihood of these species being gravely impacted by rising seas is so high that they are considered to be imperiled. For most species, predicting future risks is less clear and the conservation community typically places species in broad categories of risk.

Mitigating risk to populations requires an understanding of the species but also a keen awareness about potential threats. Often these are difficult assessments to make and, like any risk, are full of uncertainty. We work hard to anticipate emerging risks so that impacts may be reduced. However, some threats simply cannot be anticipated, leaving us to respond and develop management options in real time.

(Top) A bag of shorebirds killed over a shooting swamp on Guadeloupe. Following the killing of two whimbrels in these swamps that were tracked by CCB and TNC the research community determined that hunting continues to be a population-level threat to several shorebird species within the Western Atlantic Flyway. *Photo by Anthony Levesque.*

(Bottom) An adult male peregrine hit by a car on a Virginia bridge. Flight hazards including cars, guy wires, transmission lines and buildings are the largest mortality threats for peregrines living in urban environments. *Photo by Bryan Watts.*

DIAGNOSIS—IDENTIFICATION OF DRIVERS

For a patient, diagnosis is the process of identifying a disease, injury, or condition but may also refer to the underlying cause of the condition. In natural populations we are primarily concerned with the cause of imperilment. Although we often hear about ”death by a thousand cuts” referring to the multitude of factors that may impact a population, in most cases declines are driven by one or a small number of drivers. Once a species is identified as highly imperiled, the race is on to determine which factors are contributing to declines. We use all available information on population history, species requirements, and information on demography to begin to rough out possible drivers. Like a physician ordering more tests, this process may require additional investigations. Diagnosis of the problem is often an iterative process of information gathering, information integration and interpretation, and developing a working diagnosis.

Pushing through a diagnosis is often an all-in endeavor with complete emersion in the available information, and once that is exhausted, deciding what new information is strategically important to pursue. The Center thrives in pushing out the boundaries of what is known and driving toward a working conclusion that will lead to management options.

(Top) Laughing gull on the seaside of the Delmarva Peninsula in Virginia. The laughing gull population that nests in the marshes has declined more than 90% since 1993. Most of the marsh colonies have collapsed due to sea-level rise and regular inundation. *Photo by Bryan Watts.*

(Bottom) Whimbrel fitted with GPS transmitter. After documenting a 50% decline in whimbrels, CCB and TNC have deployed more than 80 transmitters on whimbrels to determine where they were spending their annual cycle and what threats they may be facing. This work has indicated that hunting is an important driver lowering adult survival. *Photo by Bryan Watts.*

Libby Mojica (lft) and Bryan Watts (rt) set out eagle traps on a sandbar in the Chesapeake Bay before dawn. CCB deployed more than 70 transmitters on eagles to track movements and unravel the cause of line-strike mortalities. The study led to line burial in places where lines overlapped with major eagle movement corridors. ***Photo by Craig Koppie.***

PROCESS OF ELIMINATION

There are always many possible drivers that may cause populations to decline, demographic rates to become unbalanced, or distributions to shift. However, many of these factors may be eliminated out of hand because they do not fit the behavior of the population or the set of known conditions. For example, if a population is declining but demographic metrics are in balance, we would initially eliminate considerations of adult mortality. A more likely driver for this scenario is habitat loss or degradation. Once we have eliminated the obvious outliers, we are frequently faced with several drivers that may cause the same outcome. This is comparable to differential diagnosis in medicine where additional tests are used to rule out some causes leaving the most likely one. With populations, we are forced to collect additional information designed to narrow the field.

Working down a list of potential drivers of population decline is an art just as much as a science and requires being open to nuance and new information. The Center has always thrived in this space both because of the intensity of the pursuit and the importance of the outcome.

(Top) Using a device to deliver menhaden to osprey nests in a supplementation study within the Chesapeake Bay. Many factors have been put forward to explain low reproductive rates in recent years. Direct observations of food stress and this field experiment have proven that food stress is the primary driver of low reproductive rates. *Photo by Bryan Watts.*

(Bottom) A shallow tide pool in a salt marsh within the lower Chesapeake. These tide pools are critical habitats for migrant shorebirds in the Bay. Loss of these structures to sea-level rise and erosion is the primary factor explaining the decline in shorebird use. *Photo by Bryan Watts.*

Mario Balitbit extracts a whimbrel trapped with a noose mat during fall migration. Whimbrels tracked with transmitters have allowed us to eliminate many drivers from the list of potential factors causing the population decline. We have narrowed the field down to a small number. ***Photo by Bryan Watts.***

FINAL DIAGNOSIS

A final diagnosis or identification of the drivers responsible for a population decline is reached through an iterative process involving gathering of information, interpreting and integrating the new information, revising hypotheses, and ultimately over time, increasing confidence that the causes have been identified. We should note that in many situations we may never have enough information to definitively identify the primary driver. In these cases, we must be happy with the most parsimonious explanation and move forward with working diagnoses that are open ended and subject to adjustment as new information becomes available.

Reaching a working diagnosis that identifies the underlying drivers of population decline is a critical milestone in the conservation process. The conclusion of this stage allows for the transition to identifying possible management tools and developing a management plan. Researchers need to always be open to new information in light of current hypotheses and be prepared to reassess previous conclusions.

(Top) Sibling osprey. The nestling on the left is dominant and in good shape while the one of the right is emaciated and died within days. Food stress results in brood reduction and reduced productivity. Work by CCB has demonstrated that starvation is driving low reproduction. *Photo by Bryan Watts.*

(Bottom) The rufa subspecies of the red knot has declined dramatically over the past 40 years. Long term work has demonstrated that one of the drivers of this decline is the feeding conditions within the terminal mid-Atlantic spring staging areas. *Photo by Jan van de Kam.*

Female ruffed grouse. This species has declined by more than 50% over the past few decades. Several factors such as nest predators and hunting may influence demography but the widespread loss of young forests is the primary driver of decline. Habitat creation at scale will be required to reverse this trend. ***Photo by Bryan Watts.***

Osprey and nest platform. Platform use in the Chesapeake began in the 1960s. Citizens have erected thousands of these platforms and they have played a major role in population recovery. ***Photo by Bryan Watts.***

MANAGEMENT

The immediate goal of managing imperiled species is to prevent extinction. Longer term goals are to reverse population declines and to promote recovery. Recovery in many cases refers to returning a species to a state where it is self-sustaining and no longer in need of assistance. Management is an operation that identifies all relevant tools and marshals resources toward a single objective. In the case of species management, the objective is to remove the underlying drivers of decline. This is why an accurate diagnosis of the problems is key to success. Species management is not like the construction of a house or road, it often requires innovation and the development of new techniques and approaches that are designed to overcome barriers to recovery.

The Center has played a wide range of roles in species management over the years, from developing management plans or strategies to developing and testing new management tools to executing management. There is nothing more satisfying than seeing a species recover in response to an effective management strategy.

(Top) Peregrine hack box on Franklin Cliffs. CCB (and partners) has released more than 450 young peregrines initially to re-establish the breeding population and later to establish pairs in priority landscapes. Hacking has been a critical management tool. *Photo by Bryan Watts.*

(Bottom) Artificial woodpecker cavity. Red-cockaded woodpeckers were decimated by the loss of 99% of historic old growth pine forests. Because the species makes cavities in live pines that may take one or more years to excavate, cavity availability became a barrier to population establishment. Artificial cavities were developed over many years and have become a critical management tool. *Photo by Bryan Watts.*

MANAGEMENT TOOLS

The conservation community has a large tool bag. These tools range from policy that may be used to outlaw problem chemicals or reduce the harvest of a specific species, to education programs that increase public awareness, to habitat creation or improvement to overcome bottlenecks. For dire situations, management may call for the use of captive breeding and the release of individuals to re-establish populations. In some cases, new tools must be developed that have never been conceived of before. One of the keys to successful management is to select the right set of tools for each situation so that management may be efficient and effective.

Selecting the right set of tools for successful management is one of those areas within the conservation process that requires innovation. It requires an understanding of the target species, the underlying drivers of decline, and how tools may be used to help the species overcome the obstacle. The Center thrives on working outside the box and developing innovative solutions to management.

(Top) A young barn owl in nest box. Historically, barn owls nested in large tree cavities. Nest boxes and trays have replaced this function and have become an important tool for population management. *Photo by Bryan Watts.*

(Bottom) Sheep rancher in Argentina. Chaco eagles are globally endangered, and ranchers have mistakenly viewed them as livestock predators and shot them. Outreach to educate this community has become an essential management tool. *Photo by Bryan Watts.*

A controlled burn in Virginia. Fire is a critical part of many fire-dependent ecosystems and controlled burns have become an important management tool. Many of our most imperiled species depend on burns. ***Photo by Bryan Watts.***

MANAGEMENT PLAN

A management plan is a document that lays out a road map for species recovery. The document provides details for how management tools, resources, and partners are to be orchestrated to achieve a specific recovery objective. The plan also provides measurable criteria for when the species will be considered as recovered. Many management plans also provide an estimate of the costs needed to execute the plan and contingencies. Plans vary a great deal on the level of detail but all attempt to provide an overview of objectives and a strategy for how to achieve them.

Although The Center has produced many management plans over the years, this task is typically performed by agency biologists. The Center more frequently provides an advisory role focused on the target species or management strategies. The Center may also conduct new research on the effectiveness of management tools or a critical information gap.

(Top) Male black-and-white warbler during fall migration. The lower Delmarva Peninsula is a hemispherically important stopover area for migrating passerines like the black-and-white. CCB has worked to clarify the requirements of these migrants over a 30-year period and has helped to develop several management documents to improve support. *Photo by Bryan Watts.*

(Bottom) Woodpecker translocation box. The federal red-cockaded woodpecker plan has provided a blueprint for recovery that covers a wide range of tools and activities. Translocation to establish new populations or to augment existing populations has been an important activity for success in Virginia. *Photo by Bryan Watts.*

Adult peregrine falcon in Virginia. This species was extirpated in eastern North America by the early 1960s. The successful restoration of this population was made possible by the development of an effective management plan. ***Photo by Bryan Watts.***

Laura Duval uses a level to measure topography within a black rail habitat in south Florida. Black rails have experienced a catastrophic decline and range contraction. So little is known about their requirements and management that the community is forced to learn as we go by taking management actions within an adaptive management framework. ***Photo by Bryan Watts.***

ADAPTIVE MANAGEMENT

Given the condition of many imperiled species, initiating management is urgent. However, we have to recognize the uncertainty in both identifying the primary drivers of decline and in understanding how species will respond to management. Managers rarely have the luxury of time to perform tests on the effectiveness of available management tools. Adaptive management is an approach that integrates program design, management, and monitoring to systematically evaluate how a species is responding such that management may be improved moving forward. Learning and adaptation are important components of this approach. Adaptive management is particularly important when there is a high level of uncertainty in the initial decisions.

The adaptive management or “learn and evolve as you go” approach has become a powerful tool in species management. The Center is a big advocate of this integrated approach that combines research and management and uses an iterative design to make management more effective.

(Top) Pair of eagles nesting on cell tower. Bald eagles have recovered throughout their range and their cohabitation with humans in recent decades has led to an adaptive shift in how management guidelines are being applied. *Photo by Reese Lukei, Jr.*.

(Bottom) Peregrine falcon nesting tower on the Eastern Shore of Virginia. We have used a wide range of nesting structures in marshes, on buildings and on bridges over the decades and have used adaptive management to match structures to situations in order to improve productivity. *Photo by Bryan Watts.*

RECOVERY

In a narrative arc the story typically ends shortly after the "problem" between the characters is resolved. In our conservation arc we consider the struggle to be resolved when the target species has recovered. Most management plans outline the conditions of acceptable recovery in measurable metrics so that managers recognize when they have reached this status. The term "recovered" has evolved over the years. Conservation biologists are increasingly measuring the level of recovery against a fully recovered baseline that includes the known status and distribution of the form prior to decline. In addition to these two metrics, managers are increasingly focused on the ecological role that the species performs and only considering full recovery to have been reached when the species is performing its ecological function within all parts of the range.

Scientists have long considered a species' influence on other species and on the ecosystem it inhabits to be a fundamental part of its intrinsic value. We all recognize that just having a species alive does not fulfill its ecological function. The Center supports the objective of not just restoring numbers but also restoring ecological function.

(Top) The osprey is a true global success story with most populations recovering to historic levels or beyond. The osprey is more widespread than its historic distribution and occupies the same ecological space within the historic range. *Photo by Bryan Watts.*

(Bottom) Brown pelican nest. This species was decimated by DDT but has since recovered and expanded beyond the historic range. Pelicans are now serving their historic ecological function throughout their annual cycle. *Photo by Bryan Watts.*

Bald eagle incubating along the James River. Eagles have reached recovery objectives and throughout most of their range are fulfilling their ecological role. ***Photo by Bryan Watts.***

VIGILANCE

Natural populations must confront a long parade of insults. Because imperiled species often occur in rare habitats or are positioned on the top of the food chain, they will always be vulnerable to decline. Once a species is recovered, priorities naturally shift and we have a tendency to move on and look away. However, in order to guard against new emerging threats, we must remain vigilant and maintain surveillance programs. New threats put in jeopardy all of the work to recover a species. In the long term it is not enough to recover a species. We have to work to maintain the recovery.

The world is a rapidly changing place. This is why The Center has maintained decades-long commitments to species even after recovery. In some cases, we have identified emerging threats from contaminants, disease, prey bases, habitat loss, and other hazards.

(Top) Female peregrine from the Berkley Bridge in Norfolk, Virginia. Intensive management has resulted in a successful recovery in Virginia, but this recovery can be fragile given their exposure to contaminants, diseases and urban hazards. The Center continues to work with this population and is vigilant about emerging threats. *Photo by Bryan Watts.*

(Bottom)Once considered a species of high conservation concern in the mid-Atlantic due to precarious population and perceived threats, the yellow-crowned night heron has recovered beyond its historic benchmark. The Center continues to monitor this species for emerging threats. *Photo by Bryan Watts.*

Bart Paxton measures an eaglet's bill depth. Eagles have experienced a long parade of threats since colonial times and new threats emerge on a regular basis. CCB continues to work with the species and to be vigilant about new impacts. ***Photo by Bryan Watts.***

INSTITUTIONAL PARTNERS 2024

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American Eagle Foundation
American Wind Wildlife Institute
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Atlantic Coast Joint Venture
Audubon North Carolina
Audubon South Carolina
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New Jersey Conservation Foundation
New Jersey Division of Fish and Wildlife
Norfolk Southern Corporation
North Carolina Wildlife Resources Commission
Northern Neck Audubon Society
Northern Virginia Conservation Trust
Ohio Dept of Natural Resources
Oklahoma State University
Osprey Watch Alliance
Panama Audubon
Parks Canada

Partners in Flight
Pennsylvania Game and Fish Commission
Progress Energy
Richmond Audubon
Richmond Times-Dispatch
Richter Museum of Natural History
Rockbridge Bird Club
Rockingham Bird Club
Santa Rosa Ranch
Smithsonian Institution
Smithsonian Tropical Research Institute
Solertium Corporation
South Carolina Dept of Natural Resources
Southern Company
Southern Illinois University
State University of New York
Tennessee Ornithological Society
Texas Parks and Wildlife
The Carolina Bird Club
The Nature Conservancy
The Peregrine Fund
The Wildlife Center of Virginia
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Vulcan Materials Company
West Virginia Dept of Natural Resources
West Virginia University
Whitaker Center
William & Mary
Williamsburg Bird Club
Williamson Ranch
Wisconsin Bird Conservation Initiative
Woods Hole Group, Inc
Xponent 21, Inc

(Back Cover) Red-winged blackbird within a fresh-water marsh during the fall. Like many bird species that depend on marshes, red-wings are vulnerable to changes in habitat availability. *Photo by Bryan Watts.*

THE CENTER FOR CONSERVATION BIOLOGY

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