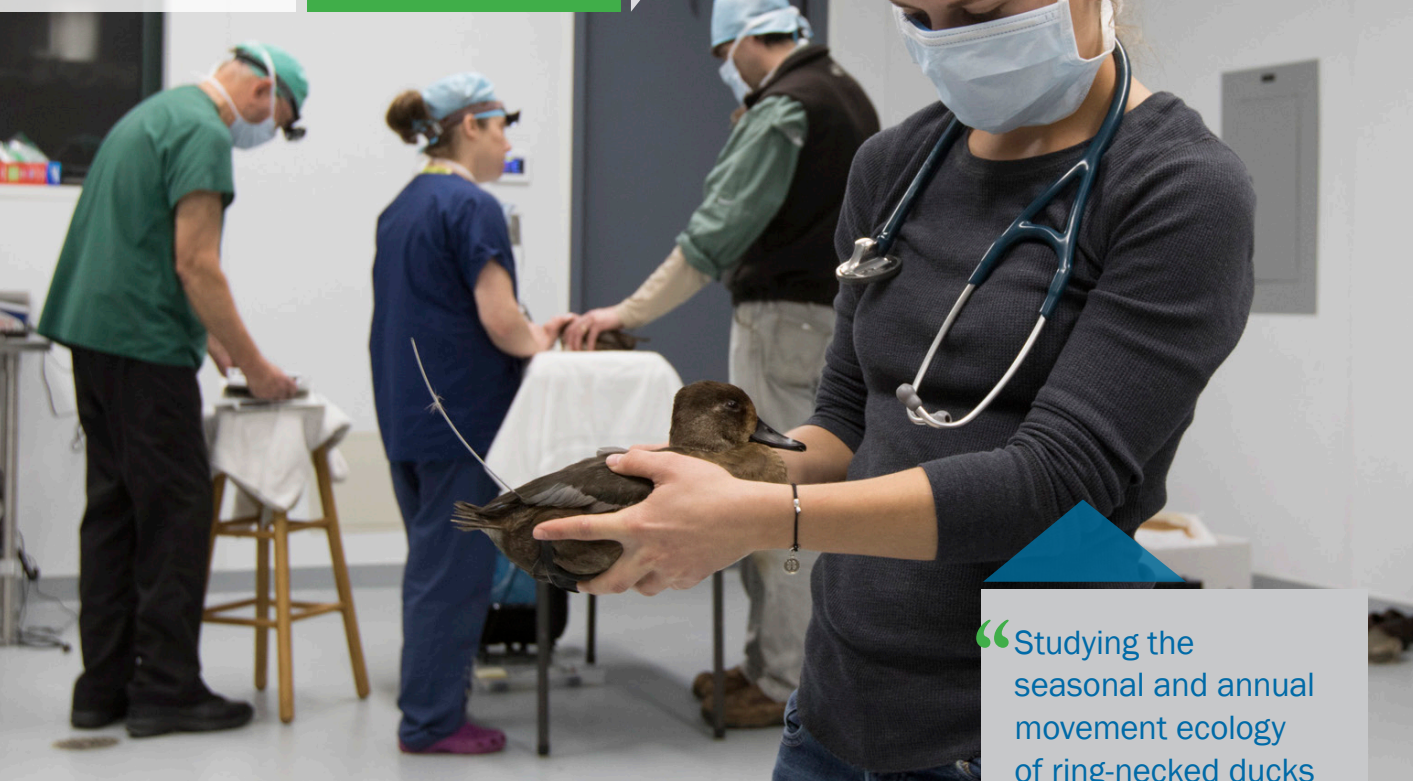




**RESEARCH AND
EDUCATION**
2021 STATUS UPDATE



Delta furthers the research that keeps waterfowl populations strong

Using the latest technology, researchers answer tough questions about duck production and wetland conservation today and in the future

Delta Waterfowl believes that waterfowl management decisions should always be based on sound science.



DELTA HAS TRAINED MORE THAN 600 MASTER'S AND DOCTORAL STUDENTS, INCLUDING SOME OF TODAY'S FOREMOST WATERFOWL BIOLOGISTS

It's a philosophy Delta has followed since Albert Hochbaum began his work as the organization's first science director in 1938 at the Delta Marsh. Delta has continually focused research on ducks and duck hunting issues in North America. This strategy allows The Duck Hunters Organization to study important, long-term issues, as well as new concerns impacting ducks and duck hunters.

This special report highlights our

“Studying the seasonal and annual movement ecology of ring-necked ducks in the southern Atlantic Flyway helped grow my passion for research and pushed me to continue my education to obtain a Ph.D.”

Tori Mezebish
UNIVERSITY OF RHODE ISLAND 2025
PH.D. BIOLOGICAL AND ENVIRONMENTAL SCIENCES

2021 research program. The summaries that follow provide a snapshot of each project, and more detailed information is available. As always, feel free to contact me to discuss any of Delta's research.

Dr. Chris Nicolai
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Canvasback Nest Success
Evaluating Predator Management
for over-water nesting ducks

TRENT ROHRER, M.S. STUDENT,
 AND DR. JOSH STAFFORD
 SOUTH DAKOTA STATE UNIVERSITY

Delta continues to seek effective and efficient application of Predator Management techniques to improve nest success for over-water nesting ducks such as canvasbacks, redheads and ring-necked ducks in the parkland habitat of Canada.

Rohrer has spent the past two years exploring whether trapping in the fall, in addition to the spring, is a more effective way to reduce key mammalian nest predators, especially raccoons. We discovered fall trapping did little to improve our take of raccoons – public enemy No. 1 of canvasbacks. However, our spring trapping in 2020 showed some very positive signs, so we intensified that effort for the second field season. That includes trapping out in wetland edges where our satellite tracking of coons showed these introduced predators spend an inordinate amount of their time. We will be counting broods using drones equipped with thermal and visual

cameras, since this approach has proven far superior to field assistants doing ground counts. Rohrer will be finishing his M.S. work this year.

Hot Spot Trapping to
Improve Dabbling Production
Evaluating dabbling nest success
with a new trapping technique

MATT DAVIS, M.S. STUDENT, AND
 DR. CHRISTOPHER MALCOM,
 BRANDON UNIVERSITY

Delta is exploring whether focusing Predator Management on highly productive patches of grassland habitats could more efficiently boost production of dabblers such as mallards, pintails and gadwalls. This project is vastly different from past nesting/predator removal projects in that we are interested in assessing how many ducks are attempting to nest, rather than simply measuring nest success.

Predator trapping has typically focused on the full area of a township-sized block. Recent Delta research projects have identified “hot spot” trapping as a potentially more effective approach to removing predators and a more efficient use of management dollars. Focusing trapping efforts on

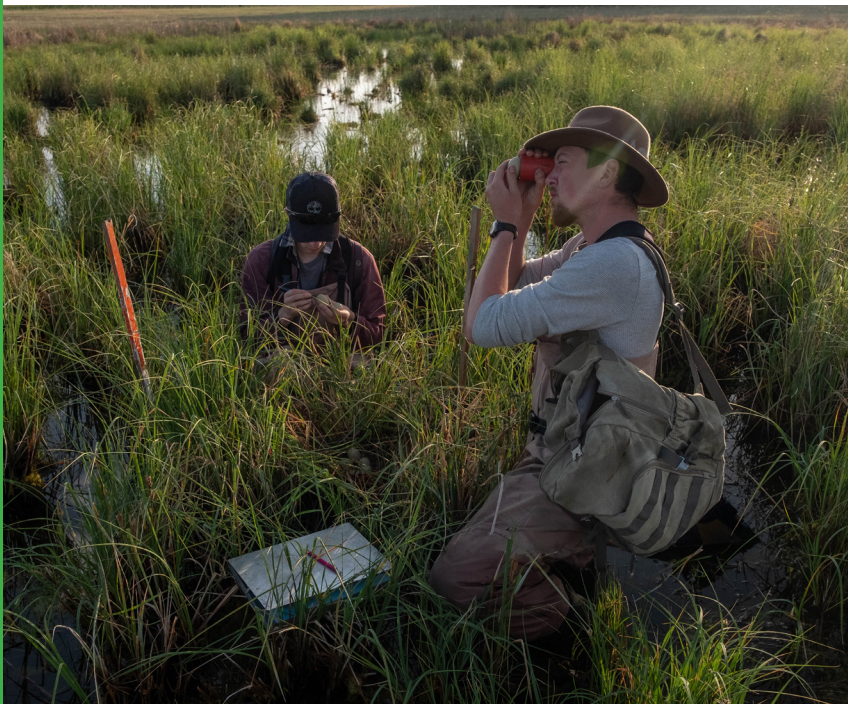
“hot spots” (i.e., grass-only sites) would allow waterfowl managers needed flexibility in both the size and location of Predator Management sites. This project will take place in North Dakota and help inform whether “hot spot” trapping can help increase duck production in the best quality habitats.

To estimate how many ducks are using the different treatment blocks, we are using a variety of methods to estimate how many nests are missed using a single pass chain drag. Efforts to use GPS to map ATV tracks and nests will allow the use of distance sampling methods. We are also dragging a sample of nesting cover a second time within 20 minutes to determine how many nests are missed on a single pass.

Raccoon Satellite Telemetry
Studying movements and habitat use
of raccoons to improve effectiveness
of Predator Management

DR. CHARLOTTE MILLING,
 POST-DOCTORAL RESEARCHER,
 DR. STANLEY GEHRT AND
 MR. SHANE MCKENZIE, MAX
 MCGRAW WILDLIFE FOUNDATION

In 2018 and 2019, we fitted 29 raccoons with GPS transmitting collars on Delta’s canvasback study block in Manitoba. The transmitters collected incredible amounts of location data on each raccoon’s daily movements. We discovered that raccoons spent a large percentage of time in wetland edges. Due to Covid-19, we were unable to track any raccoons in 2020. However, we are planning to collar 15 raccoons to track their movements in breeding duck habitat. The goal is to better understand raccoon habits so we can set traps in their preferred locations, thereby more effectively reducing these top predators of diving-duck nests. We will also use stable isotopes to evaluate the role of duck eggs in the diet of raccoons. Ultimately, the goal is to learn more about raccoons so we can manage these non-native predators and increase production of canvasbacks, redheads, ring-necked ducks and other over-water nesting ducks.





“ This experience has greatly helped my career. I’ve had the opportunity to meet many researchers, hunters, and landowners and share with them why we’re doing this research. After graduation, I’ll be starting a position as a research scientist, due in large part to the experience I gained doing research for my master’s degree with Delta Waterfowl. ”

Catrina Terry
LOUISIANA STATE UNIVERSITY 2021
MASTER OF SCIENCE



Counting Broods Using Drones

Evaluating brood use of wetlands in agricultural landscapes

CATRINA TERRY, M.S. STUDENT, AND DR. KEVIN RINGELMAN, LOUISIANA STATE UNIVERSITY

In 2019, we surveyed 242 PPR wetlands using a combination of camera-equipped drones and wetland sampling and found 240 broods. In 2020, 92 wetlands were sampled to find 88 broods.

Using a special drone equipped with a thermal-imaging camera and a regular camera, researchers survey selected wetlands in agricultural landscapes for brood use. The goal is to better understand brood use in order to conserve the most important habitat for breeding ducks. This research will evaluate the quality of wetlands as brood water by examining usage by ducks, as well as determining invertebrate abundance, vegetation structure and insecticide concentration.


Terry has finished this field work and expects to complete her M.S. this year.

Ring-necked Duck Tracking
Implanting satellite transmitters to monitor movements and habitat use

DR. MITCH WEEGMAN, UNIVERSITY OF MISSOURI

After three successful field seasons marking ring-necked ducks in 2018, 2019 and 2020, Delta implanted an additional 31 ringnecks with satellite transmitters in Maryland during the fourth and final field season of the project in February 2021.

The goals are to monitor migration paths, discover breeding areas, and understand habitat use and movements



DELTA WATERFOWL'S RESEARCH AND EDUCATION PROGRAM HAS RESULTED IN MORE THAN 950 PEER-REVIEWED STUDIES

during the ringneck's annual cycle. Little is known about ring-necked ducks, which is surprising because they are the most important diving duck in hunter

harvest — the only diver consistently in the top 10 in all four flyways.

Ringnecks are doing well, and we hope to understand why they have been so successful at increasing in numbers. In addition, this research has immediate value to waterfowl managers in the Atlantic Flyway under the recently implemented multi-stock harvest regulation-setting method. Importantly, our study suggests that ring-necked ducks that winter in the southeast are not nesting in the eastern survey area, but farther west.

Eastern Mallard banding and isotopes

Using isotopes to determine whether mallards are moving between the US and Canada during banding operations

KAYLA HARVEY, M.S. STUDENT, AND DR. MIKE SCHUMMER, STATE UNIVERSITY OF NEW YORK COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY

Mallards in the Atlantic flyway have declined by 40 percent in recent years, and reasons for this decline are not well understood. Banding data, specifically pre-hunting season banding, is an important tool used to monitor mallard and other waterfowl populations. Production and survival estimates for Atlantic flyway mallards, informed by banding data, have not changed significantly during the decline, suggesting a possible bias in these data.

An important assumption used for these estimates is that birds do not move between survey units. Recent research suggests the potential for migration of mallards during the banding period.

This project aims to use stable isotope analysis to determine whether mallards are moving during the banding period. Feather samples from pre-season banded birds throughout the Atlantic flyway will be collected for analysis of the deuterium isotope to obtain general molt or natal origins. These will then be compared to banding locations to assess movement during the banding period.



“While working as a Delta researcher, I have been able to connect and network with a wide variety of people in the hunting, research, and agricultural communities. I learned that conservation issues are complex and challenging, nothing happens overnight, and working hard to connect with people helps to build the necessary relationships that push conservation forward.”

Michael Johnson,
COLORADO STATE UNIVERSITY 2023
PH.D., FISHERIES, WILDLIFE AND CONSERVATION BIOLOGY



Q Lower Mississippi Flyway Dabbler Tracking
Determining duck locations during hunting seasons and migration

DANIEL ODIN, M.S. STUDENT, STARLA PHELPS, M.S. STUDENT, DR. DOUGLAS OSBORNE, UNIVERSITY OF ARKANSAS DIVISION OF AGRICULTURE, AND DR. MITCH WEEGMAN, UNIVERSITY OF MISSOURI

Delta Waterfowl seeks to better understand the migration and wintering ground habits of dabbling ducks in the Mississippi Flyway to determine whether further management strategies are needed.

Employing backpack transmitters powered by miniature solar panels, Delta installed radios on mallards, green-winged teal and American wigeon to record movements for the past two years. Ducks were caught during or after the 2019-2020 and 2020-2021 hunting seasons in Arkansas.

The primary goal is to understand when and where these ducks migrate, particularly in the fall, as well as how they respond to hunting pressure and weather events. Odin is focusing on describing preferred habitats each species choose to use during the winter. Phelps is assessing fine-scale movements of these radios during their time spent in the Mississippi Alluvial Valley.

Q Working Wetlands
Understanding farmers' perceptions of Delta's Working Wetlands program

DR. CHERYL WACHENHEIM, NORTH DAKOTA STATE UNIVERSITY

Delta Waterfowl, in partnership with the U.S. Department of Agriculture Natural Resources Conservation Service, initiated a new approach to conserving small wetlands in cropland. This research involves human dimensions survey work of program participants so that we can learn from producers and thereby determine how we can better serve farm operations and protect small wetlands that are critical for breeding ducks. The research will inform large, landscape-scale program development pioneered by Delta's Working Wetlands and incorporated in the 2018 Farm Bill, in hopes of conserving wetlands across the U.S. Prairie Pothole Region.

Q Pintail Harvest and Survival
How does hunting harvest impact duck populations?

THOMAS RIECKE, POST-DOCTORAL RESEARCHER, UNIVERSITY OF NEVADA RENO

Researchers are undertaking one of the big unanswered questions in waterfowl management: What

influence does hunting harvest have on populations?

By using new scientific approaches, the team can more accurately answer this question for a number of important species, including mallards, pintails and blue-winged teal. They will take a unique approach and look at population cohorts (male/female and juvenile/adult) to more fully understand how differing survival rates might help inform the relationship between harvest and population sizes. In addition, they will revisit our understanding of how density dependence (i.e., how many breeding pairs of ducks that a given year's wetlands can accommodate) works in duck populations. They are finding that long-used models may not improve our understanding of the impacts of hunter harvest on duck populations.

Q Spatiotemporal Variation in Duck Demographic Rates
How environmental change influences duck population dynamics

MADELEINE LOHMAN, PH.D. STUDENT, AND DR. PERRY WILLIAMS, UNIVERSITY OF NEVADA RENO

Waterfowl monitoring efforts have created one of the few extensive multi-species, longitudinal, individual-based data sets in the world. Using these data,



Lohman will investigate spatiotemporal variation in demographic rates of dabbling ducks in the PPR to help shed new light on basic biology and conservation needs of widely distributed wildlife populations.

This work will focus on variation in mallard demographic rates, correlations between mallard survival and age ratios, and spatiotemporal variation in natural and harvest mortality. We will then use these methods to compare multi-species demographic rates.

Has Pintail Production Declined?
Evaluating changes in pintail age structure and sex ratios

DR. TODD ARNOLD, UNIVERSITY OF MINNESOTA

Pintail population trends are of great interest to duck hunters, especially in light of U.S. Fish and Wildlife Service regulations lowering the bag limit to one bird per day in 2017-2018, and again for the 2019-2020 and 2020-2021 seasons. Dr. Arnold is reviewing pintail age and sex ratios using USFWS Parts Collection Survey data to document how age ratios (proportion of juveniles in the fall flight) and sex ratios (females to males) have changed since 1961. This work is important to inform the pintail harvest models used to set regulations.

Additionally, examining long-term pintail data has become more important, as data sets continue to grow and analytical techniques expand to make sense of long-term changes.

Atlantic Flyway Mallard Stable Isotope
Determining the origins of mallards taken by hunters in the east

SAM KUCIA, M.S. STUDENT AND DR. MIKE SCHUMMER, STATE UNIVERSITY OF NEW YORK COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY

Delta is undertaking this important research to inform mallard harvest regulations in the Atlantic Flyway.

Spring surveys suggest that the eastern U.S. mallard population is declining, while eastern Canada's mallards are holding stable. Therefore we need to understand the relative importance of the different breeding areas, particularly given the reduction of Atlantic Flyway mallard limits to two mallards (one hen) daily for the 2019-2020 and 2020-2021 seasons.

By examining stable isotopes in the flight feathers of mallards shot in the Atlantic Flyway, researchers can determine where the ducks grew those feathers in the summer. This is a novel way to determine the origins of birds shot in the Atlantic Flyway.

Banding data currently estimates that about two-thirds of mallards shot in the eastern U.S. stem from the eastern U.S. breeding population. We are finding that the banding data does not account for movement of birds from Canada prior to the banding period and that a larger proportion than expected of Canada derived birds are being banded in the U.S. Eastern mallard ecology and harvest management have taken a back seat relative to other flyways, but we aim to reverse this information deficit and deliver quality information that can help better manage eastern mallards.

Kucia is completing his analyses and writing his thesis and plans to graduate this year.

Canvasback/Redhead Integrated Population Models
Determining needs for management of key diver species

DR. DAN GIBSON, POST-DOCTORAL RESEARCHER AND DR. DAVID KOONS, COLORADO STATE UNIVERSITY

Redheads and canvasbacks use the same breeding habitat in the PPR (primarily Manitoba and Saskatchewan), and Delta has collected extensive data on pairs, nests and broods for both species. By using multiple data sets simultaneously, we can learn more

about what drives their populations.

The goal of this data analysis work is to develop a model of the annual life cycles for canvasbacks and redheads to determine what factors drive their population growth. The resulting models will characterize the importance of nest success, survival of nesting hens, brood survival, winter survival and hunting mortality on population growth of redheads and canvasbacks. The results from this study will benefit management efforts and help drive future research efforts on these species.

Q Canvasback Habitat Modeling
Analyzing nest success in relation to habitat variables

MICHAEL JOHNSON, PH.D. CANDIDATE AND DR. DAVID KOONS, COLORADO STATE UNIVERSITY

After several seasons of extensive field work on nesting canvasbacks in Manitoba, Johnson will analyze habitat variables to determine their impact on nest abundance, nest success, and brood counts. The goal is to determine the best locations on the prairie breeding grounds for canvasback production. This information will help waterfowl managers target where to best invest in wetland conservation programs to benefit canvasback production.

Q Mercury Loading in Nevada Wood Ducks
Demographics of a wood duck population in a mercury superfund site

MORGAN BYRNE, M.S. STUDENT, DR. PERRY WILLIAMS, DR. MAE GUSTIN, UNIVERSITY OF NEVADA RENO, AND DR. CHRIS NICOLAI, DELTA WATERFOWL

Delta's Dr. Chris Nicolai has maintained an 18-year project monitoring an isolated population of wood ducks in western Nevada. During the life of this project, feather samples have been collected from all banded birds and repeated feather sampling occurred for all nesting hens. Byrne collected liver, breast tissue and two types of feather samples from 100 hunter-killed



DELTA WATERFOWL'S LEGACY OF LEADING-EDGE SCIENCE DATES TO THE 1930S, WHEN ALDO LEOPOLD VISITED MANITOBA'S DELTA MARSH.

wood ducks. Importantly, she found mercury levels as high as 40,000 ppb and found a correlation between tissue and feather samples. She will compare mother and offspring levels of mercury to determine whether offspring directly, or indirectly inherit mercury loadings.

The levels of mercury found in this population of wood ducks is among the highest levels ever recorded in a bird species, exceeding levels for survival and reproduction. We will use this

data to gain understanding of the trade-offs these ducks are making to maintain a stable population.

Q Large Scale Pacific Flyway Radio Project
Monitoring movements of geese and ducks in the Pacific Flyway

DR. CHRIS NICOLAI, DELTA WATERFOWL, MIKE CASAZZA, USGS, CLIFF FELDHEIM, CA DEPARTMENT OF WATER RESOURCES, MARK PETRIE, DUCKS UNLIMITED, AND CAROLINE BRADY, CALIFORNIA WATERFOWL ASSOCIATION

This is the largest scale satellite telemetry project ever undertaken, having marked more than 800 ducks and geese of 14 species in the past six years. To do so requires numerous partners to assist with fitting birds with radios, maintaining massive data sets, and analyzing and writing papers. The three primary objectives are to assess the full annual cycle of habitat use; how different populations of the same species are delineated; and how overpopulations of some geese impact the limited food resources of ducks.

Research Leaders

Throughout the organization's storied history, Delta Waterfowl has amassed an impressive body of research that includes supporting more than 300 graduate students and publishing more than 950 peer-reviewed scientific papers.

Delta's research has profoundly influenced how waterfowl, wetlands and annual harvest are managed. It has also provided biologists, technicians and young scientists with the opportunity to gain hands-on experience and guidance to become leaders in waterfowl and wetland conservation. We are proud that many of Delta's former students are working for government and non-government agencies, as well as universities.

Delta Waterfowl's important waterfowl and wetland research is made possible by you — our generous donors, members and volunteers. We deeply appreciate your support. Thank you!



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