

CLEMSON
UNIVERSITY
JAMES C. KENNEDY
WATERFOWL &
WETLANDS
CONSERVATION
CENTER
2018
annual report



Feature Article
on page 8
**Who will mind
the marsh?**

Madison Kaminski on her first duck hunt
(4 years young, 2018).





FROM THE DIRECTOR

My longtime colleague and friend, Dr. John Eadie, the Dennis G. Raveling Chair of Waterfowl Biology at the University of California-Davis, coined the theme of this third edition of FROM THE DIRECTOR for the 2018 annual report for Clemson University's James C. Kennedy Waterfowl and Wetlands Conservation Center. The theme is, WHO WILL MIND THE MARSH? Dr. Eadie also is credited with titling and co-authoring the feature article for this report on page 8, also named WHO WILL MIND THE MARSH?

The question, WHO WILL MIND THE MARSH?, emerged from the declining trend in university-based waterfowl and wetlands programs since the 1990s in the USA and Canada. Published literature indicates that about 40% of previous university waterfowl programs have been eliminated or not re-filled with similar experts after faculty retired or passed (Kaminski 2013, *The Wildlife Professional*). This critical academic niche for training next generations of skilled waterfowl and wetlands ecologists and managers may regress further, if not abated, because over a third of current university waterfowl and wetlands faculty are over 55 years of age and getting closer to retirement (Kaminski 2013).

What is meant by the phrase WHO WILL MIND THE MARSH? To me, it means providing education and conducting science to understand ecology and guide conservation of North American waterfowl, other wetland-dependent wildlife, and their habitats. Although not easy by any means, we've been doing it successfully for 100 years, as we celebrate a century of success, coincident with the 100th anniversary of the Migratory Bird Treaty Act (1918) and its successor in conservation, the North American

Waterfowl Management Plan (1986), the greatest ecosystems conservation plan worldwide.

Clearly, there's no stopping us now, and we must recognize that conservation does not happen without people! And many past, current, and future waterfowl and wetlands ecologists and managers earned and will earn their formal academic training and experience through universities with waterfowl and wetlands programs. Indeed, other universities graduate excellent wildlife biologists and managers with knowledge of waterfowl and wetlands, but most of our leaders in waterfowl and wetlands conservation during the 20th and 21st centuries have fledged from institutions with curricula in and mentors with expertise and zeal in waterfowl/wildlife science, conservation, statistics, legal hunting and fishing, and viewing.

Despite the recent decline in university-based waterfowl and wetlands programs, the future is bright! There's a growing number of endowed waterfowl and wetlands university programs now existing in the United States, and currently seven such programs exist nationwide, one or more in each of the four waterfowl flyways. Three of the seven endowed programs were created by James C. Kennedy and a fourth by Messrs. Kennedy and David F. Grohne. Indeed, we are grateful for their generosity and dedication to keep waterfowl and wetlands programs prevailing at Mississippi State University, Clemson University, University of Wisconsin-Stevens Point, and Colorado State University. But, what about elsewhere in North America important to continental waterfowl populations?

There are critical locations where university-based waterfowl and wetlands programs must exist. The feature article herein identifies

key institutions for future endowments given their geography and importance to waterfowl, their history in university-based waterfowl and wetlands programs, and their academic and practical capacities. Amazingly, there is not a single endowed waterfowl and wetlands program in Canada in spite of the importance of Prairie, Parkland, and Boreal Canada to North American waterfowl. Where shall we begin? We provide some suggestions in the feature article but do not discourage any initiatives from consideration. Moreover, we encourage current faculty leading waterfowl and wetlands programs without an endowment, conservation agencies and organizations, and their respective development foundations to work cooperatively to identify conservation-minded philanthropists to endow existing or create such programs.

Clemson University professor, Gary E. Machlis, and Jonathan B. Jarvis, former director of National Park Service, recently published an inspiring book entitled, *The Future of Conservation in America, A Chart for Rough Water* (The University of Chicago Press). Indeed, waterfowl will face “rough waters” if university-based waterfowl and wetlands programs become an endangered niche for scientists and conservationists desiring to “mind the marsh.”

We hope you enjoy and are informed by the 2018 annual report of Clemson’s Kennedy Center for

Waterfowl and Wetlands Conservation. Mr. Jim Kennedy has remarked, “I don’t give for recognition but hope my giving inspires others to help.” We hope you will help and inspire those able to endow university waterfowl and wetlands programs in regions important to North American waterfowl and wetland dependent wildlife. There’s no stopping us now!



Gratefully,

Director,
Kennedy Center for Waterfowl and Wetlands
Conservation

Thank you to our sponsors, cooperators, and friends:



Mr. Dan Ray
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TEACHING

DEVELOPMENT, ASSESSMENT, AND MARKETING AN ONLINE UNIVERSITY COURSE IN WATERFOWL ECOLOGY AND MANAGEMENT

*Lauren Senn, Kennedy Center Ph.D.
Student Fellow, Wildlife and Fisheries Biology, Clemson University*

To our knowledge, only Clemson University currently offers an online course in Waterfowl Ecology and Management available to undergraduates and graduate students. Such a course is needed especially by wildlife students and professionals unable to matriculate to a campus where this type of course remains offered. As part of my dissertation research, Dr. Rick Kaminski and I have converted his Waterfowl Ecology and Management course from traditional face to face lecture and laboratory to online presentation, and I will be evaluating the transition, students' opinions, and marketing of the new online course.

We offered the online course for the first time in fall 2017, as an elective in Clemson University's new online Master's degree in Wildlife and Fisheries Biology. The conversion process involved video recording lecture material, using online software to transcribe the audio of each lecture, pairing transcribed video and audio with corresponding lecture slides, and re-recording audio to match videoed lectures. We wrote a script for hundreds of slides, enabling students to read text after listening to it narrated by me. You can imagine the literally hundreds of hours these tasks consumed; however, now, the course is archived and updating and revision will be manageable annual tasks.

The course is split into nine learning modules: History of Waterfowl Conservation, Waterfowl Morphology and Identification, Habitat

Use and Selection, Evolutionary Ecology Related to Waterfowl, Annual Cycle Ecology and Management (Fall/Winter, Vernal [Spring Migration], Reproduction, Post-breeding/Molting), Adaptive Harvest Management (by Dr. Beth Ross), and Waterfowl Diseases. Each module also includes readings on current research and issues related to waterfowl ecology and conservation, class discussions, and quizzes. Students are evaluated via module quizzes, a group oral presentation, a waterfowl identification exam, and midterm and final exams. To earn graduate credit, graduate students propose a research project that is approved by Dr. Kaminski, and they submit a research proposal to him written in the style of a scientific journal article. Some students are pursuing the research as part of their online Master's degree through Clemson University.

The course will be assessed each semester by evaluations submitted by enrolled students. Initial results from 2017 and 2018 will be compared to feedback from students who took the course face to face in fall 2016. Although the student populations differ each year, comparison of feedback from students pre- and post-online delivery will provide insights on students' experiences between these two teaching modes.

The initial fall 2017 offering of Waterfowl Ecology and Management had an enrollment of 11 undergraduate and 14 graduate students. All students received a grade of A, B, or C. We sent several requests to the



students to complete a voluntary evaluation survey of the course. We strongly encouraged the students to complete the survey, requested they email it to a third party who removed student identifiers to ensure anonymity, and then the third person emailed anonymous surveys to us. Despite anonymity, students may have believed their candid remarks about the course could affect their final grade and were reluctant to respond. Nevertheless, 15 (60%) of the 25 students returned the survey (i.e., 13 graduate students, 2 undergraduates). Thus, the evaluations strongly represent graduate students' perceptions, and we are working to devise strategy to increase student response rates to our surveys.

Post-course survey results indicated that 93% of the students believed the course increased their knowledge and appreciation of waterfowl, and they would recommend the course to others. On a scale of 1-5 (with 5 being increased learning experience), an average score of 3.6 (SD = 1.1) indicated the online version of the course increased student's quality and quantity of learning experience when compared to an in-person course. Eighty-seven percent of respondents stated that lecture videos were effective in helping them assimilate course material. Results also showed a need for improvement in the group presentation component of the course, with 73% of respondents either reporting 'neutral' or they believed

the project was 'somewhat effective' in helping them learn course material. Comments from the surveys indicated that students found it difficult to coordinate their schedules while working on the project, because many of the enrolled graduate students were full-time working professionals. Survey analysis will continue in 2018, with additional data collected from over 30 students pre-enrolled in spring 2018 for the fall 2018 course.

Results of these surveys will provide insights on strategies for improvement of the course and development of best practices for converting similar wildlife science and management courses to an online format. Course improvements include the addition of video of waterfowl management techniques being applied in the field to provide students with close to a 'hands-on' experience as possible online, as well as updating the group presentation so it is better integrated into an online format. In addition to working on the course, I will be collaborating with Drs. Shari Rodriguez and Kaminski on a survey to be administered to attendees of the 8th North American Duck Symposium in Winnipeg, Manitoba, Canada, August 2019. The survey will be designed to profile demographics and professional characteristics of attendees to help determine what credentials and experiences promote becoming a waterfowl professional.

A SPRING BREAK MIGRATION

Richard M. Kaminski, Ph.D.

Most species of waterfowl are migratory, meaning they move from one location to another during their annual cycle but ultimately return to or near a starting location. For example, ducks hatched and reared in the Great Lakes Region or Maritimes move in fall and may winter along the Atlantic Coast, such as in the Chesapeake Bay Region in the DELMARVA Peninsula, and then return to their northern natal grounds completing a full migration.

Clemson University-Kennedy Center undergraduate and graduate students also exhibited migratory behavior during spring break 2018. They migrated from campus to Delaware and Maryland (DELMA)

to view waterfowl and wetlands and learn about habitat conservation efforts in DELMA.

Our tour guide in DELMA was Dr. Justyn Foth, Delaware's waterfowl and gamebird biologist. Dr. Foth conducted his M.S. and Ph.D. with Dr. Kaminski at Mississippi State University. Dr. Foth hosted the Clemson clan at Burnt Ducks Hunt Club near Dover, Delaware. We are grateful to Burnt Ducks for their hospitality.

Dr. Foth organized a fantastic suite of experiences in DELMA from 16-20 March 2018. These included duck trapping and banding on public and private wetlands, a visit to historic Maryland's Susquehanna



Flats and the Havre de Grace Decoy Museum, an introduction and chat with famous decoy carver Joey Jobs in his 'carving loft,' tours of public and private waterfowl conservation areas including Delaware's Woodland Beach Wildlife Area and Ted Harvey Conservation Area with Craig Rhoads—Delaware's habitat program manager, a tour of Bombay Hook Farms with Pete McGaffin (co-owner) and Ben Vaughn (Ducks Unlimited's [DU] Regional Director), and a tour of Bombay Hook and Prime Hook National Wildlife Refuges with U.S. Fish and Wildlife Service (FWS) Biologists Susan Guiteras and Dr. Al Rizzo and DU Regional Biologist, Jake MacPhearson.

We also planned to tour Patuxent Wildlife Research Center in Laurel, Maryland to interact federal wild-

life biologists on sea duck and other waterfowl and wetlands research being conducted by center staff and Dr. Chris Williams, Director of the University of Delaware's Waterfowl and Gamebird Ecology Laboratory. However, that segment of the trip was canceled because of Winter Storm Toby, a nor'easter which dumped a foot of snow in parts of the mid-Atlantic. The snowy scape in the picture is Dr. Foth's backyard following the Clemson flock's migration back to South Carolina.

Indeed, we enjoyed and learned greatly from our spring migration to DELMA, as all these pictures attest. Thank you Dr. Foth and others cited herein for this most memorable experience.





Manikin of famous carver, Madison Mitchell, Havre de Grace, MD



FEATURE ARTICLE

WHO WILL MIND THE MARSH?

(Reprinted from Kaminski et al. 2017, Delta Waterfowl Foundation publication, Bismarck, ND)

History and Goals

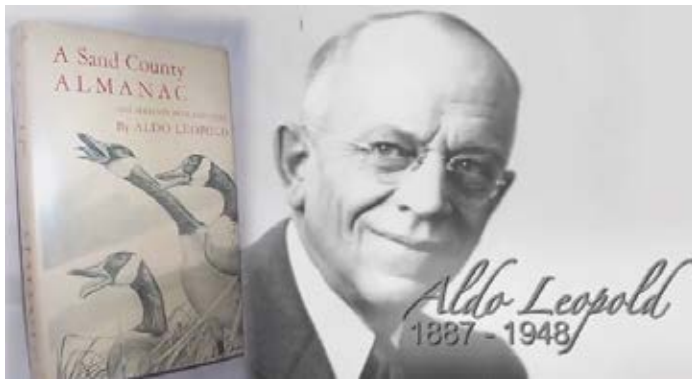
Waterfowl are ecologically, environmentally, economically, and societally important worldwide. The genesis of waterfowl conservation in North America coincided with enactment of the Migratory Bird Treaty Act in 1918, which halted market hunting of waterfowl for restaurants, millinery industries, and fostered resurgence of declining continental waterfowl populations and individual species, such as the wood duck. The “Dirty Thirties” soon followed with widespread drought across the Great Plains, further stoking conservation initiatives that benefited waterfowl and people during the simultaneous “Great Depression.” For example,

in 1933, President Franklin D. Roosevelt (FDR) established the Civilian Conservation Corps, a federally funded initiative that employed thousands and generated environmental benefits, such as building National Forests and Wildlife Refuges, state wildlife areas and parks, and implementing practices to restore eroded soils, grasslands, and wetlands. Additionally, FDR commissioned Jay Norwood “Ding” Darling in 1934 to create the first Migratory Bird Hunting Stamp (“duck stamp”) and become the first Chief of the new Bureau of the Biological Survey—the predecessor of U.S. Fish and Wildlife Service.

As wildlife conservation advanced during the 1930s, with initiatives by the Bureau, the states, Canadian provinces, and creation of Ducks Unlimited, Inc. in 1937 and Ducks Unlimited-Canada and the Delta Waterfowl Research Station in 1938, visionaries recognized the need for university education and research in forestry, wildlife, and other natural resources. Land-grant universities, which arose from the Morrill Acts of 1862 and 1890, set the stage for these niches in academia. The first university department of wildlife ecology and management worldwide was at the University of Wisconsin-Madison (UW) in 1933, which coincided with creation of the UW Chair in Game Management for Professor Aldo Leopold, who is regarded as the Father of Wildlife Management. Leopold mentored many students and professionals until his passing in 1948, merely one week after receiving notice his classic book, *A Sand County Almanac*, would be published by Oxford University Press in 1949.

Leopold’s first student to research waterfowl was Hans Albert Hochbaum, who studied canvasback ducks in the Delta Marsh, Manitoba, Canada. Hochbaum titled his thesis *The Canvasback on a Prairie Marsh*, which was published as a book





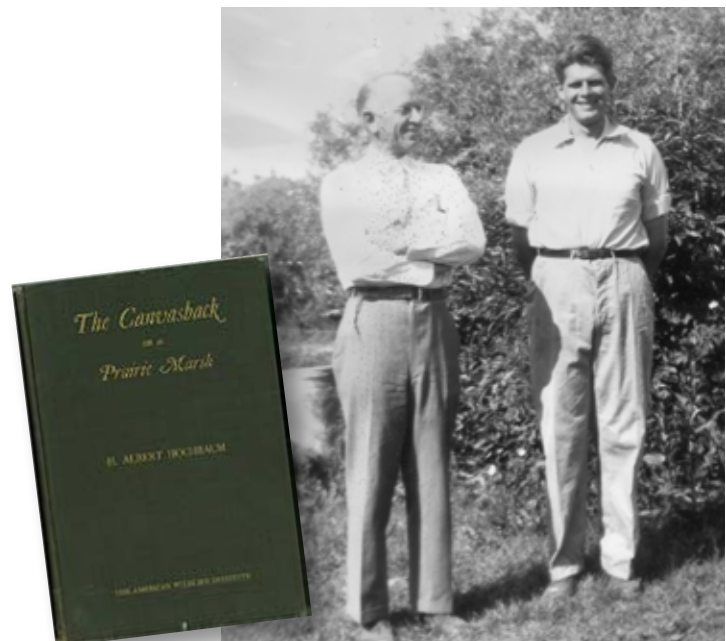
in 1944 along with his later books and exquisite wildlife and landscape artwork, *To Ride the Wind and Travel and Traditions of Waterfowl*.

Hochbaum also was the first Scientific Director of the Delta Waterfowl Research Station in 1938 until his retirement in 1970. Other renowned waterfowl ecologists to follow Leopold as faculty members at UW were Drs. Joseph Hickey, Robert McCabe, and Donald Rusch. Dr. Rusch, a foremost authority on ruffed grouse and waterfowl, passed away while grouse hunting in 1999 and was not succeeded by a waterfowl specialist at UW. The decision not to refill the position with a person possessing a similar skill set has been repeated at U.S. and Canadian universities, where there has been a 44% decline in professorships with expertise in waterfowl or wetlands. Additional positions are at risk currently given that nearly half of existing waterfowl professors may retire in less than ten years (Kaminski 2002, 2013; *Wildlife Society Bulletin* and *The Wildlife Professional*, respectively).

What can preserve these critical university programs that produce the next generations of waterfowl and wetlands scientists and stewards? One solution is to endow existing programs and establish others to secure them in perpetuity. The first such endowments were the Dennis G. Raveling Endowed Waterfowl Professorship and Chair at the University of California Davis (1995-present, Dr. John Eadie) and the James C. Kennedy Endowed Chair in Waterfowl and Wetlands Conservation at Mississippi State University (2008-2015, Dr. Rick Kaminski; 2015-present, Dr. J. Brian Davis). The next endowments both were in Texas, the C. Berdon and Rolanette Lawrence Endowed Chair in Waterfowl Research at the Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville (2012-present, Dr. Bart

Ballard) and the Bricker Endowed Chair in Wildlife Management (including waterfowl, 2014-present; Dr. Warren Conway). The first endowed program in the Atlantic Flyway was the James C. Kennedy Waterfowl and Wetlands Conservation Center at Clemson University (2015-present, Dr. Rick Kaminski). University teaching, research, and outreach in waterfowl and wetlands have returned to Wisconsin with establishment of the James C. Kennedy-David F. Grohne Chair in Waterfowl and Wetlands Conservation at UW-Stevens Point in 2016 (chair holder, Dr. Jacob Straub). And most recently, the James C. Kennedy Endowed Chair in Wetlands and Waterfowl Conservation was established at Colorado State University (2017-present, Dr. David Koons),

Indeed, we are deeply grateful to these philanthropic conservationists who “breathed perpetual life” into these programs. Nonetheless, an urgent need exists to expand efforts for additional



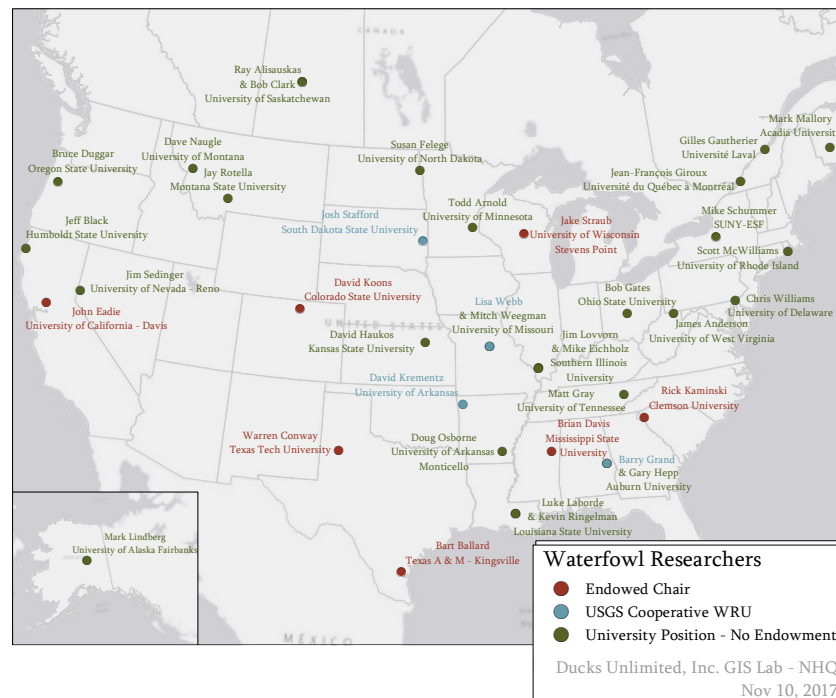


endowments to prevent further loss of university programs critical for the future of waterfowl and wetlands conservation in North America. Prominent challenges that require leadership at universities and in conservation include continued efforts to address habitat loss and uncertainties of the quality of remaining habitats amid climate and human dynamics. As habitats wane, so might human interest and understanding in waterfowl and wetland conservation. Some of this interest is attributed to a shift away from “hands-on” and experiential learning that students once cherished and universities nurtured. Today, most students are from urban backgrounds, where opportunity, interest, and passion for the outdoors may not have been fostered compared to those with rural roots. The authors of this plan still revere these values and believe endowments will help revive and perpetuate them. Only seven endowments for waterfowl programs exist in the United States and none exists in Canada or Mexico (see map). Hence, many gaps exist continentally. Clearly, we must strive to establish additional endowments in other important habitat regions across North America to assure people with the proper education will populate future positions in waterfowl and wetlands science and conservation.

For decades, university-based waterfowl and wetlands programs have been dominant features in higher education in wildlife management and natural resources and served an important niche in

education and conducting research and outreach for public and private-sector partners in waterfowl and wetland conservation. Who will “mind the marsh” in this century and subsequently if these academic niches languish and are not re-filled? To paraphrase Aldo Leopold, “To keep every cog and wheel is the first precaution of intelligent tinkering.” We believe university waterfowl and wetlands programs and their people are critical “cogs and wheels” to “mind the marsh” in perpetuity. Obviously, conservation doesn’t happen without people!

The authors of this document are professionals affiliated with the seven existing endowed university waterfowl and wetlands programs, Delta Waterfowl Foundation, Ducks Unlimited Inc., and Ducks Unlimited-Canada. Because of the dire need to expand endowed university-based waterfowl and wetlands programs, we convened a caucus at Colorado State University on 16 September 2017 to develop this vision and business plan. One of our focal tasks was to identify a priority group of universities in key regions of North America with history and capacities for teaching, research, and outreach in waterfowl and wetlands ecology and management. Herein, we identify these universities, justify their selection as priority candidates for endowment in the next five years and thereafter, and seek to establish an advisory council of philanthropic conservationists who would assist us



in finding donors for needed endowments. This plan is ambitious but we believe it is essential for the future of waterfowl, wetlands, and people that benefit from the eco-services of these resources and continued success of the North American Waterfowl Management Plan—the greatest ecosystems conservation plan worldwide.

Priority Endowments

At the Colorado State University caucus, we discussed in detail criteria for prioritizing future endowed chairs or centers at North American universities. Foremost among our identified criteria were geography, including the geographic importance of a region for sustaining continental waterfowl populations, and urgency of preserving academic programs in these regions to train future professionals. Importantly, we are in desperate need of university waterfowl and wetland programs in Canada where Ducks Unlimited-Canada, the provinces, and Environment and Climate Change Canada are experiencing great difficulty in recruiting employees with relevant waterfowl and wetlands education and experience to manage habitats for breeding waterfowl and at major migratory stopover areas. These disciplines are no longer taught at most Canadian universities, and where they are instructed, the experts providing the training will retire soon. In addition to the importance of geography, we also identified other significant criteria important to consider when prioritizing universities that can foster successful waterfowl and wetlands programs:

- Institutional capacity to deliver training in wetlands ecology and management from recognized specialists (if not an expertise of the endowed chair)
- Institutional capacity to deliver training in human dimensions and natural resource policy from recognized specialists (if not an expertise of the endowed chair)
- Institutional capacity for outreach and extension to public and private sector partners

- Institutional capacity to deliver training in basic biology and other essential courses (e.g., ecology, ornithology, populations, communities, statistics, etc.)
- Programs providing training in applied wildlife / natural resource management that qualifies graduates for federal, state, or NGO positions (a minimum of an M.S. degree is now common)
- Program offers B.S., M.S., and Ph.D. degrees
- Existence of strong donor / alumni connections
- Existence of financial development professionals who can help describe and establish donation options, and provide stewardship to donors and partners
- Willingness to network in teaching, research, and outreach with other endowed programs and colleagues to provide cross-region experiences for faculty and students



We evaluated North American universities based on the criteria listed above, to the best of our knowledge. Each individual present at the caucus voted for five universities to be considered a priority for establishing future endowed chairs/programs in waterfowl and wetland conservation. Here, we place universities receiving two or more total votes in tier 1, and those receiving one vote in tier 2. We encourage consideration of endowment at tier 1 universities in the next five years (by 2022) but do not discourage any university having the above



attributes and fiscal resources from proceeding with plans for an endowment. Additionally, socio political and funding differences between Canada and United States warrant university programs in both countries to provide research and education needs in the geographic regions that are most important for sustaining waterfowl.

TIER 1 UNIVERSITIES, CANADA: Based on the critical importance of the Prairie Pothole Region for breeding waterfowl in North America, its risks from agriculture and energy developments, and the criteria listed above, we agreed that the University of Saskatchewan (Saskatoon) is the priority in Canada for establishing an endowed chair within the next five years. Leading experts at this institution are soon to retire and are federal employees, with no guarantee that Environment and Climate Change Canada will succeed these faculty with waterfowl experts. Additionally, these faculty have demonstrated through their research that the university is also well-positioned to study breeding waterfowl in the boreal forest of Canada and the Arctic. Another tier 1 institution in western Canada is the University of Alberta (Edmonton). Given its importance for fall and spring staging during waterfowl migration, an endowed chair in the Great Lakes Region would be the next priority in Canada. Although several universities could be targeted, we believe the University of Guelph, with its existing wildlife and natural resources curricula,

best meets the necessary criteria in the Great Lakes Region. The University of Western Ontario and the University of Waterloo (Ontario) also are possibilities.

TIER 1 UNIVERSITIES, UNITED STATES: In the Prairie Pothole Region, we agreed South Dakota State University best meets the necessary criteria, with the University of Minnesota and the University of Montana being other tier 1 possibilities. In the Great Lakes Region, the State University of New York College of Environmental Science and Forestry is the best choice. We also agreed the University of Alaska (Fairbanks) should be a high priority for establishing an endowed chair because of its strong wildlife program, history of top-tier waterfowl research, and its ideal position to address research, education, and outreach needs in the Arctic and boreal forest regions, which contribute greatly to goose and duck populations in the Pacific Flyway. The importance of the Gulf Coast region for wintering waterfowl is unparalleled, and although there are strong waterfowl and wetland programs in Texas, Mississippi, and Louisiana, the historically strong program at Louisiana State University is not currently endowed and its persistence cannot be guaranteed. Notably, LSU recently executed an agreement with Ducks Unlimited de Mexico (DUMAC) to help with DUMAC's research needs.

TIER 2 INSTITUTIONS: Given its relevance to the history of waterfowling and continued importance for both migrating and wintering waterfowl, the Chesapeake Bay region greatly needs an endowed waterfowl and wetland chair. The University of Delaware has a strong existing waterfowl and game bird teaching, research, and outreach program and would serve as an excellent choice for an endowed chair in the mid-Atlantic region. Other tier 2 universities that received mention at the caucus are scattered across important waterfowl geographies and include Michigan State University, Oregon State University, University of Missouri, University of Nebraska, and Utah State University.

Need for an Advisory Board

The geographic breadth and overall enormity of the potential to develop future waterfowl conservation

programs in North America begs for guidance from, and close communication with, an advisory board composed of philanthropic conservationists. We believe a board of generous individuals of sound business acumen could successfully advocate for the priority universities to philanthropists, NGOs, industries, and foundations who may have interest establishing an endowed waterfowl and wetlands program at suggested or other institutions. Our caucus group desires to work closely with this advisory board and share our institutional knowledge of working in universities and with university development foundations to promote success of new endowments. The cost of endowing professorships, chairs, and centers varies among institutions but generally ranges between \$1M-\$5M (U.S. currency). A median range for recent endowed chairs in waterfowl and wetlands science and conservation in the U.S. has been \$2M-\$3.3M.





RESEARCH ABSTRACT

Influence of Widgeongrass (*Ruppia maritima*) Management on Aquatic Invertebrate Communities in South Carolina Coastal Impoundments

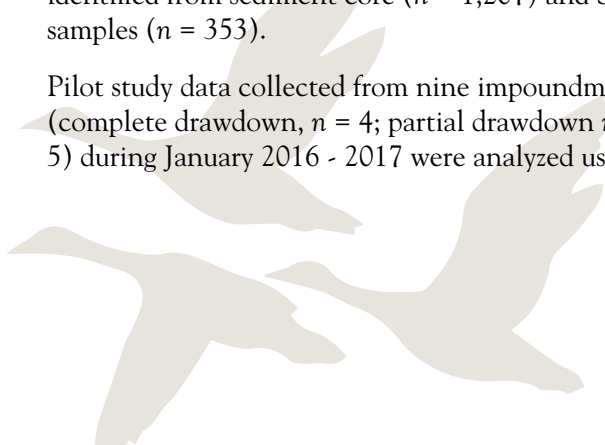
Beau A. Bauer, M.S. Wildlife and Fisheries Biology Student, Clemson University

Widgeongrass is a cosmopolitan submersed aquatic vegetation (SAV) generally inhabiting brackish wetlands. Management of widgeongrass and other SAV is practiced in impounded tidal wetlands in coastal South Carolina to provide forage for wintering waterfowl. Widgeongrass and its associated detritus also provide food and substrate for aquatic invertebrates, which are proteinaceous foods for waterbirds. I am investigating effects of complete versus partial water drawdowns during summer on aquatic invertebrate biomass in impounded, managed wetlands in coastal South Carolina, because such data do not exist to inform managers of best management practices. Results from this study will provide estimates of invertebrate, widgeongrass, and other SAV biomass that will be used to estimate carrying capacity of similar wetlands managed for waterfowl and other waterbirds in the South Atlantic Flyway.

Field work has been completed with samples collected during January, August, November, and December 2016 and January, February, and April 2017. Samples were collected from 10 completely drawdown and 10 partially drawdown impoundments (i.e., 0 cm until substrate is dry, followed by 5 – 70 cm of flooding based on elevation) and 3 un-impounded tidal marshes (control sites) across three properties located within the Ashepoo, Combahee, and Edisto Rivers Basin, South Carolina. Aquatic macroinvertebrates have been processed, sorted, and identified from sediment core ($n = 1,207$) and SAV samples ($n = 353$).

Pilot study data collected from nine impoundments (complete drawdown, $n = 4$; partial drawdown $n = 5$) during January 2016 - 2017 were analyzed using

mixed-model with repeated measures analysis of variance to explore effects of drawdown regimes and obtain preliminary invertebrate biomass estimates ($\text{g}[\text{dry}]/\text{m}^2$). Mean biomass of invertebrates in completely drawdown impoundments was $4.63 \text{ g}/\text{m}^2$ ($\text{SE} = 0.33$, $\text{CV} = 7.22\%$) and $4.65 \text{ g}/\text{m}^2$ ($\text{SE} = 0.20$, $\text{CV} = 4.31\%$) in partially drawdown impoundments; thus, no effect of drawdown regime was detected ($P = 0.99$). I am currently in the process of drying and weighing remaining invertebrate and SAV samples for analysis of the entire data set. Project completion is slated for December 2018.



RESEARCH ABSTRACT

Nesting Duck Use, Production, and Selection of Nest Structures in Coastal South Carolina

Gillie D. Croft, M.S. Wildlife and Fisheries Student, Clemson University

In 2016, I initiated a two-year landscape-scale survey of nest-structure use and duckling production by wood ducks, black-bellied whistling ducks and hooded mergansers across the Ashepoo, Combahee, and Edisto and Santee Delta Rivers Basins in coastal South Carolina. Furthermore, I modeled effects of nest box size, location, and surrounding habitat on box selection by wood ducks and black-bellied whistling ducks. I am interested in black-bellied whistling ducks because of their increasing population size and range expansion in South Carolina and the southeastern United States. In 2016 and 2017, three duck species used boxes disproportionately (wood ducks, 61%; black-bellied whistling ducks, 15%; hooded merganser, 0.3%; overall use, 66%). Nest structures also were used by other birds, including Carolina wrens (11%), eastern bluebirds (7%), great-crested flycatchers (5%), and eastern screech owls (1%). Wood ducks nested from January through August 2016-2017 (average = 181-day nesting season) with peak nesting in March and April. Black-bellied whistling ducks began nesting in May and continued into September 2016-2017 (average = 116-day nesting season) with peak nesting in June. Nest box size and canopy density above boxes had greatest influence on nest box selection by wood ducks. Wood ducks were more likely to nest in boxes with 1,700 cm³ less internal volume ($\beta = -0.33$; $P = 0.0031$) and boxes with 20% less overhead canopy cover ($\beta = -0.63$; $P < 0.0001$) than boxes not used by the species. Nest box selection by black-bellied whistling ducks was influenced most by nest box size, overhead canopy density, height of box entrance above ground or water, and distance to nearest box. Black-bellied whistling ducks nested in boxes with 2,766 cm³



larger internal volume ($\beta = 0.96$; $P < 0.0001$) and boxes with 13 cm higher entrances above land or water ($\beta = 0.62$; $P = 0.0058$) than boxes not used by the species. Additionally, black-bellied whistling ducks selected boxes that were, on average, 46 m closer to other boxes ($\beta = -1.54$; $P = 0.0038$) and boxes with 10% less overhead canopy cover ($\beta = -0.46$; $P = 0.0232$) than boxes not used. Wood ducks and black-bellied whistling ducks exhibited similar nest success; at least one duckling departed from approximately 60% of all nests. Based on egg-shell membranes recovered in structures, an estimated 3,378 wood duck, 531 whistling duck, and 19 hooded merganser ducklings exited nest structures in 2016-2017 for an average of six ducklings/box/year (3,928 membranes/718 used and non-used boxes over two years). Most identifiable unsuccessful duck nests (~20%) resulted from abandonment or egg predation by red-bellied woodpeckers and yellow rat snakes. My study did not estimate duckling and brood survival into fall populations nor subsequent spring-summer use of boxes by marked individual females to assess recruitment and cost: benefits from boxes. This research is needed throughout the breeding range of wood ducks and other cavity nesting ducks in North America.



RESEARCH ABSTRACT

Evaluation of Aerial Strip-Transect Surveys to Estimate Abundance of Wintering Waterfowl and Other Waterbirds in South Carolina

Nicholas M. Masto, M.S. *Wildlife and Fisheries Biology Student and Kennedy Fellow, Clemson University*
Molly R. Kneece, *Wildlife Biologist, South Carolina Department of Natural Resources*

Aerial surveys for waterfowl and other waterbirds are essential for understanding population size and trends, habitat relationships, and spatio-temporal distributions of these birds. Resulting information guides harvest regulations, habitat conservation initiatives, and research. Researchers have designed and conducted aerial surveys that provide estimates of wintering populations of ducks and other waterfowl; yet, few conservation agencies have implemented probability based surveys which enable estimation of bird abundance. In response to cessation of the Midwinter Waterfowl Survey by the U.S. Fish and Wildlife Service in 2016 and need for reliable probability based surveys of wintering waterfowl and other waterbirds in South Carolina, Clemson University's James C. Kennedy Waterfowl and Wetlands Conservation Center and its partners initiated aerial strip-transect surveys for waterfowl and other waterbirds in fall 2016, using a fixed-winged aircraft and 250-m wide transects and flying approximately 60 m above ground elevation. To our knowledge, South Carolina is the first state in the Atlantic Flyway to implement these types of aerial surveys for waterfowl and other waterbirds inland of the Atlantic Ocean. Following fall 2016–winter 2017 surveys, we revised survey strata across South Carolina. We excluded forested wetlands with dense canopies and understory that precluded detection of waterbirds, human populated areas, and no-fly zones. These exclusions reduced survey strata area by nearly 38% (9,132.74 km² to 5,676.08 km²); yet, we retained 98% of all waterbird detections.

In 2017–2018, we conducted aerial surveys encompassing revised survey strata at a sampling rate of $\leq 7.5\%$ proportional to stratum area to estimate population indices (\hat{I}) of nine groups of waterbirds. Estimated total ducks during fall–winter ranged from 1,464–74,503 (29.05% \leq CV \leq 36.41%) with greatest abundance of ducks observed in January 2018, a month with unseasonable cold temperatures, snow, and ice along the Atlantic Coast including South Carolina. Combining all ducks, geese, and swans slightly increased estimates (2,023–75,604; 24.08% \leq CV \leq 36.03%). Our 2017–2018 estimates were similar to total duck numbers reported for the January 2012–2015 Midwinter Waterfowl Surveys (80,247–135,271; average = 97,272). We believe our estimates are reasonable, but we must increase sampling effort to achieve targeted levels of statistical precision (CV \leq 15–20%). We also will analyze double-observer data from 2017–2018 to compare estimates resulting from two simultaneous



observers in front (Molly Kneece) and rear (Nick Masto) seats of the aircraft, habitat associations of waterbirds, and other possible

detection biases that may influence waterfowl and other waterbird abundances.

Managed (above) and non-managed (below) historic rice field impoundments in Lowcountry South Carolina.



COLLABORATIONS

Collaborative teaching, research, and outreach with colleagues and students from other universities are a continuing ambition and goal of the Kennedy Center. Such collaboration provides diverse educational and experiential opportunities for engaging institutions, students, and faculty. Indeed, we learn and prosper by “cross-pollinating.”

Dr. Kaminski continues to collaborate with Dr. Brian Davis, Director of the James C. Kennedy Endowed Program in Waterfowl and Wetlands Conservation at Mississippi State University (MSU), where Dr. Kaminski was named an Emeritus Professor in the Department of Wildlife, Fisheries, and Aquaculture after retiring from MSU in 2015, following 33 years of service. Dr. Kaminski also served as a graduate committee member or co-major professor to MSU alumni, Drs. Joe Marty and Joe Lancaster.

Joe Marty completed his doctorate, graduating in May 2017. Dr. Marty’s dissertation provided estimates of waste rice, natural seeds, and wetland bird use in Gulf Coast Prairie ricelands in Louisiana and Texas. Waste rice (i.e., seeds escaping mechanical harvest) and natural seeds are important forage for waterfowl, and estimates of their abundance enable biologists and managers to determine the foraging habitat carrying capacity of production and idled rice-lands for wintering waterfowl. The Gulf Coast Joint Venture of the North American Waterfowl Management Plan use these and energetics data to determine the landscape’s capacity to support desired population levels of wintering waterfowl. Dr. Marty also conducted surveys of waterfowl and other wetland birds using rice-lands. Dr. Marty is now employed as Biologist Supervisor and Research Coordinator for the Louisiana Department of Wildlife and Fisheries

at the Rockefeller Wildlife Refuge in southwest coastal Louisiana.

Joe Lancaster defended his dissertation in November 2017 and received his Ph.D. in May 2018. Joe’s dissertation research addressed movements, survival, and habitat use of radio-marked female mallards in the Mississippi MAV. He is a Post-doctoral Research Associate with the Forbes Biological Station, Illinois Natural History Survey/University of Illinois at Havana, IL succeeding another Mississippi State University alumnus, Dr. Heath Hagy, who joined the U.S. Fish and Wildlife Service as a waterfowl ecologist for National Wildlife Refuges in southeastern United States. In Joe’s role at the Forbes Biological Station, he is collaborating on a number of waterbird related research projects, including diet selection of green-winged teal, spring stopover duration and movements of green-winged teal and gadwall, marsh bird occupancy, ecology of urban Canada geese, and estimation of metabolizable energy of submersed aquatic vegetation and rhizomes by ducks.



Participants in Colorado State University Caucus, September 2017.

In September 2017, Kennedy endowed program directors from MSU, Clemson University, University of Wisconsin-Stevens Point, and Colorado State University, directors of other endowed waterfowl and wetlands programs at University of California-Davis, Texas A&M-Kingsville, and Texas Tech University, plus senior staff of Ducks Unlimited (DU), Inc., DU-Canada, and Delta Waterfowl Foundation, met and were hosted by Dr. Dave Koons (Colorado State University [CSU]), James C. Kennedy Chair of Wetlands and Waterfowl Conservation), and Mr. Bob and Mrs. Kitty Wilson during a weekend caucus to discuss future university-based endowed waterfowl and wetlands programs in the United States and Canada. A summary of the caucus appears in this annual report's feature article, WHO WILL MIND THE MARSH?



The Kennedy Center was represented at Clemson's College of Agriculture and Life Sciences (CAFLS) event during Military Recognition Day in November 2017. Drs. Kaminski and Thomas Rainwater and Beaux (Rick's Labrador) greeted people on campus prior to Clemson's football game against The Citadel. Dr. Rainwater is a wildlife scientist and herpetologist, with the Baruch Institute and the Tom Yawkey Wildlife Foundation. This venue was an important recruiting event, especially for rising high school seniors who attended the festivities and consulted with Drs. Kaminski and Rainwater about CAFLS's major undergraduate programs. Beaux contributed with kisses!



Dr. Kaminski serves as faculty advisor to Clemson's student chapter of DU. Dr. Kaminski and DU Ducklings are pictured below at the students' November 2017 banquet at Denver Downs near Clemson, SC. The evening was chilly but the Ducklings heated up donations amounting to near \$10,000. Way to go Team DUCK!





Dr. Kaminski also coordinated development of signage of the endowed Kennedy programs at Mississippi State University, Clemson University, University of Wisconsin-Stevens Point, and Colorado State University. Below is a picture of Mr. Kennedy seated amidst the signs where they are displayed at his York Woods lodge in Mississippi. In addition to the signs, each of the aforementioned universities have sent flags from their respective institution to Mr. Kennedy for display at York Lodge.

In January 2018, Clemson's Kennedy Center, Clemson's Department of Forestry and Environmental Conservation (FEC), FEC's Natural Resources Graduate Student Association, the South Carolina Cooperative Fish and Wildlife Research Unit (Coop Unit) hosted Dr. Dave Koons, already mentioned, from CSU. Dr. Koons is pictured with Dr. Beth Ross, Assistant Coop Unit Leader, who completed her Ph.D. under Dr. Koons at Utah State University before Dr. Koons moved to CSU. Dr. Koons presented two seminars, one on campus and at the Baruch Institute and Kennedy Center, entitled "Integrated Approaches to Solving Demographic Puzzles in Ecology." Both seminars were well attended and most informative. Dr. Koons enjoyed interacting with faculty and graduate students, as well as duck hunting. We are grateful to Messrs. Dan Ray and George Dean Johnson for inviting us for wonderful hunts at Annandale and Pon Pon Plantations,



respectively. A video of Dr. Koons seminar is at: <http://tcsapp1.clemson.edu/tcs/#page:recordingList&pageNumber:1&id:787A082E-F4F9-4C75-A5BE-0D1E196F8964>

Dr. Kaminski also is collaborating with Dr. Phil Lavretsky of the University of Texas-El Paso. Dr. Lavretsky is a renowned waterfowl geneticist, who is investigating genetics of North American ducks, including mottled ducks which occur in South Carolina and along the Gulf Coast. Dr. Lavretsky desires samples of mottled ducks from South Carolina for DNA analyses. Thus, Dr. Kaminski and fellow biologists collected hunter harvested mottled ducks for DNA analyses. This project will continue to determine to what extent, if any, wild and released mallards are interbreeding with mottled ducks. Dr. Lavretsky also delivered two seminars, one on campus and at the Kennedy Center in the Baruch Institute of Coastal Ecology and Forest Science. His seminars were entitled,



Mr. Jim Kennedy at York Woods amidst signage of his endowed university waterfowl and wetlands programs (January 2018).

“Genomics of Hybridization: Lessons Learned from the Mallard Complex.” A video of Dr. Lavretsky’s seminar is at: <http://tcsapp1.clemson.edu/tcs/#page:recordingList&pageNumber:1&id:B9F26CE3-3AA9-4D0B-AFC2-F9D-C442EE552>



Dr. Phil Lavretsky, University of Texas-El Paso, visiting Baruch Institute and Kennedy Center

The Nemours Wildlife Foundation (NWF) in the ACE Basin hosted the inaugural South Atlantic Flyway Waterfowl and Wetlands Workshop (20-22 February 2018). Drs. Ernie Wiggers (NWF), Paul Schmidt (consultant; retired USFWS and DU), Rick Kaminski (Clemson Kennedy Center), and Chris Williams (University of Delaware) helped plan and facilitate the workshop.

The goal of the workshop was to form a multi-state partnership to identify priority research needs for wetlands and waterfowl habitat and populations in the southern region of the Atlantic Flyway (Delaware through Florida) and develop a process for addressing these needs. The partners will continue working to facilitate increased cooperation among state, federal, non-governmental, and university partners to assure priority research needs can be addressed. About 30 colleagues assembled for two days of discussions and project planning and prioritization. We are grateful to the NWF and its Board for sponsoring and graciously hosting this workshop at the Foundation’s headquarters. Priority research projects identified by workshop attendees were shared by Dr. Paul Schmidt at the 2018 North American Wildlife and Natural Resources Conference in March 2018. Subsequent refinement and dissemination of the priorities is planned for 2108, with a goal to seek funding and implement initial studies in 2019-2020.



Dr. Ernie Wiggers, Executive Director of Nemours Wildlife Foundation (standing in classroom) and participants (pictured in- and outdoors) of the inaugural South Atlantic Waterfowl and Wetlands Workshop, hosted by NWF, Yemassee, SC.

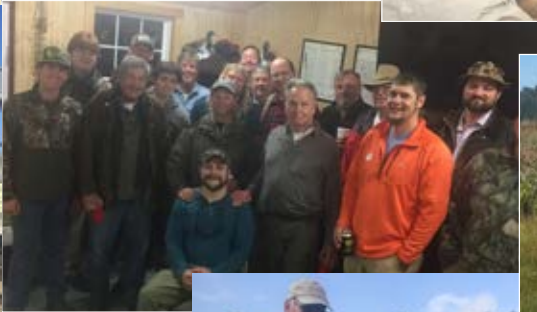
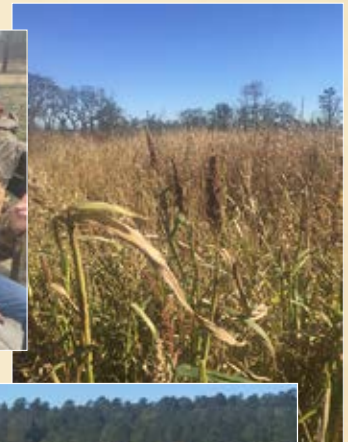


OUTREACH

SERVICE ACTIVITIES BY THE KENNEDY CENTER

The term outreach means communicating research and other technical knowledge from various reputable sources to public and private stakeholders, as Extension units do for land-grant universities and citizens of their state or nation. Land-grant universities also often term outreach as service, coupled with teaching and research missions of such universities. Clemson is the land-grant university of South Carolina; hence, an obvious role of the Kennedy Center is and will continue to be outreaching technical information on ecology and management of waterfowl and wetlands.

This year, the Kennedy Center and Clemson Extension convened a Waterfowl Habitat and Hunting Management Workshop in The Greater Pee Dee River Basin at The Catfish Farm near Marion, SC, on February 6-7, 2018. The workshop graciously was hosted by Mr. Joseph Richardson, owner of Richardson Construction, Inc. (Columbia, SC) and his The Catfish Farm staff and facilities. Over 50 participants attended to hear lectures and witness demonstrations by waterfowl and other wildlife experts from South Carolina. The workshop announcement and selected pictures from the workshop and landowner/organization outreach activities in South Carolina, Colorado, Mississippi, and California are shown below.







AWARDS AND REWARDS

We are pleased to announce receipt of fellowships and other awards to Kennedy Center-Nemours students.

- **Beau Bauer**, current M.S. Wildlife and Fisheries Biology Student, Clemson University, researching aquatic invertebrate communities in managed impoundments in coastal South Carolina. Nemours Wildlife Foundation, the Kennedy Center, and Clemson's Department of Forestry and Environmental provide support for Beau's assistantship, research, tuition, and technical assistance.
- **Gillie Croft**, current M.S. Wildlife and Fisheries Biology Student, Clemson University, student, researching wood duck and other bird use and production from nest structures across coastal South Carolina. Gillie is likewise supported as Beau Bauer.
- **Nick Masto**, M.S. Wildlife and Fisheries Biology Student, Clemson University, and Kennedy Center Master's level fellow, coupled with research sponsorship by Nemours Wildlife Foundation, SC DNR, Delta Waterfowl Foundation, Ducks Unlimited, SC Waterfowl Association, and U.S. Fish and Wildlife Service for his research with Molly Kneece (SC DNR) to conduct aerial line-transect surveys of waterbirds.
- **Lauren Senn**, Ph.D. Wildlife and Fisheries Biology Student, Clemson University, and Kennedy Center Ph.D. student fellow. Lauren is working with Dr. Kaminski to transform the waterfowl ecology and management from face-to-face to online delivery. Lauren and Dr. Kaminski have taught the new online course in fall semesters 2017 and 2018.
- **Charles "Will" Gallman**, 2017 Kennedy Center Undergraduate Research Technician and Scholarship Recipient and the 2017 Outstanding Graduating Senior in Wildlife and Fisheries Biology. Will also was selected as the 2017 Outstanding Undergraduate Wildlife Student by the South Carolina Chapter of The Wildlife Society (see picture). Currently, Will is a M.S. student working under Dr. Joshua Stafford at South Dakota State University, Brookings, SD.
- **Ian Talty** was the 2017-2018 recipient of the James C. Kennedy Undergraduate Student Scholarship. Ian is a junior wildlife and fisheries biology major, with a 3.54 GPA overall. He is significantly engaged as a Kennedy Center undergraduate intern, besides serving in the National Guard.



Charles "Will" Gallman



Ian Talty

Clemson's 2017-2018 Academic Year Undergraduate Kennedy Center-Nemours Wildlife Interns and Creative Inquiry Students Summer 2018 Employment, Internships, and Interviews

Sean Byrd

- Senior and graduated, Wildlife and Fisheries Biology (WFB) major, Forestry (FOR) and Biological Science minor
- Interviewing with Department of Health and Environmental Control and applying for other positions in the environmental and natural resources arena

Richard Coen

- Junior, Environmental and Natural Resources (ENR) major
- Baldwin Conservation Lab, Nemours Wildlife Foundation, and partners undergraduate intern mapping historic rice fields in South Carolina

Jess Eidson

- Junior, FOR major
- National Wild Turkey Federation youth shotgun instructor

Harold "Colin" Farah

- Senior, ENR major
- Summer classes at Clemson University

Ryan Frazier

- Senior and graduated, Agricultural Mechanization (AGMECH), Agribusiness minor
- Entrepreneur building custom furniture

Matthew King

- Senior and graduated, WFB major, FOR minor
- Interviewing for Wildlife Biologist/Manager position for Fenwick Island and Research Liason for McKenzie Field Station in the ACE Basin, South Carolina

Robert "Castles" Leland

- Junior, WFB major
- Wildlife summer intern at Nemours Wildlife Foundation and James C. Kennedy Waterfowl and Wetlands Conservation Center; assisting Nemours-Kennedy graduate student, Beau Bauer

Cameron Massey

- Senior, WFB major, FOR minor
- South Carolina Department of Natural Resources (SCDNR) intern at Bonneau Ferry Wildlife Management Area (WMA), Cordesville, South Carolina

Caroline Sharpe

- Junior, WFB major
- Part-time position at Clemson's Barnwell County Cooperative Extension, Blackville, South Carolina and summer classes at USC-Aiken

**Justin “Ryan” Theo**

- Senior and graduated, AGMECH major
- Accepted a position as a sales representative for Ag-Pro Companies

Ian Talty

- Junior, WFB major
- Senior, Wildlife Biology, summer classes at Clemson, advanced ROTC training at Fort Knox, Kentucky.

Tristan Turner

- Senior, WFB major
- SCDNR intern at Samworth Wildlife Management Area, Georgetown, South Carolina under former Kennedy Research Specialist, Molly Kneece, Wildlife Biologist

KENNEDY CENTER ACKNOWLEDGEMENTS

We sincerely thank the advisory board members of the Kennedy Center listed below and their affiliations for their guidance and especially for financial support of the Center's research and outreach programs.

- **Jason Ayers**, South Carolina Coastal Program Coordinator, U.S. Fish and Wildlife Service;
- **Billy Dukes**, Chief of Wildlife, SCDNR;
- **Breck Carmichael**, Special Assistant to the Director, South Carolina Department of Natural Resources (SCDNR);
- **Jim Clark**, Manager, Weehaw Plantation;
- **Jamie Dozier**, Project Leader, Tom Yawkey Wildlife Center, SCDNR;
- **Travis H. Folk**, Woodland and Wildlife Consultant, Folk Land Management, Inc., Green Pond, SC;
- **Dean Harrigal**, Retired Waterfowl Biologist, SCDNR; Consulting wildlife biologist, Folk Land Management
- **Gary Hepp**, Emeritus Professor, Waterfowl Ecology, Auburn University
- **Jason Hewett**, Manager, Clarendon Farms;
- **Craig R. LeSchack**; Director, Conservation Programs – Southeast; Ducks Unlimited; Southern Region; South Atlantic Field Office;
- **Beth Ross**; Assistant Leader, South Carolina Cooperative Fish & Wildlife Research Unit; Clemson University;
- **Thomas Rainwater**, Wildlife Research Scientist, Yawkey Wildlife Foundation and Belle W. Baruch Institute of Coastal Ecology and Forest Science;
- **Sharon Richardson** and **Heather VanTassel**, South Carolina Audubon Society;
- **Buford Mabry**, Delta Waterfowl Foundation;
- **Bob Perry**, Retired SCDNR, Wildlife and Wetlands Consultant;
- **Michael Prevost**, Wildlife Biologist and Land Manager, White Oak Forestry and Rochelle Plantation;
- **Derrell Shipes**, Retired, Chief-Statewide Programs, Research & Surveys Wildlife Section, SCDNR;
- **Skip Van Bloem**, Director, Baruch Institute of Coastal Ecology and Forest Science;
- **Craig Watson**, South Atlantic Coordinator, U.S. Fish and Wildlife Service, Charleston Ecological Services Field Office;
- **David Wielicki**, Executive Director, South Carolina Waterfowl Association;
- **Ernie Wiggers**, CEO Nemours Wildlife Foundation;
- **R. Kenneth Williams**, Owner, Williams Land Management Company;
- **Greg Yarrow**, Professor and Chair of Clemson's Department of Forestry and Environmental Conservation



Completed or Current Journal Articles/Abstracts (*n* =14)

- Masto, N., and G. Croft. 2018. A spring migration to the DELMARVA Peninsula: Following ducks to enhance Clemson University wildlife students' experiential learning. *The Wildlife Professional*. In press.
- McClain, S.E., M.C. Gross, J.D. Lancaster, C.N. Jaques, N.M. Masto, R.M. Kaminski, and H.M. Hagy. 2018. Assessment of excreta collection methods to estimate true metabolizable energy of waterfowl foods. *Wildlife Society Bulletin*. Submitted.
- Schummer, M.L., A.M. Smith, R.M. Kaminski, K. Hunt, E. St. James, and H. Havens. 2018. Achievement-oriented effects on waterfowl-hunt quality at Mississippi Wildlife Management Areas. *Journal of Southeastern Fish and Wildlife Association*. Submitted.
- Straub, J.N., A.G. Leach, R.M. Kaminski, A.W. Ezell, and T.D. Leininger. 2018. Red oak acorn yields in green-tree reservoirs and non-impounded forests in Mississippi. *Wildlife Society Bulletin*. Submitted.
- Post, C. J., M. P. Cope, P. D. Gerard, N. M. Masto, J. Vine, R. Y. Stiglitz, E. A. Mikhailova. 2018. Monitoring spatial and temporal variation of dissolved oxygen and water temperature in the Savannah River using a sensor network. *Journal of Environmental Monitoring and Assessment*. In press.
- Kaminski, R.M., et al. 2017. Who will mind the marsh? Delta Waterfowl Foundation, Bismarck, North Dakota.
- Foth, J.R., R.M. Kaminski, J.B. Davis, J.N. Straub, and T.D. Leininger. 2017. Aquatic invertebrate community composition, diversity, and biomass from sweep-net samples in non-impounded bottomland hardwood forests and greentree reservoirs. *Journal of the Southeastern Fish and Wildlife Association*. In press.
- Kneece, M.R., J.C. Shipes, J.B. Davis, E.P. Wiggers, R.M. Kaminski, and M.E. Colvin. 2017. Nesting ecology of mottled ducks in Coastal South Carolina. 2016 Annual Report, James C. Kennedy Endowed Chair of Waterfowl and Wetlands Conservation, Mississippi State University: <http://www.cfr.msstate.edu/kennedychair/>
- Marty, J.R., J.B. Davis, R.M. Kaminski, M.G. Brasher, E. Brinkman. 2017. Index of spent shot in Louisiana and Texas Gulf Coast ricelands. 2016 Annual Report, James C. Kennedy Endowed Chair of Waterfowl and Wetlands Conservation, Mississippi State University: <http://www.cfr.msstate.edu/kennedychair/>
- Marty, J.R., J.B. Davis, R.M. Kaminski, M.G. Brasher, and S. Rush. 2017. Waste rice and natural seed abundances in ricelands in the Gulf Coast prairies of Louisiana and Texas. 2016 Annual Report, James C. Kennedy Endowed Chair of Waterfowl and Wetlands Conservation, Mississippi State University: <http://www.cfr.msstate.edu/kennedychair/>
- Foth, J., F. Vilella, and R.M. Kaminski. 2017. Waterbird use of wetlands in the Gulf Coast Region and aquaculture ponds in the Mississippi Alluvial Valley. 2016 Annual Report, James C. Kennedy Endowed Chair of Waterfowl and Wetlands Conservation, Mississippi State University: <http://www.cfr.msstate.edu/kennedychair/>

- Feaga, J., F. Vilella, R.M. Kaminski, and J.B. Davis. 2017. Waterbird use of catfish ponds and Migratory Bird Habitat Initiative wetlands in Mississippi. 2016 Annual Report, James C. Kennedy Endowed Chair of Waterfowl and Wetlands Conservation, Mississippi State University: <http://www.cfr.msstate.edu/kennedychair/>
- Monroe, K.C., J.B. Davis, R.M. Kaminski, M.J. Gray, A.P. Monroe, and D.L. Evans. 2018. Winter, diel habitat selection by female American black ducks in Tennessee. *The Condor*. Submitted
- Tapp, J.L., M.W. Weegman, E.B. Webb, R.M. Kaminski, and J.B. Davis. 2017. Waterbird communities and seed biomass in managed and reference restored wetlands in the Mississippi Alluvial Valley. *Restoration Ecology*. In press.





Presentations (*n* = 36)

- Kaminski, R.M., P. Lavretsky, S. Whitmire, T. O'Halloran, M. Montallebi, and S. Van Bloem. 2018. Boeing and Baruch: A conversation concerning collaboration in coastal conservation. Presentation to Boeing Environmental Specialists. Belle W. Baruch Institute of Coastal Ecology and Forest Science and James C. Kennedy Waterfowl and Wetlands Conservation Center. Georgetown, SC. 11 May 2018.
- Masto, N. M., and R. M. Kaminski. 2018. Wetland management for waterfowl and other wetland dependent wildlife. Invited Presentation to Wetland Wildlife Biology undergraduate students, Clemson, SC. 12 April. 2018.
- Masto, N. M., R. C. Leland, and R. M. Kaminski. 2018. Aerial surveys and undergraduate waterfowl and wetlands research at Clemson University. Invited Presentation, Clemson University Student Chapter of the Wildlife Society, Clemson, SC. 9 April 2018
- Masto, N. M., M. R. Kneece, R. M. Kaminski, B. E. Ross, K. Barrett, and P. Gerard. 2018. An update on aerial surveys of waterfowl and waterbirds in South Carolina. Invited Presentation, South Carolina Department of Natural Resources Migratory Game Bird Committee Meeting, James W. Webb Wildlife Center, Garnett, SC. 4 April 2018.
- Croft, G.D., E.P. Wiggers, R.M. Kaminski, P.D. Gerard. 2018. Reproductive use and selection of nest boxes by wood ducks and black-bellied whistling ducks and satellite tracking of black-bellied whistling ducks in coastal South Carolina. Invited Presentation, South Carolina Department of Natural Resources Migratory Game Bird Committee Meeting, Webb Wildlife Center, Garnett, SC. 4 April 2018.
- Eidson, J., C. Sharpe, R. C. Leland, R. H. Coen, I. Talty, S. Byrd, C. Farah, R. Frazier, M. King, C. Massey, R. Theo, T. Turner, N. M. Masto, R. M. Kaminski. 2018. Evaluation of a rake-collection method to estimate biomass of submersed aquatic vegetation as waterfowl forage in managed coastal South Carolina wetlands. Poster, 13th Annual Focus on Creative Inquiry Forum, Clemson, SC. 2 April 2018.
- Masto, N. M. 2018. College of Agriculture, Forestry, and Life Sciences (CAFLS) video nomination and donor event. Interview, Madren Center Broadcasting Studio, Clemson, SC. 15 March 2018.
- Croft, G.D., E.P. Wiggers, R.M. Kaminski, P.D. Gerard. 2018. Waterfowl use, production and selection of nest boxes and satellite tracking of black-bellied whistling ducks in coastal South Carolina. Invited Presentation, Friends of Nemours Wildlife Foundation Event, Yemassee, SC. 10 March 2018.
- Kaminski, R.M. 2018. Waterfowl and wetlands science and conservation at Clemson University. Invited presentation to Southeastern Wildlife Exposition, Charleston, SC. 16-17 February 23, 2018.
- Senn, L.H.R., A. McCracken, and A. Hoots. 2018. Environmental Studies Alumni Panel. Invited speaker, Wofford College, Spartanburg, SC. February 22, 2018.
- Kaminski, R.M., and C.K. Williams. 2018. University-based waterfowl and wetlands history and research programs. Invited presentation to South Atlantic Flyway Workshop, Nemours Wildlife Foundation, Yemassee, SC. 21 February 2018.

- Senn, L.H.R., B.A. Bauer, G.D. Croft, N.M. Masto, and R.M. Kaminski. 2018. Current Research of Clemson's James C. Kennedy Waterfowl & Wetlands Conservation Center. Poster, Presented at Hobcaw Research Symposium 2018, Georgetown, SC. February 9, 2018.
- Masto, N. M., M. R. Kneece, R. M. Kaminski, B. E. Ross, K. Barrett, P. Gerard, A. T. Pearse. 2018. Aerial waterbird surveys in South Carolina: An overview and application to the Santee Delta region. Invited presentation, Hobcaw Research Symposium, Georgetown, SC. 9 February 2019.
- Senn, L.H.R., B.A. Bauer, G.D. Croft, N.M. Masto, and R.M. Kaminski. 2018. Current Research of Clemson's James C. Kennedy Waterfowl & Wetlands Conservation Center. Poster, Belle W. Baruch Institute of Coastal Ecology and Forest Science 50th Anniversary Event, Georgetown, SC.
- O'Rourke, B., A. M. Alexander, N. Masto, and M. Owens. 2017. Philanthropy at Clemson: The power of philanthropy. Invited presentation to Presidential Leadership Institute, Madren Center, Clemson, SC.
- Croft, G.D., E.P. Wiggers, R.M. Kaminski and P.D. Gerard. 2017. Waterfowl and other bird use and production from nest boxes in coastal South Carolina. Poster, The Department of Forestry & Environmental Conservation, Clemson University NRGSA, Clemson, SC.
- Eadie, J., R. Kaminski, D. Koons, and K. Ringelman. 2017. Who's minding the marsh? Future of waterfowl conservationists and professionals. Invited presentation to Future of Waterfowl Workshop and Symposium, National Conservation Training Center, Shepherdstown, WV. September.
- Masto, N. M., M. R. Kneece, R. M. Kaminski, B. E. Ross, K. Barrett, P. Gerard, A. T. Pearse. 2017. Aerial strip-transect surveys of waterfowl and waterbirds in South Carolina: Summary and Revisions to 2016-2017 Surveys. Poster, 71st Annual Conference of SEAFWA, Louisville, KY.
- Croft, G.D., E.P. Wiggers, R.M. Kaminski, P.D. Gerard. 2017. Lowcountry Survey of Box Nesting Ducks and Other Birds. Invited Presentation at Joint SE-TWS/SEAFWA Wetlands Wildlife Committee Meeting. 71st Annual Conference of SEAFWA, Louisville, KY.
- Masto, N. M., M. R. Kneece, R. M. Kaminski, B. E. Ross, K. Barrett, P. Gerard, A.T. Pearse. 2017. Aerial surveys to estimate waterbird abundance and distribution in South Carolina: Summary and Revisions to 2016-2017 surveys. Invited Presentation at Joint Southeastern TWS/SEAFWA Wetlands Wildlife Committee Meeting. 71st Annual Conference of SEAFWA, Louisville, KY.
- Croft, G.D., R.M. Kaminski, E.P. Wiggers, and P.D. Gerard. 2017. Waterfowl and other bird use and production from nest boxes in coastal South Carolina. Poster, 71st Annual Conference of SEAFWA, Louisville, KY.
- Bauer, B.A., J. D. Lanham, R.M. Kaminski, P. D. Gerard, E. P. Wiggers, and C.P. Marsh. 2017. Influence of wetland management for widgeongrass (*Ruppia maritima*) on aquatic invertebrate communities in South Carolina coastal impoundments. Poster, 71st Annual Conference of SEAFWA, Louisville, KY.
- Kaminski, R. M. 2017. "I have a dream" for sustaining university waterfowl and wetlands programs: James C. Kennedy Waterfowl and Wetlands Conservation CENTERS. Invited presentation. Horry-Georgetown Technical College, Georgetown, SC. 10 October 2017.



- Masto, N.M., M.R. Kneece, R.M. Kaminski, B.E. Ross, A.T. Pearse, P. D. Gerard, and K. Barrett. 2017. Aerial strip-transect surveys of waterfowl and waterbirds in South Carolina. 2017 Annual Meeting of South Carolina Chapter of The Wildlife Society, Columbia, SC.
- Croft, G.D., R.M. Kaminski, E.P. Wiggers, and P.D. Gerard. 2017. Waterfowl and other birds use and production from nest boxes and satellite tracking of black-bellied whistling ducks in coastal South Carolina. 2017 Annual Meeting of South Carolina Chapter of The Wildlife Society, Columbia, SC.
- Bauer, B., J. D. Lanham, R. Kaminski, P. Gerard, E. Wiggers, and C. Marsh. 2017. Influence of wetland management for widgeongrass (*Ruppia maritima*) on aquatic invertebrate biomass in South Carolina coastal impoundments. Poster, 71st Annual Conference of SEAFWA, Louisville, KY.
- Bauer, B.A. 2017. Waterbirds, aquatic Invertebrates, and wetland management in coastal South Carolina. Seminar Series in Biological Sciences, University of South Carolina Beaufort. 22 September 2017.
- Kaminski, R. M. 2017. University-based waterfowl programs: Past, present, and seeking a bright future. Introduction to a Caucus to Advance University-based Waterfowl and Wetlands Programs, Colorado State University, Fort Collins, Colorado. 16 September 2017.
- Kaminski, R. M. 2017. 5 minutes about the James C. Kennedy Waterfowl and Wetlands Conservation Center. Speaker Series in Ecology and Natural Resources, Clemson University. 31 August 2017.
- Bauer, B.A. 2017. Widgeongrass management and aquatic invertebrates. South Carolina Plantation Managers Association Annual Meeting, Beaufort, SC. 17 August 2017.
- Masto, N. M., M. R. Kneece, R. M. Kaminski, B. E. Ross, A. T. Pearse, P. Gerard, and K. R. Barrett. 2017. Aerial line-transect surveys to estimate abundances and habitat associations of waterfowl and other waterbirds in South Carolina. Annual Meeting of Sponsors of Aerial Survey Project, Georgetown, SC. 3 August 2017.
- Croft, G., R.M. Kaminski, E. Wiggers, P. Gerard, and G. Yarrow. 2017. Waterfowl and other bird production from nest boxes in coastal South Carolina. Annual Meeting of the Pate Foundation, Belle W. Baruch Institute for Coastal Ecology and Forest Science, Georgetown, SC. 28 July 2017.
- Kaminski, R.M. 2017. Roles of the James C. Kennedy Waterfowl and Wetlands Conservation Center. Invited presentation to the Georgetown County Soil and Water Conservation District. Georgetown, SC. 19 June 2017.
- Kaminski, R. M. 2017. Roles of the James C. Kennedy Waterfowl and Wetlands Conservation Center. Invited seminar to Georgetown, SC Rotary Club. 16 May 2017.
- Kneece, M. R. and R. M. Kaminski. 2017. Aerial Surveys for Waterfowl and Waterbirds Take Flight! Invited Seminar to Baruch Institute of Coastal Ecology and Forest Science, Georgetown, SC. 15 May 2017.
- Croft, G.D., R.M. Kaminski, E.P. Wiggers, and P.D. Gerard. 2017. Waterfowl and other birds use and production from nest boxes and satellite tracking of black-bellied whistling ducks in coastal South Carolina. 2017 Annual Meeting of South Carolina Chapter of The Wildlife Society, Columbia, SC.

- Bauer, B., J. D. Lanham, R. Kaminski, P. Gerard, E. Wiggers, and C. Marsh. 2017. Influence of wetland management for widgeongrass (*Ruppia maritima*) on aquatic invertebrate biomass in South Carolina coastal impoundments. Poster, 71st Annual Conference of SEAFWA, Louisville, KY.
- Bauer, B.A. 2017. Waterbirds, aquatic Invertebrates, and wetland management in coastal South Carolina. Seminar Series in Biological Sciences, University of South Carolina Beaufort, 22 September 2017.
- Kaminski, R. M. 2017. University-based waterfowl programs: Past, present, and seeking a bright future. Introduction to a Caucus to Advance University-based Waterfowl and Wetlands Programs, Colorado State University, Fort Collins, Colorado. 16 September 2017.
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Photos on front cover (Madison Kaminski)
and back cover (Tanner and Penelope Mayberry) are
Dr. Richard Kaminski's grandchildren

Design by Charlene P. Mayfield
Clemson University, PSA Publications



Tanner and Penelope Mayberry (7 and 4 years, 2018), ready for their first game cleaning lesson.