WATERBIRD SOCIETY ANNUAL MEETING 2022

OCTOBER 31ST – NOVEMBER 4TH

46TH ANNUAL MEETING

CORPUS CHRISTI, TEXAS

Sponsors

Vendors

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Social Media

Facebook: @waterbirdsociety

Instagram: @the_waterbird_society

Twitter: @WaterbirdSociet

For meeting information

Website: https://waterbirds.org

Meeting Website: wbsmeeting2022.dryfta.com

Welcome from the President

Welcome to our 46th annual meeting!

It is such a pleasure to return to our in-person annual meeting after a pandemic hiatus. I want to thank Dale Gawlik and his team, for producing an intellectually stimulating, socially vibrant, and place-attached conference. We are grateful for their commitment to make this an in-person/virtual hybrid conference so that members who could not travel, can participate in our scientific sessions. Our Diversity, Equity, and Inclusion committee has worked tirelessly in collaboration with the local committee to ensure this meeting is safe, inclusive, and respectful.

The events of the past two and a half years have many of us reflecting on our values and priorities. It was 25 years ago that I attended my first Waterbirds meeting, in Lafayette, Louisiana. I was just a few months into my graduate program and nervous and intimidated to attend much less to speak to anyone. The members of The Waterbird Society have nurtured me professionally and personally to this day. They became my friends and a well-spring of new scientific collaborations. More than any other professional aspect, it was the loss of in-person interaction with this community that I missed the most during the pandemic. I believe I speak for us all when I say to our younger members: Welcome! We are glad you are here! We appreciate your participation and encourage your involvement.

This year, Council formed the Strategic Plan Steering Committee, composed of seven Council members. We have solicited comments from committees, we have reviewed those comments to form recommendations, and following discussion with Council, we will soon be reaching out to the full membership to disseminate information and to solicit your feedback. I encourage each of you, and especially our younger members, to actively engage in this process – you are the future of this society and of waterbird science. Reach out to the officers and Councilors, attend the business meeting, let us know what you are interested in and that you want to get involved. We will help you find opportunities to match your interests.

Finally, I want to thank Ricardo Zambrano, Vice President, Chair of the 2022/23 Scientific Programs, and Chair of the local committee for the 2023 meeting in south Florida. He has worked hard to juggle these simultaneous and significant responsibilities. He has done a wonderful job and always with the most positive and affirming attitude.

It is great to be back. I wish you all the same outstanding science and enduring friendships that I have come to value in this community.

Warm regards, Patty

Patricia Szczys
President 2022-23

Welcome from the Conference Planning Committee Chair

On behalf of the Conference Planning Committee, we welcome you to Corpus Christi, Texas, for the 46th annual Waterbird Society Conference. This conference is the Waterbird Society's first in hybrid format and the first meeting since the start of the pandemic allowing for in-person interactions.

A foundation of the Planning Committee's thinking was that attendees want to get back to networking and having in-person professional interactions in a safe environment that emphasizes the cultural, social, and natural diversity of the region. We aim to facilitate collaborations and networking by bringing attendees together as often as possible. We offer long breaks between sessions, and we provide two complementary lunches in a room with plenty of space for break-out groups. We also offer three evening social events with food and entertainment.

One of the social events occurs at the Texas State Aquarium, where attendees can wander the halls exchanging ideas and taking in the aviary and aquatic exhibits. The aquarium event also includes a new science-entertainment element of the conference, TIDE talks (Technology, Innovation, Design, and Education), which highlight the creativity of the next generation of science professionals. Students will have opportunities to engage in an evening of organized social activities at a trendy downtown venue and to participate in a mentoring lunch at the conference hotel.

Finally, we established a "Collaboration Café", with a popcorn machine, water, and comfortable furnishings open 7 am – 11 pm each day to provide a relaxing atmosphere to facilitate partnerships and for attendees to develop ideas more deeply.

We could not have offered all the elements of this conference without the extremely generous support of our South Texas sponsors (all listed on page i.). Most notably, the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University Corpus Christi, the Caesar Kleberg Wildlife Research Institute at Texas A&M Kingsville, and the Texas State Aquarium. They share with the Waterbird Society strong science and conservation values and a desire to help advance waterbird science and conservation.

Finally, whereas we are proud to host the Waterbird Society in our coastal community bordering the Gulf of Mexico, we also recognize that this land was originally inhabited by the Nde [end e] or Lipan [Lēpan] Apache, the Karankawa, and the Coahuiltecan [Cō – ōl – ta – cän] people, among others whose tribal and nation names we have unfortunately forgotten. Our gratitude to the land and water and to the indigenous people who have, and who continue to, steward both. May we all commit today to eradicate the erasure of Indigenous cultures wherever we live.

Sincerely,

Dale Gawlik, Harte Research Institute for Gulf of Mexico Studies, Texas A&M University Corpus Christi (TAMUCC)

Conference Planning Committee Members:

Bard Ballard, Cesar Kleberg Wildlife Research Institute, Texas A&M University Kingsville

Antonio Cantu, Harte Research Institute, TAMUCC

Clay Green, Texas State University

Beau Hardegree, U.S. Fish & Wildlife Service

Barbara Howard, Harte Research Institute, TAMUCC

Adriana Leiva, U.S. Fish & Wildlife Service

Emily McCauley, Harte Research Institute, TAMUCC

David Newstead, Coastal Bend Bays & Estuaries Program

Kristen Vale, American Bird Conservancy

Kim Withers, TAMUCC

Woody Woodrow, U.S. Fish & Wildlife Service

Ricardo Zambrano, Florida Fish & Wildlife Conservation Commission

Welcome from the Scientific Program Chair

I'd like to extend a warm welcome to all participants of the 46th Annual Meeting of the Waterbird Society. We have an exciting program for you this year. This year there will be symposia ranging from new tools and applications using UAVs to reddish egret and black tern conservation, among others. Our Texas waterbirders will also host the Texas Coastal Waterbirds Issues symposium and there will be a separate Texas Waterbird meeting. The scientific program will include 55 oral presentations, 15 lightning talks, six symposia, and three plenary lectures for a total of 128 presentations! We have 40 student presentations, a Cultural Diversity, Equity and Inclusion event, and TIDE talks (Technology, Innovation, Design, and Education), which highlight the creativity of the next generation of science professionals. The 2022 Annual Meeting will close with the Waterbird Society Business Meeting and the Award Ceremony.

I want to extend a huge thank you to Danielle D'Auria, Liam Wolff, Patty Szczys, Antonio Cantu de Leija, and Barbara Howard, as well as the folks from the local planning committee for their assistance in putting together this exciting program. Thanks to Gail Fraser for coordinating the student judging, Juliet Lamb for putting together the mentoring luncheon, and Pat Baird for spearheading the online silent auction. I think you will be quite pleased with the results.

Warm Regards,

Ricardo Zambrano,

Chair of the Scientific Program and Vice President of The Waterbird Society

About the Waterbird Society

Our Mission

The Waterbird Society is an international scientific, not-for-profit organization whose mission is to foster the study, management, and conservation of the world's aquatic birds. The Society's primary goals are to: (1) promote the basic and applied research on waterbirds and their habitats, (2) foster science-based waterbird conservation globally, and (3) enhance communication and education at all levels – among professionals, policy makers, and citizens. To accomplish these goals, the Society publishes an international peer-reviewed journal, hosts scientific meetings, provides grants and awards, and facilitates other activities.

Our History

The Society was established in 1976 following the North American Wading Bird Conference held in Charleston, South Carolina, USA, and named the Colonial Waterbird Group. The organization changed its name to the Colonial Waterbird Society in 1986. In 1999, the organization became The Waterbird Society to reflect an expanded interest in all aquatic birds.

Waterbird Society Council

Officers

Patricia Szczys – *President*   Ricardo Zambrano – *Vice President*

Kate Shlepr – *Secretary*   Christine Custer – *Treasurer*

***Waterbirds* Editors**

Gopi Sundar – *Editor-in-Chief*

Elected Council Members

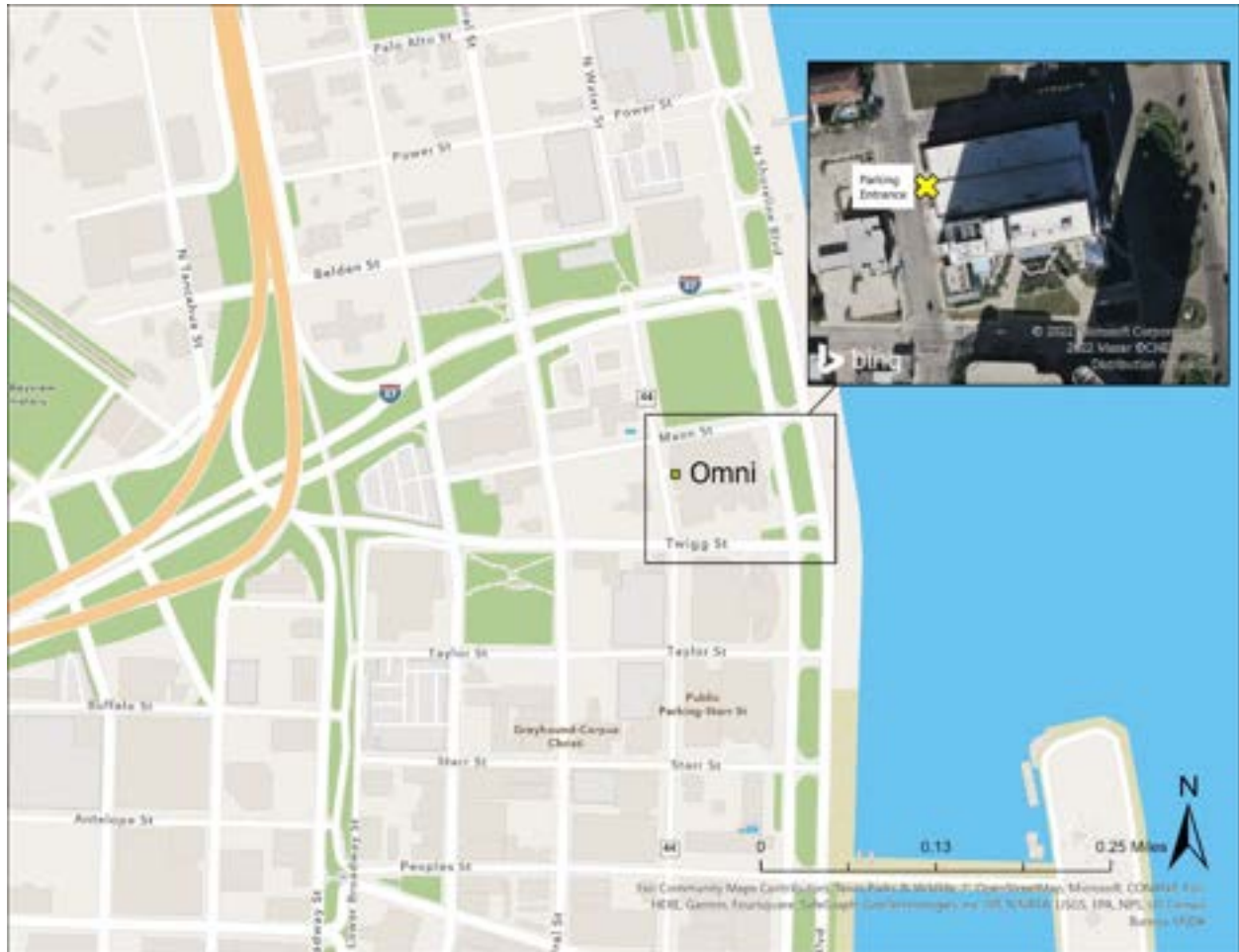|			
John Anderson	Don Lyons	Marisa Martinez	Aliya Caldwell
Gail Fraser	Jim Lyons	Michelle Stantial	
Terry Master	Caz Taylor	Kiah Williams	

Past Presidents

Dave Moore (2020-2021)

Clay Green (2018-2019)

Erica Nol (2016-2017)

Omni Hotel Location and Parking Information

- Omni Hotel has free shuttles to and from the airport.
  - *Arrival*: reserve your complimentary shuttle ahead of time by calling 361-887-1600. Ask for guest services and be ready to give them your flight number and arrival time.
  - *Departure*: reserve your complimentary departure shuttle when you arrive at the Omni front desk. The shuttle departs Omni at the top of each hour.
- **Parking** at the Omni hotel is complimentary for conference attendees and is located in the parking garage on the north side of the hotel. The entrance and exit to the parking garage are on the west side of the hotel, on N. Water St.
- San Antonio airport is a 2-hour drive from Corpus Christi.
- Houston airport is 4-hour drive from Corpus Christi.

Omni Hotel Floor Plan

Corpus Christi Bayfront First Floor

Bayview

56'

57'

Service Entrance

Main Entrance

■ Column
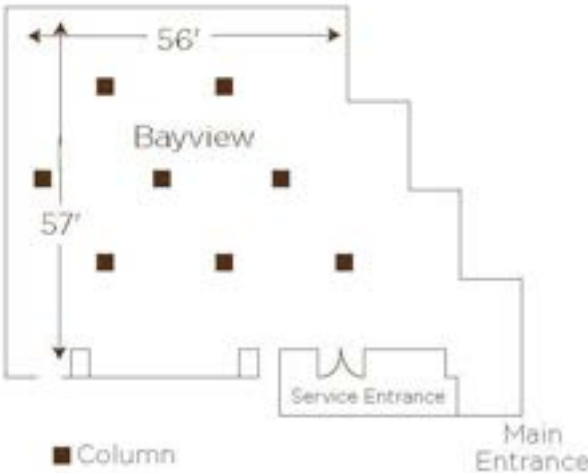
Corpus Christi Bayfront Third Floor

Nueces Ballroom

B   A

Corpus Christi Ballroom

REG. DESK

A   B   C

PRE-FUNCTION

CORVINO   LAGUNA MADRE

PARTNERSHIP BOARDROOM

ARANSAS   MATAGORDA
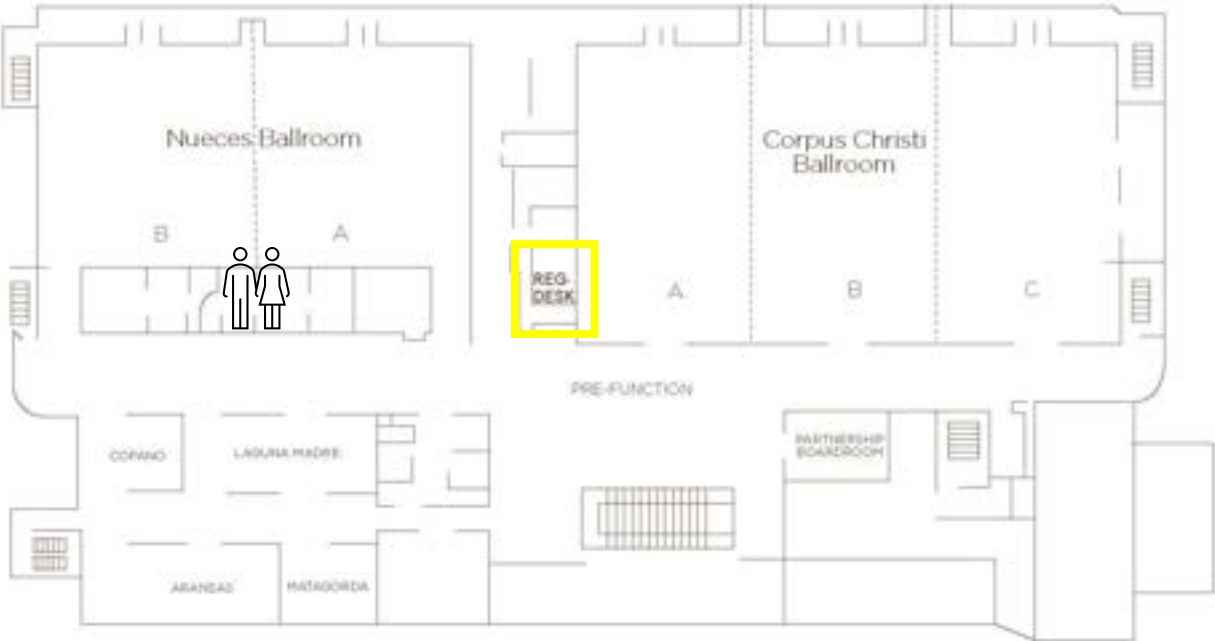
Meals / Catering
Daily Logistics
*Virtually Accessible

Program at a Glance

Sunday, October 30			Travel Day
3:00 pm	Council Arrival / Check-In	Hotel Front Desk	

Monday, October 31			Day 1
Breakfast on your own			
7:00 am – 11:00 pm	Storage/Speaker Ready Room	Conference room	
7:00 am – 11:00 pm	Storage	Registration Desk	
7:30 am – 1:00 pm	Registration	Registration Desk	
7:00 am – 12:00 pm	Council Meeting	Aransas Room	
1:00 pm – 5:00 pm	*State WBS Meeting	Laguna Madre Room	
3:00 pm – 3:30 pm	Break	Hallway	
3:00 pm	Participant Arrival / Check-In	Hotel Front Desk	
Dinner on your own			
6:00 pm – 8:00 pm	Ice Breaker Reception	Bayview Room	
8:00 pm – 10:00 pm	Council Meeting	Aransas Room	

Meals / Catering   Welcome & Plenary   *Virtually Accessible
Daily Logistics   Breakout Sessions

Tuesday, November 1			Day 2
7:00 am – 11:00 pm	Storage/Speaker Ready Room	Conference Room	
7:00 am – 11:00 pm	Registration / Storage	Registration Desk	
7:00 am – 11:00 pm	Silent Auction Room	Copano Room	
7:00 am – 8:15 am	Breakfast on your own		
7:00 am – 11:00 pm	Collaboration Café	Aransas Room	
7:30 am – 5:30 pm	Vendors	Corpus Foyer	
8:15 am – 8:30 am	*Welcome & Introductions	Nueces Ballroom A and B	
8:30 am – 9:30 am	*Plenary, Dr. Erica Nol, *The secrets of a non-declining shorebird: lessons from a long-term study*	Nueces Ballroom A and B	
9:30 am – 10:00 am	Break AM	Nueces Foyer	
10:00 am – 12:00 pm	*Breakout Sessions #1	Nueces A	Nueces B
12:00 pm – 1:00 pm	Buffet Lunch and Student-mentor Lunch	Corpus A/B	
1:00 pm – 3:00 pm	*Breakout Sessions #2	Nueces A	Nueces B
3:00 pm – 3:30 pm	Break PM	Nueces Foyer	
3:30 pm – 5:30 pm	*Breakout Sessions #3	Nueces A	Nueces B
Dinner on your own			
Student Social at the BUS			

Wednesday, November 2		Day 3	
7:00 am – 11:00 pm	Storage/Speaker Ready Room	Conference Room	
7:00 am – 11:00 pm	Registration / Storage	Registration Desk	
7:00 am – 11:00 pm	Silent Auction Room	Copano Room	
7:00 am – 8:15 am	Breakfast on your own		
7:00 am – 11:00 pm	Collaboration Café	Aransas Room	
7:30 am – 5:15 pm	Vendors	Corpus Foyer	
8:15 am – 8:30 am	*Welcome & Announcements	Nueces Ballroom A and B	
8:30 am – 9:30 am	*Plenary, Dr. James Fraser, *How to do a long-term study without really trying*	Nueces Ballroom A and B	
9:30 am – 10:00 am	Break AM	Nueces Foyer	
10:00 am – 12:00 pm	*Breakout Sessions #1	Nueces A	Nueces B
12:00 pm – 1:00 pm	Buffet Lunch	Corpus A/B	
12:00 pm – 12:45 pm	Wildlife Acoustics Lunch and Learn	Laguna Madre	
1:00 pm – 3:00 pm	*Breakout Sessions #2	Nueces A	Nueces B
3:15 pm – 4:45 pm	*Breakout Sessions #3		Nueces B
3:15 pm - 4:45 pm	*Film: *Truly Texas Mexican.* The Native American roots of Texas Mexican food: tacos, feminism, and cultural resistance	Nueces A	
5:15 pm	First shuttle departs Omni for Texas State Aquarium		
6:15 – 7:15 pm	Strolling Dinner Buffet	Texas State Aquarium	
7:15 pm	*TIDE Talk, Dr. Kate Shlepr, *Happy Hours aren't all fun & games! Political literacy benchmarks for conservation biologists*	Texas State Aquarium	
7:30 pm	*TIDE Talk, Dr. Leo Calle, *Meatballs in a can of varying sizes: an attempt to quantify career trajectories*	Texas State Aquarium	
7:45 pm	Explore aquarium on your own	Texas State Aquarium	
7:45 pm	First shuttle departs the Texas State Aquarium for Omni		

Meses / Catering   Welcome & Plenary   *Virtually Accessible
Daily Logistics   Breakout Sessions

Thursday, November 3			Day 4
7:00 am – 11:00 pm	Storage/ Speaker Ready Room	Conference Room	
7:00 am – 11:00 pm	Silent Auction Room	Copano Room	
7:00 am – 11:00 pm	No registration desk on this day		
7:00 am – 8:15 am	Breakfast on your own		
7:00 am – 11:00 pm	Collaboration Café	Aransas Room	
8:15 am – 8:30 am	*Welcome & Announcements	Nueces Ballroom B ONLY	
8:30 am – 9:30 am	*Plenary, Dr. Larry McKinney, *Gulf of Mexico waterbirds and their habitats: testing resilience without a nest*	Nueces Ballroom B ONLY	
9:30 am – 10:00 am	Break AM	Nueces Foyer	
10:00 am – 12:00 pm	*Breakout Sessions #1	Bayview Room	Nueces B
12:00 pm – 1:00 pm	Lunch on your own		
1:00 pm – 3:00 pm	*Breakout Sessions #2	Bayview Room	Nueces B
3:00 pm – 3:30 pm	Break PM	Nueces Foyer	
3:30 pm – 4:30 pm	*Business Meeting of The Society	Bayview Room	
6:30 pm – 10:00 pm	Awards Banquet	Corpus B/C	

Friday, November 4		Day 5
6:00 am – 2:00 pm	Birding on the King Ranch field trip	Departs from and returns to the Omni Hotel bay side entrance
7:00 am – 2:00 pm	Whooping Crane & Coastal Birding Tour field trip	Departs from and returns to the Omni Hotel bay side entrance
7:30 am – 1:00 pm	Birding around Corpus Christi Bay field trip	Departs from and returns to the Omni Hotel bay side entrance
All day	Checkout	Hotel Front Desk

Plenary Speakers

Dr. Erica Nol

Nov. 1, 8:30 am – 9:30 am

Nueces Ballroom

"The secrets of a non-declining shorebird: lessons from a long study"

Dr. Erica Nol is a professor and Program Coordinator for Conservation Biology at Trent University. She has a long history of conducting exceptional research focused on the ecology and conservation of shorebirds and land birds. She has published over 150 papers, including over 90 papers on shorebirds, many in top-tier journals. Her research has greatly advanced our understanding of the full-cycle ecology and demography of sub-arctic and arctic-breeding shorebirds. She has also made important contributions to understanding the impacts of a warming climate on the habitats, life histories, and conservation of these species. Dr. Nol was the recipient of the Robert Cushman Murphy Prize from The Waterbird Society in 2021.

Dr. James Fraser

Nov. 2, 8:30 am – 9:30 am

Nueces Ballroom

"How to do a long-term study without really trying"

Dr. James Fisher has served as a professor for the Department of Fisheries and Wildlife Science at Virginia Polytechnic Institute and State University for 36 years. He has conducted extensive research on raptors and waterbirds, with a focus on the behavior, habitat, population ecology, and conservation of imperiled species, especially the endangered Piping Plover and Red Knot. He has published over 130 papers, many in top-tier journals, and he is an integral member of the Virginia Tech Shorebird Program, which aims to promote the conservation of coastal wildlife resources through transformational research. Dr. Fraser was awarded the Kai Curry-Lindahl Award for Excellence in Conservation by The Waterbird Society in 2020.

Dr. Larry McKinney

Nov. 3, 8:30 am – 9:30 am

Nueces Ballroom B

"Gulf of Mexico waterbirds and their habitats: testing resilience without a net"

Dr. Larry McKinney is the Chair for Gulf Strategies at the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University Corpus Christi, the institution for which he also served 12 years as the Senior Executive Director. Earlier in his career, Dr. McKinney served as Senior Director for Aquatic Resources and Director for Coastal Fisheries at Texas Parks and Wildlife Department, where, among other things, he adopted ecosystem-based approaches for coastal fisheries and wetland conservation and restoration, approaches that continue to benefit waterbird populations in the Gulf of Mexico. Dr. McKinney established Texas OneGulf, a consortium of nine leading Texas marine research institutes and the first RESTORE Act Center of Excellence in the Gulf of Mexico. Most recently, Dr. McKinney and coauthors published in PNAS a Gulf-wide review of restoration projects following the Deepwater Horizon oil spill.

Winner of the 2022 Robert Cushman-Murphy Award

Dr. Peter Frederick

Dr. Frederick's career exemplifies a lifetime of exceptional, published research that has resulted in major contributions to the study and conservation of waterbirds.

Dr. Frederick has a long publication history, spanning from 1985 to present, almost entirely on the behavior, ecology, physiology, toxicology, genetics, and conservation of wading birds. He has published more than 126 papers in peer-reviewed journals (44 first-authored), many in high-tier journals, and has maintained a continuous output, averaging 3.6 peer-reviewed publications per year.

Cumulatively, Dr. Frederick's research has made significant impacts on our understanding and conservation of the Everglades ecosystem, and on the ecology and conservation of wading birds, both as species and communities in wetland systems. Dr. Frederick is an excellent scientist, an effective communicator of his work, and an advocate for conservation. He has an impressive record of service to the scientific community, and a long history of service to and participation in the Waterbird Society.

Dr. Frederick will deliver the Robert Cushman Murphy Prize Plenary in 2023 when The Waterbird Society will meet on his home turf: south Florida!

The Robert Cushman Murphy Prize highlights either a lifetime of exceptional, published research, or a single extraordinary research accomplishment that has resulted in a major redirection of studies on waterbirds. It honors the memory of one of the giants in the field, the author of Oceanic Birds of South America, a landmark first published in 1936 and still an essential reference 60 years later.

TIDE Talks

The Waterbird Society is proud to host its first ever TIDE Talk event at the Texas State Aquarium as part of the 2022 Waterbird Society Annual Conference. The acronym TIDE represents Technology, Innovation, Design, and Education – four key elements in waterbird study, management, and conservation. These talks will depart from the typical format of scientific presentation and instead introduce novel and exciting ideas and innovations in waterbird research in an engaging and dynamic manner. Shuttles will be available to transport participants from the Omni Hotel (bay side entrance) to the State Aquarium starting at 5:15 pm.

Speakers

Dr. Katherine Shlepr

"Happy Hours aren't all fun & games! Political literacy benchmarks for conservation biologists"

Dr. Kate Shlepr began her career observing *Larus* gulls at the Alice Eno Research Station (College of the Atlantic) in the Gulf of Maine, converting this study into a M.Sc. (University of New Brunswick) project on the impacts of anthropogenic food on gull populations. She carried her interest in wildlife management to Florida to pursue a Ph.D. (Florida Atlantic University) on Wood Stork *Mycteria americana* conservation in the Everglades, then to coastal Texas where she worked as the research coordinator for a waterbird colony restoration planning project at the Harte Research Institute. Kate is now in Washington, D.C. to begin her 1-year term as a Knauss Legislative Fellow (NOAA/Sea Grant) where she works on Coast Guard and maritime transportation policy for the U.S. House of Representatives. She has been a proud member of the Waterbird Society since 2011 and currently serves as the Society's Secretary.

Dr. Leo Calle

"Meatballs in a can of varying sizes: an attempt to quantify career trajectories"

Dr. Calle is a Senior Scientist and Lead Model Developer for the startup company Regrow, Inc. – a company that's creating carbon market in the agricultural sector by providing science-based estimates of carbon sequestration potential greenhouse gas accounting. He considers himself a scientist, ecologist, and ecosystem modeler. He likes to think about and build mathematical and numerical models of natural and human systems. He has a background in researching and developing process-based models as tools to study Avian ecology, coastal hydrology, terrestrial aquatic systems, forest demography, and carbon and nitrogen cycles. An underlying focus of interest is scaling, in space and time. He received his Ph.D. from the Department of Ecology at Montana State University.

Social Program

Ice-Breaker Reception

Monday, October 31   •   Bayview Room (1ˢᵗ Floor)   •   6 pm – 8 pm

This reception welcomes participants to the conference as a mixer with hors d'oeuvres and a cash bar.

Student-Mentor Luncheon

Tuesday, November 1   •   Corpus A & B   •   *12 pm – 1 pm*

This event will bring students and early-career professionals together with senior scientists and managers from academia, agencies, non-governmental organizations, and the private sector for an informal opportunity to discuss research interests and career goals. It is a chance to pick the minds of established professionals and learn from their experiences and advice. The lunch will take place at the conference venue during the scheduled lunch break.

Student Social Evening

Tuesday, November 1   •   Bar Under the Sun (BUS)   •   6 pm

This event gathers students in a relaxed and friendly environment following the first day of the scientific program. It is an opportunity to hang out in person, re-unite with old friends, and make new ones. This venue is located two blocks from the Omni Hotel (see map below), and more information can be found on The BUS Website (barunderthesun.com).

TIDE Talk Mixer

Wednesday, November 2   •   Texas State Aquarium   •   5:15 pm – 9:30 pm

This mixer will take place at the Texas State Aquarium preceding the TIDE Talks. Shuttles will transport participants from the Omni Hotel to the Aquarium starting at 5:15 pm. A walking buffet with an array of hors d'oeuvres and a cash bar will be available here for refreshments.

Awards Banquet

Thursday, November 3   •   Corpus Christi Ballroom   •   6:30 pm – 10 pm

This event will celebrate the winners of the Student Paper Awards and the Outstanding Contribution to Conservation Award. A provided Caribbean food buffet and cash bar will be available to attendees.

Detailed Scientific Program

Key
Nov 1
Nov 2
Nov 3
Symposium
General
Nueces A
Nueces B
Bayview
Room

Time	Nueces A	Nueces B
	Symposium: Double-crested Cormorants: Population Trends and Recent Management Activities Moderator: Rachael Pierce	*Waterbird Reproduction* Moderator: Alan Maccarone
10:00 am	**[89] Rachael Pierce** *Management of Double-crested Cormorants in the United States: an overview of the new rule and annual take*	**[24] Willow Dalehite** *Parental investment in Black Guillemots (Cepphus grylle) on the Isles of Shoals*
10:15 am	**[38] Kris Godwin** *Double-crested Cormorant management in Mississippi*	**[109] Hillary Thompson** *Factors affecting Whooping Crane colt survival in the eastern migratory population*
10:30 am	**[54] Patrick Hubert** *Ontario cormorant policy, influence on management actions and preliminary results from year one of a cormorant hunting season*	**[29] Elisa Elizondo** *Estimating Clapper Rail (Rallus crepitans) nest and chick survival in Delaware, USA*
10:45 am	**[19] Peter Carter** *Ontario cormorant monitoring*	**[85] Dave Moore** *Modeling the effects of water level and weather on Common Tern colony dynamics, abundance, and breeding success*
11:00 am	**[13] Paul Burr** *Population monitoring and status of the Double-crested Cormorant in the southeast United States*	**[93] Andrea Santariello** *Caught on camera: factors that influence the breeding success of Royal Terns (Thalasseus maximus) and Black Skimmers (Rynchops niger) breeding on Louisiana's coastal islands.*
11:15 am	**[103] Christopher Somers** *Double-crested Cormorant populations in prairie Canada: a need for more systematic monitoring*	**[40] Katharine Goodenough** *Selective pressures influence a grow fast, fly young strategy for Black Skimmers nesting in the Peruvian Amazon*
11:30 am	**[7] Ruth Boettcher** *Double-crested Cormorants (Nannopterum auritum) in the Atlantic flyway*	**[69] Alan Maccarone** *Nest-activity patterns and reproductive success by Little Blue Herons (Egretta caerulea) in an urban mixed-species colony*
		General Lightning Talks Moderator: Alan Maccarone
11:45 am	**[22] Francie Cuthbert** *Double-crested Cormorant pair estimates and trends in the U.S. Great Lakes: 2018*	**[90] Anastasia Rahlin** (Lightning Talk) *Using environmental DNA metagenomics to detect cryptic wetland birds as a potential management tool*
11:50 am		**[50] Alexia Hilber** (Lightning Talk) *Endoparasite community of Order Gruiformes in South Florida*
11:55 am		**[63] Kristy Lapenta** (Lightning Talk) *Prey and tidal state affect the presence of Sanderling and Dunlin on Virginia's barrier islands during peak spring migration*

Key
Nov 1
Nov 2
Nov 3
Symposium
General
Nueces A
Nueces B
Bayview
Room

Tuesday, November 1, Breakout Session #2		
Time	**Nueces A**	**Nueces B**
	Cormorant Symposium (continued) Moderator: Rachael Pierce	*Contaminants and Disease* Moderator: Kate Sheehan
1:00 pm	**[86] Dave Moore** *Recent population trends of Double-crested Cormorant in the Laurentian Great Lakes*	**[28] Elena Duran** *An investigation onto a novel health condition of an iconic shorebird: implications for the understanding of emerging zoonotic diseases, coastal bird species management, and conservation*
1:15 pm	**[73] Michelle McDowell** *Double-crested Cormorant western population monitoring and trends*	**[74] Kate Sheehan** *Creating a species distribution model of Avian Botulism outbreaks in Michigan*
1:30 pm	**[65] James Lawonn** *A status assessment of the Double-crested Cormorant in Oregon*	**[23] Francie Cuthbert** *Significant Caspian Tern mortality from HP Avian Influenza in the U.S. Great Lakes: 2022*
1:45 pm	**[14] Paul Burr** *Research, management, and population monitoring of Double-crested Cormorants in Mississippi*	**[21] Christine Custer** *Assessing exposure to PFAS from different sources using a model species: the Tree Swallow*
2:00 pm	**[26] Brian Dorr** *Double-crested Cormorants and societal interactions: research update*	**[62] Juliet Lamb** *Rapid loss of maternal immunity and increase in environmentally mediated pathogen exposure in urban gull nestlings*
2:15 pm	Double-crested Cormorant symposium wrap-up	**[98] Kate Sheehan** *Free Bird Worms!*
	Symposium: New Tools and Applications for Waterbird Science and Monitoring: UAVs, AI, and Computer Vision Moderator: Anna Vallery	*General Lightning Talks* Moderator: Kate Sheehan
2:30 pm	**[113] Anna Vallery** *Precision monitoring of colonial waterbird islands using UAVs and machine learning*	**[53] Alexandra Hopkins** *Can solar garden lights deter nocturnal predators at Common Tern nesting sites? An experimental study*
2:35 pm		**[91] Gibson Rieger** *Influence of Atlantic Puffin (Fratercula arctica) breeding stage and capelin (Mallotus villosus) migration on Larus gull foraging behavior in Newfoundland, Canada*
2:40 pm		**[52] Wriley Hodge** *Finding a home: nesting density and fledging success between three habitats in Herring Gull (Larus smithsonianus)*
2:45 pm	**[57] Krish Kabra** *Developing machine learning algorithms for automated precise waterbird monitoring*	**[101] Bonnie Slaton** *Presence of mammalian predators in seabird colonies located on restored barrier islands of Louisiana*
2:50 pm		**[77] Pamela E. Michael** *Migration, breeding location, and seascape shaping seabird assemblages in the northern Gulf of Mexico*

Key
Nov 1
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Symposium
General
Nueces A
Nueces B
Bayview
Room

Tuesday, November 1, Breakout Session #3

Time	**Nueces A** *UAV Symposium (continued)* Moderator: Anna Vallery	**Nueces B** *Movement and Habitat* Moderator: Juliet Lamb
3:30 pm	**[104] Callie Stirling** *Multi-scale shorebird breeding habitat assessment in the Hudson Bay Lowlands using UAVs*	**[6] Anne Blondin** *Movement and length of stay of shorebirds during migratory stopover in the Pacific Flyway*
3:45 pm	**[119] Peter Frederick** *Using high-resolution drone imagery and deep learning processes to routinely document nesting numbers and nest success of long-legged wading birds in a large wetland aquascape*	**[97] Alexander Sharp** *Nonbreeding movement patterns of coastal Little Blue Herons (Egretta caerulea) in Florida*
4:00 pm	**[36] Hailey Glasko** *Using UAVs to discover secretive marsh bird nests*	**[70] Olivia Maillett** *Post-breeding dispersal of the Short-billed Dowitcher (Limnodromus griseus)*
4:15 pm	**[64] Timothy Lawes** *Using UAVs as a low-impact sampling approach and machine learning to estimate colony size and density at Aleutian Tern colonies in Alaska*	**[107] Caz Taylor** *Population dynamics of eastern-breeding Semipalmated Sandpipers: a flyway model*
4:30 pm	**[79] Rostam Mirzadi** *Evaluating the use of drones for monitoring waterbird nest abundance and nest survival*	**[44] Chris Gulick** *Breeding season selection of anthropogenic resources varies across age and pre-breeding movement modes in the American White Ibis*
4:45 pm	**[17] Antonio Cantu de Leija** *A meta-analysis of disturbance caused by drones on nesting birds*	**[11] Andrew Brown** *Long-distance dispersal in a recovering Piping Plover population facilitates recolonization of historical nesting sites following decades of extirpation*
5:00 pm	**[88] Tabitha Olsen** *A preliminary assessment of thermal imaging equipped aerial drones for secretive marsh bird detection*	**[114] Aimee Van Tatenhove** *Weather radar as a tool to quantify local airspace-use of a large migratory waterbird*
	General Lightning Talks Moderator: Anna Vallery	
5:15 pm	**[58] Kayoko Kameda** (Lightning talk) *Toward reducing the conflicts between native cormorants and local residents – knowledge discovery from historical records and its application to current conflicts.*	**[61] Juliet Lamb** *Optimizing number and distribution of transmitters to maximize representativeness in automated radio telemetry studies of animal movement*

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Wednesday, November 2, Breakout Session #1		
Time	**Nueces A**	**Nueces B**
	Symposium: Texas Coastal Waterbirds Issues Moderator: David Newstead	*Foraging and Behavior* Moderator: Marisa Martinez
10:00 am	**[117] William Vermillion** *Inland foraging habitat objectives and availability for fall migrating shorebirds on the Texas Coast*	**[105] Eric Swan** *Impacts of invertebrate community composition on Piping Plover (Charardrius melodus) survival between ocean and bay side habitats on Fire Island*
10:15 am	**[31] David Essian** *Colony Island Network Design and Implementation (CINDI): a prioritization tool for beneficial use of dredged material at rookery islands in Texas, USA*	**[48] Erin Heller** *Use of prey in relation to availability by Red Knots in Virginia during spring migration using fecal DNA metabarcoding*
10:30 am	**[112] Kristen Vale** *Protection, monitoring, and outreach for breeding Least Terns (Sternula antillarum), Snowy Plovers (Charadrius nivosus), Wilson's Plovers (Charadrius wilsonia) and Black Skimmers (Rynchops niger) in Coastal Texas.*	**[102] Olivia Smith** *Impacts of Atlantic Butterfish (Peprilus triacanthus) in the diet of Common Terns (Sterna hirundo): a case study of climate change effects in the Gulf of Maine*
10:45 am	**[67] Brooke Laycock** *Investigating the role of contemplative and steering approaches to mitigate recreational disturbance to waterbirds*	**[15] Aliya Caldwell** *Common Tern (Sterna hirundo) foraging movement: characterizing interannual and intraspecific variations*
11:00 am	**[80] Abigail Meeks** *An overview of factors influencing recreational disturbance to coastal wildlife*	**[41] Katharine Goodenough** *Taking a peek into the everyday lives of the American Oystercatcher: GPS telemetry reveals important foraging dynamics for pairs nesting in variable habitats*
11:15 am	**[45] Amanda Hackney** *Examination of habitat use by Laughing Gulls (Leucophaeus atricilla) in both developed and undeveloped areas of the Lower Galveston Bay Watershed*	**[108] Liam Taylor** *Demographic and behavioral evidence of social development in young American Herring Gulls*
11:30 am	**[25] Wyatt Egelhoff** *High Island Rookery Expansion and Resiliency Project: 5 years later*	**[71] Marisa Martinez** *What the tides reveal about where and how wading birds forage – a modeling approach for intertidal foraging ecology*
		Marshbird Lightning Talks I Moderator: Marisa Maratinez
11:45 am	**[81] Todd Merendino** (Lightning Talk) *Beneficial dredge use planning for bird island restoration – Texas GLO Regions 3 and 4*	**[122] Jennifer Wilson** (Lightning Talk) *Using autonomous recording units to document non-breeding season vocalizations of Eastern Black Rails in Coastal Texas*
11:50 am	**[121] Amie West** (Lightning Talk) *Synthesizing the status of colonial waterbirds for the Texas Ecosystem Health Report Card*	**[56] Austin Jones** (Lightning Talk) *Camera trapping Black Rails in Coastal Texas*
11:55 am	**[126] Rachel Fern** (Lightning Talk) *Use of coastal refugia by overwintering waterfowl using Audio Recording Units (ARUs)*	**[87] Leah Moran** (Lightning Talk) *Characterizing ecological drivers of secretive marsh bird distribution across southeastern Louisiana*

Wednesday, November 2, Breakout Session #2

Time	Nueces A	Nueces B
	Symposium: The Gulf of Mexico Avian Monitoring Network: Working Together to Restore Gulf of Mexico Birds Moderator: Auriel Fournier	*Movement and Habitat* Moderator: Willow English
1:00 pm	**[34] Auriel Fournier** *GoMAMN: a forum for connection and collaboration focused on values driven priorities for bird monitoring*	**[120] Chelsea Weithman** *Hurricane-related habitat loss may be associated with shorter stopover duration and fewer migrating Piping Plovers on South Point, Ocracoke Island, NC*
1:15 pm	**[42] Clay Green** *Monitoring of colonial waterbirds in the Gulf of Mexico: next steps for the GoMAMN wading bird group*	**[100] Ankita Sinha** *Informing global conservation priorities for specialist river birds*
1:30 pm	**[51] Kathy Hixson** *An atlas and registry for seabird colonies and associated habitats in the northern Gulf of Mexico*	**[30] Willow English** *Winter reset: temporal delays carry over across seasons except the non-breeding period in Arctic-breeding shorebirds*
1:45 pm	**[125] Ke Zhang** *Non-breeding utilization ranges of white ibis and tricolored herons in the Gulf of Mexico region*	**[1] Alexandra Anderson** *Shorebird Science and Conservation Collective: A central resource of shorebird data and support for on-the-ground conservation*
2:00 pm	**[59] Peter Kappes** *Status and future direction of the GoMAMN Renewable Energy Working Group*	**[9] Sarah Bonnett** *Effects of elevation on Semipalmated Sandpiper (Calidris pusilla) nest habitat, fate, and food availability*
2:15 pm	**[124] Mark Woodrey** *Application of a tidal marsh bird monitoring program for the Gulf of Mexico: a case study from Mississippi*	**[92] Tara Rodkey** *Habitat selection of a migratory shorebird in a fragmented agricultural landscape*
2:30 pm	**[33] Auriel Fournier** *NOAA Firebird: fire effects in Gulf of Mexico marshes on Mottled Ducks, Black and Yellow Rails*	**[37] Eleanor Gnam** *Comparing survey methods for Leach's Storm-Petrels on a Maine island*
		Marshbird Lightning Talks II Moderator: Willow English
2:45 pm		**[82] Lauren Monopoli** (Lightning Talk) *Fire effects on breeding marsh birds*
2:50 pm		**[47] Eleonora Hargett** (Lightning Talk) *Abundance of Eastern Black Rails in southeastern Colorado*
2:55 pm		**[96] Jessica Schmit** (Lightning Talk) *Breeding and migration ecology and distribution and abundance of Arkansas King Rails*

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	Wednesday, November 2, Breakout Session #3	
Time	**Nueces A**	**Nueces B** *Symposium: Reddish Egret Ecology and Conservation* Moderator: Clay Green
3:15 pm	Film: *Truly Texas Mexican*. The Native American roots of Texas Mexican food: tacos, feminism, and cultural resistance	**[43] Clay Green** *Reddish Egret Conservation Plan 2022-2032: advancing the strategies and goals for conserving a tidal flat specialist*
3:30 pm		**[39] Ernesto Gomez** *Recovering habitat for Reddish Egret through mangrove ecological restoration at Yucatán, Mexico*
3:45 pm		**[111] Salvador Narváez Torres** *Implementing the business plan for the conservation of Reddish Egret in Mexico*
4:00 pm		**[116] Phillip Vasseur** *Effects of tropical cyclones on Reddish Egret populations in Louisiana*
4:15 pm		**[94] Joel Verde** *The Reddish Egret of the Northern Belize Coastal Complex: population, distribution, and nesting colonies*
4:30 pm		
4:45 pm		

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Thursday, November 3, Breakout Session #1		
Time	**Bayview Room**	**Nueces B**
	Conservation Moderator: John Brzorad	*Symposium: Progress and Priorities: Black Tern Conservation Consortium* Moderator: Ann McKellar
10:00 am	**[35] Erin Gallagher** *Estimating nest productivity and identifying sources of nest and chick mortality in Least Tern colonies in the Outer Banks*	**[32] Scott Flemming** *Updated North American status assessment of Black Terns: regional variations within a range-wide trend*
10:15 am	**[5] Allison Anholt** *Characterizing Arctic Seabird Bycatch in Eastern Canada*	**[99] Nicholas Shephard** *The Black Tern Conservation Consortium: understanding threats across the annual cycle*
10:30 am	**[60] Alison Kocek** *Recent contribution of rescued eggs to the endangered Great Lakes Piping Plover population*	**[106] Patricia Szczys** *Weak genetic structure coupled with shared non-breeding areas and extensive movement in North American Black Terns*
10:45 am	**[123] Sam Wolfe** *X number of peeps: the importance of counting shorebirds through the International Shorebird Survey*	**[84] Dave Moore** *Distribution and habitat use of North American Black Terns during boreal winter*
11:00 am	**[66] James Lawonn** *The rapidly declining conservation status of Caspian Terns in the Pacific Flyway*	**[76] Pamela E. Michael** *Black Terns in the northern Gulf of Mexico: vessel-based observations and insights from the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS)*
11:15 am	**[8] Sarah Bolinger** *Using simulation to investigate storm-related bias to nest survival estimates in beach-nesting birds*	**[75] Ann McKellar** *First-ever individual tracking of Black Terns for home range and habitat selection during breeding and stopover, based on satellite telemetry*
11:30 am	**[12] John Brzorad** *Identification of factors causing population decline among Egretta*	**[10] Annie Bracey** *Minnesota marsh tern surveys and habitat assessments: methods and objectives*
11:45 am	**[2] John Anderson** *Impact of an oyster aquaculture site on seabird loafing activity in Maine, USA*	**[95] Jennifer Fuller** *Nanotags improve estimates of Black Tern fledging success in Michigan*

Thursday, November 3, Breakout Session #2	
Time / **Bayview Room**	**Nueces B**

Time	Bayview Room	Nueces B
	Conservation Moderator: Allison Anholt	*Management, Restoration, & Conservation* Moderator: Antonio Cantu
1:00 pm	**[55] Kristen Johnson** *Potential avian predators of Piping Plover: a study at Fire Island, NY in 2022*	**[110] Chang-Hong Tsao** *2014-2020 CAWC data analysis: diversity and dominance of waterbirds at Crooked Tree Wildlife Sanctuary, Belize*
1:15 pm	**[83] Lisbeth Montenegro** *Conservation and rehabilitation: an entire Elegant Tern colony becomes the patient*	**[3] Rachel Anderson** *Tidal marsh bird population monitoring and conservation applications for the Gulf of Mexico*
1:30 pm	**[78] Pamela E. Michael** *Seabird vulnerability to oil: exposure potential, sensitivity, and uncertainty in the northern Gulf of Mexico*	**[115] Hope VanDerwater** *Assessing demographic effects of habitat restoration for Piping Plovers (Charadrius melodus) at Democrat Point, Fire Island, NY*
1:45 pm	**[16] Mikayla Call** *Avian and ghost crab predation threats to American Oystercatcher chick survival at an important breeding location on the Western Atlantic Flyway*	**[68] Aylett Lipford** *If you build it, will they come? Assessing habitat quality for birds at created marshes in southeastern Louisiana*
2:00 pm	**[49] Lindsay Hermanns** *Breeding site environmental conditions and flyway tidal habitat influence survivorship of an arctic breeding shorebird*	**[18] Antonio Cantu de Leija** *Surface water dynamics of Chihuahuan Desert wetlands: implications for migratory waterbird habitat conservation*
2:15 pm	**[27] Sharon Dorsey** *"Plover-view": the role of viewshed in Piping Plover nest-site selection*	**[46] Christy Hand** *Who said "kickee-doo" and other insights into the vocal repertoire of the Eastern Black Rail*
		General Lightning Talks Moderator: Antonio Cantu
2:30 pm	**[118] Christy Wails** *Piping Plover (Charadrius melodus) demography during trophic downgrading of the predator community at Fire Island, NY*	**[72] Miyuki Mashiko** (Lightning Talk) *Virtual net as an alternative bird net to reduce duck damage in lotus fields*
2:45 pm	**[4] Allison Anholt** *Community science Western Snowy Plover monitoring in northern Oregon*	

Field Trips

Birding on the King Ranch

With 825,000 acres of varied habitat, the King Ranch is a haven for birds and birdwatchers alike. Named as a site on the Great Texas Coastal Birding Trail and as a Globally Important Bird Area by the American Bird Conservancy, the ranch boasts a bird list of more than 370 species. This half-day birding tour will showcase South Texas brush species such as Green Jay, Groove-billed Anis, Olive Sparrows, Audubon's Oriole, and much more. The tour will explore the Santa Gertrudis division of the King Ranch near the ranch visitor center in Kingsville, approximately 50 min drive from the Omni Hotel. The tour departs from the hotel at 6 am and return by 2 pm. A box lunch is provided.

Whooping Crane & Coastal Birding Tour

This 3-hour guided boat trip leaves from Rockport, Texas and travels alongside Aransas National Wildlife Refuge, the winter home of the endangered Whooping Crane. Participants will see numerous wading bird and waterfowl species, though Whooping Crane is not guaranteed. The boat is spacious and comfortable, but those sensitive to seasickness should take precautionary measures. Lunch is not provided, but the tour will stop at a seafood restaurant upon returning to the dock. The tour departs from the hotel at 7 am and returns by 2 pm. There is a 45 min transit to Rockport.

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Birding Around Corpus Christi Bay

Corpus Christi, "America's Birdiest City" and the surrounding area is renowned as a birding destination. This 5-hour guided tour will travel around the bay by vehicle making stops at top birding locations representing unique habitats such as shallow intertidal flats, intergraded saltmarsh/black mangroves, the dense seagrass meadows of the hypersaline Laguna Madre, and the beaches of the Gulf of Mexico. Many waterbirds will be seen including an array of terns, gulls, pelicans, waders, and maybe even frigatebirds. The tour departs from the hotel at 7:30 am and returns by 1 pm. A box lunch is provided.

What to Bring on Field Trips

Dress for weather! You can anticipate cooler temperatures on the boat than the other trips. Bring what you would normally bring on a casual day in the field – binoculars, sunscreen, glasses, a hat, hiking shoes, and bug spray (mosquitoes are year-round in south Texas!). Although bottled drinking water will be available, bringing your own reusable conference water bottle will reduce waste. If box lunches are provided, they will be arranged with participants prior to departure. All field trips depart from the bay (east) side entrance to the Omni Hotel.

Corpus Christi Guide

Nearby Attractions

Texas State Museum of Asian Cultures

2 min drive (0.7 mi) • 12 pm – 5 pm (closed Sun thru Tue), $6 admission per adult

Corpus Christi Museum of Science and History

3 min drive (0.8 mi) • 10 am – 5 pm (closed Monday), $12 admission per adult

The Art Museum of South Texas

3 min drive (0.8 mi) • 10 am – 5 pm (closed Monday), FREE Admission

The USS Lexington Museum

6 min drive (2.7 mi) • 9 am – 5 pm, $19 admission per adult

Texas State Aquarium

6 min drive (2.8 mi) • 10 am – 5 pm, $40 admission per adult

South Texas Botanical Gardens & Nature Center

20 min drive (14.6 mi) • 9 am – 6 pm, $9 admission per adult

Padre Island National Seashore

38 min drive (28 mi) • 24/7, $10 admission per vehicle

Mustang Island State Park

32 min drive (23.4 mi) • 8 am – 5 pm, $5 admission per person

Local Events – November 2 – 6, 2022

Birding on the Boardwalk – Port Aransas
Wednesday, Nov. 2nd, 9 am – 10 am
More Information
710 W Avenue A, Port Aransas, Texas

Downtown Farmers Market
Wednesday, Nov. 2nd, 5 pm – 8 pm
More Information
Corpus Christi Art Center, 100 N Shoreline Blvd
Corpus Christi, TX 78401

First Friday Art Walk
Friday, Nov. 4th, 5:30 pm – 9 pm
More Information
Le Retama Park, N Mesquite St, Corpus Christi, TX 78401

Southside Farmers Market
Saturday, Nov. 5th, 9 am – 12 pm
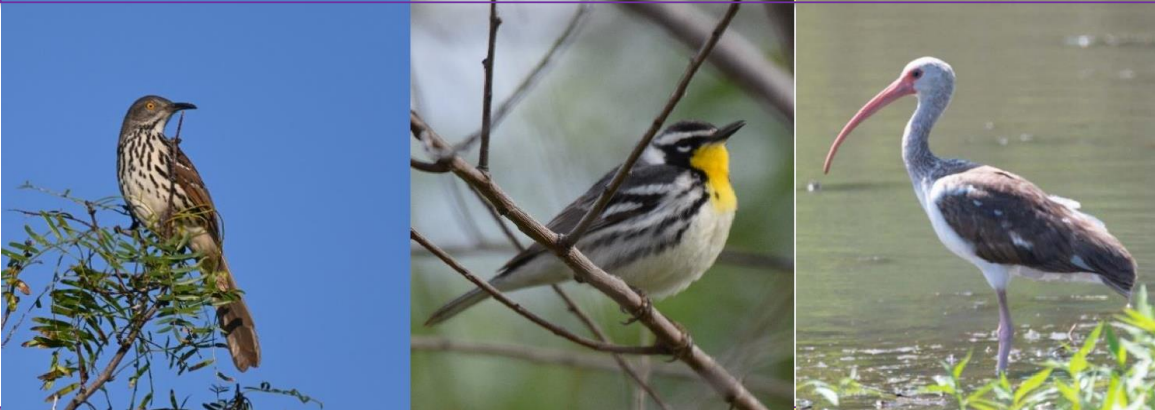More Information
5800 Everhart Rd, Corpus Christi, TX 78413

BridgeWalk
Sunday, Nov. 6th, 8 am – 11:30 am
More Information
Harbor Bridge, Corpus Christi, TX

Coastal Bend Audubon Society's Big Day

Saturday, November 5, 2022

Big Day Roost (at South Texas Botanical Gardens & Nature Center) **5:00-7:30 pm**

What is Big Day? An annual bird-watching event where participants form teams and bird throughout the day. The goal for the event is to count different bird species sighted and help introduce interested people to the fun of birding.

When and Where? Participants can start any time on **Saturday, November 5th** and can bird anywhere in the 12 counties of the Coastal Bend. The event concludes with the "**Big Day Roost**" at the **South Texas Botanical Gardens & Nature Center** for team reports, light refreshments, a cash bar, prizes / raffle results, 5:00-7:30 PM.

How much? Registration is **$20 for adults** and **$15 for kids** through October 22, 2022* (Fee includes a Big Day T-shirt, light refreshments at the Roost & a raffle ticket). Soft drinks & adult beverages will be available at the Cash Bar during the Big Day Roost.

* Registration is $30 for adults and $20 for children if received October 23-November 2.

For more information visit our website at www.coastalbendaudubon.org or Contact Paula McKinney: pjmck1973@gmail.com

Popular Birding Locations

<u>Within walking distance of The Omni Hotel</u>:

Corpus Christi Bay

1 min walk to 20 min walk (50 m – 0.9 mi)   •   24/7, FREE

Along Shoreline Boulevard (the street parallel to the Omni Hotel), the Corpus Christi Bay is accessible north to the Art Museum (0.7 mi walk) and south to McGee Beach (1.2 mi walk). This stretch of shoreline provides many viewpoints to see many waterbird species, such as gulls, terns, and shorebirds. The Marina areas (0.6 mi to 0.9 mi walk) allow close views of a breakwater jetty that often hosts American Oystercatcher, Ruddy Turnstone, and *Calidris* sandpipers.

Blucher Nature Park

4 min drive, 18 min walk (0.9 mi)   •   24/7, FREE

This is a small park in downtown that is renowned for migratory songbirds. Many neotropical warblers will still be migrating through in early November, and the park still hosts many Texas specialties such as Golden-fronted Woodpecker, Great Kiskadee, Couch's Kingbird, Long-billed Thrasher, Black-crested Titmouse, and Clay-colored Thrush.

<u>Within 1-hr driving distance from the Omni Hotel</u>:

Suter Wildlife Refuge

15 min drive (8.2 mi)   •   5 am – 11 pm, FREE

This is a small park on Oso Bay that has a 1.3 mi trail through brushy mesquite woods. Bushy understory hosts wrens, sparrows, and thrushes while the covered deck at the end of the boardwalk provides a viewpoint and blind to see hundreds of ducks and shorebirds. This is a great site to see Kiskadees and Golden-fronted Woodpeckers as well as dozens of species of waterbirds at close range.

Pollywog Pond

16 min drive (14.8 mi) • 24/7, FREE

Valuable freshwater habitat is available for birds here (over 320 species recorded) in this hole-in-the-wall birding spot with 1.2 mi of trails managed in part by the Audubon Outdoor Club of Corpus Christi. Two freshwater ponds host Least Grebe and Green Kingfisher, 22 species of ducks and geese, rails, many shorebirds, all resident wading bird species, and a few species of gulls and terns. In the brushy habitat around the ponds, birders can see Golden-fronted and Ladder-backed Woodpeckers, Groove-billed Ani, Couch's Kingbird, Great Kiskadee, Black-crested Titmouse, Verdin, Long-billed Thrasher, sparrows, and migrating neotropical warblers.

Hazel Bazemore Park

20 min drive (17.4 mi) • 8 am to 9 pm, FREE

This is a 77-acre park in the Callalen area nestled along the Nueces River. This birding site attracts hundreds of birders each year to partake in hawk watches in the fall where 2 dozen or more raptor species may be seen on their southward migration. The 2022 hawk watch season stretches from August 15 to Nov 15 and visitors are welcome to assist the hired counters on the hawk watch platform. The park also boasts a feeder blind where White-tipped Dove, Buff-bellied Hummingbird, Golden-fronted and Ladder-backed Woodpecker, Green Jays, Black-crested Titmouse, Long-billed Thrasher, and Clay-colored Thrush may be seen coming to the feeders (as well as Javelina!). Elsewhere In the park, in brush and around the ponds, Green Kingfisher, Great Kiskadee, Verdin, Olive Sparrow, and sometimes Pyrrhuloxia can be found and near the Golf Course, Tropical and Couch's Kingbirds, Vermilion Flycatcher, and Bronzed Cowbird take advantage of the open space.

Oso Bay Wetlands Preserve

21 min drive (11.4 mi) • 24/7, FREE

This is a 162-acre nature preserve with 3.3 mi of nature trails in brushy mesquite woods. There are multiple access points to Oso Bay, where Sandhill Cranes, shorebirds, and waterfowl may be seen. The parking lot is open 7 AM to 7 PM, but parking is available on the street or at the Holly Rd. trailhead and the trails are accessible 24/7.

Packery Channel Park (Padre Island)

24 min drive (21.3 mi)   •   7 am – 6 pm, FREE

A popular birding location located on Padre Island, this park overlooks Packery Channel, a waterway connecting the Laguna Madre to the Gulf of Mexico. Here is a great location to scope for shorebirds, wading birds, gulls, and terns. There is an Oak motte with a short boardwalk trail than can host Vermilion Flycatcher, Pyrrhuloxia, Great Kiskadee, Couch's Kingbird, Scissor-tailed Flycatcher, and a handful of sparrow species.

Mustang Island

50 min drive (40 mi)   • $5 per adult in the State Park (free elsewhere on the island)

An 18-mile-long barrier island connecting Padre Island to Port Aransas. Best known for its many pairs of Aplomado Falcons and White-tailed Hawks residing around the dunes and coastal grassland, often seen from the highway. The state park provides access to the Gulf of Mexico beach (other beach accesses require a beach parking pass and permit vehicles on the beaches) where shorebirds and other beach birds (such as Magnificent Frigatebirds) can be found. In front of the Sea Gull and Sandpiper Condos, there is a grove of willow trees that attracts neotropical migrants. Some warblers may still be migrating through in early November.

Padre Island National Seashore

40 min drive (32.2 mi)   •   24/7, $10 admission per vehicle   •   24/7

Padre Island National Seashore (PINS) is a protected section of North Padre Island that includes four easy access points to the Gulf of Mexico and one easy access point to the Laguna Madre. In the dune and coastal grasslands, White-tailed Hawks can be seen hunting or perched and Bobwhite are often darting or flushed along the access roads. The Bird Island Basin area overlooks the Laguna Madre and is good shorebirds while the Gulf of Mexico beaches provide habitat for gulls, terns, and more shorebirds.

For more information on birding in Texas, visit Texas Parks and Wildlife Department's Great Texas Coastal Birding Trail website at: tpwd.texas.gov/huntwild/wildlife/wildlife-trails/ctc

Abstracts
(alphabetical order)

Bolded names (and emails, in blue) are the presenters. Asterisk represents a student participating in the student presentation award competition

[1] Harrison, Autumn, Lynn[2], Candace Stenzel[2], **Anderson, Alexandra**[1], and Rick Lanctot[3]

[1]Shorebird Science and Conservation Collective, Smithsonian Migratory Bird Center, Washington, D. C., USA; [2] Smithsonian Migratory Bird Center, Washington, D. C., USA; [3]U.S. Fish and Wildlife Service, Alaska Migratory Birds Office, Anchorage, Alaska, USA; andersona@si.edu;

Shorebird Science and Conservation Collective: A central resource of shorebird data and support for on-the-ground conservation

Over the past few decades, scientists across the Americas have used miniature technologies to track shorebird movements. Data have revealed the habitats that shorebirds rely on during their hemisphere-spanning migrations and how sites are connected. Tracking data holds great potential for conservation. However, there has been no single resource for conservation stakeholders to connect to this crucial information or to receive analytical assistance for on-the-ground conservation needs. The Shorebird Science and Conservation Collective is a new partnership of over 50 scientists who have contributed shorebird tracking data collected from over 2,800 individuals across 29 species to inform on-the-ground conservation action. The Collective serves a vital bridging function between scientists and conservation stakeholders by organizing and applying knowledge from shorebird science to address urgent conservation questions while ensuring data uses are approved by contributors. We will highlight partner case studies from our first year showing how tracking data have been requested and applied. Examples include informing species status assessments at the national level, siting of conservation easements at the regional level, and outreach initiatives at the local level. We encourage owners of shorebird tracking datasets to contribute data to The Collective and conservation stakeholders to connect with The Collective to discuss how tracking data could support their work.

[2] Anderson, John G. T.[1]

[1]College of the Atlantic, Bar Harbor, ME, USA; janderson@coa.edu

Impact of an oyster aquaculture site on seabird loafing activity in Maine USA

Aquaculture is regarded as a potential savior of working waterfront communities in an era of climate change and collapsing wild fin- and shell-fish stocks. At the same time, there is

concern that aquaculture sites may increase visual and water pollution and attract large numbers of birds that will be a nuisance to surrounding land-holders and present a threat to low-flying aircraft. I have studied changes in the abundance of seabirds and other water-fowl around an aquaculture operation in eastern Maine, USA for 8 years. This site is of particular concern, given its presence within 2km of an active airport runway. Observations were conducted from shore using binoculars and/or spotting scopes. Diversity and the number of individuals varied widely depending on seasonality and tide-cycle, with peak numbers of particular species corresponding to expected patterns in breeding and post-breeding dispersal. Cormorants, gulls and terns were drawn to oyster floats as suitable loafing sites. Deployment of predator decoys by the harvesting company failed to deter loafing activity, whereas the placement of short spikes along the upper surfaces of floats reduced gull and cormorant occupancy. Following the cessation of spike deployment, Double-crested cormorant and Herring gull numbers increased significantly during summer months, but neither species flies high enough in the area to pose much threat to aircraft. The number of gulls using the floats for loafing pales when compared to use of surrounding mudflats at low tide, but does ensure the presence of gulls at all stages of the tide cycle. Cormorants were only present during the summer months, as they disperse to the south for the rest of the year. The presence of increased numbers of birds utilizing the aquaculture site for loafing would appear to be primarily an issue of public relations.

[3] Anderson, Rachel A.*[1], Jared M. Feura[2], Ray B. Iglay[1], Kristene O. Evans[1], Carlos R. Ramirez[3], and Mark S. Woodrey[1]

[1]Department of Wildlife, Fisheries and Aquaculture and Coastal Research and Extension Center, Biloxi, Mississippi, USA; [2]Department of Wildlife, Fisheries, and Aquaculture, Starkville, Mississippi, USA; [3]Coastal Research and Extension Center, Biloxi, Mississippi, USA; rva21@msstate.edu;

Tidal marsh bird population monitoring and conservation applications for the Gulf of Mexico

Long-term monitoring of animal populations is necessary to detect population changes over time and apply conservation measures as necessary. The benefits of long-term monitoring are most noticeable in dynamic ecosystems subject to numerous ecological stressors, such as tidal marshes in the Gulf of Mexico coastal region. However, disentangling the best approach and application of population estimates can be challenging. Across the northern Gulf of Mexico, secretive tidal marsh birds are understudied, despite their role as bio-indicators of marsh ecosystem health. Furthermore, the Gulf and its bird communities face myriad disturbances such as hurricanes, oil spills, land use change, and the looming threat of sea-level rise. Given our current lack of knowledge of marsh bird populations across the Gulf, long-term monitoring strategies are crucial for assessing tidal marsh bird populations and associated distributions. We generated preliminary species-specific population estimates of secretive marsh birds across the Mississippi Gulf Coast in

2019 and 2021 utilizing a robust sampling design, standardized monitoring protocol, and spatially explicit abundance modeling. The most abundant species included Red-winged Blackbirds (*Agelaius phoeniceus*), Clapper Rails (*Rallus crepitans*), Seaside Sparrows (*Ammospiza maritima*), Common Yellowthroats (*Geothlypis trichas*), Boat-tailed Grackles (*Quiscalus major*), and Least Bitterns (*Ixobrychus exilis*). We estimated a total of 32,635 ± 1,196 Clapper Rails, the most abundant secretive marsh bird, across 264 points distributed among 12 marsh complexes. Clapper Rail abundance was also negatively impacted by percent of developed land and distance from the marsh-water edge, but positively affected by edge density. Using this multifaceted framework, we demonstrate the importance of investigating site-level and landscape-level variables that affect species-specific abundance. We also propose further application of abundance and distribution estimates including projecting the effects of sea-level rise and urbanization on future populations to help identify best practices for conserving species of concern.

[4] **Anholt, Allison**[1], Jennifer Provencher[2], and Heather Major[1]

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Characterizing Arctic Seabird bycatch in eastern Canada

The global Arctic is an emerging area of study for fishery impacts on seabird populations. Opportunities for fishing in the Arctic have increased and are expected to continue to grow as a result of retraction of summer sea ice, shifts northward of targeted fish species, and increased infrastructure supporting fishing enterprises. With this increase in potential fisheries operations, the risk to Arctic-breeding seabirds from fisheries bycatch is likely to increase as well. In the eastern Canadian Arctic, one of the main fisheries operating in Baffin Bay and Davis Strait targets Greenland halibut (*Reinhardtius hippoglossoides*) utilizing trawlers, as well as mobile and fixed deep-set gillnets. This study characterizes seabird bycatch monitoring data obtained from onboard fisheries observer programs between 2010-2019 in the Baffin Bay and Davis Strait region (NAFO fishery regions 0A and 0B). Fishery observer coverage was nearly 100% across all years in 0A, and averaging 10% in 0B. 0A During the observation timeframe, Northern Fulmars (*Fulmarus glacialis*) constituted the majority of the individuals caught (76% of recorded observations, n=620 individuals). Four other species were recorded, including three shearwater species and Iceland gull (*Larus glacoides*), with 815 individuals bycaught across all avian species. An additional 19% of observed individuals were not recorded to the species level. 81% of seabird bycatch occurred between August 15-October 15 across years, despite substantial annual variability. While this effort represents the most comprehensive characterization of seabird bycatch in the eastern Canadian Arctic, inconsistent data reporting, lack of species-level identifications, and difficulties obtaining spatially-explicit corresponding fisheries effort data

all hinder efforts to comprehensively assess risk to seabirds through fishery operations in the region.

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Community science Western Snowy Plover monitoring in northern Oregon

The community science Plover Patrol program takes place on the northern Oregon coast, is a successful collaboration between Portland Audubon, Oregon State Parks and Recreation, and the Oregon Biodiversity Information Center's Institute of Natural Resources. The program recruits and trains community science volunteers on the northern Oregon coast to conduct intensive monitoring and migration surveys for Western Snowy Plovers (*Charadrius nivosus nivosus*). Western Snowy Plovers, listed as threatened under the Endangered Species Act, are small, camouflaged shorebirds of open sandy beaches. Due to these characteristics, they are famously difficult to monitor even for very experienced observers, and most plover monitoring programs throughout the range of the Snowy Plover are conducted by professional staff. This program was begun in response to the recent recolonization of historic nesting habitat following years of population increases on the nearby southern Oregon coast. The challenges faced by plovers on the northern Oregon coast differ from the population strongholds in the south, affecting their nesting success (44% fledging success in southern Oregon, 2% in northern Oregon in 2021). The Plover Patrol collaboration hinges on the efforts of over 75 trained volunteer observers. Since 2018, volunteers have conducted 652 surveys and monitored over 124 nests. This presentation will highlight the efforts of volunteers and the unique benefits of utilizing a volunteer-based model for plover monitoring. The complex data collection requirements, combined with the requirements of safely monitoring federally listed species, also present unique challenges. We will discuss the training and communication strategies used to successfully overcome these challenges.

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Movement and length of stay of shorebirds during migratory stopover in the Pacific Flyway

Shorebirds depend on stopover sites to rest and refuel during their long-distance migrations between their Arctic breeding and southern overwintering grounds. We investigated differences in northward and southward migration stopover usage and duration of Western Sandpipers (*Calidris mauri*) between two important stopover sites in British Columbia, Canada: a large estuarine site, and a mudflat/beach complex site. We

used the Motus Wildlife Tracking System to i) estimate average length of stay at each stopover site and ii) track shorebird movements among habitats within each stopover site. We also quantified benthic prey availability at each stopover site to help explain our findings. We captured shorebirds at both sites during northward and southward migration and attached small radio transmitters (nanotags) to track their movements from 2018 to 2021. Western Sandpipers used the two major stopover locations differently. Despite having similarity in invertebrate prey abundance, Western Sandpipers using the large coastal estuary had a longer stopover duration (northward 5.5 days; southward 6.7 days) compared to birds using the mudflat and beach complex (northward 2.5 days; southward 5.5 days). Within stopover sites, Western Sandpipers in the large estuary moved less among habitats during northward migration than southward migration, whereas in the mudflat/beach complex there was no difference in the number of habitat movements between migration seasons. Variability in stopover site use indicates these areas fulfill different requirements for migrating shorebirds, highlighting the importance of conserving these critical areas.

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Double-crested Cormorants (*Nannopterum auritum*) in the Atlantic Flyway

The Atlantic Flyway Double-crested Cormorant population is composed of the Atlantic (*Nannopterum auritum*) and Southern (*N. a. floridanus*) subpopulations and breed in all four Atlantic Canadian provinces and Quebec, and in all 14 U.S. eastern seaboard states as well as Pennsylvania and Vermont. To date, population monitoring has been a patchwork of survey effort, which has made interpretation of these data challenging. Recently, each state and province was asked to provide its most current cormorant breeding pair estimate, the year cormorants were last surveyed, and the next planned survey year. Based on the best available estimates, Atlantic Flyway states support approximately 49,800 breeding pairs and the provinces of New Brunswick, Prince Edward Island and Quebec support roughly 46,000 pairs. These estimates were gleaned from surveys conducted by states and provinces between 2015 and 2022 and were often part of broader colonial waterbird survey efforts. At times, data on cormorants was only included if they were nesting with or near other colonial species. Nearly all Atlantic Flyway states plan on conducting a coordinated survey of cormorants in 2023 and/or 2024 along with one or more of the following species: Common Terns, Least Terns, Black Skimmers and Laughing Gulls. This survey will set the stage for future recurrent coordinated surveys designed to: (1) obtain improved cormorant population estimates on which to base maximum annual allowable take in the lower 48 states; and (2) establish population trends for species of high conservation and management concern at multiple spatial scales. The U.S. Fish and Wildlife Service is assisting states with the development of a sampling design that is repeatable, has sufficient

power to detect change, and does not require surveying every colony. Moreover, the Atlantic and Mississippi Flyway Nongame Migratory Bird Technical Sections are updating the 2010 Atlantic and Mississippi Flyways Double-crested Cormorant Management Plan that will include coordinated monitoring strategies, data management protocols, potential funding sources, and a flyway-based governance structure that will ensure the permanency of future surveys and inspire coordination with Canadian partners. The Plan will be submitted to both flyway councils for approval in February 2023.

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Using simulation to investigate storm-related bias to nest survival estimates in beach-nesting birds

Daily survival rate (DSR) of nests is commonly estimated using field evidence. Storms increase the uncertainty of DSR estimates in beach-nesting birds because evidence of true fate may be washed away and failure erroneously attributed to the storm. I used simulated data to investigate how changing storm duration/frequency affects uncertainty of DSR estimates. I simulated nests with randomly assigned initiation dates. The model had a true DSR and a conditional daily failure probability from multiple causes, plus an observation process (nest discovery probability and observation interval). I simulated storms at different frequencies and durations, then compared the bias and variance of DSR estimates from three different models under each scenario. I found that storm frequency has a larger effect on variance than storm duration, although increased sample size mitigates bias in DSR estimates. Reducing the observation interval and using a Bayesian framework also reduced bias. As climate change increases vulnerability of coastal sites as well as duration/frequency of storm events, storm-related bias is important to consider, especially for studies that lack the budget or appropriate location for camera monitoring (such as public beaches).

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Effects of elevation on Semipalmated Sandpiper (*Calidris pusilla*) nest habitat, fate, and food availability.

Shorebirds nest in the arctic in part to take advantage of the insect emergence providing food when chicks hatch. Shorebird nest initiation and arthropod emergence are related to snowmelt timing on the Arctic Tundra and within an area, snowmelt can be influenced

greatly by topography and underlying vegetation. My study investigates the impact of elevation on an Arctic breeding shorebird's nest habitat, reproductive success, and food availability. Eighty-three Semipalmated Sandpiper (*Calidris pusilla*) nests were monitored over 3 years (14 in 2018, 34 in 2019, and 35 in 2021) in 34 6ha plots approximately 120km north of Baker Lake Nunavut. To assess food availability at different elevations in 2021, 21 pitfall traps were set out in 5 different plot groups, traps were set in a line at every 5m of elevation change. Traps were collected weekly throughout the season and arthropods were later identified to the Family level where possible. Biomass (mg) was calculated using published body length-biomass equations. I will provide preliminary results on the impacts of elevation on Semipalmated Sandpiper nest habitat, reproductive success, and food availability.

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Minnesota marsh tern surveys and habitat assessments: methods and objectives

Tern populations in North America have experienced habitat loss and degradation on their breeding grounds due to development and land-use changes. Understanding the colony dynamics and habitat use of declining species is critical to developing effective conservation measures. In Minnesota, Black Tern and Forster's Tern are species of conservation concern due to documented long-term population declines and habitat loss. To fill gaps in our knowledge about the breeding ecology of these species, we conducted a comprehensive assessment of the current and historical distribution and abundance of Black and Forster's Tern breeding in Minnesota. Our objective was to identify key habitat features that influence nesting occupancy by quantifying local- and landscape-level characteristics, including basic vegetation structure and composition. In 2022, we conducted surveys at 33 wetland sites across the state and collected in-depth surveys focusing on monitoring water levels and assessing food availability at a subset of sites (n = 9). Black and Forster's Terns were present at 52% of sites surveyed, 18% of which were historical nesting sites for one or both species. Black Terns were not observed at three sites where nesting activity had been confirmed in recent years. A total of 287 Black Terns and 259 Forster's Terns were counted from shoreline or flush surveys across the 33 sites. We will repeat this sampling protocol at a new set of sites in 2023. By assessing habitat characteristics at locations which have historically been used as breeding sites, but are currently unoccupied, and comparing those to sites that have persisted over time, we will identify key features associated with colony occupancy that can help inform conservation efforts and prioritize restoration actions.

[11] Brown, Andrew D.*[1], Cuthbert, Francesca[2], Van Zoeren, Alice[2], Schubel, Stephanie[2,3], Nol, Erica[1]

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Long-distance dispersal in a recovering Piping Plover population facilitates recolonization of historical nesting sites following decades of extirpation

After extirpation from most of the Great Lakes by the 1980s, the Piping Plover (*Charadrius melodus circumcinctus*) did not nest again outside Michigan until 1998. The number of Plovers breeding in the region has gradually increased, with nesting locations expanding from Michigan. We studied the pattern of dispersers recolonizing their historical range after near extirpation using data from individually identifiable banded birds. Objectives were to determine if: (1) the origin of the first recolonizing individuals was Michigan; (2) dispersers remained within the Great Lakes population boundaries;(3) colonizing individuals were mainly natal dispersers; and (4) dispersal distances differed between the sexes and between natal and breeding dispersers. Finally, we tested the effects of time (year), yearly average Great Lakes water-level anomalies, and number of breeding pairs per year in Michigan on the rate of colonization outside Michigan. Plovers recolonized the Great Lakes primarily via recruits from Michigan. Additionally, six individuals were recorded leaving the Great Lakes and colonizing locations within Northern Great Plains and Atlantic Coast population boundaries. Colonizers dispersed on average 489.0 ± 55.0 km with no significant differences in distances between males and females or between natal and breeding dispersal events. No significant effect was found of water-level anomalies or number of breeding pairs in Michigan on the number of colonizers, but there was a positive effect of year. Our findings demonstrate that birds will return to sites unused for decades if the habitat is still suitable. The results also identify key locations that can support the continued growth of the endangered Great Lakes Piping Plover population as it increases towards recovery goals.

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Identification of factors causing population decline among *Egretta*. Is there a smoking gun?

The "Recovering America's Wildlife Act of 2021" (H.R. 2773, RAWA) passed in the US House of Representatives on 14 June 2022. If Senate Bill 2372 passes and is signed into law by President Biden, it would offer unprecedented resources for state wildlife agencies and

partners to aid species of greatest conservation need (SGCN), and for the US Fish and Wildlife Service to aid federally listed species. However, if population trends of SGCN can be stabilized and directed upward, costly resources associated with federally listed species could be better spent on conservation opportunity areas and SGCN. But how do we identify key factors causing species' declines? Among the Ardeidae, a survey of State Wildlife Action Plans (SWAPs) from Maine to Florida identified as Species of Special Concern or SGCN, in rank order, Snowy Egrets (*Egretta thula*; 12 out of 14 states), Little Blue Heron (*Egretta caerulea*; 11 out of 14 states), and Black-Crowned Night Herons (*Nycticorax nycticorax*; 10 out of 14 states). Here we review the sorts of data collection that could be used to identify a clear cause, or causes, of decline so that when and if funds become available, the most direct paths toward recovery can be taken. Audience participation will be encouraged.

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Population Monitoring and Status of Double-crested Cormorants in the Southeast United States

Monitoring Double-crested Cormorant (*Nannopterum auritum*) populations throughout their wintering grounds in the southeastern United States is a difficult task as wintering cormorants are highly mobile and have large shifting home ranges. However, because cormorants spend most of their time at night roosts, roosts surveys have proven to be a useful way to monitor cormorant populations within a region. Roost surveys first began over the growing concern that cormorants may impact the aquaculture industry in the southeast, primarily in Mississippi, Alabama, and portions of Arkansas and Louisiana. These surveys have given ecologists and wildlife managers valuable information needed to study the biology and behavior of cormorants, as well as to help manage them. Here we discuss the history and application of two main roost survey techniques, mid-winter roost surveys and aerial roost surveys. Each of these surveys has their own potential pitfalls, benefits, and uses in the monitoring and managing of cormorants throughout their wintering grounds. We also use data from these surveys to present annual and seasonal trends in cormorant abundance, migration timing, movements, and general status over the years. Lastly, we touch on the utility of Christmas bird count data to monitor cormorant population status and trends.

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Research, Management, and Population Monitoring of Double-crested Cormorants in Mississippi

Extensive efforts in monitoring and research of Double-crested Cormorants (*Nannopterum auritum*) in the southeastern U.S. occur within the state of Mississippi. Most of these efforts stem from human-wildlife conflict between cormorants and Mississippi's aquaculture industry, however a great deal has also been learned regarding cormorant wintering ecology. Recent studies have examined cormorant population dynamics, migration timing, foraging behaviors, and management strategies. A large-scale monitoring program began in 1989 to estimate the abundance and location of cormorants at all known roosts in the primary aquaculture region of Mississippi. These roost surveys continue today and are pivotal to researchers and wildlife managers in understanding how cormorants behave. This extensive data set was used to address various hypotheses pertaining to cormorant ecology, particularly in relation to aquaculture. This work found that the Midwest breeding population of cormorants has been increasing, but the abundance of cormorants wintering in Mississippi has decreased, closely following the decline in aquaculture. Cormorant roost use is closely tied to the amount and proximity of surrounding aquaculture, particularly prior to migration. Multiple studies indicate cormorant behavior and distribution in Mississippi is largely driven by the extent of aquaculture. It was also found that peak cormorant abundance in Mississippi is occurring 2.14 days earlier each year, which may be indicative of changes in migration phenology. Research has also been done to understand how changes in the aquaculture depredation order (AQDO) have influenced cormorants. Studies found that cormorant use of aquaculture relative to natural waterbodies was greatest when the AQDO was ceased, and lowest when it was in full effect. This trend highlights the potential influence of changes in mortality risk have on cormorant behavior. Research currently ongoing include testing the effectiveness of nonlethal roost harassment at managing cormorant population distribution, and testing deterrents methods for oyster farms. Information gained from these past and future studies aid in cormorant damage mitigation, as well as furthering our understanding of cormorant ecology, particularly in relation to foraging behavior. These studies show changes in agriculture, policy, and potentially climate change, can influence phenology, distribution, and abundance of cormorants at large geographic scales.

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Common Tern (*Sterna hirundo*) foraging movement: characterizing interannual and intraspecific variations

As central place foragers, seabirds' reproductive success is partially dictated by local forage fish (small, juvenile, and schooling fishes) availability. Such forage fish populations are often highly variable in space and time; thus, quantifying variability in seabird foraging behavior, seabird diet, and prey availability will be important as seabirds continue to face pressure from climate change-induced shifts in prey base, coastal development, and offshore wind energy. In the Gulf of Maine (GOM), Common Terns (*Sterna hirundo*) rely on local forage fishes during the breeding season, though little is known about their foraging movements in relation to their prey populations. Our research assesses within-season and between-year variation in Common Tern foraging movements in relationship to prey availability at the Isles of Shoals (New Hampshire and Maine, USA). Tern movement data were collected via GPS satellite tags deployed during the 2019 (n=11), 2021 (n=20), and 2022 (n=11) breeding seasons. Foraging movements were extracted from the GPS data using Hidden-Markov Models (HMM). Tern diet data were collected during observational surveys of adults provisioning their chicks, and local prey availability was quantified in 2021 and 2022 by bait scoop, minnow trap, purse seine, and eDNA surveys. Metrics of tern foraging movements were compared with indices of prey availability using Generalized Linear Mixed Models (GLMM). Locations of foraging by terns varied among individuals and between years. Particularly, foraging areas utilized in 2019 and 2021 were concentrated in river mouths and estuarine waters, while those used in 2022 were concentrated more locally in coastal waters surrounding the colony. Chick provisioning data revealed within-season variability in major prey items brought back by adults. The most common prey items delivered to chicks were hake species, herring species, and sand lance, and the most commonly available in the environment were herrings, silversides, and sticklebacks. Our work highlights variability in tern foraging movements and diet, likely reflecting local forage fish availability. Such understanding has implications for the use of Common Terns as indicators of NH forage fish populations in a changing ecosystem.

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Avian and ghost crab predation threats to American Oystercatcher chick survival at an important breeding location on the Western Atlantic Flyway

Evaluation of the current threats to American Oystercatcher (*Haematopus palliatus*) reproductive success on Metompkin Island, Virginia, is needed to inform management of this species at this globally significant site. Average annual reproductive output on the

island has declined from 0.69 ± 0.04 (SE) fledged chicks/pair in 2011-2015 to 0.34 ± 0.08 (SE) fledged chicks/pair in 2016-2020, despite continued management, such as pre-nesting season removal of red fox (Vulpes vulpes). Field and camera-based monitoring have provided insight into the factors driving nest survival. However, identifying threats to chick survival is difficult, as chicks are difficult to relocate after hatching and signs indicating causes of chick mortality may be ephemeral. We monitored the reproductive success of approximately 30 pairs of American Oystercatchers per year on Metompkin Island in 2021 and 2022 using a combination of nest and brood surveys and radio telemetry to track one chick per brood (n = 35 chicks total) until death or fledging. Reproductive output was below the 2011-2015 average in both years (0.58 and 0.21 fledged chicks/pair in 2021 and 2022, respectively). Radio-tagging chicks improved our chances of relocating chicks and chick remains, allowing us to identify fate and sources of mortality. We confirmed fledging or a suspected cause of mortality for 57% of radio-tagged chicks (versus 31% of untagged chicks). The cumulative probability of surviving to 35 days (i.e., average time to fledging) was 0.30 ± 0.08 (SE) and median survival time was 15 days. No chicks in our study were suspected to have been predated by a mammal, indicating mammalian predator management appears to be successful. However, 48% of radio-tagged chicks that did not fledge (n = 25) were suspected to have been predated by other birds (n = 6; 24%) or were recovered in or near Atlantic ghost crab (*Ocypode quadrata*) burrows (n = 6; 24%), though we could not confirm if ghost crabs were predating or scavenging the chicks. Our results suggest that despite fox removal, the predation threat to chick survival is ongoing through avian predators, and possibly ghost crabs.

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A meta-analysis of disturbance caused by drones on nesting birds

The use of drones for monitoring nesting birds is rapidly increasing given their affordability and efficiency in bird detection and quantification across habitats. Reports of disturbance caused by drones on different bird species have been mixed, with no consensus on the degree to which different factors affect disturbance responses. Given the lack of systematic assessments of disturbance from drones on nesting birds, we conducted a formal meta-analysis to quantify the degree of disturbance caused by multi-rotor drones on nesting birds, with a particular focus on the effects of altitude of flights and species nesting traits. Eighteen studies met our criteria for inclusion in the analysis, from which we extracted 32 effect sizes in the form of log-odds ratio. Drones showed a small disturbance effect (-1.38;

95% CI: -2.59, -0.16) on nesting birds overall, but heterogeneity was large; drone flights >50 m had small odds of disturbance on nesting birds. Conversely, flights at low altitudes (â‰¤50 m) showed larger disturbance effects, with the largest odds of disturbance observed on ground solitary and non-ground solitary nesters. Only ground colonial nesters showed small disturbance effects regardless of the drone altitude. We conclude that the use of drones can be an efficient and safe means of surveying nesting birds if altitude and nesting traits are considered in survey protocols.

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Surface water dynamics of Chihuahuan Desert wetlands: implications for migratory waterbird habitat conservation

Wetlands in the Chihuahuan Desert provide crucial stopover and wintering habitats for migratory birds. The timing and spatial distribution of surface water availability across this landscape is fundamental to migratory success. Without this resource, the increase in energetic cost of migration can severely affect survivorship and impact their populations. Anthropogenic activities and climate change are impacting wetland habitats across arid systems globally through increasing consumptive water use and changes in climate-driven hydrologic patterns, including regions within North America's central and pacific flyways, and resulting in spatiotemporal changes in surface water availability for migratory birds. However, these effects have not been assessed in the Chihuahuan Desert. To better understand patterns of habitat availability in this ecoregion, we evaluated surface water dynamics of 29 historically important wetlands to migratory waterbirds by reconstructing a 36-year (1984-2019) time series of seasonal (October-March) surface water extent via remote sensing. At the ecoregional level, annual surface water extent increased slightly over the observed period (tau = 0.14, $p < 0.05$). However, at the site level, we observed mixed trends; 5 sites experienced declines in surface water (tau < -0.10), particularly in the northern part of the Chihuahuan Desert, 12 experienced increased surface water (tau > 0.10), particularly in the central and southern part, and 13 sites demonstrated no change (tau < 0.10 and > -0.10). Evapotranspiration best explained annual surface water extent variability in the region. The periodicity of wet and dry cycles differed by site, ranging from 2 to 12-year recurrence intervals, with several sites matching El Niño Southern Oscillation patterns, while no periodicity was observed for seven sites. Our results provide quantitative insight into patterns and trends in surface water availability and inform where restoration and protection efforts may be most beneficial. Moreover, as other regions within the same

flyways are experiencing water declines, wetlands in the Chihuahuan Desert could take an increased role in supporting migratory bird populations.

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Ontario cormorant monitoring

The Double-crested Cormorant (*Nannopterum auritum*; hereafter "cormorant") is found in large numbers throughout the nearshore islands of the Great Lakes and many large inland lakes in Ontario. Monitoring has occurred, mostly on Great Lakes colonies, by several groups and agencies, with the earliest nest count records from the 1920s. Most surveys and censuses have been conducted by researchers visiting colonies by boats and recording active and inactive nests of cormorants and other waterbirds as well as numbers of adults. Ontario Ministry of Natural Resources and Forestry monitoring has occurred mainly within provincial parks and on Lake Huron. All monitoring data have been compiled into a database for trend analyses. Combined with historical data, Ontario portions of Lake Superior, the St. Lawrence River and Lake Ontario show continuation of increasing trends whereas the Lake Huron population remained stable following a 60% decline in the 2000s.

The Ontario Ministry of Natural Resources and Forestry has conducted a renewed monitoring program starting in 2019 as part of the introduction of a cormorant hunt in 2020. In the first year, we conducted surveys by boat, the traditional method, and compared those results with an aerial photographic survey. For cormorants, the aerial photo survey proved to be effective and more time and fiscally efficient when nesting occurs on the ground. The photo survey was conducted again in 2021 for regions where cormorants are mostly ground nesting. Large inland lakes with established colonies were also surveyed by photo survey and from the ground by aquatics staff conducting other monitoring. Combined with historical data, trends for each major waterbody were estimated, accounting for monitoring gaps, with varying results.

We will determine the frequency that aerial photo surveys need to be conducted as we assess the data collected and our objectives. Data collected by partner agencies proves to be invaluable for coordinating surveys, filling gaps, and covering areas where aerial photo surveys are inefficient. We are grateful for the efforts of others as this collaboration is an integral part of monitor efforts in Ontario.

[21] Custer, Christine[1], Paul M. Dummer[1] and Natalie Karouna-Ranier[2]

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Assessing exposure to PFAS from different sources using a model species: the Tree Swallow

While exposure of wildlife to per- and polyfluoroalkyl substances (PFAS) can come from many sources, one prominent source are facilities that use aqueous film-forming firefighting foams (AFFF), both operationally and for training. Other sources include manufacturing facilities and industrial plants that use PFAS-containing products. The objective of this study is to use a model avian species, the tree swallow (*Tachycineta bicolor*), to assess exposure to and quantify effects, if any, of PFAS at Department of Defense (DoD) installations in the Mid-Atlantic region, USA compared to reference locations, and compared to locations with other PFAS sources. Tree swallow nest boxes were sampled in 2020 and 2021 at selected military installations (AFFF source), two reference locations at the Patuxent Research Refuge, Laurel, MD, and at two sites near the Twin Cities, MN which have other PFAS sources. Tree swallow nesting was monitored weekly, and egg, nestling, and diet samples were collected at the appropriate times in the nesting cycle. Samples were analyzed for 33 PFAS, as well as, for biomarker responses. Two levels of effects were assessed relative to PFAS and other contaminant exposures. At the population level, reproductive effects were measured as percent hatching and daily probability of nest success. Biomarker responses, which are indicative of whether exposure is high enough to elicit even a physiological response in individual birds, was compared to normal responses in reference swallows and relative to PFAS exposure. There were different levels of PFAS exposure across study sites, and also differences in the patterns of specific PFAS depending on the source. These differences will allow for a robust assessment of which PFAS are contributing to effects, if any effects are documented.

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Double-crested Cormorant nesting pair estimates and trends in US Great Lakes: 2018

Complete censuses of all colonial waterbird species in the U.S. Great Lakes were conducted at decadal intervals 4 times from the 1970s-1990s. After the 4th, estimates were obtained for Double-crested Cormorants (DCCO) biennially between 2012 – 2018. During this time, the method was converted to a "Priority Census" which focused on nest counts at sites that captured the largest cormorant colonies. This new approach reduced time and favored more frequent detection of trends important for management. Estimates were

obtained from total ground counts or counts from aerial photos. The most recent survey in 2018 documented 31,436 pairs at 38 Priority Sites. Although cormorants nested at > 38 sites in prior surveys those monitored in 2018 captured 88-92% of the total pairs present in each survey conducted between 1997 and 2016. To understand trends, three timeframes were examined at the regional scale. Peak numbers were documented in 2005; therefore, we compared the 2018 numbers at Priority Sites to those at Priority Sites in 2005. This comparison indicated a decline of 34%. Next, we compared numbers at Priority Sites between the first priority survey in 2012 to the current one; this comparison indicated a decline of 8.6%. Last we compared estimates at Priority Sites between 2016 and 2018, which indicated that DCCOs had recently experienced an increase of 3.8%. The small increase in overall US Great Lakes numbers between 2016 and 2018 is presumably due to cessation of DCCO management after the Public Resource Depredation Order was vacated in 2016 but no further lake wide surveys have been done since 2018. At the local scale, numbers at several locations and management units declined despite release from management but in other areas a dramatic increase occurred that continued to drive conflict in those areas. A population monitoring plan for the US Great Lakes is in the planning stage and the next survey for cormorants will occur in 2024.

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Significant Caspian Tern mortality from HP avian influenza in the U.S. Great Lakes: 2022

In early 2022, highly pathogenic H5 avian influenza (HPAI) was confirmed in US domestic poultry farms and waterfowl. In May, biologists found unusual mortality in US Great Lakes Caspian Terns (CATE) as well as in Double-crested Cormorants (DCCO), American White Pelicans (AWPE) and Ring-billed and Herring gulls. Because CATE colony sites are well known and censused, and have high conservation status, the best records of mortality among all species of colonial waterbirds are available for this species. The purpose of this presentation is to summarize colony sites visited, carcasses found, regional distribution, estimated dates of death, and verification of AI. Mortality numbers are compared to most recent CATE population estimates (2018). A minimum of 1,623 dead or dying terns was found at 5 locations, all in northern Lake Michigan. Based on condition of birds at discovery, we estimate HPAI arrived and circulated at affected sites from mid-May to early June and likely was spread by virus-positive migrants arriving to nest. At several sites,

carcasses were collected and sent to USGS and USDA labs for HPAI testing and confirmation. Positive identification of AI was confirmed from all submitted specimens. During the recent census in 2018, 5,020 nests (10,040 adults) were estimated at 12 sites. Using these estimates, a minimum of 16% of adults died from AI in 2022. It is important to conduct a complete census in US and Canadian Great Lakes waters in 2023 to document HPAI presence and estimate the 2022 impact of HPAI on this uncommon species of conservation concern in the Great Lakes.

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Parental investment in Black Guillemots (*Cepphus grylle*) on the Isles of Shoals

Studying black guillemots (*Cepphus grylle*) on the Isles of Shoals affords a unique opportunity to understand how a cold climate-adapted species could respond to changing environmental conditions. As ocean temperatures rise, climate change has the potential to affect both parental fitness and reproductive success. To better understand how black guillemots respond to these changes, we researched how parents balance investment in current and future reproductive efforts. We established a monitoring program and collected nest footage using trail cameras to analyze how frequently parents return to the nest and how much time they spend there, as opposed to foraging at sea. Preliminary results suggest that nest visits often are made without prey but involve other behaviors such as vocal communication, and that nest visit rate does not necessarily predict nest success. Future monitoring of this study population will shed light on long-term trends.

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High Island Rookery Expansion and Resiliency Project: 5 years later

Three hurricanes and a drought from 2011-2013 in Texas wreaked havoc on the long-established High Island Rookery in Smith Oaks Bird Sanctuary. Nesting habitat was reduced to mainly non-native invasive species, and water levels dropped to unprecedented levels risking predator invasion as the resident American Alligator population had limited habitat to maintain patrols. In 2018, in partnership with Ducks Unlimited and with funding from the Nation Fish and Wildlife Foundation, Houston Audubon attempted to increase water catchment capacity and the availability of nesting habitat by creating two additional

islands. Together, these islands totaled approximately1 acre of newly available habitat. The islands were planted with native trees and supplemented with 250 ft^2 of artificial nesting platforms. The first three years after the islands were created had limited success in recruiting breeding bird populations. Despite our efforts to entice nesters, it wasn't until the 2021 breeding season that the first pair of Tricolored Herons nested on one of the new islands. Now, five years after their creation, the new islands are thick with nesting birds from several taxonomic orders and water levels are being maintained around the islands, despite recent drought conditions. In 2022, nesting bird populations on both islands continued to increase from the previous year, though the composition of species on each island varied, likely based on the timing they initiate breeding behaviors.

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Double-crested Cormorants and societal interactions: research update

The question of potential cormorant impacts to commercial and natural resources is complex and often controversial. While a considerable amount of research has been conducted to better understand and address this complexity and controversy, many questions remain. Here we present information on recent and ongoing lines of research investigation involving the U.S. Department of Agriculture, Wildlife Services, National Wildlife Research Center and many collaborators. This research addresses issues including; modeling efforts to identify when and if cormorant predation impacts fisheries and whether those impacts are actionable, how to best measure avian predation impacts to fisheries, and management methods that are non-lethal or reduce the need for lethal take of cormorants to address effects of cormorant impacts to commercial and natural resources. These research efforts are focused on providing tools for science-based decision making and if management is determined necessary, the availability of primarily non-lethal management methods.

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"Plover-view": the role of viewshed in Piping Plover nest-site selection

Nest-site selection in ground-nesting shorebirds is driven by the need to select areas that minimize probability of competition, predation, and flooding. The piping plover (*Charadrius melodus*), an imperiled shorebird, nests on "open and sparsely vegetated" sandy beaches. Suggested reasons for this choice are that it enhances an incubating plover's visual detection of predators and allows for early initiation of distraction behavior to protect its nest. To test the hypothesis that plovers were selecting nest-sites that favored visual detection of terrestrial predators, we predicted that the viewshed at nests would be greater than the viewshed at randomly selected nearby points. We also hypothesized that when viewshed is added to a previously created nest-site selection model for the population of plovers in Fire Island, NY, the resultant model would be improved. We conducted a Viewshed Analysis in ArcGIS Pro and expressed viewshed as the percent of area within 30-m buffer of the nest or random point that would be visible to an incubating plover while considering landscape-based visual obstructions (e.g., dunes and vegetation). We compared nest and random point viewshed values via a use-versus-availability analysis. To assess if adding viewshed as a covariate improves the predictive ability of the previously tested nest-site selection model from Walker et al. 2019, we performed a likelihood ratio test comparing two generalized linear models. There is a significant, overall positive effect of viewshed on the probability of a point being used as a nest-site ($\beta = 0.722$, p-value = 0.002). Additionally, the likelihood ratio test between the models with and without viewshed was significant (LRT = 25.87; p-value = 3.65e-07) suggesting that the addition of viewshed creates a more predictive model. Researchers have shown growing interest in learning how visual information influences animal behavior. Should nest viewshed be an important predictor for nest-site selection in other ground-nesting species, it would help conservation practitioners identify important microhabitat characteristics in the landscape. An application of this could inform management decisions on the breeding grounds related to the management of visual obstructions on the landscape.

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An investigation into a novel health condition of an iconic shorebird: implications for the understanding of emerging zoonotic diseases, coastal bird species management, and conservation

In the summers of 2018 and 2020, biologists from the Gulf Coast Bird Observatory, located in Lake Jackson, Texas, documented an unusual health condition appearing in black skimmer (*Rynchops niger)* chicks. This condition involved the growth of torsional primary

wing feathers, which was followed by the chicks' inability to fledge, and eventual mortality. Here, I discuss the findings of a two year-long investigation into the status of black skimmer chick health on the east Texas Gulf Coast. In the summer of 2022, this anomalous condition occurred again, as did concurrent die-offs of chicks and fledglings, and we began an investigation into the cause. We present the results from that investigation, as well as baseline health data for the establishment of reference intervals for plasma chemistry and complete blood count values for this species. Black skimmers are iconic coastal birds which, like many avian species, are experiencing population declines and are in need of conservation intervention. Additionally, birds are important sentinels of environmental change and degradation. Anomalous health conditions of birds are therefore important to document and investigate, as declining health of birds may represent a greater threat to ecological, and even human, health. We discuss the results of our investigation within the broader context of emerging zoonotic diseases, coastal bird species management, and conservation.

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Estimating Clapper Rail (*Rallus crepitans*) nest and chick survival in Delaware, USA

Tidal marsh ecosystems are severely threatened by anthropogenically accelerated climate change, sea level rise, and marsh degradation. Avian survey data from the northeast USA indicate population declines in saltmarsh specialist species, including an annual decline in the Northern Clapper Rail (*Rallus crepitans crepitans*) population of ~5%. The underlying causes of this decline remain unknown as the cryptic nature of rail species make the collection of demographic data challenging. Although some demographic rates are estimated in the Gulf of Mexico, few to no regional data exist for contemporary adult, juvenile, or nest survival along the Atlantic Coast. Brood survival monitoring has not been possible due to the difficulty of capturing rail chicks and their small size (prohibiting the use of all but the smallest and thus shortest-lived radio transmitters). Brood counts are not feasible to conduct in the marsh as the chicks are cryptic and the brood may be split between the two parents, leading to inaccurate counts. To estimate Clapper Rail nest and chick survival rates, we located nests on foot and with drone-based thermal imaging. We monitored each nest every few days and increased our frequency of visits near the estimate time of hatching. When chicks were present at nest checks, we captured them by hand and radio-tagged them. This method was only effective if the nest was checked during a hatching event as the chicks can readily evade capture once they are more than a day old. We monitored 196 nests from 2019-2021 and estimated daily nest survival using a Bayesian approach. We estimated daily nest survival to be 0.97 (SE = 0.004). We radio-

marked 81 chicks in 2020-2021 and although chick tag retention was low (average retention time 3-4 days), 16 chicks were tracked for ≥ 14 days with an apparent period survival rate of 81%. These results include the first Clapper Rail chick survival information and will serve as an important baseline to gauge the impacts of sea level rise and marsh degradation on avian populations.

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Winter reset: temporal delays carry over across seasons except the non-breeding period in Arctic-breeding shorebirds

The seasons of migratory birds are separated by time and space, but conditions that affect a bird during one season may continue to affect it long after it moves elsewhere; these are known as carry-over effects. The currency of carry-over effects is often time: factors that delay a bird can have compounding consequences if the delays continue, and even increase, into subsequent seasons. This can occur if the delays cause phenological mismatches with resources, such as ephemeral food sources at breeding sites, or increased overlap with predators on migration. We used tracking and breeding data from 523 individuals of 10 Arctic-breeding shorebird species to track whether migration delays continue across seasons, or whether birds can compensate for delays. Despite shorebirds being extreme long-distance migrants, we hypothesise that the non-breeding period offers sufficient time for them to "reset the clock" and address any energetic or time deficits. In general, we found that birds who leave an area late arrive at their subsequent destination late, but are able to partially make up some time, suggesting that mitigating delays is advantageous. Birds made up more time in the spring than the fall; this is consistent with the timing of spring arrival being extremely important for breeding success, but also implies that there may be selection for early arrival to the wintering grounds. Birds that successfully hatched nests left the breeding grounds later than those with failed nests, but only by six days, which is also consistent with early fall migration being beneficial. In contrast to the other seasons, there was no relationship between arrival and departure times from the wintering grounds; this suggests that birds are able to reset their timing during this period, preventing delays from accumulating across years. We show temporal carry-over effects between seasons and with breeding success in Arctic-breeding shorebirds, despite apparent efforts to mitigate delays. While the wintering period appears to be long enough for birds to make up for delays accumulated through the rest of the year, this may come at a cost that is not identifiable through tracking data.

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Colony Island Network Design and Implementation (CINDI): a prioritization tool for beneficial use of dredged material at rookery islands in Texas, USA.

The degradation of colonial waterbird nesting islands has prompted a move to rehabilitate eroding islands in Texas. To date, island rehabilitation projects have been the products of opportunity, with location and design a function of engineering feasibility and funding. However, there are no quantitative tools for predicting the degree to which species will benefit from an island based on its physical characteristics or location, resulting in high uncertainty in management outcomes and no understanding of the contribution a rehabilitated island would make to regional waterbird populations. Therefore, we initiated the Colony Island Network Design and Implementation project (CINDI), which uses a co-production process to develop a prioritization tool for island rehabilitation projects that will help conserve colonial waterbird populations on the coast of the Gulf of Mexico. As part of the early co-production process, we conducted unstructured one-on-one interviews with managers to identify uncertainties in the selection of sites for beneficial use. We also sent surveys to managers to identify environmental variables that should be included in models of colony-level breeding abundance and occupancy. Each manager indicated that site selection for beneficial use projects has mainly focused on sites with the most obvious need, and thus the major sources of uncertainty for managers were related to funding and operations, rather than uncertainty around ecological responses. Survey respondents identified nesting substrate, human disturbance, predator disturbance, and energy availability as the greatest constraints on breeding abundance, though the predicted effects of these variables on breeding abundance were variable. As a first step toward producing quantitative tools for CINDI, we used a hierarchical zero-inflated Poisson model to estimate bay-level population trends of Great Egret (Ardea alba), Reddish Egret (Egretta rufescens), Tricolored Heron (Egretta tricolor), Caspian Tern (Hydroprogne caspia), and Black Skimmer (Rynchops niger), from Texas Colonial Waterbird Survey breeding pair counts (1973-2014). We found significant colony-level population trends that were relatively synchronous across the five bay systems This preliminary analysis helped us specify the omnibus model upon which to develop more complex models, which will be used to test the effects of colony characteristics and habitat variables on breeding pair counts.

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Updated North American status assessment of Black Terns: regional variations within a range-wide trend

Understanding connections among populations across the annual cycle as well as spatial variation in drivers of these trends are key to uncovering the causes of range-wide population declines and developing appropriate management strategies. Black Terns (*Chlidonias niger*) have experienced long-term population declines across North America, but population trends appear highly variable across their range. Black Terns breed in freshwater marshes but switch to marine habitats in winter, and thus face diverse threats throughout the year. Currently, little is known about which factors on the breeding grounds, during migration, or winter may be driving regional population trends. As a first step towards understanding causes of population declines, we present a comprehensive and up to date review of all available abundance and trend information for the species within North America. Starting with recent route-level analyses of North American Breeding Bird Survey data, we show that Black Tern population declines are most severe in peripheral areas of the range, such as in Ontario and the western US, while increasing trends tend to be observed in more central and northern populations, such as in the Boreal Transition Zone of Alberta and Saskatchewan. We then examine the influence of habitat covariates as potential drivers of trends in the core of the species range, the Prairie Pothole Region. Finally, we examine region specific trend data using Provincial and State survey data and discuss the varying trends in relation to potential drivers. By reviewing regional trends in the context of North American range-wide declines, during this symposium we hope to develop a better understanding of threats and drivers throughout the annual cycle so as to inform priority research areas and guide future conservation actions.

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NOAA Firebird: Fire Effects in Gulf of Mexico Marshes on Mottled Ducks, Black and Yellow Rails

Although extensive work has been done in upland systems to understand the role of fire in maintaining ecosystem functions, little has been done on the maintenance of coastal wetlands, or the response of birds in high marsh wetlands. High marsh is a unique habitat type, imminently threatened by sea level rise and characterized by a community of specialized emergent vegetation that tolerates irregular tidal inundation. Land managers' decisions about prescribed fire in high marsh systems are complicated by uncertainty around the response of birds to the application of prescribed fire. Without an understanding of how prescribed fire impacts high marsh ecosystems, natural resource managers will be limited in our ability to manage and conserve the biodiversity of the Gulf Coast. Black rail, yellow rail, and mottled duck are birds of concern, and uncertainty currently limits the application of prescribed fire for the benefit for all three species. We will present our work to date in monitoring the response of our three focal species to prescribed fire management of their habitats, and what we've learned along the way in terms of sampling design for three birds that can be challenging to study.

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The Gulf of Mexico Avian Monitoring Network (GoMAMN): A forum for connection and collaboration focused on values driven priorities for bird monitoring

Conservation planning for large, dynamic coastal and marine ecosystems has multiple benefits but is often challenging to implement. Prior to the Deepwater Horizon oil spill, avian monitoring projects frequently used study designs inconsistent with understanding species' population trends, species response to management actions (or restoration projects) and understanding ecological processes at larger scales. In addition, many research or monitoring efforts occurred at smaller spatial and temporal scales. Finally, there was little to no effort to coordinate across bird monitoring efforts such that target avian monitoring metrics could potentially be evaluated at larger spatial and temporal scales increasing relevance. In response to this, the Gulf of Mexico Avian Monitoring Network was created, to serve a forum for collaboration and coordination. To identify potential priorities for future bird monitoring efforts, GoMAMN used the principles of structured decision making to identify stakeholder objectives and values, which in turn led to the identification of specific bird monitoring priorities. The Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico (Wilson et al. 2019) was an application of these goals into a series of monitoring guidelines designed to improve the utility of monitoring efforts. By using stakeholder objectives and values to identify bird monitoring priorities, practitioners and decision-makers have: (1) a set of agreed upon objectives and core values; (2) a transparent means of setting priorities across political and jurisdictional boundaries; and (3) a framework to facilitate communication and collaboration of data needs. Several of these priorities have already led to large collaborative co-production projects, which we will discuss in this presentation. We will also present on how GoMAMN is now working towards identifying what priorities we now need to focus time and energy, and better serving and responding to the broader Gulf of Mexico bird conservation community.

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Estimating nest productivity and identifying sources of nest and chick mortality in Least Tern colonies in the Outer Banks

Least Terns are a beach nesting species, and their breeding sites are especially vulnerable to both human and non-human impacts. Least Terns are listed as a Species of Special Concern in North Carolina. We are assisting the National Park Service at Cape Hatteras National Seashore to evaluate the efficacy of their existing Least Tern protection protocols by measuring daily survival rates for Least Tern nests and unfledged chicks and identifying

human and non-human sources of nest and chick mortality. Data and observations were collected in the summers of 2019 – 2022 using two monitoring methods: ground-nest counts and incubating-adult counts. Chick fates were determined by banding individual chicks. Along with nest and chick fate, we recorded data on potential sources of human and non-human causes of mortality. We calculated daily survival rate (DSR) for Least Tern nests and chicks using survival analyses included in the R package RMark. Known fates were recorded for 35 nests in 2019, 291 nests in 2020, 973 nests in 2021, and 408 nests in 2022. The percentage of nests that hatched was 74.3, 74.2, 76.5, and 34.6 for 2019, 2020, 2021, and 2022 respectively. The leading cause of nest loss in 2020 and 2021 was weather. Depredation by coyotes led to a substantial increase in nest loss in 2022. Fate was determined for 48 Least Tern chicks in 2022, representing approximately 25-30% of observed chicks. The fledge rate for banded chicks was 64.6%. The leading cause of chick loss before fledging was likely depredation. Using both field observations and DSR analyses to identify the influence of human and non-human factors will allow us to assess the efficacy of alternative buffer designs which will be implemented in 2023 and 2024.

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Using UAV to discover secretive marsh bird nests

Unoccupied Aerial Vehicles (UAVs) provide new methods to study wildlife in a potentially more efficient manner than traditional methods. UAV methods could be particularly useful for studying secretive marsh birds, as marsh accessibility varies greatly, and UAVs can provide access to otherwise inaccessible areas. We used a UAV equipped with a thermal imaging camera to search for Clapper Rail (*Rallus crepitans*) and other tidal marsh birds nesting in salt marshes on the coast of Delaware, USA in 2021 - 2022. We conducted traditional ground-based systematic nest searches with a field crew at two intensive sites with different levels of accessibility and compared the number of nests detected between ground surveys and the thermal camera deployed on the UAV. Thermal imaging flights were conducted before sunrise for the greatest thermal contrast between the nests and the marsh vegetation. Suspected nest points were ground-truthed after each flight to confirm that the point was a nest and determine which marsh bird species it belonged to, as it is difficult to distinguish species from the thermal imaging alone. We found that the UAV detected a similar number of Clapper Rail nests to ground surveys in the accessible sites (15 and 19 nests respectively in 2021) and the UAV detected more Clapper Rail nests than the ground surveys where access was low (12 and 2 nests respectively in 2021). We also detected nests of much smaller tidal marsh passerines like Seaside Sparrow (*Ammospiza maritima*) and Red-winged Blackbird (*Agelaius phoeniceus*), indicating that thermal imaging flights with UAVs could be used to document species breeding in tidal marshes. Using the

data collected in 2021 and 2022, we will compare the efficiency of each method of finding marsh bird nests (ground surveys vs UAV) to determine if one method is more efficient than the other at the two intensive study sites. Given the current conservation challenge associated with maintaining tidal marsh breeding birds during rapid increases in sea-levels, a non-invasive and rapid survey method that can efficiently document and quantify breeding can aid in prioritizing marshes for conservation, management, or restoration.

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Comparing survey methods for Leach's Storm-Petrels on a Maine Island

Precise counts of cryptic, burrow-nesting seabirds such as Leach's Storm-Petrels (*Hydrobates leucorhous*) are notoriously difficult to obtain. Detecting burrows, accounting for uneven distributions, and factoring in rates of burrow occupancy are among the challenges that surveys must overcome. Great Duck Island, an 89-hectare island located 19 km offshore in the Gulf of Maine, is the largest Leach's Storm-Petrel colony in the eastern United States. Counts, conducted irregularly over 40 years of research, have all used different methods and have produced widely varied results, making it difficult to draw conclusions about population trends. Our 2022 count, the most extensive completed to date on Great Duck, expanded on a grid-based method used in a 1986 survey. We divided the island into 50-meter grid squares, then surveyed subplots within each square, covering approximately 12.5% of the island's total area. We will present our results in the context of previous studies and discuss the implications of different methods and their outcomes. Finally, we will recommend a method for future counts with an eye towards consistent long-term monitoring of this colony.

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Double-crested Cormorant management in Mississippi

The catfish industry in Mississippi has substantially changed over the last 25 years, going from 110,000 water acres, to currently less than 39,000 as of the last NASS report. Double-crested cormorant impacts to the remaining industry have also changed as management of ponds has gone from open pond structures to split level pond management systems on several farms. Loss of the Double-crested Cormorant Depredation Order in 2016 forced the catfish industry to change how they managed farm level cormorant harassment/depredation programs.

After the vacated order and development of an Environmental Assessment, the U.S. Fish and Wildlife Service established the ability for catfish farmers to apply and be issued depredation permits, allowing for limited lethal take across 37 central and eastern states. In 2017, Mississippi catfish producers were quickly transitioned over to a permit system for limited lethal control on production facilities to reinforce non-lethal hazing and harassment, as was USDA APHIS Wildlife Services. Over time, population monitoring of double-crested cormorants allowed for increased take numbers under US Fish and Wildlife Service depredation permits. The Mississippi WS Double-crested Cormorant management program involves aerial observation of roosts sites, a Delta wide roost count, roost dispersal program, and summer nesting activity monitoring. Several of these activities have been in place for over 20 years. Using a grant, Delta Wildlife has aided Wildlife Services' efforts by developing a farmer text thread letting farmers know when to disperse birds for the roost dispersal program, assisting with on farm cormorant harassment, and assisting with all our other Wildlife Services activities.

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The north of the Yucatan Peninsula is recognized for mantain a high density for Reddish Egret, using the region as a breeding and feeding site, particularly in swamp areas and basin mangrove forests.

However, these habitats has been suffering a very high pressure in recent decades, fragmenting these regions for different causes, such as natural events or human disturbances. This has led to the vulnerability of the species and the loss of mangrove cover for its survival.

Since 2019, together with Pronatura Noreste, CINVESTAV and UNAM, Pronatura Península de Yucatán has been developing ecological mangrove restoration actions for the habitat recovery for the species and the ecosystem services of the mangrove.

This restoration zone covers 270 hectares of mangrove at the Mexican reserve "Ciénagas y Manglares de la Costa Norte de Yucatán, México". The actions include the formation of technical group, including local people as a key piece for the development of the activities, dredging of natural canals and water passages, opening new canals for hydrological recovery. Finally, an afforestation is carried out through dispersal centers, consisting of platforms where propagules and mangrove seeds adjacent to the restoration area are transplanted. Has been implemented a monitoring for restoration success through benchmark indicators and Reddish Egret population, resulting information to apply new rehabilitation actions through adaptive management for the species and its habitat.

It was observed that the hydrological, physicochemical and biological variables (hydroperiod, salinity, temperature, pH, redox potential and seedling growth) at the restoration areas are different from surrounding conserved areas, although with the restoration actions, these are in homologation process. It was observed an increase in the relative abundance of Reddish Egret individuals using the restoration areas comparatively between the years 2019 (abundance of 0.53 individuals/hectare) and 2020 (abundance of 0.87 individuals/hectare). This shows the importance of the habitat restoration for the species and the continuity of actions over time and necessities for increasing the area.

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Selective pressures influence a grow fast, fly young strategy for Black Skimmers nesting in the Peruvian Amazon

The Black Skimmer *Rynchops niger* occupies a wide breeding range that spans both North and South America. We used the pace-of-life syndrome as a framework to compare life history traits of Black Skimmer populations across the Americas. While selective factors influencing reproduction and survival are similar for populations across latitudes, the intensity and variation of these selective factors across populations could drive variation in life history traits creating a gradient of population responses. We compared a suite of traits which included clutch size, daily nest survival rate, hatching success, incubation bout, incubation period, chick growth rates, food provisioning rates, and fledge rates from populations in New York, USA (40˚N) south to populations in Manu (12˚S) and the Brazilian Pantañal (16˚S). Mean clutch size, daily nest survival rate, hatching success, and incubation period did not vary across latitude. Results suggest that chick growth rates in the Manu population were comparable to more northern populations while provisioning, and fledge rates were observed to be higher. We conclude that the Manu skimmers fall on the fast end of the pace-of-life spectrum rather than the predicted slower pace expected for tropical species. High food availability coupled with a tenuous nesting situation appear to select for individuals that exploit abundant food resources and maximize chick growth rates, such that a reduced growth period limits exposure to floods and predators. The result is a pace of life that mimics that of many northern bird populations, wherein food is seasonally abundant but only for a short period of time.

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Taking a peek into the everyday lives of the American Oystercatcher: GPS telemetry reveals important foraging dynamics for individuals nesting in variable habitats

Approximately 400 pairs of American Oystercatchers *Haematopus palliatus* (AMOY) nest in North Carolina with the majority nesting on natural marsh islands or on barrier island beaches (28% and 46%, respectively), while others nest on dredged-material islands (18%). In some regions of the AMOY breeding range, these alternative breeding locations can have up to 17.6 times more breeding pairs per kilometer than barrier island and natural island habitats. The distance between breeding ground and forage location has often been hypothesized as a factor in annual avian reproductive success, i.e., the longer time spent away typically results in an increasing probability of chick mortality. Working under an optimality framework, we hypothesize that AMOY nesting on dredged-material islands may travel longer distances to forage grounds compared to natural marsh and barrier island habitats. Using fine scale GPS telemetry, we examined the foraging dynamics of AMOY nesting in both natural and dredged-material islands. A total of 30 GPS dataloggers were deployed on nesting AMOY during the 2019, 2021, and 2022 breeding seasons. Our research documented that foraging distances were smaller for AMOY pairs that nested in habitats with adjacent foraging grounds compared to locations without adjacent forage. We also documented that all monitored AMOY foraged throughout the night from dusk to dawn (2200-0400) across incubation and chick rearing periods with distinct tidal cycle influences. Data such as what we have collected, could be very valuable to conservation and management planning.

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Monitoring of colonial waterbirds in the Gulf of Mexico: Next steps for the GoMAMN wading bird group

The Gulf of Mexico Avian Monitoring Network (GoMAMN) developed the Strategic Bird Monitoring Guidelines for the Northern Gulf of Mexico (Wilson et al. 2019) to overview threats, challenges, assumptions, and uncertainties and to provide a framework for avian monitoring in the Gulf of Mexico. Within the GoMAMN framework, species were grouped based on their taxonomy and ecology. One of these working groups, the wading bird group, represents 16 species that reside during all or portion of their life cycle in the Gulf of Mexico. The group includes cranes (Gruiformes), herons, egrets, ibises, and spoonbills (Pelecaniformes), and storks (Ciconiiformes). Of these species, the working group identified 9 species and 2 subspecies as priority species for monitoring: Whooping Crane, Wood Stork, Great Egret, Little Blue Heron, Tricolored Heron, Reddish Egret, White Ibis, Roseate

Spoonbill, Florida Sandhill Crane and Mississippi Sandhill Crane. In October 2021, GoMAMN held a Community of Practice Virtual Meeting that included a session on wading birds. During the wading bird session, we discussed the standardization of monitoring guidelines for wading birds to include specific protocols and metrics required. We also discussed completing gap analyses on species monitoring to include what species are being monitored, geographic scope of monitoring and periodicity. The purpose of this presentation within the GoMAMN symposium is to present ideas on next steps as a working group to include monitoring and gap analyses as well as share and discuss other recommended ideas and directions for the working group to advance wading bird conservation throughout the Gulf of Mexico.

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Reddish Egret Conservation Plan 2022-2032: Advancing the strategies and goals for conserving a tidal flat specialist.

The Reddish Egret International Working Group recently developed and drafted a 10-year conservation plan for the species. The overall goal of this conservation plan is to increase Reddish Egret populations by at least 10% over the next decade (~2032). Conservation strategies focusing on monitoring, legal protection, threat mitigation and management, education and outreach, and capacity-building have been developed for the plan. Effective implementation of all strategies is necessary to achieve our overarching goal of population increase. The strategies, within the plan, are presented in order of recommended implementation as the initiation, progress and ultimate completion of a strategy's goals and objectives provide the necessary foundation for initiation and completion of other strategies. For example, Strategy 1 (Implement Population Monitoring) is a critical first step as the assimilation and dissemination of population and habitat data is necessary to strengthen legal protection (Strategy 2), increase protected habitats (Strategy 3) and manage, steward, and restore priority habitats (Strategy 5). Species conservation is a cyclical process of assessment, planning, implementation, analyses and adaptation, and sharing. As the assessment and planning phases have been completed, the Working Group now moves into the implementation phase. We will review the conservation strategies and begin the initial steps of implementation during this symposium on Reddish Egrets.

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Breeding season selection of anthropogenic resources varies across age and pre-breeding movement modes in the American white ibis.

Humans have extensively altered landscape across the southeastern United States, which has resulted in major negative impacts to waterbird habitat in the region. Anthropogenic changes in resource predictability can influence birds' foraging habitat and philopatry to breeding sites, thereby influencing population structure. Additional research on this subject would enhance our understanding of human-related impacts on waterbird populations. To help fill this knowledge gap, we tracked movements of twenty-three American white ibises in the northern Gulf of Mexico (*Eudocimus albus*) across multiple subsequent breeding seasons. The white ibis is known to facultatively forage in human-altered landscapes and may alter its movements to capitalize on available resources. We hypothesized that ibises which dispersed from their previous breeding range would be less likely to select anthropogenic resources, compared to individuals that returned to their previous breeding range. Further, we expected that inexperienced subadult birds would be more likely to rely on stable resources in human-altered landscapes, compared to adults with more foraging experience. To test this hypothesis, we estimated average cover of human-altered landscapes (pastures, croplands, and developed areas containing roads, parking lots, buildings, or other human infrastructure) across the breeding home ranges of seventeen white ibises from 2020 to 2022. We used logistic regression in a resource selection framework to estimate the probability that an individual would select anthropogenic resources during the breeding season. Dispersing white ibises tended to select against anthropogenic resources, while residents and migrants did not show a strong preference for or against these human-altered landscapes. Counter to our expectations, we found that subadults selected against anthropogenic resources, while adults did not select for or against human-altered landscapes. Our results indicate that anthropogenic resources influence resource selection of white ibises, and that this effect is modulated by age and movements prior to the breeding season. This suggests that human-caused landscape change is influencing wading birds' movement and habitat in the northern Gulf of Mexico. This analysis represents preliminary data from an ongoing project on wading bird movements and resource selection.

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Examination of habitat use by Laughing Gulls (Leucophaeus atricilla) in both developed and undeveloped areas of the Lower Galveston Bay Watershed

Laughing Gulls (LAGU) (*Leucophaeus atricilla*) are native, year-round residents of the Mid-Atlantic and Gulf Coasts. LAGU, like many gull species, feed on both natural food sources

and anthropogenic sources. We examined existing LAGU observation data to determine where LAGU concentrated in the Lower Galveston Bay Watershed during breeding and non-breeding seasons. Bird presence data was obtained from citizen science platforms (eBird, iNaturalist). Data was grouped into five year sections- 2005-09, 2010-14, 2015-2019. Records from April-August were further grouped as "breeding" season, while records from September-March were labeled as "non-breeding." As online citizen science reporting was just being developed at the early end of the study period, direct number comparisons would yield poor results. Every record was assigned a factor value that was a percentage of all individual birds counted during the time period. We ran an optimized hotspot analysis on shapefiles for breeding and non-breeding seasons. Hotspots in West Bay and the opening of Galveston Bay into the Gulf of Mexico were present in all years. In later years, hotspots occur around west Baytown, the Brazos River delta, and wetlands on Brazoria NWR. In non-breeding seasons, populations were more dispersed, but still utilizing several of the breeding season sites. A GIS space time cube was created to analyze population trends over time. The west side of Galveston Bay and inland remained a persistent hotspot for reports. New hotspots were clustered to the west and north- indicating that more reports have occurred in recent years in these inner city and outer loop areas. A ring of emerging hotspots is visible southwest of Lake Jackson and the Brazos River. This work indicated several broad conclusions: gulls clustered near major waterway intersections, there is some activity related to landfills and parks, there were more reports to the west and north of the bay over time, and hotspots/ higher densities were shifting inland during non-breeding months. Previous large-scale analyses in the Galveston Bay region have only used Texas Waterbird Society rookery surveys. Citizen science data offers a different view of LAGU habitat use across a rapidly urbanizing landscape.

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Who said "*kickee-doo*" and other insights into the vocal repertoire of the Eastern Black Rail

The Black Rail is among the most secretive of the secretive marsh bird species in North America. The eastern subspecies (*Laterallus jamaicensis jamaicensis*) was recently listed as federally threatened, prompting increased research into the distribution and status of this previously understudied bird. Since Black Rails are far more often heard than seen, understanding the vocal repertoire is critical to making accurate assessments and effective conservation decisions. Beyond the three most common call types, published terminology describing Black Rail vocalizations is inconsistent and incomplete. Interpretations of most call types are also lacking. Beginning in 2015, the South Carolina Department of Natural Resources has been collecting acoustic recordings and videos of Black Rails as part of a larger project focused on developing and implementing effective management strategies to

promote breeding success and survival. We have cataloged and interpreted eight call types used by adults and five juvenile call types. We provide a more consistent and complete set of terminology for vocal repertoire of the subspecies.

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Abundance of Eastern Black Rails in southeastern Colorado

Eastern black rails (*Laterallus jamaicensis*) are notoriously cryptic and difficult to study. Their elusive nature makes population estimation difficult. Surveys rely heavily on acoustic observations and are largely aimed at occupancy estimation. Black rail use of high salt marshes along the gulf and mid-Atlantic coast make them susceptible to habitat loss due to rising sea levels and urbanization. This habitat loss and observed population declines resulted in the species being federally listed as threatened in 2020. Due to the low detection probabilities and patchy distribution along the coast, occupancy modeling is used to document presence and response to management. However, being able to estimate abundance would allow for a more complete understanding of the impacts of management on the species, especially in an area with high levels of occupancy, such as Southeastern Colorado. This population provides a unique opportunity to test different abundance models with robust sample sizes. From 2019-2022, we conducted broadcast surveys at 98 locations across the Arkansas River Valley in Southeastern Colorado. In addition, during the summer of 2022, we tested the efficacy of acoustic recording units to detect individual rails. Both in-person and remote surveys will be used to estimate abundance and compare model outputs. The results of this work will inform future recommendations on the best practices for estimating eastern black rail abundance.

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Use of prey in relation to availability by red knots in Virginia during spring migration using fecal DNA metabarcoding

Every year during spring migration, thousands of federally-threatened migratory red knots (*Calidris canutus rufa*; knots hereafter) use Virginia's barrier islands as stopover habitat to regain the fat required to continue flights to breeding grounds. While previous studies suggested that knots in Virginia primarily consumed bivalves (i.e., coquina clams, *Donax variabilis*; blue mussels, *Mytilus edulis*), no study has confirmed that these knots preferentially consume bivalves or whether other invertebrates are also consumed. Knots have fast digestive turnovers (~ 56 minutes), meaning that the composition of their feces likely varies based on foraging location within the past hour. To determine which prey were available to foraging red knots, we collected substrate core samples containing prey on sand and peat substrates in May 2017 – 2019. We also collected red knot feces during the same period and used fecal DNA metabarcoding to determine which invertebrates red knots consumed. We then used compositional analysis to determine which prey red knots selected on these islands. Crustaceans (Orders Amphipoda and Calanoida) were the most abundant prey available on both sand and peat, though red knots consumed bivalves (Orders Venerida and Mytiloida), crustaceans (Orders Amphipoda and Calanoida), and insect larvae (Order Diptera). Red knots selected bivalves over non-bivalve prey, though non-bivalve prey may still be an important portion of the total caloric intake on Virginia's stopover, given their abundance and use. It is important that coastal conservation practices in the Western Mid-Atlantic stopover region continue to be designed to promote natural barrier island movement which leads to the formation of the peat banks used by many prey.

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Breeding site environmental conditions and flyway intertidal habitat influence survivorship of an Arctic-breeding shorebird

The *arcticola* dunlin (*Calidris alpina arcticola*) is an Arctic-breeding shorebird that migrates along the East Asian-Australasian Flyway (EAAF) to non-breeding areas around Japan, Taiwan, and China. Previous studies estimated *arcticola* adult survival at unsustainable rates, and concluded poor conditions on the non-breeding grounds could account for low survival. We used a Barker modeling approach to estimate true survival rates of adult *arcticola* by using 19 years (2003–2021) of capture, recapture and resight data, collected from the Utqiaġvik, Alaska breeding area, along with ~120 resighting observations collected from arcticola non-breeding sites. Our true adult survival rate (S = 0.70, 95% CI = 0.45–0.83) 20% higher than previous estimates conducted at Utqiaġvik (2003–2009, Hill 2012), and, over multiple arctic sites (2010–2014, Weiser et al. 2018). The higher survival rate may be attributed analyzing data over different temporal or spatial scales, but is likely

due to off-site resight data accounting for emigration from initial capture sites at the breeding location. Model comparisons suggest both breeding-site and non-breeding site environmental factors affect survival. Our preliminary analysis shows that the breeding-site variables (date of 20% snow-cover, days below minimum temperature, precipitation, predator abundance, and fox control) with the addition of tidal-flat changes on the non-breeding region account for 62% of the model variation predicting *arcticola* annual survival.

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Endoparasite Community of Order Gruiformes in South Florida

In South Florida, wading birds from Order Gruiformes are common along wetland environments, where their diet consists of snails, insects, worms, and other opportunistic prey. An important, but understudied, aspect of their biology is the diversity of endoparasites within their gastrointestinal system. In addition to potentially harming their hosts, these parasites represent connections between trophic levels, play key ecological roles, and can indicate ecosystem health. There have been previous studies identifying the endoparasitic communities in Gruiformes, however comparisons between species and rare event species communities have yet to be examined. For this project, 60 birds from eight Order Gruiformes species were examined for endoparasites. Within the Family Rallidae, the American Coot (*Fulica americana; n=8*), Common Moorhen (*Gallinula chloropus; n=14*), Sora (*Porzaba Carolina; n=7*), Purple Gallinule (*Poryphyrio martinicus; n=7*), Virginia Rail (*Rallus limicola; n=2*), and King Rail (*R. elegans; n=1*) were examined, as well as the Limpkin (*Aramus guarauna; n=20)* from Family Aramidae and the Sandhill Crane (*Antigone canadensis; n=1)* from Family Gruidae. The trachea, esophagus, stomach, intestines, and cloaca were examined, as well as intestinal and stomach washes. The parasites were then stained in acetocarmine and identified to the lowest possible taxon. Endoparasite examinations revealed that these birds host diverse parasite communities including members of Acanthocephala, Nematoda, Cestoda, and Digenea. Echinostomes (Digenea) were the most abundant intestinal parasites across all birds, and were particularly prevalent in *Aramus guarauna*. Acanthocephalans were the least abundant, and were only found in five birds. Parasites were only rarely encountered in the stomach 36 across all carcasses. *A. guarauna*, *Poryphyrio martinicus*, and *Gallinula chloropus* were the only species in which stomach parasites were observed. Between species, *Gallinula chloropus* possessed the highest percentage of infected individuals and *Fulica americana* had the heaviest parasite load among examined species with 19.7 parasites per bird. *Porzaba carolina* had the lightest parasite load at 1.3 parasites per bird. With this study, the dynamics of the endoparasites and their corresponding avian species are explored, along with any similarities and

differences of the parasitic communities between host species. These comparisons can then be further used to describe each Gruiformes species' role in their environment.

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An atlas and registry for seabird colonies and associated habitats in the northern Gulf of Mexico

The coastal zone of the northern Gulf of Mexico supports a diverse array of breeding nearshore seabirds that nest colonially on islands, in marshes, on mainland beaches, and human-made structures. Although nest-site fidelity is common among seabirds, the dynamic nature of the coastal zone can result in inter-annual shifts in the locations of colonies and in the existence, size, or stability of the islands or habitats that support them. Such changes can subsequently affect not only the location of breeding sites for seabirds, but also the population size or structure, as well as likely foraging locations. Overlaid on this dynamic system is a stakeholder network responsible for management of these species and their breeding habitats that includes natural resource agencies from five states, multiple federal agencies, and numerous private organizations. There is no single source of information for seabird nesting sites in the northern Gulf of Mexico that is current or readily accessible. Information and data regarding the location and status of seabird colonies is scattered among the stakeholder network and difficult to source. The strategic monitoring guidelines recently released by the Gulf of Mexico Avian Monitoring Network (GoMAMN) highlighted the need for a spatial inventory of breeding sites to support energy development and marine spatial planning, oil spill response, restoration planning, habitat management, and monitoring and research. We seek to address this information gap by creating an atlas and registry for seabird colonies in the northern Gulf of Mexico that will integrate existing data from the stakeholder network. A steering committee will guide the process including the final structure and function of the products. The development of these products is a critical step in understanding the distribution and status of breeding seabirds in the region.

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Finding a home: nesting density and fledging success between three habitats

in Herring Gulls (*Larus smithsonianus*)

Understanding how different habitats influence nesting birds and fledging success has important implications for management and conservation. Colonial seabirds are long-lived, nest in dense colonies, and often travel long distances to forage during the breeding season. These factors may influence their use of different habitats within their colonies. This study aims to understand why Herring Gulls (*Larus smithsonianus*) nest in different densities within a colony of approximately 700 pairs on Great Duck Island, ME (44° 09' N. 68° 15' W). Although much of the island appears to be unused habitat, the majority of gulls nest on the rocky shoreline in high density, while fewer gulls nest in lower densities in high vegetation and open meadow habitats. Adult gulls were color banded and nest locations were mapped into an island-wide GIS, which will allow us to compare site fidelity within and between each habitat over subsequent years. We conducted daily nest checks to record survivorship and basic morphometrics on 53 nests across these three habitats and showed that there was no significant difference in fledging success between habitats. In year two, we will investigate other aspects of each habitat that may explain the differences in the density of nesting Herring Gulls.

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Can solar garden lights deter nocturnal predators at Common Tern nesting sites? An experimental study

Nocturnal predation by Black-Crowned Night Herons (*Nycticorax nycticorax*) is a major cause of chick and egg loss at Common Tern (*Sterna hirundo*) colonies and a common cause of colony failure. However, few prevention methods are known to deter this behavior. Anecdotal evidence from a Lake Champlain tern colony suggested that artificial lighting might deter night heron predation. We investigated whether lighting affects night heron nocturnal behavior and hypothesized that activity of night herons and predation intensity would decrease in the presence of artificial lights. Twenty-two tern nests were studied in ~24 m² control and experimental plots at Little Island, Oneida Lake, NY, in 2021. Sixteen low-intensity, solar garden lights were placed in a 4 x 4 grid pattern within the experimental plot. Night heron presence and behavior was recorded by trail cameras taking timelapse and motion-sensitive photos and videos. Behavior of nesting Common Terns was quantified to screen for potential adverse effects of solar lights. Black-Crowned Night Herons were detected significantly more frequently in the control plot than the experimental. Additionally, more chick and egg predation occurred in the control plot. Common Terns did not alter their incubation behavior in the presence of solar lights. Our

results supported the hypothesis that night heron activity and predation intensity was reduced in areas with artificial lights. Night herons appeared to focus nocturnal activities in vegetated areas of the control plot, suggesting that concealment might also be preferred. Although promising, since only a single night heron was observed during this study, further work is required to assess the general utility of artificial lighting as a management tool.

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Ontario cormorant policy, influence on management actions and preliminary results from year one of a cormorant hunting season.

Cormorants are not protected federally under the *Migratory Birds Convention Act* in Canada. In Ontario, cormorants, their nests and eggs are protected under the provincial *Fish and Wildlife Conservation Act* (FWCA).

Ontario's objective is to maintain cormorants as an important component of the aquatic ecosystems of Ontario. However, policy enables the government of Ontario to consider cormorant management on Crown land if the birds are found to be having significant negative, ecological impacts on specific habitats or other species. This approach has resulted in government-led management to protect natural heritage values at one provincial park.

Ontario does not manage cormorants on private land. Protection of private property rights under the FWCA allow landowners to harass or kill cormorants on their own property, without any authorization, to prevent damage. Hunters with a small game licence can act as an agent to support a private landowner addressing damage concerns on their property.

In 2020, Ontario re-designated the Double-crested Cormorant (*Nannopterum auritum*) as a "game bird" and established a hunting season, while retaining other aspects of provincial cormorant policy. The season was established in response to ongoing concerns from some members of the public and stakeholders about perceived cormorant impacts. Preliminary results from year one of the hunt indicate a small number of hunters participated, with highly variable effort and harvest.

Insights gained from the last 20 years of cormorant policy, management and science efforts in Ontario will be discussed.

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Potential avian predators of Piping Plover: a study at Fire Island, NY in 2022

The Piping Plover (*Charadrius melodus*) is a federally-threatened shorebird that relies on nesting habitat along the Atlantic coast, including in New York. A variety of management strategies to protect nesting plovers at Fire Island, NY, target mammalian predation, though the impact of avian predation remains largely unknown. We identified potential avian predators of Piping Plovers present at Robert Moses State Park and the Fire Island Lighthouse during the summer of 2022. We recorded abundance and behavior for raptors, gulls, corvids, blackbirds, and other shorebird species (*i.e.* Ruddy Turnstone *Arenaria interpres* and American Oystercatcher *Haematopus palliatus*) that are known or suspected to take Piping Plovers or their nests. During routine monitoring activities, we made instantaneous counts of potential avian predators while in plover nesting areas from early June to mid-August and recorded their habitat (*e.g.* intertidal, wrack line, dry sand), behavior (*e.g.* loafing, foraging), and flock size. Gulls were the most abundant potential avian predator and were observed daily (Great Black-backed Gull *Larus marinus* = 122.1 birds/day, Herring Gull *Larus argentatus* = 58.0 birds/day, and Lesser Black-backed Gull *Larus fuscus* = 35.5 birds/day), though we detected little evidence of gulls taking plovers. Peregrine Falcons (*Falco peregrinus*) were seen infrequently (0.3 birds/day), but were observed hunting nesting shorebirds, including confirmed takes of plovers. Our observations will be used to construct a map of avian predator density across the area monitored in relation to locations of Piping Plover nests and broods. Understanding the distribution and types of avian predators present can inform future management decisions such as modifying potential perches and vegetation control.

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Camera trapping Black Rails in coastal Texas

Camera traps are useful for exploring questions about the behavioral, natural history, and fine-scale habitat use in waterbirds including the threatened Eastern Black Rail (*Laterallus jamaicensis jamaicensis*). We compared two different strategies for camera trap placement when sampling for Black Rails. We surveyed along the Texas mid-coast in the San Bernard National Wildlife Refuge complex during the spring months of 2021 and 2022 coinciding with the Black Rail breeding season. Reconyx Hyperfire 2 camera traps (n=10) were factory focused to 0.6 meters and were set for 7 trap nights in all cases for both seasons. Cameras were placed at 90 pre-determined points in the 2021 season and at 80 points during the

2022 season. In the 2022 season we allowed more observer discretion with camera placement, as auditory survey data, and habitat characteristics were considered when placing camera traps. Specifically, we placed cameras in high salt marsh habitat in patches of gulf cordgrass *(Spartina spartinae)* with a high amount of canopy cover and with little bare ground visible. In some cases, cameras were placed under large wrack lines within high salt marsh habitat consisting of stalks of smooth cordgrass (*Spartina alterniflora*) produced by the high-water events caused by hurricane Harvey in 2017. Cameras were focused on natural spaces between the vegetation, with small sprigs of vegetation being pinned back or trimmed to avoid obstruction of the motion sensor. In 2021, 0 Black Rails detections were captured at 90 camera sets. In 2022, we captured 21 detections at 11 of the 80 camera sets. While camera traps have been successful in studying Eastern Black Rails, care needs to be taken with microhabitat selection and camera placement to increase detectability of this secretive species.

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Developing machine learning algorithms for automated precise waterbird monitoring

In recent years, object detection, the task of localizing one or more objects in an image with corresponding classifications, has seen immense progress in the field of computer vision consequential to the advancements of deep learning. However, the adoption of deep learning-based object detectors for precise waterbird monitoring has remained limited. In this work, we develop a deep learning-based object detection pipeline for the task of detecting colonial waterbirds from drone imagery. We outline the steps needed to prepare a dataset to train convolutional neural network-based object detectors, and how these detectors can be deployed for real-world applications. We apply our method to the task of detecting 16 classes of waterbirds commonly found in nesting islands along the Texas coast. We observe that our models achieve over 90% average precision on three of the most common waterbird classes, and over 80% average precision on six of the most common waterbird classes. Finally, we highlight future directions of our work, including the enhancement of our models to distinguish visually similar waterbirds, such as Royal Terns

(*Thalasseus Maximus*) and Sandwich Terns (*Thalasseus sandvicensis*), and the expansion of our models to detect a larger number of waterbird species with greater accuracy.

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Toward reducing the conflicts between native cormorants and local residents -- Knowledge discovery from historical records and its application to current conflicts

The Great Cormorants (*Phalacrocorax carbo*) have increased rapidly in recent years and have been causing the damage on inland fisheries and forests in Japan. However, the cormorants have been closely associated with people, in particular, there is a complex interrelationship between cormorants, forests, and local residents. We clarified the historical relationship between them from avian ecology, vegetation ecology, historical folklore, and environmental sociology, and are trying to explore knowledge and perspectives to reduce current conflicts by using temporal information analysis. We examined the cases of Chikubu Island in Lake Biwa, Shiga Prefecture, Japan, where the great cormorants and local residents have been fighting each other for a long time, and Unoyama in Aichi Prefecture, where the cormorants and local residents have had mutualistic relationships for more than 100 years. In this presentation, we would like to mainly show the results of Chikubu Island.

We discovered old documents describing the increase of the great cormorants and herons in Chikubu Island in 1860s-1880s and 1920s-1940s, which led to the damage on forest and fisheries and implementation of measures to reduce it. Maintenance of the forest was especially important on Chikubu Island. In the 1960s-1970s, the number of the great cormorants declined nationwide due to development and the harmful chemicals. Probably because of this era, many local residents recognize that there weren't many cormorants in Lake Biwa in the past. At the same time, the great cormorants were recognized as threatened species and it was hesitated to take drastic measures. This shows that absence of cormorants may have prevented the transfer of previous records and memories on the conflicts with cormorants when the cormorants increased again in 1980s.

Based on these findings, it is suggested that familiar native species such as the Great Cormorant have been repeatedly in conflict with people from the past, and as a result, large population dynamics might have been repeated. Economic activities and social systems have changed at the same time. It would be necessary to consider countermeasures based

on such complex and dynamic changes in order to reduce the conflict caused by native species.

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Status and future direction of the GoMAMN Renewable Energy Working Group

The Renewable Energy Working Group (REWG) began virtual meetings following the 2021 GoMAMN Community of Practice (CoP) to leverage key stakeholders' expertise on the Gulf of Mexico (GoM) avian community and offshore wind development to inform research and regulatory decision-making aimed at minimizing impacts of offshore wind development in the GoM. Offshore wind development is progressing quickly in the GoM, and there is a need to support near-term decisions while ensuring research efforts are in place to assess the effects of offshore wind on bird populations. The REWG is open to all interested parties and currently consists of a diverse group of state and federal agency, academic, and NGO scientists and stakeholders, seeking to ensure that siting decisions, risk assessments, and mitigation efforts are aligned and supported by the best available science and monitoring efforts. Following the CoP meeting, the group identified the following overlapping broad topic areas as high-priority needs for the GoM: 1) data portal/repository; 2) distribution and movement patterns (e.g., spatially and temporally, including elevational movements); 3) attraction avoidance (e.g., testing technologies, understanding causes of displacement); 4) monitoring (inform siting and baseline for post-development comparison); 5) vulnerability assessment. We will discuss these in more depth and highlight how the group collaborated on a response to a call from BOEM for study ideas to integrate components of these priorities into a submission describing five potential study ideas. The group continues to build on these ideas while sharing funding opportunities addressing these needs and is currently assembling a team to identify priority knowledge gaps and needs for a vulnerability assessment for the GoM avian community. These will be shared with the wider group to address further needs and knowledge gap priorities already identified by the group. The team developing a research priorities statement to communicate with regulatory and industry stakeholders and further guide future discussions.

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Recent contribution of rescued eggs to the endangered Great Lakes Piping Plover population

Rescuing eggs from abandoned nests has been a method to aid recovery efforts of the federally endangered Great Lakes Piping Plover (*Charadrius melodus*) since 1992. Chick captive-rearing (CR) methods have become more refined over time. We sought to determine how these refined efforts have impacted the survival and productivity of CR birds relative to wild-reared (WR) birds (2015-2022). We compared nest survival of WR and CR birds by age, sex, and use of nest exclosure. Nest exclosures were found to increase survival of nests in all cases. WR females were found to have higher nest survival than CR females, but WR males had lower nest survival than CR males. Males nesting for the first time had lower nest survival rates than older males and females of both age groups. We used Barker models to compare survival, and site fidelity of WR and CR birds by age and sex. We found that survival was overall low compared to other studies ($0.27 - 0.727$), that WR birds had higher survival rates than CR birds, that WR birds showed a lower propensity to nest at their natal site during their first breeding attempt than CR birds were to nest at their release site, and that adult WR birds had higher breeding site fidelity than CR birds. First time breeding males were the exception to this pattern, as CR males were more likely to survive to their second year than WR males. Survival of first year breeding birds was much higher in our study than in earlier studies (Roche et al. 2008) but survival of 2+ year old birds was somewhat lower. These findings indicate that low adult survival rates, especially for males, may be cause for concern for the expansion of the population despite years of high nest survival. The inclusion of CR birds was found to increase population size, and small-scale egg rescue is recommended for boosting imperiled species populations.

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Optimizing number and distribution of transmitters to maximize population-level representativeness in automated radio telemetry studies of animal movement

Telemetry is a powerful and indispensable tool for evaluating wildlife movement and distribution patterns, particularly in systems where opportunities for direct observation are limited. However, the effort and expense required to track individuals often results in small sample sizes, which can lead to biased results if the sample of tracked individuals does not fully capture spatial, temporal, and individual variability within the target population. To

better understand the influence of sampling design on results of automated radio telemetry studies, we conducted a retrospective power analysis of very high frequency (VHF) radio telemetry data from the Motus Wildlife Tracking System for two species of birds along the United States Atlantic Coast: a shorebird, the piping plover (*Charadrius melodus*), and a nearshore seabird, the common tern (*Sterna hirundo*). We found that ~100-150 tracked individuals were required to identify 90% of receiver stations where at least one individual was detected, with 40-50 additional individuals required to include 95% of stations where detections occurred. For any number of individuals, the percentage of stations included in the sample was higher for common terns than for piping plovers when tags were deployed within a single site and year. Percentages of stations included increased for piping plovers when birds were tagged over multiple sites and, to a lesser extent, years, and increased with average length of the tracking period. The probability that any given receiver station used by the population would be included in a subsample increased with the number of birds tracked, station proximity to a migratory stopover or staging site, number of receiving antennas per station, and percentage of the tracked population present. Our results provide general guidance for the number and distribution of tagged birds required to obtain representative VHF telemetry data, while also highlighting the importance of accounting for station network configuration and species-specific differences in behavior when designing automated radio telemetry studies to address specific research questions. Our results have broad applications to remotely track movements of small-bodied migratory wildlife in inaccessible habitats, including predicting and monitoring effects of offshore wind energy development.

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Rapid loss of maternal immunity and increase in environmentally mediated pathogen exposure in urban gull nestlings

Urban wildlife can play an important role in disease circulation between animal and human populations. Generalist coastal marine birds such as gulls (Laridae) are highly mobile, interact regularly with human activities, and contribute to the spread of pathogens among population centers, making them promising sentinels for detecting and monitoring the circulation of zoonotic pathogens. While adult gulls may move long distances during the annual cycle, disease exposure in nestlings can provide a localized index of disease circulation. However, evaluating disease exposure in early life is complicated by the fact that antibody levels represent a combination of maternally-transferred immunity, which decreases over time, and local environmental exposure, which increases over time. To evaluate the relative contributions of maternal and environmental antibodies during development, we studied the dynamics of immune responses to three pathogens—avian

influenza virus (AIV), *Toxoplasma gondii*, and infectious bronchitis virus (IBV)—in nestlings of yellow-legged gulls (*Larus michahellis*). We exchanged eggs between nests and repeatedly sampled nestling antibody levels after hatch, allowing comparison of nestlings with similar innate immunity raised under differing levels of environmental exposure. We found differences in prevalence among the three pathogens, with AIV being widespread, *T. gondii* occasional, and IBV absent. Rates of decline in maternal antibodies were similar among pathogens; however, AIV had higher starting values and took longer to reflect environmental influences (25 days) than *T. gondii* (15 days). After this time, differences between biological and foster siblings were comparable, suggesting that environmental exposure rates are relatively consistent among nests. Our results highlight the utility of nestling antibody levels for long-term surveillance of pathogen circulation, as well as the importance of considering chick age and underlying pathogen prevalence in sampling design.

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Prey and tidal state affect the presence of Sanderling and Dunlin on Virginia's Barrier Islands during peak Spring migration

Conservation of migratory shorebirds requires understanding their prey selection on staging sites. We studied two long-distance migratory shorebirds, Sanderling (*Calidris alba*) and Dunlin (*Calidris alpina*), during their spring migration stopover on Virginia's barrier islands from 2007-2018. Our objectives were to 1) compare the abundances of prey found at sites used versus not used by Dunlin and Sanderling and 2) assess the influences of prey abundance and tidal state on whether Dunlin and Sanderling were present or absent at sites on sand and peat substrate on the barrier islands off the Eastern Shore of Virginia from 2007-2018. We monitored spring migrant shorebirds and their prey from May 21 – May 27 each year at random points on eleven barrier islands in the Virginia Coast Reserve. We employed Wilcoxon rank sum tests and logistic regression to determine if prey abundances or tidal state was linked to the presence of each species at sampling points. Available prey items in peat and sand substrates samples consisted of crustaceans, blue mussels, coquina clams, and miscellaneous prey including angel wing clams, horseshoe crab eggs, annelids, snails, and insect larvae. Sanderlings used 79% of sampling sites and were observed foraging in areas that had more crustaceans than random points. Dunlin only used 47% of available sites and selected sites with higher abundances of crustaceans, bivalves, insect larvae, and polychaete worms than random points. Only Dunlin had a

relationship with tidal state and were more likely to be absent on the barrier island beach during low and rising tides than high tide. Our study offers new insights into migratory shorebird diets on Virginia's barrier islands and provides an opportunity to study habitat-population relationships with understudied yet prevalent species that are declining along the Atlantic flyway.

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Using UAVs as a low-impact sampling approach and machine learning to estimate colony size and density at Aleutian tern colonies in Alaska

Aleutian terns (*Onychoprion aleuticus*) are a coastal nesting seabird with breeding colonies found exclusively in Alaska and Russia. Population declines in the Alaska portion of its range prompted an effort to design a statewide monitoring program beginning in 2015. Aleutian terns nest at relatively low densities compared to other tern species and colony disturbance can be a limiting factor to nesting success. Survey methods to estimate abundance have traditionally relied on colony flushes to count birds in the air, and standardized, low-impact monitoring protocols are needed. During the 2018-2019 nesting seasons, we used unmanned aerial vehicles (UAVs) to photograph Aleutian tern colonies with the objective of generating unbiased estimates of colony-wide abundances and densities while limiting human-caused disturbances. To estimate the number of adult terns present at each colony, we developed a customized neural network to search for and detect terns in UAV-derived photographs using a fully automated (i.e., no verification) method and a computer-assisted (i.e., human verification) method. Because Aleutian terns often nest sympatrically with arctic terns (*Sterna paradisaea*), and it is difficult to distinguish between the two species in the UAV photographs, we trained the detector to detect "terns" and relied on species ratios collected by human observers during UAV surveys to allocate tern counts by species. The fully automated detection method produced substantial false positive tern identifications or occasionally failed to flag terns present in the photos (i.e., false negatives); however, results of the computer-assisted method were more promising. Counts from the computer-assisted method were lower, but generally in-line with, contemporaneous direct counts of terns conducted by experienced observers in 2018. The lower counts were likely a function of the UAV photography not capturing flying birds and accounting for flying terns during the 2019 UAV surveys helped alleviate some count discrepancies. We were successfully able to fly UAVs over tern colonies in Alaska without causing colony disturbances, and found that photographing Aleutian tern colonies using

UAVs and computer assisted photo enumeration to be an efficient and accurate method for assessing colony-wide abundance and density of Aleutian terns.

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A status assessment of the Double-crested Cormorant in Oregon

Oregon supports a large proportion of the western population of Double-crested Cormorants (*Nannopterum auritum*); however, breeding abundance within the state has recently declined, both as an expected result of management and from other factors. Abundance at colonies in the Columbia River estuary and on the Oregon Coast declined from 16,409 breeding pairs in 2014 to 7,521 pairs in 2021. Most of this decline is attributable to the collapse of the East Sand Island colony in the Columbia River estuary, which was the largest in the region prior to federal management to reduce colony size. Likely contributing factors to the collapse of this colony were management by the Army Corps of Engineers, which involved large scale culling of adults and nest take, and colony disturbances by Bald Eagles. Concurrent with the collapse of the East Sand Island colony, breeding abundance increased dramatically at the nearby Astoria-Megler Bridge colony and other estuary colonies, apparently because of recruitment of cormorants displaced from East Sand Island. As a result of redistribution of individuals to new colony sites, a reduction in cormorant predation on imperiled salmonids, the rationale for management of the East Sand Island colony, is unlikely to have been achieved. Along the Oregon Coast, average breeding abundance during 2017-2021 declined 31% compared to 2009, when the last regional status assessment was conducted. An apparent contributing factor to this decline was an increase in Bald Eagle disturbances at colonies. The decline in coastal Oregon suggests limiting factors for the western population, which has declined approximately 32% since management on East Sand Island began in 2015. However, the precision of population estimates associated with the regional monitoring plan has been poor in recent years, complicating efforts to estimate the severity of the recent decline and evaluate the impact of a recent substantial increase in allowable take for the western population. To improve precision and reliability of monitoring, a revised status assessment is warranted over the near term for the western population of Double-crested Cormorants that includes identifying and surveying all active colonies across the region.

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The declining conservation status of Caspian Terns in the Pacific Flyway

Since 2000, a large portion of the Caspian Tern (*Hydroprogne caspia*) population in the Pacific Flyway of North America (regional population) has nested on East Sand Island in the Columbia River estuary. This colony has been managed since 2008 under a federal management plan that sought to reduce tern predation on imperiled steelhead and salmon (salmonids) within the Columbia River basin, while promoting the conservation status of the regional Caspian Tern population by creating and managing alternative colony sites across the flyway. Although the management plan was successful at reducing tern predation on salmonids, the breeding abundance of Caspian Terns has declined far lower than anticipated, both within the Columbia River estuary and regionally. Under the management plan, East Sand Island was expected to support a minimum of 3,125 pairs annually; however, the colony supported only 2,387 and 2,050 breeding pairs in 2020 and 2021, respectively, and it appears no more than about 500–1,000 pairs attempted to nest on East Sand Island in 2022. Productivity on East Sand Island has also been low; during 2017—2022, terns have either failed to fledge offspring (n = 4 yrs) or experienced productivity < 0.25 chicks per pair (n = 2 yrs). Recent work suggests the primary proximate causes of declining abundance and productivity at this colony are disturbances by Bald Eagles and subsequent nest depredation by gull species. Concurrent with the recent decline of the East Sand Island colony, the regional Caspian Tern population has declined in turn. In 2021, the minimum census estimate for the regional population was 7,658 breeding pairs, about 46% of the minimum census estimate in 2008, the year management was first implemented. Adaptive management to increase productivity at East Sand Island and to create and manage alternative colony sites elsewhere in the flyway is warranted if managers wish to avoid a sustained decline in the status of the regional Caspian Tern population.

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Investigating the role of contemplative and steering approaches to mitigate recreational disturbance to waterbirds

Wildlife disturbance goes hand in hand with increases in coastal recreation. Specifically, waterbirds have been experiencing heightened threats of this nature along the Texas coast, hindering their ability to thrive. The Texas Parks and Wildlife Department must find ways

to balance the well-being of waterbirds, while simultaneously formulating strategies to manage a bourgeoning coastal recreation and tourism industry. To mitigate recreational disturbances to waterbirds, we explored the utility of contemplative pedagogy, an approach to teaching and learning focused on attention, reflection, and heightened awareness. In secluded environments that lack rules and regulations, law enforcement patrols, or spectators, such as the rookery islands that waterbirds inhabit, contemplative approaches may be a pathway to help recreationists manage their own behavior through, for example, enhanced empathy and communication. However, few studies have explored the role of contemplative approaches in this context. To fill this gap, we investigated the role of mindfulness, one popular type of contemplative approach, to elicit recreationists' level of intention, attention, and attitude towards waterbird populations in four locations on the Texas coast. We conducted 20 semi-structured interviews with guides, anglers, boaters, and non-motorized recreationists. Participants were selected based on extensive experience in decision making, communication, or coordination about improvements for waterbird conservation. Preliminary findings indicate that study informants' deficient knowledge of waterbird populations played a role in their willingness to adhere to prospective waterbird conservation mechanisms such as restricted access and no wake zones. Without a rudimentary level of comprehension on the status of waterbird populations, recreationists stated they unknowingly cause increased pressures to waterbird populations, though it may be perceived that they intentionally enter restricted sites. Data also suggests that self-policing plays a strong role in the effort to conserve and protect waterbird populations. Recreationists who were more thoughtful about their intentions, attention, and attitudes towards waterbird populations emerged more likely to conserve waterbirds. We conclude that wildlife managers who design their education and outreach programming to target mindfulness will likely achieve higher rates of compliance with pro-waterbird guidelines and policies, thereby, decreasing waterbird disturbances due to coastal recreation.

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If you build it, will they come? Assessing habitat quality for birds at created marshes in southeastern Louisiana.

Habitat loss from natural and anthropogenic processes threatens wetland bird populations along the northern Gulf Coast. In Louisiana, marsh creation projects are utilized to combat marsh loss, however, the effectiveness of such efforts on wetland dependent wildlife is not well understood. Site-specific hydrologic conditions directly affect habitat suitability for

wetland bird species and dictates the vegetation community that will establish at the site. The necessary hydrologic features are often lacking from created marshes in Louisiana due to the high elevation at which many are built. Our study compares bird species richness, occurrence, vegetation, and site-specific hydrology between natural and created marshes across southeastern Louisiana. We conducted point counts and vegetation surveys at six created and six natural marshes in 2021 and at 10 created and 10 natural marshes in 2022. All species of birds seen and heard were recorded and a call-back survey was performed to increase detection of our five focal species: Common Gallinule (*Gallinula galeata*), Purple Gallinule (*Porphyrio martinicus*), Least Bittern (*Ixobrychus exilis*), Clapper Rail (*Rallus crepitans*), and King Rail (*Rallus elegans*). At each created site, a water level recording device was set up to quantify differences in water levels and flooding frequency among sites. Our results suggest that created marshes vary widely in hydrologic regimes and vegetation communities. While some created sites had overall lower water levels than the natural marshes and therefore a more upland vegetation community, others had more variable water levels that allowed for frequent flooding and establishment of emergent vegetation. During the 2021 season, Common Gallinules, Purple Gallinules, and King Rails were more abundant at natural sites, however, during the 2022 season, all of our focal species were more abundant at created sites. Trends suggest that site-specific hydrologic characteristics are major drivers of waterbird communities and therefore, building marshes at the right elevation that allows for flooding and establishment of emergent vegetation may improve suitable habitat for wetland birds.

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Nest-activity patterns and reproductive success by Little Blue Herons (*Egretta caerulea*)

in an urban mixed-species colony

Little Blue Herons (*Egretta caerulea*) are medium-sized ardeids that often join other egrets and herons in mixed-species colonies. In June and July 2018, a random sample of 26 Little Blue Heron nests located in a large urban colony were monitored during the breeding season. The goals of this study were to characterize nest-activity patterns by the attending parent over the course of the breeding cycle and document reproductive success in an urban colony amid several forms of human disturbance. Scan samples with 5-min intervals were used to record adult activity during 50 h of observation on 24 study nests. An additional 52 h of focal samples on two different nests documented fine-scale activities and nesting phenology. Observations made at random times yielded 626 nest-hours across the breeding cycle. During incubation, the attending parent mostly sat (63%) or stood (23%) in

or near the nest and spent less time in nest maintenance (5 %) and self-maintenance (scratching and preening; 5 %). By midway through the breeding cycle, attending adults spent more time standing (70%) and less time sitting (11%) and in nest maintenance (1%). Later, both parents were away from the nest 69% of the time. Of 26 nests monitored, 39 chicks fledged (1.4 $\pm$ 0.3 chicks/nest). The 16 successful nests (61 %) fledged a mean of 2.4 $\pm$ 0.2 chicks. Most unsuccessful nests were taken over or destroyed by Cattle Egrets (*Bubulbus ibis*), or the chicks eaten by Black-crowned Night-Herons (*Nycticorax nycticorax*).

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Post-breeding dispersal of the Short-billed Dowitcher (*Limnodromus griseus*)

Birds are vulnerable to different threats at each stage of their annual cycle, so it is important to examine factors that could contribute to population decline on both their breeding grounds and along their migratory pathway. Little is known about the migration of the Short-billed Dowitcher (*Limnodromus griseus*), a shorebird breeding in the Churchill, Manitoba region. There are indications of declining populations in their subarctic and boreal breeding areas but the reason for their decline has not yet been investigated. The objective of this study is to characterize the post breeding dispersal of Short-billed Dowitchers from their Churchill, Manitoba breeding areas using the international and collaborative Motus Wildlife Tracking System (motus.org). With detections from radiotelemetry receiving stations across North America, we aim to determine key migratory timing, pathways, and potential stopover and non-breeding locations. We deployed 28 radio transmitter tags on breeding Short-billed Dowitchers to track their dispersal to non-breeding locations during their 2021 and 2022 southbound migration. Short-billed Dowitchers tagged in Churchill, Manitoba all followed a similar migration route: they were first detected at towers in the Great Lakes Region during quick, long-distance flights. Many were last detected on the southeastern coast of the US, with several detections in the same areas of coastal South Carolina, North Carolina, and Florida. Understanding the connectivity between these breeding and wintering populations can help us to assess the varying threats to migratory shorebirds throughout their annual cycle.

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What the tides reveal about where and how wading birds forage – a modeling approach for intertidal foraging ecology

We evaluated spatiotemporal patterns of resource selection and foraging activity of Little Blue Herons (*Egretta caerulea*) in tidally-influenced habitats. We used the Tidal Inundation Model of Shallow-water Availability (TiMSA) to estimate water depth and time-integrated habitat availability (TiHAB) at foraging sites in the Florida Keys and Florida Bay from 2016 – 2018. TiHAB is an empirically-derived metric of the magnitude and duration of resource change and thus a distinct attribute of wading bird foraging habitat in intertidal environments. Although average TiHAB varied considerably among years and between study areas, selection for TiHAB was temporally and spatially consistent. Little Blue Herons were 4 times more likely to forage at sites with 12 hours of TiHAB versus 1 hour. Variables TiHAB, distance to land, and distance to deep water were superior to estimates of prey density in predicting resource selection at both study areas. Metrics of foraging activity did not differ between years or study area and was best explained by changes in TiHAB. As TiHAB decreased, Little Blue Herons foraged with increasing frequency (strike min^{-1}), success (capture min^{-1}), and efficiency (capture step^{-1}). These relationships were more consistent with a change in foraging strategy than changes in prey availability. We conclude that spatiotemporal variation in resource availability reliably predicts patterns of foraging habitat selection and explains flexible foraging strategies of wading birds in intertidal environments. This modeling approach can be applied to other waterbird species in tidally-influenced habitats to quantify the spatiotemporal availability of resources in real-time or under simulated hydrologic scenarios, and predict species occurrence and behavior.

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Virtual net as an alternative bird net to reduce duck damage in lotus fields

Covering with physical nets is the most effective method to exclude avian pests from orchards, aquaculture, and crop fields. Many lotus fields around Lake Kasumigaura, the largest producing area of lotus root crops in Japan, have been covered with bird nets since

2004 to prevent duck damage. However, covering large fields with nets is difficult; an inadequate setting of nets with openings or using large mesh sizes could not reduce the damage costing about $2 million annually. Flooded lotus fields are semi-natural wetlands providing valuable foraging habitats for waterbirds including threatened species. Unfortunately, those birds occasionally become entangled and victims of netting. To manage the balance between reducing agricultural damage and conserving waterbirds' habitats, we invented a Virtual Net (VN) as an alternative. VN is a small machinery equipped with a laser emission for scaring out Mallards and Eurasian Coots, the two major pest species that eat lotus roots in the mud at night during harvest in winter. The VN consists of two parts: bird-call detecting with a non-AI machine learning system and laser emission with simple/robust mechanics. Once the VN detects calls of the pest species, it emits laser beams over the pre-harvest field for a while. This focusing laser emission prevents birds from getting used to the stimuli and avoids affecting birds that do not damage lotus roots. During the field trial of the VN in the pre-harvest field from February to March 2022, we confirmed that the number of individuals of the pest species decreased in the footage of a camera trap. Not all laser-firing events were correct, but the VN showed promising results in reducing duck damage. At the same time, many individuals of coots, mallards, and other species of ducks foraged residual lotus roots on the water surface of the adjacent post-harvest field. Therefore, post-harvest fields could serve as temporal sanctuaries for repelled birds, and the VN guide them from pre- to post-harvest fields. We plan to improve the cooperative usage of multiple VNs and realize a dynamic equilibrium of the pest birds within the region.

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Double-crested Cormorant western population monitoring and trends

In 2014, the Pacific Flyway Council implemented their Double-crested Cormorant (*Nannopterum auritum*) Monitoring Strategy (Strategy). The goal is to conduct coordinated, long-term, flyway-level monitoring to estimate breeding population size, trend and change in the distribution of the Western population. This information supports effective management recommendations and helps guide management actions pertaining to Double-crested Cormorant depredation on fish resources. The Strategy uses a dual-frame methodology of sampling and analysis. Colonies are stratified by size, weighted so that all large colonies are sampled, and then randomly selected for monitoring; additional data

from non-selected colonies are contributed by partners and used in the analysis. The Strategy calls for monitoring every 3 years, but additional sample years occurred as part of the US Army Corps of Engineers' 2015 Double-crested Cormorant Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary. Coordination was through the Nongame Technical Committee of the Pacific Flyway Council. State and federal personnel and partners count nests to estimate peak number of breeding Double-crested Cormorants, but the data are assembled, processed, and analyzed by the US Fish and Wildlife Service to derive population estimates. The next monitoring year is planned for 2024. The 2014-2021 estimated Western population size ranged from 21,537-36,719 breeding pairs. The 2021 estimate for the Western population was 24,849 (17,132-32,566; ±95% confidence limit) breeding pairs. The estimated Western population size was smaller in 2017, 2019 and 2021 compared to 2014, 2015, and 2016 ($P < 0.03$). There was an overall shift in the numbers of colonies in size classes, from larger to smaller. The Astoria-Megler Bridge hosted the largest colony surveyed in 2017, 2019 and 2021, with an observed 2021 peak of 4,151 breeding pairs. This was a shift from 2014-2016 and 2018, when East Sand Island was the largest colony. East Sand Island had the largest decrease in size through time; from 13,626 breeding pairs in 2014 to 350 pairs in 2019. Both colonies are within the Columbia River Estuary; the distance between the sites is approximately 7 miles.

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Creating a species distribution model of avian botulism outbreaks in Michigan

Avian botulism is a deadly disease that has caused widespread die-off events in waterfowl and seabirds all over the world. Hundreds of thousands to millions of birds can die in a single Avian Botulism outbreak. The disease is caused by a neurotoxin (BoNT/C) produced by an anaerobic, spore-forming bacterium. The bacterium (*Clostridium botulinum*) is ubiquitous in aquatic substrates, soils, and even the intestines of animals. *C. botulinum* spores can persist in the environment for decades and organisms like algae, plants, invertebrates, and fish can be carriers of the spores. *C. botulinum* is harmless in the spore state, BoNT/C is only produced when bacteriophages that encode for toxin protein replicate with the bacteria. These specific conditions required for an outbreak means that Avian Botulism is intermittent, unpredictable, and inconsistent in when outbreaks occur and the species it infects. Once the spores enter the food webs of birds and begin producing BoNT/C, the outbreak is self-perpetuating. This is a part of Avian Botulism that is often overlooked, the importance of insect vectors in the transmission of the bacterium and its toxin to vulnerable hosts through the carcass-maggot cycle. Avian botulism spreads through necrophagous dipteran flies laying eggs in animal carcasses that contain the toxin. The maggots hatch and consume BoNT/C from the carcass, concentrating the toxin. Birds consume the intoxicated maggots and become intoxicated themselves, eventually

succumbing to the disease and dying, resulting in more intoxicated carcasses, starting the cycle over again. Because of this self-perpetuating cycle, outbreaks of Avian Botulism can result in huge die-off events. Here, we develop a species distribution model of Avian Botulism from the perspective of its fundamental niche. We incorporate both abiotic climatic factors, like temperature, precipitation, and hydrological features, and biotic factors, like presence of insect vectors and presence of bird colonies into the model. We use Michigan as the basis of the model based on past Avian Botulism outbreaks in the state. We will use the model built in Michigan to predict where future Avian Botulism outbreaks might occur in Alaska.

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First-ever individual tracking of Black Terns for home range and habitat selection during breeding and stopover, based on satellite telemetry

Understanding the movement and habitat use of migratory birds across their annual cycle is critical for developing appropriate conservation and management plans. However, for many smaller avian species such as some waterbirds, the large size and high cost of tracking devices previously limited the spatial and temporal resolution at which movement data could be collected. Furthermore, for species with low breeding site fidelity, the ability to obtain tracking data from smaller, archival tags (e.g., light-level geolocators) is hindered by low recapture rates. The North American Black Tern (*Chlidonias niger*) is a declining waterbird with very low site fidelity, and it is unknown whether threats on the breeding grounds, at stopover sites, or on winter grounds are most limiting to populations. In this study, we deployed for the first time satellite tracking devices (2g Argos PTT, Microwave Telemetry) on four adult Black Terns breeding in Saskatchewan, Canada, to examine home range size and foraging distance on the breeding grounds, and to compare third-order (within-home range) habitat selection between breeding and first stopover during southward migration. We found that home ranges were extensive and breeding foraging distances were substantially larger (up to 35 km) than previously thought (2-5 km). As predicted, terns showed strong selection for wetlands and open water on the breeding grounds relative to forest and cropland, but interestingly also showed selection for developed areas. At stopover sites, they showed selection for open water, forest, and cropland, but no strong selection for wetland or developed areas. This may be due to the unpredictable nature of wetlands in stopover areas or a weak correlation between cropland and open water. Despite a small sample size, this is the first study to track individual Black Terns at a high temporal and spatial resolution and has implications for conservation and wetland management practices relevant to the spatial scales at which habitat is required for the species during breeding and stopover.

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Black terns in the northern Gulf of Mexico: Vessel-based observations and insights from the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS)

Black Tern (*Chlidonias niger*) are the only obligate marsh breeding terns native to the New World and are experiencing population declines across their breeding range. On their annual migration from northern breeding grounds in the continental interior, many Black Tern migrate through the Gulf of Mexico on the way to their wintering grounds in South American waters. Given lethal historical impacts of interacting with oil, a better understanding of how Black Tern use the Gulf of Mexico can improve the understanding of the threats encountered by this species. Using most spatially and temporally extensive vessel surveys for seabirds in the northern Gulf of Mexico, within the US EEZ (nGoM) to date, we characterize the occurrence and distribution of Black Tern and assess their habitat associations in the nGoM. Across 14 cruises between April 2017 – September 2019, the Gulf of Mexico Marine Assessment Program for Protected Species (GoMMAPPS) made ~720 detections of Black Tern, totaling ~12,000 individuals. Group size ranged from 1 – 760 individuals with a mean of 16.7 birds per detection. Black Tern accounted for ~30% of the total number of identifiable seabirds seen in GoMMAPPS vessel-based observations. Approximately 78% of Black Tern were observed in fall, ~ 19% in the summer, and 3% in spring. None were observed in winter, but this season had the least survey coverage. Black Tern occurred primarily on the continental shelf, and rarely on the continental slope and in pelagic areas. Effort-controlled individuals per kilometer (e.g., relative density) was greatest from the Mississippi River Delta through Mobile Bay and moderate near Corpus Christi. Based on modeled habitat, the predicted relative density of Black Tern agreed with observations. Specifically, modeled relative densities were greatest in the fall, on the continental shelf, and in areas with moderate chlorophyll concentrations. These data are the most comprehensive Black Tern observations in the offshore environment in the nGoM and provide novel insight into Black Tern habitat use in this region.

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Migration, breeding location, and seascape shaping seabird assemblages in the northern Gulf of Mexico

The northern Gulf of Mexico (nGoM) is a warm-temperate to tropical semi-enclosed sea with complex bathymetry, significant river input, and dynamic oceanographic features. A taxonomically broad assemblage of seabirds occurs in the nGoM, but patterns in the distribution of seabirds in this region are less known than in many other regions. To fill this information gap, we identify and characterize distinct seabird assemblages in the nGoM. Using cluster analysis, we characterize seabird assemblages based on seabird relative density. For each assemblage, we identify the dominant or co-dominant species, spatial distribution, and areas of greater relative density. We also assess the relationship of the total relative density within each assemblage with environmental covariates, including spatial and temporal aspects. We identified four seabird assemblages composed of 17 seabird species. Seventy-six percent (13) of species analyzed have breeding origins outside the nGoM. Two assemblages occurred, namely, on the continental shelf, one dominated by Black Tern (*Chlidonias niger*) and the other co-dominated by Northern Gannet (*Morus bassanus*) and Laughing Gull (*Leucophaeus atricilla*). A Sooty tern (*Onychoprion fuscatus*)-dominated assemblage occurred along the continental slope into pelagic areas. The fourth assemblage had no dominant species, was broadly distributed, and was composed namely low relative density observations. Differentiation of assemblages was linked to migratory patterns: Black Tern and Northern Gannet, residency: Laughing Gull, and breeding location: Sooty Tern. Environmental covariates and spatial distributions indicate associations with river outflows and ports by continental shelf assemblages, and conditions indicative of mesoscale features were associated with the Sooty Tern and low relative density assemblages. Three of these assemblages: Black Tern, Northern Gannet and Laughing Gull, and Sooty Tern, can be linked to potential prey species while potential functional relationships, suggesting these assemblages may be distinct seabird communities. These findings highlight the importance of seasonal migrations and dynamic features across the seascape, shaping seabird assemblages. Awareness of these unique patterns and considering the potential far-ranging impacts of interactions with seabirds in the nGoM could inform potential monitoring, research, restoration, and continued development.

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Seabird vulnerability to oil: exposure potential, sensitivity, and uncertainty in the northern Gulf of Mexico

The northern Gulf of Mexico (nGoM) is a globally important region for oil extraction and supports a diverse assemblage of marine birds. Due to their frequent contact with surface waters, diverse foraging strategies, and the ease with which oil adheres to feathers, seabirds are particularly susceptible to hydrocarbon contamination. Given the chronic and acute exposure of seabirds to oiling and a lack of studies that focus on the exposure of seabirds to oiling in sub-tropical and tropical regions, a greater understanding of the vulnerability of seabirds to oil in the nGoM appears warranted. We present an oil vulnerability index for seabirds in the nGoM tailored to the current state of knowledge using new, spatiotemporally expensive vessel-based seabird observations. We use information on the exposure and sensitivity of seabirds to oil to rank seabird vulnerability. Exposure variables characterized the potential to encounter oil and gas (O&G). Sensitivity variables characterized the potential impact of seabirds interacting with O&G and are related to life history and productivity. We also incorporated uncertainty in each variable, identifying data gaps. We found that the percent of seabirds' habitat defined as highly suitable within 10 km of an O&G platform ranged from 0%-65% among 24 species. Though O&G platforms only overlap with 15% of highly suitable seabird habitat, overlap occurs in areas of moderate to high vulnerability of seabirds, particularly along the shelf-slope. Productivity-associated sensitivity variables were primarily responsible for creating the gradient in vulnerability scores and had greater uncertainty than exposure variables. Highly vulnerable species (e.g., Northern gannet (*Morus bassanus*)) tended to have high exposure to the water surface via foraging behaviors (e.g., plunge-diving), older age at first breeding, and an extended incubating and fledging period compared to less vulnerable species (e.g., Pomarine jaeger (*Stercorarius pomarinus*)). Uncertainty related to productivity could be reduced through at-colony monitoring. Strategic seabird satellite tagging could help target monitoring efforts to colonies known to use the nGoM, and continued vessel-based observations could improve habitat characterization. As offshore energy development in the nGoM continues, managers and researchers could use these vulnerability ranks to identify information gaps to prioritize research and focal species.

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Evaluating the use of drones for monitoring waterbird nest abundance and nest survival

Surveys of colonial waterbirds are used to monitor species' population status, contaminant levels, and to derive metrics that can be used to assess wetland ecosystem restoration and management and activities. Previous studies have found that drone surveys provide accurate estimates of nest abundance and survival for ground-nesting waterbird species such as terns (Laridae Spp.), but drones have not been used to estimate survival for waterbirds nesting in a canopied marsh habitat, and potential sources of bias in drone surveys have not been examined in depth. We examined potential visibility biases associated with using a drone to survey colonies of wading birds (Ciconiiformes and Pelecaniformes) in marsh habitat in Florida in 2020 and 2021. Monthly nest counts and survival were compared between traditional (combination of fixed-wing aircraft and ground surveys) and drone survey methods. Ground-based and drone nest transect surveys were conducted to estimate survival and detection probabilities of each species and plumage color. Generalized linear mixed-effects models were used to quantify the degree to which visual occlusion of nests influenced detectability. Estimates of white-colored waterbird nests were significantly greater for drone surveys than those derived from traditional survey methods but estimates of dark-colored waterbirds from drone surveys were biased low. Variation in detection was best explained by canopy cover, plumage color, and nest stage. Overall, there was no difference between survival estimates from either method. However, drone-derived estimates of dark-colored waterbirds had lower accuracy. Our results suggest that drone surveys are a viable method to conduct monthly nest surveys and estimate survival of waterbirds breeding in marsh habitat, but researchers should consider their study area and species before choosing a survey method.

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An overview of factors influencing recreational disturbance to coastal wildlife

Coastal environments are popular destinations for recreationists and tourists. Marine and coastal tourism is one of the fastest growing sectors, estimated to make up 26% of the global ocean economy by 2030. The rise in popularity has coincided with declines in coastal wildlife species due, in large part, to increased human-wildlife interactions. Tourism and recreation are often conflated and, as such, researchers have attempted to characterize the nature of recreational disturbance to coastal wildlife. These studies often focus on shore-based wildlife, and far less attention has been paid to avian species, which are less

charismatic but valuable indicators of healthy coastal environments. We undertook a review of the scientific literature to assess the existing research impacts to coastal wildlife, with special attention paid to waterbird species. This approach allowed us to better consider often overlooked factors that may play a role in human response to coastal wildlife conservation. Waterbird species, in particular, are motile and tend to reside offshore, attributes that present novel challenges to their conservation using existing management approaches. We also invoked a social-ecological systems lens to clarify the linkages between social, natural, and waterbird systems. Preliminary results indicate that researchers have thus far paid scant attention to the influence of social factors, such as human behavior or management approaches, often focusing on biological and ecological factors such as mortality or habitat quality. Additionally, management implications are often species- and site-based, which hinder our ability to think about how to solve recreational disturbance holistically and at broad scales, on- and off-shore. We propose a novel way to think about connections between social, ecological, and wildlife domains to improve how we research and manage recreational disturbance in these regions.

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Beneficial dredge use planning for bird island restoration -- Texas GLO Regions 3 and 4

Dredging is required to develop and maintain ship channels that support the Texas economy. Dredgers need physical locations (e.g., placement areas or PAs) to deposit the dredged material. Unfortunately, PAs are generally in locations that lack environmental value, and many of the locations along the Texas coast are nearing capacity. Rather than placing material into PAs, resource agencies and stakeholders have long advocated using dredged material beneficially to create and restore wetlands, nourish beaches, and counteract land loss. However, difficulty arises in that Beneficial Use of Dredged Material (BU) projects are multi-year, multifaceted undertakings in which different organizations manage dredging schedules, funding streams, project design, permitting, and construction activities.

Through the Coastal Management Program Cycle 26 Gulf of Mexico Energy Security Act (GOMESA) funding via the Texas General Land Office, Ducks Unlimited and project partners Port of Corpus Christi, Anchor QEA, and TXDOT are working with stakeholders in Regions 3 and 4 to identify potential BU restoration sites.

Through a stakeholder process we have identified and preliminary list of restoration sites, and further identified sites where we have have initiated the field survey and engineering design.   Several of the sites will involve the restoration and creation of islands for nesting waterbirds.   We will discuss the site selection process, engineering and design efforts,

project designs, and future plans to implement the bird island restoration sites. A status update of the planning process and progress to date, including the sites that are currently under design will be discussed. This includes This effort will provide for engineering, design, and permitting of the highest priority sites and will complement an ongoing coast wide BU planning being led by DU and facilitate BU restoration projects in Regions 3 and 4.

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Fire effects on breeding marsh birds

The continued loss and degradation of coastal marsh habitats within the United States poses a serious threat to marsh-dependent species like the eastern black rail (*Laterallus jamaicensis*). Federally threatened, the eastern black rail has declined by 75 % over the last decade with populations patchily distributed along the Atlantic and Gulf coasts. The elusive nature of the species has made studying black rails challenging, resulting in the species being poorly understood. This lack of knowledge regarding black rail ecology further complicates conservation efforts, particularly management decisions as they relate to prescribed fire. The goal of this study was to determine the effect of different fire regimes on breeding marsh birds in Mississippi and Florida looking specifically at prey abundance, predator community composition, and nest success. Data on predator communities and prey abundance were collected from March to July 2022 using game cameras and floating aquatic pitfall traps. To determine nest success, small cameras attached to DVRs were placed at clapper rail and red-winged blackbird nests that reached full clutch. Nests were continuously recorded until hatching, or a predation event occurred. Understanding fire return intervals is a necessary and critical step in managing habitat and food resources for eastern black rail.

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Conservation and rehabilitation: an entire Elegant Tern colony becomes the patient

The Elegant Tern (ELTE), *Thalasseus elegans*, is listed as near threatened due to its small breeding range. Up to 95% of the population breeds on Isla Rasa in the Gulf of California, east of the Baja California peninsula. At least three other Mexican islands are used occasionally and there are also small populations that breed in Southern California at Bolsa Chica, San Diego Bay, and Los Angeles Harbor. In 2021, the breeding colony at Bolsa Chica, which has the largest breeding population of Elegant Terns in Southern California, was disturbed by drone activity. The disturbance led the colony to abandon its typical nesting area and settle on barges in the Long Beach Harbor in California, which proved to be unsuitable for the colony to raise their chicks. To address the problem, International Bird Rescue, a wildlife rehabilitation organization, launched an emergency response to protect and aid the breeding colony of Elegant Terns nesting on the Long Beach Harbor barges. A coordinated effort with various local and state organizations, wildlife rehabilitators, scientists, veterinarians, and volunteers resulted in over 3,000 exhausted and hypothermic Elegant Tern chicks being treated over a span of 52 days. Over 1,000 were federally banded for continued monitoring. Additionally, a committee was created to share expertise and knowledge that can help identify and combat the threats the species faces today and in the future. This talk explores the challenges, innovations, and partnerships during this wildlife emergency response and hopes to show how collaboration with wildlife rehabilitators can be an important contribution to species conservation.

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Distribution and habitat use of North American Black Terns during boreal winter.

Black Tern (*Chlidonias niger*) populations have declined across their range in North America since the 1980s. The causes of this decline remain largely unknown, but factors during non-breeding may be important. Little is known regarding Black Tern non-breeding ecology, the locations of or conditions at staging and stop-over sites, or the distribution of over-wintering sites. Current information on Black Tern winter habitat is based on limited, sporadic sightings at sea; nonetheless, these suggest that some birds are using marine pelagic zones during this part of their annual cycle.

To this end, we tracked full-cycle movements of Black Terns nesting in Ontario (n= 11 recovered tags), Michigan (n=5) and Saskatchewan (n=3; total = 19) using light-level

geolocators. Here we focus on the distribution and habitat use of tagged birds during boreal winter.

There was a high degree of individual variation in locations used among individuals, and individuals used multiple stationary sites during winter (range = 3-15 locations/bird, median=6). Most birds spent at least part of the winter around the coasts of Panama, but some ranged throughout the Caribbean Sea, and some as far south as southern Peru on the Pacific Ocean. All birds used marine habitats extensively in winter, with some individuals spending extended periods (i.e. >60 d) at sea. There was a high degree of individual variation in the oceanic zones utilized. Some terns spent >60% of the winter in pelagic zones (i.e. >50 km offshore; n=6), others used coastal waters predominantly (i.e. <50 km from shore; n=2), and many used a mix of both areas (n=11). Some birds also spent time at inland sites (n=8; range = 4 – 46% of stationary periods, median=12.9%). Terns for which we had data spanning two winters (n=4) exhibited considerable variation in habitat use between years. The results of modeling winter habitat use as a function of ocean bathymetric and productivity data will be presented.

This information will allow us to identify critical periods or locations for this species, and inform where conservation actions should be directed during the non-breeding season.

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Modeling the effects of water levels and weather on Common Tern colony dynamics, abundance and breeding success.

Effective conservation of seabird populations demands an understanding of the factors that drive colony dynamics. We examined the effects of lake level and weather on Common Tern colony dynamics and abundance, on the North Channel of Lake Huron (area = 7,770 km^2; > 260 islands), during 10 complete annual surveys (1980, 1989, 1999, 2008/9, 2010-14, 2016). Terns nested at 96 islands during ≥ 1 survey. We also measured survival to 15 d for enclosed broods (n=255) at 6 sites for 1-3 years each from 2010-2012 (10-20 /site/yr).

We used hierarchical, zero-inflated, negative binomial models to examine (a) site persistence (% surveys occupied), the probability of (b) abandonment or (c) colonization in the subsequent census, and (d) nest abundance as a function of: (i) habitat quality index (site elevation, % vegetation cover), (ii) co-nesting species abundance, (iii) lake level and (iv) mean weather conditions during May/June (rainfall, temperature, wind speed, and # of potential flooding events). A binomial mixed model was used to examine the relationship between brood survival and the variables above.

Tern abundance (range = 233 - 3482 nests; mean±SD = 2361±1004) and site occupancy (6 - 34% /yr) varied widely among census periods. Persistence increased with habitat quality and co-nester abundance. Sites were more likely to be abandoned (n=113; 55%) in years when lake level was above average, colony size was small, and habitat quality was low. Vacant sites were more likely to be colonized (n=95; 15%) when lake levels were below average, and habitat quality and co-nester abundance were high. Nests were more abundant when habitat quality was high, at sites with high co-nester abundance and when lake levels were low. Brood survival varied among sites and years (range = 0-1.6 chicks/nest; mean±SD = 0.50±0.56), and was negatively correlated with lake level, # of potential flooding events, and total rainfall.

In this study, water level and/or adverse weather affected tern site selection, abundance and breeding success. As both sea level and severe weather are predicted to increase, these factors are likely to affect tern distribution and abundance in future.

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Recent population trends of Double-crested Cormorants in the Laurentian Great Lakes

With the restricted use of USFWS Depredation Orders since 2016, and travel restrictions due to Covid-19 in 2020/ 2021, there has been a marked reduction in population monitoring and management activities of Double-crested Cormorants in recent years. The objective of this paper is to provide an update on population levels and trends of cormorants on the five Great Lakes, where data were available.

Data sources were nest counts for: (1) all colonies in Lake Ontario and the St. Lawrence River (annually, 2008-2022), (2) focal colonies in 2018 and 2022 in US lakes Michigan, Huron and Superior and Canadian Georgian Bay (Lake Huron), and (3) all colonies in Canadian lakes Erie, the main body of Lake Huron and the North Channel in 2007-08 and 2022.

Population trends varied across the Great Lakes region. There was substantial annual growth in Lake Ontario (5.3%/yr, from 22,496 to 40,485, 49 sites), the St. Lawrence River (5.5%/yr, from 2,682 to 4,909 nests; 31 sites) and at focal colonies in Lake Michigan (4.6%/yr, from 2,563 to 3,156 nests; 5 sites). The trend was stable to a slight decline in Canadian Lake Erie (-0.6%/yr, from 12,228 to 11,124 nests; 6 sites). Population declines

were observed in the main body of Canadian Lake Huron (-1.8%/yr, from 4,546 to 3,411 nests; 12 sites), the North Channel (-4.9%/yr, from 7,380 to 1,999 nests; 33 sites) and at focal colonies in Georgian Bay (-10.2%/yr, from 1,102 to 542 nests; 3 sites), US Lake Huron (-5.1%/yr, from 2,315 to 1,726 nests; 4 sites) and US Lake Superior (-4.1%/yr, from 392 to 311 nests; 2 sites)

The declines in Lake Huron are likely the result of a trophic regime shift, noted in the mid-2000s and continuing into the mid-2010s. Noteworthy gaps in recent population data exist for Lake Superior, parts of Lake Michigan and Georgian Bay. Impacts of the 2022 avian influenza epizootic, especially in Lake Michigan where substantial waterbird die-offs were documented in 2022, cannot be estimated at this time.

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Characterizing ecological drivers of secretive marshbird distribution across southeastern Louisiana

Multi-scale habitat characteristics such as edge dynamics, vegetation communities and flooding patterns affect the abundance and occurrence of secretive marshbirds within coastal systems. Understanding how these species react to shifts within their territory is crucial within the deltaic plain of Louisiana, a highly dynamic and anthropogenically-modified system. Increasing frequency of hurricanes, flooding and chances of oil spills make modeling the distribution of marshbirds vital across marsh types ranging from fresh to saline. Combining three years of callback surveys, movement data, hydrological data, and remote sensing imagery we will model the distribution of key marshbird species including King Rail (*Rallus elegans*), Clapper Rail (*Rallus crepitans*), Least Bittern (*Ixobrychus exilis*), Common Gallinule (*Gallinula galeata*) and Purple Gallinule (*Porphyrio martinicus*) at different time and spatial scales across various marsh types within southeastern Louisiana. Our specific objectives are to determine the effects of hydrological variability and vegetative communities on marshbird abundance and distributions and also how these variables influence short- and long-term movement to better identify key restoration features for marshbird management and conservation.

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A Preliminary Assessment of Thermal Imaging Equipped Aerial Drones for Secretive Marsh Bird Detection

Rails are a highly secretive group of marshland obligate species that are difficult to consistently survey and detect. Current survey efforts utilize either call-playback or autonomous recording devices, but the low detection probabilities for rails create challenges for long-term systematic monitoring. Between 8 April and 16 May 2022, we flew a small aerial drone equipped with a thermal camera to survey for six species of rail (Back Rail [*Laterallus jamaicensis*]; Yellow Rail [*Coturnicops noveboracensis*]; Sora [*Porzana carolina*]; Virginia Rail [*Rallus limicola*]; Clapper Rail [*R. crepitans*]; King Rail [*R. elegans*]) along the Gulf Coast of Texas in order to assess the feasibility of long-term drone monitoring. We successfully conducted 34 flights and detected rails 55.5% of the time at known occupied points. We achieved 27 total rail detections, including 12 Black Rail/Yellow Rail detections. Of the birds detected, 81% exhibited no response to the drone's first approach. We intend for this preliminary data to shape future survey protocol for secretive species occupying difficult to navigate terrain.

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Management of Double-crested Cormorants in the United States: an overview of the new rule and annual take

In May 2016, a judge remanded the Service's 2014 Environmental Assessment supporting depredation orders in place for cormorant management. These depredation orders authorized the take of cormorants under specific conditions without the need for an individual permit and were widely used to address conflicts with wild and stocked fisheries. When those orders were vacated, states and tribes lost the ability to address conflicts associated with cormorants. To be responsive to the continued needs of agencies to manage cormorant conflict, the Service published a final rule in 2020 that established a new special cormorant permit authorizing a State or Tribal fish and wildlife agency to take cormorants on lands or in waters managed by the agency for: depredation of fish at agency owned aquaculture facilities; human health and safety; threats to the recovery of protected wildlife; damage to agency property; and depredation of wild and publicly stocked fish managed by the agency. The Rule is applicable to all conterminous 48 United States. To determine maximum allowable take under the new permit, the Service developed a Potential Take Limit (PTL) model for each of the four cormorant subpopulations based on the minimum population size, maximum growth rate, and management objectives. Subpopulation-specific maximum allowable take levels are: Atlantic, 37,019; Interior, 78,632; Western, 4,539; and Southern (Florida), 1,314; for a total of 121,504 birds annually.

The Service has been monitoring both authorized and reported take since implementation of the new rule to ensure the maximum annual allowable take is not exceeded. In 2021, authorized take in each of the four subpopulations was far below the maximum annual take levels (Atlantic – 17,553, Interior – 56,596, Western – 2,532, and Southern – 547), and actual reported take was even lower. Additionally, the Service is working with partners to establish population monitoring programs that will assess the effects of lethal take on cormorant populations and ensure take is commensurate with population status. The new permit provides States and Tribes the flexibility they need to be able to make the best decisions for managing cormorants while ensuring sustainable populations.

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Using environmental DNA metagenomics to detect cryptic wetland birds

We collected environmental DNA (eDNA) samples from four sites in northern Illinois in order to test the ability of eDNA metabarcoding to detect common, cryptic, and rare wetland bird species (Great Egret, Sora, American Coot, Red-winged Blackbird, Black Rail, King Rail, Virginia Rail, and American Bittern). Using a CTAB extraction protocol, we filtered and extracted eDNA from silty wetland water samples. We used 16S degenerate bird and vertebrate primers to amplify and sequence bird eDNA within our samples, and sequenced samples on a MiSeq. We built a database of known bird DNA sequences using Genbank and used the Basic Local Alignment Search Tool (BLAST) with a conservative species match cutoff to compare each sequence in our custom database to each sample sequence and determine if there was a species match. We created custom Python scripts to dramatically cut down on BLAST search processing time. We successfully detected common and rare wetland bird species in our samples, and are currently using our method to process samples from ~50 wetlands in Illinois and Michigan. Our method appears robust for detecting rare and cryptic rails, and for calculating point estimates of wetland bird diversity. However, using eDNA sampling to distinguish between rail species or to detect herons may require creating species-specific primers.

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Influence of Atlantic Puffin (*Fratercula arctica*) breeding stage and capelin (*Mallotus villosus*) migration on *Larus* gull foraging behaviour in Newfoundland, Canada

Varying prey availability drives changes in seabird foraging behaviour. On the Newfoundland Shelf, capelin (*Mallotus villosus*), a key forage fish, migrates annually from offshore to inshore regions to spawn. Multiple seabird species rely on capelin as prey to successfully provision their chicks and the chick-rearing period typically coincides with the inshore arrival of spawning capelin in early- to mid-July. I investigated how the inshore arrival of capelin and the stage of Atlantic Puffin (*Fratercula arctica*) breeding affects the predation and kleptoparasitic risk imposed by Great Black-backed (*Larus marinus*) and Herring Gulls (*Larus argentatus*) on puffins at a multi-species colony in July and August 2021 and 2022. Behavioural observations of gulls inside and outside of defined puffin burrowing areas allowed estimation of gull-based risk on puffins and recording of kleptoparasitic and predatory attacks. In both years, I also surveyed a standardized transect for puffin carcasses every 2–4 days on the colony to quantify predation on adult puffins. During focal observations in 2021, ~30% of gulls entered puffin burrowing areas and, of those that did, Great Black-backed Gulls spent a higher proportion of time inside and engaged in behaviours associated with predation and kleptoparasitic attacks than Herring Gulls, especially during capelin spawning. Similarly, scan sampling and behavioural observations in 2022 revealed greater numbers of Great Black-backed than Herring Gulls present within puffin burrowing areas throughout July and August, and only Great Black-backed Gulls were observed successfully kleptoparasitizing adult puffins and depredating puffin chicks. The bulk of predation on adult puffins occurred before our arrival in the study area in both years, during the early stages of the gull breeding season, as indicated by the puffin carcass surveys. Together, my findings suggest that only a few Great Black-backed Gulls specialized on puffin adults and chicks, exerting adult predation risk before the inshore migration of spawning capelin and kleptoparasitic and chick predation risk during capelin spawning. This research provides insight into how the migration of spawning capelin affects the risks posed to puffins during breeding and informs conservation efforts for puffins in Newfoundland.

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Habitat selection of a migratory shorebird in a fragmented agricultural landscape

Migratory shorebirds are one of the fastest declining groups of North American avifauna. An obligate grassland shorebird and long-distance migrant, the buff-breasted sandpiper (*Calidris subruficollis*) has been identified as a flagship species for other grassland

shorebirds. A recent range-wide tracking study identified the Texas Gulf Coastal Plain as a key stopover area for the species. To study local movements and estimate habitat selection in the region, we tracked 52 and 37 adult buff-breasted sandpipers with GPS satellite devices during spring and fall migration in Texas during 2021 and 2022, respectively. Devices provided between 8 and 11 GPS locations per day for an average of 10 days per bird. Preliminary observations suggest great reliance by the species on sod farms, but use of surrounding croplands may be dependent on rainfall and crop height. Location data will be used to build a species distribution model using nested hierarchical resource selection analyses at two orders of selection using the USGS Cropland Data Layer land cover classification. Because of their small declining population and the conversion of their historic grassland habitats to agriculture, an understanding of the species reliance on historic and novel habitats at this critical stopover site is imperative for implementing effective conservation of the species.

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Caught on Camera: factors that influence the breeding success of Royal Terns (*Thalasseus maximus*) and Black Skimmers (*Rynchops niger*) breeding on Louisiana's coastal islands

The rapidly disappearing coastal marshes and islands of Louisiana are important breeding habitat for many seabird species. This study investigated the factors that influence the breeding success of Royal Terns and Black Skimmers on a number of Louisiana's coastal islands. Motion-detection game cameras were used to observe colonies 24/7 throughout each breeding season from 2018-2021. Breeding success and causes of nest failure were recorded for a sample of nests detected by each camera. We used generalized linear models, with binomial structure, and covariates that include island/colony habitat characteristics and predator activity to investigate how they influence breeding success. We found that the most common cause of nest failure was due to flooding, followed by opportunistic predation from colony disturbance. The results of this study provide important information on the conservation of Royal Tern and Black Skimmer breeding colonies in Louisiana, specifically as it relates to the restoration of its coastal islands.

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The Reddish Egret of the Northern Belize Coastal Complex: population, distribution, and nesting colonies

The Reddish Egret (*Egretta rufescens*) is classified globally as Near Threatened with a moderately small and declining global population estimated to be between 5,000 and 9,999 mature individuals (BirdLife International, 2022). Northern Belize accounts for an estimated 1,000 to 2,500 resident birds (BirdLife International, 2022). This population estimate for Belize is not based on species survey data, but on Important Bird Area (IBA) checklists and is potentially an overestimation.

This report evaluates the species population status, trends, and threats, and seeks to determine the importance of Northern Belize's population to the national, regional, and global Reddish Egret populations. For two consecutive years, breeding surveys were conducted at three identified nesting colonies following the PROALAS point count technique which consists of counting all the birds seen or heard 30 meters around a fixed point for a period of 10-15 minutes. Results show that the breeding population of Reddish Egrets in Belize is thought to account for an estimated 12% of the global population with an estimated population of between 500 and 600 birds based on data derived from nesting surveys (SACD, 2021) and peer-reviewed eBird sighting reports – much smaller than the previous estimate of 1,000 to 2,500 significantly impacting the overall global estimate. During the assessments, coastal development, climate change, and knowledge or data gaps were identified as the main threats impacting the Reddish Egret population in Belize. The species is site-specific in its selection of breeding sites, so degradation and loss of mangrove cayes in Northern Belize are likely to have a greater impact on this species than on other waterbirds in Belize. As these cayes are small, it should be feasible to place them under immediate protection within the Northern Belize Coastal Complex of marine protected areas without impacting national and regional development plans or objectives.

Despite limitations, data on population abundance and trends generated by formal surveys in 2019 / 2020 have been extremely useful for assessing the current population, with the establishment of a baseline against which to measure future trends, and for identification of management measures for the survival and distribution of the species.

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Nanotags improve estimates of Black Tern fledging success in Michigan

Secretive marshbirds represent a monitoring challenge, yet they are of particular conservation concern due to observed population declines across multiple species and survey programs. For this project, we focused on the Black Tern (*Chlidonias niger surinamensis*), which is a marshbird species that has experienced severe long-term population declines in the Great Lakes region. Precise estimates of Black Tern fledging success are non-existent, largely because chicks swim and hide when approached, prohibiting efforts to count nearly-fledged individuals at colonies. To address this knowledge gap, we affixed Avian NanoTags on 28 Black Tern chicks prior to fledging at Wigwam Bay and St. Clair Flats in Michgian during the summer of 2021. Of the 28 deployed tags, 12 tags had multi-receiver detections at Motus towers that indicated fledging. This tag-based fledging rate of 43% was nearly double the "observed" fledging rate of 25% that was based solely on on-the-ground confirmations of fledging (i.e., 7 of 28 individuals observed flying). Of the 12 tagged fledglings, 9 had detections at Motus receivers along the Atlantic coast, indicating heavy stopover use in this area prior to continued southward migration. National Wildlife Refuges along the Atlantic coast were also frequently used by multiple individuals, with important implications for future habitat management actions within these refuges. More broadly, our work demonstrates that research and conservation efforts for Black Tern outside of the breeding season should focus on threats and environmental conditions along the Atlantic coast, which are likely to boost the recovery of Michigan-breeding Black Tern populations. We are currently incorporating results from this work into an integrated population model, which will reveal the demographic drivers of Black Tern population growth, as well as population viability, at Michigan colonies.

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Breeding and migration ecology and distribution and abundance of Arkansas King Rails

King rails (*Rallus elegans*) are a secretive marsh bird species of conservation concern in Arkansas. Their population has declined over the last few decades due to habitat loss and wetland degradation. Freddie Black Choctaw West WMA has multiple pairs of breeding King Rails and offers an opportunity to investigate King Rails in Arkansas and determine how Choctaw West WMA functions as a source for other sites in Arkansas and throughout the Mississippi Flyway.

Our objectives are to determine King Rail migratory connectivity and site fidelity to Choctaw West, compare abundance and distribution to other sites in the Arkansas Delta, and distinguish regional habitat and landscape characteristics.

To determine migratory connectivity and habitat use during migration and breeding season, we captured and outfitted 8 birds with Argos GPS tags.

We searched for nests within random points and in areas where birds had been observed or vocalized. Habitat surveys were performed at each of the random points and nests to help evaluate nest site selection and compare against available habitat.

This study will contribute to an understanding of habitat needs for these majestic birds in Arkansas specifically, and aid in researching wetland restoration outcomes to guide future management. At this time, we are awaiting the return of migration data through GPS tags to determine wintering locations, migration routes, and whether they return to Choctaw as adults or disperse to other locations.

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Nonbreeding movement patterns of coastal Little Blue Herons (*Egretta caerulea*) in Florida

Understanding landscape use patterns during the nonbreeding period is critical for the conservation of coastal waterbirds because both migratory and residential individuals spend most of their lives on their nonbreeding grounds. Moreover, coastal habitats are becoming areas of high human activity, with approximately 75% of the human population living within coastal watersheds. However, little is known about how individual birds utilize coastal wetlands during the nonbreeding season, and thus how they could be affected by management practices and other anthropogenic activities for much of the year. Therefore, we quantified nonbreeding space use and habitat selection, local and long-distance movements, and site fidelity of the Little Blue Heron (*Egretta caerulea*). We attached satellite transmitters to 30 Little Blue Herons (*Egretta caerulea*) in the lower Florida Keys (Great White Heron National Wildlife Refuge, FL, USA) and the Charlotte River Estuary (J.N. "Ding" Darling National Wildlife Refuge, Sanibel Island, FL, USA) during the nonbreeding season of 2021-2022. To date, we have collected approximately 13,500 GPS locations from our sample of tagged herons, with an average of 450 points per heron. Kernel utilization distributions suggest that this species used approximately 8.7 ($\pm$2.26) ha of core habitat and 59.5 ($\pm$16.95) ha of home range habitat. Analysis of each space-use estimate suggests that neither core ($F_{1,24} = 0.40$, P= 0.53) nor home range ($F_{1,24} = 1.81$, P=

0.19) usage was different between study sites. Tagged herons used primarily 5 roost sites throughout the nonbreeding season, utilizing their primary roost 50% of the nights. Ten birds were classified as residents of their respective study site (n=9 from Ding, n=1 from GWH), 15 were long-distance migrants (n=4 from Ding and n=11 from GWH), and migration status could not be determined for the remaining five. Nesting colony location was highly variable between individuals from both study sites, with herons travelling to West Cuba (n=2), North Florida (n=8), South Georgia (n=3), and South Carolina (n=2). Data collection is ongoing and the results will be used to inform future management for this species and the habitats they occupy throughout the entire annual cycle.

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Free bird worms!

Helminthic worms are often considered to be problematic for avifauna, as they require energetic resources that are obtained at the expense of their hosts. However, some parasitic worms can also serve as a food source when they are found free in the environment. This is commonly reported for invertebrate consumers like bivalves, but is seldomly reported in avifauna, because the occurrences of large-bodied helminths that could serve as substantial forage are rare. It appears that in ideal circumstances that this is a possibility for short time periods when *Schistocephalus solidus* (Cestoda: Diphyllobothriidea) is highly abundant. Here, we document recent cases where adult *S. solidus* worms were detected in patchy distributions along the shallow littoral shoreline of Cheney Lake, Anchorage, AK. We discuss the competing hypotheses for the mechanism for delivery of the worms into the water, the confirmation of adult status of the parasites, and the retention time of these animals in the lake. This is the first adult life-history research on adult *S. solidus* in several decades. After performing structured field surveys, we conclude that adult waterfowl (eg., Mallards, *Anas platyrrhynchos*) shed adult *S. solidus* and this only occurred within a limited time window each day. While we rarely observed bird consuming the worms, we present evidence of water foraging (eg., Scolopacidae and Laridae) and suggest that these worms may serve as opportunistic energetic resources. Thus, in times of high parasite frequencies, when host food resources are abundant and parasitized, and partially-competent hosts function as parasite habitats, parasite populations can be quite successful with minimal consequence on host condition and serve as food for other avifauna.

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The Black Tern Conservation Consortium: understanding threats across the annual cycle

Knowledge of full annual cycle ecology and migratory connectivity are particularly important for waterbirds due to their tendency to congregate in specific locations, thus providing the ability to protect important habitats, predict the probability of local extinction, and develop strategies to address the causes of population declines. Studies on migratory connectivity have increased over the past decade; however, for many species of conservation concern we still have only a rudimentary understanding of connections of individuals and populations across the annual cycle. Among these species is the North American Black Tern (*Chlidonias niger*), a declining waterbird that breeds in inland wetlands across the northern United States and southern Canadian provinces. The identification of patterns of migratory connectivity would benefit Black Tern populations by allowing for targeted conservation action, such as at key non-breeding sites. In 2016, we formed a large-scale collaboration with researchers across the Black Tern breeding range representing study sites within three provinces and five states, and supported by the Migratory Connectivity Project, in order to fill this gap in Black Tern full annual cycle ecology. Thus far, we have deployed light-level geolocators on individuals in Maine (n=10), Ontario (n=31), Michigan (n=9), Wisconsin (n=7), Minnesota (n=10), Saskatchewan (n=48) Oregon (n=1), and British Columbia (n=24). We have also deployed avian nano-tags on individuals in Ontario (n=28) and Saskatchewan (n=56). In this symposium, we will present preliminary tracking and migratory connectivity results and discuss future plans for the Black Tern Conservation Consortium, including studies of productivity on the breeding grounds.

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Informing global conservation priorities for specialist river birds

Rivers support high levels of biodiversity and endemism, despite covering a small proportion of the Earth's surface. Although an abundant and diverse array of bird species have evolved niches to use riverine production and occupy high-energy fluvial environments, they are often overlooked globally in studies of river ecology and conservation. We compiled data on the distribution, range and IUCN status of bird specialised for high energy fluvial systems, and evaluated how their richness, endemism and threat status are distributed globally. We also examined habitat-use and contemporary threats to the conservation of these species.

We identified 66 species from 19 families specialized for high energy rivers spread across 29 passerines and 37 non-passerines. Large areas of North America, Europe and mainland Australia hold few or no specialist river birds reflecting global topography and relief. Most specialist river birds occur in the eastern Himalayan and Malayan ranges followed by the Andes, with peak richness at latitudes between 20-30[0] N. Our data from the Himalayan mountains reflects the roles of environmental filtering and phylogeny in these patterns – but riverine specialists appear to have evolved in several different phylogenies. Populations are declining in more than half of these species according to the IUCN. The Brazilian Merganser and the White-bellied Heron are the most threatened species followed by the Blakinston's Fish Owl, Blue Duck, Black-bellied Tern, Indian Skimmer, Scaly-sided Merganser and the Sri Lanka Whistling Thrush. These species occupy locations where rapid environmental change and the exploitation of riverine (e.g. abstraction, impoundment) and riparian resources (logging, agricultural intensification) may make then vulnerable to multiple stressors simultaneously. Smaller distribution ranges, for example on islands, and larger body size also appear to increase threat risk. We identify priority areas for the conservation of river birds in south-east Asia, especially large parts of India, Myanmar and China, but also suggest that the conservation of specialist river birds everywhere relies on natural flows, reduced pollution and habitat protection.

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Presence of mammalian predators in seabird colonies located on restored barrier islands of Louisiana

The aggregation of seabirds is usually attributed to nesting substrate and predation pressure. Colonial seabirds are one of the most abundant but vulnerable species inhabiting the Barataria-Terrebonne Bay island system. Colonial nesting seabirds, such as Brown

Pelicans (Pelecanus occidentalis) and other wildlife depend on these unique habitats for breeding and survival. Coastal land loss due to erosion, subsidence, and overwash from tropical storms and hurricanes has caused Louisiana's barrier islands to decrease more than 40 percent in the last century. This rapid land loss has led to the state's completion of several restoration projects on barrier islands. We investigate the presence or absence of mammalian species on barrier islands pre- and post-restoration in Barataria and Terrebonne Basins in order to determine predation pressure on colonial nesting seabirds.

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Impacts of Atlantic butterfish (*Peprilus triacanthus*) in the diet of Common Terns (*Sterna hirundo*): A case study of climate change effects in the Gulf of Maine

Climate change and associated shifts in marine prey communities can alter food availability for foraging seabirds. This issue is illustrated in the Gulf of Maine by the northward shift of the Atlantic butterfish (*Peprilus triacanthus*; hereafter butterfish) and its subsequent increase in seabird diet. Here, we examine the impact of butterfish in the diet of the Common Tern (*Sterna hirundo*), a threatened species in this region. Our objectives were to evaluate butterfish suitability for tern chick consumption through handling time and feeding success, examine the effect of butterfish on tern chick growth, and explore signs of adaptive foraging in adults. The diet and growth of Common Tern chicks were studied for three breeding seasons on White and Seavey Island, NH in the Gulf of Maine. Prey items were identified during feedings and grouped into five prey categories: butterfish, herring, hake, other fish, and invertebrates. Chicks were weighed to calculate growth rate, which was then compared to the diet. Across prey categories, butterfish were handled by chicks for the greatest amount of time ($P < 0.001$) but were swallowed the least ($P < 0.001$). Furthermore, chick growth rates were negatively correlated with proportion of butterfish in the diet ($P = 0.001$). There was significant within-year variation in diet composition between nests in two of the three years studied ($P < 0.001$ in 2018 and 2019) and some breeding pairs were never observed provisioning butterfish to their young. We propose that the variation in diet and butterfish avoidance are evidence that some, but not all, adult terns adapt their foraging behavior to avoid unsuitable prey for their chicks. Whether terns are successful in the avoidance of unsuitable prey is particularly important, as Gulf of Maine warming is expected to increase, and butterfish are likely to become even more prevalent in seabird diets.

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Double-crested cormorant populations in prairie Canada: a need for more systematic monitoring

The Canadian prairie provinces of Manitoba, Saskatchewan, and Alberta represent a large portion of the breeding range of double-crested cormorants in North America. All three provinces have experienced fisheries conflicts based on perceptions about increasing abundance of these birds. Despite these challenges, there has been no systematic effort to monitor changes in cormorant distribution and abundance in prairie Canada. Surveys conducted from 1968-2006 in Saskatchewan showed a marked increase in the total breeding population size of cormorants from 1,080 to over 34,000. In addition, most of the population growth occurred in the central part of the province in the Boreal Plain ecozone. Sporadic surveys have been completed over long time intervals at specific sites in Manitoba (e.g., Lake Winnipegosis) and showed large, but fluctuating numbers of cormorants. The population size of these birds may be as high as 40,000 breeding pairs on Manitoba's large lakes alone. The situation in Alberta is similar, with population assessments focused on specific areas of conflict, such as Lac La Biche and several sites in the Bonnyville area. Ultimately, prairie Canada lacks a systematic population monitoring program that can adequately address questions about changes in cormorant distribution and abundance.

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Multi-scale shorebird breeding habitat assessment in the Hudson Bay lowlands using UAVs

The Hudson Bay Lowlands comprise the southern-most edge of the breeding range of the arctic-breeding shorebirds, Dunlin and Whimbrel. The ecozone is one of the largest contiguous wetlands in the world and an important breeding area for thousands of migratory shorebirds and waterfowl. Graminoid fens near the coast of the bay provides nesting habitat. The region is at the southern extent of continuous permafrost and climate warming is anticipated to cause changes in the ecosystem, including habitat for shorebirds. Few studies have previously investigated the topographical and other microhabitat features important to these populations at the southern extent of breeding range. Nest selection behaviour can provide benefits to shorebirds; such as protection from predation and adverse weather conditions. We used unmanned aerial vehicles (UAVs), to obtain orthomosaic imagery of 21 shorebird nests in the Hudson Bay Lowlands in the Canadian sub-arctic (10 Dunlin, 11 Whimbrel) . We used fine-scale resolution imagery gathered by

UAVs to develop digital elevation models and terrain models that were used to generate relative vegetation height, viewshed and land classification of Whimbrel and Dunlin breeding habitat. Using multivariate analysis of variance, comparisons were made between used and available habitat in the area captured around each of the 21 nests as well as between species. We found that nests had greater vegetation height than the surrounding area and visibility from the nets was greater, hypothesized to facilitate predator detection. We have demonstrated nesting habitat selection preferences of shorebirds and intend to further define the process of habitat selection of breeding shorebirds in the Hudson Bay Lowlands. Shorebirds have experienced significant declines in population and understanding their nesting habitat selection preferences will allow us to understand how the changing landscape of the Canadian sub-arctic may further impact the species.

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Impacts of invertebrate community composition on Piping Plover (*Charadrius melodus*) survival between ocean and bay side habitats on Fire Island

The Piping Plover (*Charadrius melodus)* is a federally-threatened shorebird that breeds from early April to late August along the Atlantic coast, including New York. Conservation efforts to protect Piping Plover habitat at Fire Island, NY, focus on conserving vital foraging areas and conducting habitat restoration projects. We analyzed the terrestrial component of Piping Plover prey by comparing invertebrate community composition between ocean and bay side habitats, and assessed brood locations in relation to prey availability in likely foraging habitat. We sampled invertebrates when plover chicks were present in June-August 2014-2019 and 2022 with insect traps that comprised of paint stirrers covered in Tanglefoot glue and identified invertebrates to taxonomic Order. Thysanoptera was the most abundant invertebrate prey sampled with 3,298 individuals followed by Diptera with 2,682 individuals collected over the study. Annual abundances of invertebrates varied, and was greatest in 2014 with 875 individuals collected. Across all years, invertebrate abundances were greatest in June compared to July and August. Invertebrate abundance was greater in bayside habitat (3,883 invertebrates collected) than oceanside foraging areas (2,191 invertebrates collected). Our analyses revealed that broods were more frequently detected in oceanside habitat with greater invertebrate abundance; however, in bayside habitat, the frequency of brood detections was independent of invertebrate abundance. Understanding the prey availability of invertebrate communities for Piping Plovers on Fire Island can facilitate the identification of suitable foraging habitat to protect for shorebird foraging in the future.

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Weak genetic structure coupled with shared non-breeding areas and extensive movement in North American Black Terns

Understanding the genetic structure and movements of avian populations is an important first step towards effective conservation, particularly for species that migrate over long distances, as this allows researchers to recognize how populations may face different risks throughout the annual cycle. In this study, we combined population genetic and individual tracking data (light-level geolocation) to quantify the genetic structure and full-cycle movement patterns of the declining North American Black Tern (*Chlidonias niger surinamensis*). A total of 147 genetic samples were collected from nine breeding colonies across the range (Maine, Ontario, Michigan, Iowa, Wisconsin, Nebraska, Saskatchewan, and Oregon), and a total of 19 geolocators were recovered from individuals from three colonies (Ontario, Michigan, and Saskatchewan). Our results demonstrated weak genetic structure across the Black Tern breeding range, and tracking data demonstrated the use of different migratory routes but shared use of non-breeding areas between central (Saskatchewan) and eastern (Ontario and Michigan) breeding populations. Our tracking data also provide novel evidence of long-distance breeding dispersal (~1,400 km between breeding locations across years) based on an individual tracked across multiple years, as well as short distance dispersal (~2.5-57 km) based on new recovery locations of six tracked individuals. Our results are consistent with the hypothesis that the shared use of non-breeding areas can contribute to dispersal and gene flow among breeding populations of waterbirds. This study is the first to explore both population genetics and migration tracking for the North American Black Tern. The extensive movement of individuals may pose a challenge from a conservation perspective, and future studies should build on our work by tracking individuals from more breeding sites and examining carry-over effects to further investigate when in the annual cycle populations are most limited.

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Population dynamics of eastern-breeding Semipalmated Sandpipers: a flyway model

Identifying factors that affect declines in migratory birds requires model frameworks that analyze demographic processes across the full annual cycle. We created a seasonal, age-structured, demographic model of the declining Atlantic Flyway population of Semipalmated sandpiper (*Calidris pusilla*), an Arctic breeding migratory shorebird. We included the dynamic of a proportion of yearlings forgoing migration to oversummer in South America. We joined the demographic model with a stochastic observation model and used a Bayesian approach to produce posterior distributions of age- and season-specific survival and productivity from a mark-recapture dataset of > 40,000 banded birds with > 3400 re-sighted at least once after banding. To exclude observations of individuals not belonging to the Atlantic flyway population, we made use of a known cline in bill length across the breeding range and subtracted a distribution of bill lengths of known-sex Atlantic flyway birds from distributions in parts of the flyway that were not-exclusively used by Atlantic flyway birds. 30 datasets were created by randomly subsampling from the full dataset to exclude the correct proportion of non-Atlantic flyway birds. Models generated by fitting each dataset were cross-validated with all datasets and the final model was generated by average weighted by goodness-of-fit. We found that the percentages of Atlantic flyway birds increased from west to east in the winter grounds (Suriname 41%, French Guiana 47%, Brazil 52%) and spring stopover regions on the Gulf Coast (Louisiana 25%, Alabama 32%). The model suggested that the flyway population was declining at ~2% per year. We estimated that ~90% of yearlings over-summered and summer survival of non-migrant yearlings was slightly higher than migrant spring, breeding, and fall survival combined. Individually, birds were most vulnerable during their first fall migration as yearlings, survival during this period was very low. However, the population growth rate was most sensitive to decreases in spring and winter survival, suggesting that protecting birds during these seasons would be the most effective conservation tactics.

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Demographic and behavioral evidence of social development in young American Herring Gulls

Most seabirds delay reproduction for several years. The canonical explanation for this delay is foraging development: young seabirds get better at foraging as they age, which shifts the relative energetic costs of reproduction. My hypothesis is that social development, rather than foraging development alone, influences age at first breeding in colony-nesting seabirds. In contrast to foraging development hypotheses, a social development hypothesis predicts that young birds return to colonies and engage with the social aspects of breeding before they actually reproduce. I tested this hypothesis by studying the demographic and behavioral dynamics of young American Herring Gulls (*Larus smithsonianus*) on Kent Island (New Brunswick, Canada) and Great Duck Island (Maine, USA). Like other large gulls, American Herring Gulls usually do not breed until ~4 years old, and younger birds show distinct predefinitive plumages that progress from brown to white, gray, and black over several years. I found that the youngest, brown-plumaged birds (~1-2 years old) made up <1% of the total population at summer breeding colonies. In contrast, adolescent birds in brown-white-gray plumages (~2-3 years old) made up 3-7% of total populations during the incubation season. These adolescent birds frequently fought in foreign territories and occasionally engaged in courtship. However, adolescent birds were socially distinct from older, breeding birds. They were more likely to loiter in non-territorial regions, were more likely to lose conflicts, and almost never raised young. These results are consistent with the idea that young gulls have obstacles to, or opportunities for, social development before reproduction begins. I argue that evidence of social development raises new questions about the evolution of delayed plumage maturation in seabirds (are young gull plumages functional and plastic social signals?) More generally, I highlight the fact that dense and socially intricate breeding colonies can be a cause, rather than a consequence, of avian life history evolution.

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Factors affecting Whooping Crane colt survival in the Eastern Migratory Population

The reintroduced Eastern Migratory Population (EMP) of Whooping Cranes (*Grus americana*) has exhibited appropriate breeding behavior, including pair formation, territory defense, nest building, and fertile egg production. However, recruitment has been much lower than what is needed for a self-sustaining population due to poor nest success and high colt mortality. During 2006 - 2022, there have been 180 colts hatched in the EMP, with only 33 colts surviving to fledging. For the population to survive without continued releases of captive-reared individuals, we must develop management strategies that increase recruitment to a level higher than mortality rates. We examined long-term monitoring data collected via aerial and ground surveys using radio telemetry and observations of all wild-hatched Whooping Cranes during 2006 - 2022. In this study, we explored relationships

between colt survival and parental experience, spatial or habitat data, and nest characteristics. Preliminary results indicated there was a 24.5% reduction in probability of colt mortality if both members of the nesting pair had previously hatched a colt. Additionally, there was an 11.5% increase in the probability of fledging a colt and a 4.9% increase in estimated colt survival per year of female nesting experience. Since colt survival is positively related to parental experience, we can expect colt survival and recruitment to improve in the future. We should also continue to address gaps in the data, specifically related to habitat use of family groups, cause-specific mortality for pre-fledged cranes, and the effects of land management strategies on Whooping Crane productivity.

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2014-2020 CAWC data analysis: diversity and dominance of waterbirds at Crooked Tree Wildlife Sanctuary, Belize

In 2014, Belize Audubon Society initiated the waterbird census in Crooked Tree Wildlife Sanctuary. Consistent effort of data collection including water level has been something interesting to observe, especially the trends of species richness and abundance over time. As seen in various part of the world, deforestation and land degradation have been the major problem causing diminution of species abundance and species richness. Wetland, one of the most important ecosystems provides the nursery, foraging and breeding ground for a vast variety of waterbirds and also increase resilience to flood hazard. In this study, the identification of diversity and dominance of waterbirds will serve as indicator to explain the close relationship between these species and the habitats found in the wetland. Shannon Index, Olmstead-Tukey corner test, ANOVA and Pearson Correlation are the statistical approach used to justify species population status across sites and study period. Results have proven that water level is one of the essential factors to determine diversity and abundance. Agricultural and urban disturbance is considered another factor affecting the waterbird community. Therefore, this study can be used as a guide to evaluate waterbird abundance for future reference.

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Implementing the business plan for the conservation of the Reddish Egret in Mexico.

The reddish egret (Egretta rufescens) is one of the rarest species and its biology one of the least known in the Americas. Its global population is estimated to be between 5,000 - 7,000 individuals and even though apparently stable reproductive populations exist, there is evidence of a decline in its global population. In Mexico it is considered in the "Endangered" category according to the Mexican Official Norm 059-SEMARNAT-2010. To address the threats faced by the species in Mexico, Pronatura Noreste led an effort to develop the Business Plan for the Conservation of the Red Heron, using the Open Standards for the Practice of Conservation (CMP, 2020) methodology. Some of the main threats identified in this document are related to anthropogenic activities such as changes in land use, pollution, interruption of hydrological flows, feral species, overfishing, disturbances due to recreational and productive activities. To address these threats we proposed 6 strategies, 1- Science for decision making. 2- Protection. 3- Restoration and enhancement of habitats. 4- Strengthening of the Working Group for the Conservation of the REEG in Mexico. 5- Governance. 6- Outreach, education and social participation. During the implementation of this document, protection agreements have been signed in Tamaulipas for the benefit of more than 5,000 ha in Tamaulipas, collaboration agreements have been signed with government institutions, more than 2,000 ha of wetlands have been improved, and more than 150 ha have been restored. of nesting islands. We established annual winter monitoring plans for more than eigth years in five states of Mexico. In addition, education and capacity building efforts have been implemented for fishermen. The next steps are to increase and strengthen these efforts in Mexico. Additionally, some of these efforts are replicating in Belize. We hope to be able to expand these conservation initiatives to other nations of Central America and the Caribbean in order to have a better understanding of the global population and to implement conservation efforts throughout the species' range of distribution.

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Protection, Monitoring & Outreach for Breeding Least Terns (*Sternula antillarum*), Snowy Plovers (*Charadrius nivosus*), Wilson's Plovers (*Charadrius wilsonia*), and Black Skimmers (*Rynchops niger*) in Coastal Texas

Human disturbance is one of the leading causes of reproductive failure for beach-nesting birds. American Bird Conservancy and our partners have worked together since 2012 to implement some combination of habitat protection, monitoring, and public outreach for Least Terns (*Sternula antillarum*), Snowy Plovers (*Charadrius nivosus*), Wilson's Plovers (*Charadrius wilsonia*), and Black Skimmers (*Rynchops niger*) along the Texas coast. Each of

these species are a Species of Greatest Conservation Need in Texas Parks and Wildlife Department's Conservation Action Plan. We work closely with land and natural resource managers to implement strategies that support breeding success for these species. By implementing such measures, we can: 1. gain baseline reproductive data about these birds to successfully and adaptively manage for them, 2. increase public awareness and influence behavioral changes to reduce human disturbance at critical nesting locations, and 3. build reproductive data sets that contribute to setting short- and long-term conservation goals for these species. We will present reproductive demographics for these species, including nest survival and fates from 2012 to 2022 and discuss the factors that caused failures.

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Precision monitoring of colonial waterbird islands using UAVs and machine learning

Waterbirds are among the most iconic and widespread vertebrates that nest in large groups. North America's coasts are home to several species of breeding colonial waterbirds. Monitoring waterbirds at colonial nesting islands is a common monitoring technique used to track population trends, inform conservation decisions, and better understand the health of the associated ecosystems. However, censusing these nesting sites is not without considerable effort and risk. Traditional monitoring studies of waterbirds have been conducted by traversing the colony on foot, surveying via boat, or surveying aerially using small, manned aircraft. Each of these methods has its own set of challenges and consequences. Small Unmanned Aerial Vehicles (UAVs), also referred to as drones, have been available for several years and are already proving to be a useful wildlife management and research tool. UAV technology allows researchers to remain safely on the ground while gathering data. It also allows biologists to survey areas of interest with less cost and greater ease than traditional aerial surveys (Watts, A., 2010). In studies where this technology has been applied, the use of UAVs was found to result in more precise count estimates than traditional, ground surveys (Hodgson, J.C., 2017). Manually counting and digitizing the very large sets of photos or videos, however, is an incredibly time-consuming task. To reduce the time needed to generate accurate counts from waterbird colony

imagery, we developed guidelines for acquiring UAV footage of colonial waterbird nesting islands and a deep-learning tool that can be applied to precisely, accurately, and efficiently count and digitize multi-species waterbird colonies. We trained algorithms to detect 16 classes of waterbirds nesting on islands along the Texas coast using convolutional neural network-based object detectors. We found the use of UAV-collected aerial imagery and deep learning can significantly improve the accuracy of these monitoring events, while reducing staff processing time and colony disturbance.

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Weather radar as a tool to quantify local airspace-use of a large migratory waterbird

Avian tracking technology is becoming increasingly sophisticated, but high resolution satellite tags remain expensive and tag deployment requires comprehensive training and considerable labor, limiting sample sizes and study conclusions. As such, inexpensive avian tracking data collection methods that require minimal labor are needed. Radar image analysis offers the opportunity to study bird movement without tagging birds, and has been applied in a variety of avian tracking studies, primarily to quantify high-use habitat, areas of conservation concern, and migration corridors. However, radar analyses have been historically focused on total bird biomass rather than specific species. Here, we demonstrate a novel species-specific machine learning analysis of avian radar signatures, with minimal need for costly tag deployment. NEXRAD weather radar is a powerful remote sensing tool, and NEXRAD stations exist across the continental United States, providing a broad area for which to collect comparable and freely accessible data. We tested the efficacy of NEXRAD radar for quantifying space-use of a population of American white pelicans *(Pelecanus erythrorhynchos)* around Great Salt Lake, Utah. We used satellite tracking data from 65 GPS-tagged pelicans to identify radar signatures of pelicans in Great Salt Lake airspace. Our model could predict pelican locations with high predictive performance (AUC = 0.94), based on velocity and reflectivity radar-derived variables, and date-time covariates. We then used the model to identify flocks of untagged pelicans within the study period. Our approach demonstrates a proof-of-concept for identifying individual bird species from weather radar, a valuable improvement over current radar-based tracking for birds which has been species-agnostic. This approach allows for radar-based monitoring of pelicans and other large avian species of concern, and may aid future avian space-use

research in other areas, including quantification of population trends, daily and seasonal movements, and migration phenology at the species level, and reduces time spent capturing birds and costs spent on tracking technology.

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Assessing demographic effects of habitat restoration for Piping Plover (*Charadrius melodus*) at Democrat Point, Fire Island, NY

Globally, shorebird populations are in decline, largely due to habitat loss caused by erosion, vegetation succession, human disturbance, and recreation-focused beach nourishment projects. Ground-nesting shorebirds, like the federally threatened Piping Plover (*Charadrius melodus*), are particularly susceptible to beach habitat loss. Coastal populations of this plover thrive in flat, sparsely vegetated sandy beaches with shell and pebble cover. Shaped by extreme waves and wind, barrier islands like Fire Island, NY are prone to dynamic changes in available shorebird nesting habitat through natural accretion and erosion. Democrat Point is a protected shorebird nesting area on the western end of Fire Island with minimal disturbance from foot or vehicle traffic during the summer breeding season. From 2016-2022, we monitored plover nests and conducted near-daily observations of adults. In the winter of 2021-2022, a habitat restoration project flattened dunes and removed vegetation, increasing plover nesting and foraging habitat from 40 ha to 64.9 ha (62.3% increase). We compared the number of nesting pairs, reproductive success, and mean individuals observed per survey hour at Democrat Point before and after restoration using generalized linear models. Although the number of nesting pairs has been increasing annually, restoration significantly increased nesting pairs above the observed trend (mean annual increase 2015-2021 = 2 pairs/yr, 9 additional pairs [16% increase] observed in 2022) and the mean number of breeding and non-breeding individuals observed per survey hour increased from 6.8 birds/survey hr in 2021 to 7.5 birds/survey hr. Additionally, restoration provided nesting habitat that established a new Black Skimmer (*Rynchops niger*) colony. However, the increased abundance of nesting plovers did not translate into an increase in reproductive success. It may require several years for landscape features beneficial to pre-fledging plovers (e.g., vegetative cover from avian predators, beach berms that limit flooding) to form. Our results underscore the value of habitat restoration which may be especially beneficial to attracting new breeders and promoting hatching success.

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Effects of tropical cyclones on Reddish Egret populations in Louisiana

We examined tropical cyclones (i.e., tropical depressions, tropical storms, and hurricanes) directly impacting Louisiana from 2016 – 2021 to determine the effects on Reddish Egret populations. We deployed satellite transmitters on adult Reddish Egrets in southeastern (n = 11) and southwestern (n = 14) Louisiana to monitor their movements and survival. Fourteen tropical cyclones (6 hurricanes, 5 tropical storms, 1 tropical depression, and 2 extratropical cyclones) impacted Louisiana during the study period, and for each storm event, we reviewed telemetry data immediately on and around its arrival ($\pm$1 day). We presumed that a mortality occurred based on 1) an absence of data transmission following a storm or 2) stationary GPS fixes for multiple days. We could not recover any carcasses for various logistical reasons so we did not confirm any deaths. However, we estimate that 9 of 25 (36%) transmittered Reddish Egrets died from the direct impacts of 5 tropical cyclones; 7 of 9 mortalities were associated with 3 major hurricanes. Previous telemetry studies reported Reddish Egrets exhibited little response to hurricanes and that such intense storms did not significantly affect populations. Yet, over one-third of the transmittered birds in our sample population may have died from storm-related impacts, and we suspect the population declined drastically during the time of this study. Because the Reddish Egret is a coastal specialist restricted to island habitat for nesting, the species appears to be particularly vulnerable to tropical cyclone effects. If predictions of increased frequency and intensity of tropical cyclones by the end of this century are accurate, these storms pose a significant threat to Reddish Egret populations. With accelerated loss and degradation to suitable coastal habitats, protection and restoration of key foraging and nesting sites for sensitive species like the Reddish Egret are needed in Louisiana and other disturbance-prone areas along the Gulf Coast.

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Inland foraging habitat objectives and availability for fall migrating shorebirds on the Texas Coast

The Gulf Coast Joint Venture (GCJV) is a regionally based, biologically driven, landscape-oriented volunteer partnership of private, state, and federal conservation organizations

dedicated to delivery of habitat conservation important to priority bird species. For habitat project planning and delivery, the GCJV region is subdivided into six Initiative Areas, three of which span coastal Texas. The Shorebird Working Group (SWG) of the GCJV Science Team identified a suite of shorebird species for conservation planning. The SWG stepped down continental shorebird population estimates to the GCJV Initiative Areas and developed population objectives for the fall (July – November) migratory period. Those population objectives were then allocated among foraging habitat types using available resource selection information and expert opinion. An energetic model framework was used to translate population objectives into habitat objectives for fall migrant shorebirds using inland saturated soil, open shallow water, and flooded grasslands. GCJV staff developed parameter estimates of water depth and vegetation density in those inland habitat types from field observations. Parameter estimates were combined with remotely sensed indices of wetness and vegetation greenness to quantify habitat availability. Assessments from 2008-2021 indicated that in most years, habitat demand exceeded availability in inland saturated soil, open shallow water, and flooded grassland shorebird habitats in the Laguna Madre, Texas Mid-Coast and Texas Chenier Plain Initiative Areas of the GCJV region. U.S. Department of Agriculture programs that provide incentives to agricultural producers for developing and maintaining shallow water wetlands, and similar programs offered by non-governmental organizations have potential to increase shorebird habitat availability in the region.

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Piping Plover (*Charadrius melodus*) demography during trophic downgrading of the predator community at Fire Island, NY

Understanding activity and abundance of shorebird predators is important for effective shorebird management. Along the Atlantic coast, red foxes (*Vulpes vulpes*) are key predators that both take shorebirds and impact populations of smaller mesopredators. We monitored the mammalian predator community at Fire Island, NY, a barrier island that provides nesting habitat for the federally threatened Piping Plover (*Charadrius melodus*). In 2015, an outbreak of sarcoptic mange in red foxes led to a severe population reduction and localized extirpation, which was followed by the expansion of feral house cats (*Felis catus*). We quantified cat activity and identified individual cats using images collected via trail cameras deployed during the winter and distributed across Fire Island. We tested whether cat activity and abundance during the winter explained fledging rates of Piping Plover from the previous summer. Following the mange outbreak, we observed a 7-fold increase in cat

activity adjacent to plover nesting sites, with concentrated activity in the upper dunes and in areas with high human traffic. Plover broods in areas with elevated cat activity fledged fewer chicks per brood (mean ± SE fledging rate in low cat activity areas 0.63 ± 0.08 vs fledging rate in high cat activity areas 0.54 ± 0.05, 14% reduction), though we did not detect a strong, population-level effect during the early years of cat increase as plover chick survival to fledging for this population remained stable (0.56, 95% CI: 0.43 – 0.69). Since 2018, chick survival to fledging has declined 37% as the cat population exceeded 35 identifiable individuals (4.5× increase from 2015). Our results underscore the importance of monitoring turnover within predator communities, which may have delayed demographic impacts to nesting shorebirds.

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Using high resolution drone imagery and deep learning processes to routinely document nesting numbers and nest success of long-legged wading birds in a large wetland aquascape.

Two major problems have historically plagued the accurate documentation of populations of colonially nesting birds: variation in human counting or estimation abilities, and not counting nests due to turnover within a season. These effects can be large (to 50% and 350% underestimates, respectively) and are especially pernicious in highly vegetated locations, and species with long breeding seasons. Over three breeding seasons we flew drones over breeding colonies of egrets, ibises, storks and spoonbills in the 10,000 km2 Everglades, and designed an automated pipeline to manage the approximately 900 images per colony per week, link images to a coordinate system based on field-surveyed location markers, and stitch images together to provide georectified imagery for each colony throughout the 6-month nesting season. Based on hundreds of human-labeled nests, we created a machine learning algorithm that can currently detect 78 – 91% of the birds (precision) depending on species. In addition to the 6 species studied in the Everglades, this algorithm has also been shown to be applicable and accurate for a wide array of other colonial nesters (average across 13 studies of 84% recall and 69% precision). Based on centimeter scale positional accuracy, we have used the bird detector to identify consistent nest occupancy (algorithm finds 93% of human found nests) allowing us to follow the progress of individual nests over time. This allows for the documentation of individual nest success with very large sample sizes. Using measured nest turnover rates, we plan to use a superpopulation approach to estimate the total numbers of nests initiated throughout the breeding season. Compared with other approaches, the methods reported here allow for a) a gross reduction in human error in estimating nests, b) high accuracy and repeatability of

counts, and c) the ability to estimate both nest success and nest starts, scalable to a large (10,000 km^2) wetland system.

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Hurricane-related habitat loss may be associated with shorter stopover duration and fewer migrating Piping Plovers on South Point, Ocracoke Island, NC

Migratory shorebirds rely on stopover locations to rest and refuel during their journeys between their breeding and non-breeding grounds. Changes in habitat at stopover locations may lead individuals to alter their stay duration or choose other locations altogether, influencing migratory routes and arrival timing at their destinations. South Point, Ocracoke Island, North Carolina is an important stopover location for federally threatened Atlantic Coast Piping Plovers during their fall migration. An estimated 15% of the population used South Point during fall migration in 2016, comprising some of the largest migratory flocks recorded for the species. In early September 2019, Hurricane Dorian struck Ocracoke Island as a Category 1 storm, eroding an estimated 70 hectares of habitat that plovers primarily used while foraging. We investigated potential differences in stopover population dynamics at South Point 2016–2021, 4 years pre-storm and 2 years post-storm, using an integrated superpopulation model on resight and count data. Total passage population size decreased 44% in the years post-storm, from an average of 504 to 282 plovers. Peak stopover population estimates also declined an average of 40% post-storm, although the date of peak stopover varied annually and was not affected by the storm. Plovers' stopover duration at South Point was longer in pre-storm years by an average of 8.8 days. Habitat loss on South Point may have altered the fall migratory routes and timing of a significant portion of the Atlantic Coast plover population that had used South Point prior to Hurricane Dorian. The decrease in stopover duration length and passage population size suggest plover populations size may be constrained by available habitat, even in areas that they inhabit temporarily.

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Synthesizing the status of colonial waterbirds for the Texas Ecosystem Health Report Card

The Texas Coast Ecosystem Health Report Card Program synthesizes available data to describe the status of regional social-ecological systems. The Texas Colonial Waterbird Society has been surveying nesting birds on the Texas coast for more than 50 years. This valuable dataset is being used to help communicate about changes in nesting populations and habitat use for the 2022 Report Cards. Our analysis includes nine species of colonial waterbirds to be broadly representative of the variety of Texas's coastal habitats and considers how recent bird abundance relates to long-term observations. Our analysis suggests reduced nesting populations in recent years for several species and long-term trends of decline throughout the bay regions of Texas. We will discuss our strategy for calculating report card scores and summarize regional results.

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Using Autonomous Recording Units to Document Non-breeding Season Vocalizations of Eastern Black Rails in Coastal Texas

The Eastern Black Rail (*Laterallus jamaicensis jamaicensis*) is most frequently identified through sound recognition during its breeding season. However, the conspecific California Black Rail is known to vocalize outside its breeding season. In addition, limited observations in Texas suggest that the Eastern subspecies does as well. We placed continually operating autonomous recording units (ARUs) at locations with known Eastern Black Rail occupancy at San Bernard National Wildlife Refuge outside of the breeding season. We share our assessment of timing, frequency and types of vocalizations detected. Formal research into this topic may be beneficial for guidance for survey options outside the breeding season.

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X number of peeps: the importance of counting shorebirds through the International Shorebird Survey

The International Shorebird Survey (ISS) was developed by Manomet in 1974 to collect long-term shorebird data across a broad area. The surveys are conducted by volunteers,

but operating the network requires careful statistical design by Manomet staff at the regional scale. Participation in the ISS in Texas has decreased over the last decade. Since the beginning of 2022, our local staff in Texas has been establishing priority sites along the coast using citizen science data, GPS tracking information, and knowledge from local experts. So far, we have identified 20 priority sites across 8 counties, and continue to make progress in recruiting volunteers to consistently survey the sites.

For the last 48 years, data from this initiative has allowed scientists to estimate species populations and understand trends, leading to targeted conservation action and monitoring the success of those actions. In a recent comprehensive analysis of ISS data, our partners from Environment and Climate Change Canada carried out trend analyses for 28 species of shorebirds during fall migration. This analysis used data from over 100,000 surveys conducted between 1980 and 2019. Results from hierarchal Bayesian models indicate significant declines in 26 out of 28 taxa. Further analysis of 3-generation trends indicates accelerating declines in at least 13 species.

Here we describe results from a comprehensive analysis of ISS data, ways in which the ISS has led to conservation success, and the work we are doing to improve the ISS in Texas.

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Application of a tidal marsh bird monitoring program for the Gulf of Mexico: A case study from Mississippi

The 2010 Deepwater Horizon Oil Spill demonstrated a clear lack of Gulf of Mexico-wide monitoring data critical for evaluating impacts on natural resources across the region, including birds. One group particularly vulnerable to oil spill effects was tidal marsh birds. While on-going studies of tidal marsh bird ecology were occurring in local wetlands across the Gulf, these data were of limited value for evaluating the impacts on this group of birds across the Mississippi coast, let alone the Gulf of Mexico region. In 2018-2019, we developed and initiated a probabilistic sampling framework among tidal marsh complexes in Mississippi to (1) generate robust species-specific tidal marsh bird abundance estimates for both non-breeding and breeding species; (2) determine species-habitat relationships for tidal marsh birds across the Mississippi coast; and, (3) demonstrate the successful application of a tidal marsh bird monitoring program across extensive marsh complexes. Using a line transect sampling approach, we found Red-winged Blackbirds (*Agelaius*

phoeniceus) were the most abundant species in tidal marshes during the winter (non-breeding), followed by Marsh Wren (*Cistothorus palustris*), Seaside Sparrow (*Ammospiza maritima*), Clapper Rail (*Rallus crepitans*), Swamp Sparrow (*Melospiza georgiana*), Nelson's Sparrow (*Ammospiza nelsoni*), Sedge Wren (*Cistothorus platensis*), and Common Yellowthroat (*Geothlypis trichas*). Breeding bird data using call-broadcast point count surveys showed Red-winged Blackbird were most abundant, followed by Clapper Rail, Seaside Sparrow, Common Yellowthroat, Boat-tailed Grackle (*Quiscalus major*), and Least Bittern (*Ixobrychus exilis*). Our study demonstrates the successful application of a tidal marsh bird monitoring program across extensive marsh systems in coastal Mississippi. Extending such efforts across the entire northern Gulf of Mexico will require considerable logistical planning and coordination and a significant investment of financial and human resources. However, the benefits of a Gulf-wide tidal marsh bird monitoring effort include, but are not limited to estimating species-specific population sizes and trends, addressing uncertainties associated with management actions and the impacts of ecological processes, allowing the evaluation of on-going tidal marsh restoration, and informing future marsh restoration efforts, as well as understanding the potential impacts of future sea level rise.

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Non-breeding utilization ranges of White Ibis and Tricolored Herons in the Gulf of Mexico region

White ibis (*Eudocimus albus*) and tricolored heron (*Egretta tricolor*) are common wading bird species that can be observed year-round along the northern coast of the Gulf of Mexico (GOM). Individuals of both species show complex migratory behaviors: (1) some individuals exhibit Trans-Gulf migration, (2) some individuals exhibit long-range post-breeding season dispersal, and (3) some individuals remain as year-round residents. In Alabama, it has been documented that white ibis and tricolored herons breed on the coastal islands in Mobile Bay and Portersville Bay, but the population distribution after birds leave the breeding sites remains unknown. To investigate the population distribution of white ibis and tricolored herons in the non-breeding period, we deployed Argos transmitters and tracked the movement of tricolored herons and white ibis captured in the breeding sites in coastal Alabama. We divided birds into groups of migrant ($n = 11$), mixed migrant ($n = 3$), disperser ($n = 28$), and resident ($n = 12$) using a Net Squared Displacement (NSD) method. We estimated utilization ranges in the non-breeding season at the population and individual levels using a Kernel Density method. We also identified utilization hot spots by overlapping individual utilization ranges. The utilization range by white ibis covered the coastal regions of Louisiana, Mississippi, Alabama, the panhandle and Tampa Bay areas of Florida, and the Zapata Peninsula of Cuba. The range of tricolored

herons included the coastal regions of Louisiana, Mississippi, Alabama, the Yucatan Peninsula of Mexico, the east coast of Belize, and the Mosquito Coast of Nicaragua. None of the tracked birds ever visited Everglades National Park (FL) in which most of the research on white ibis and tricolored herons had previously been conducted. The utilization hot spots included the Grand Bay Savannah Coastal Preserve and the Grand Bay National Estuarine Research Reserve in Mississippi, the Biloxi State Wildlife Management Area, and the Jean Lafitte National Historical Park and Preserve in Louisiana. The results from this study improve the understanding of wading bird life-history in the GOM, and identify potentially important conservation areas for these two wading bird species.

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Use of coastal refugia by overwintering waterfowl using Audio Recording Units (ARUs)

The coastal refugia program was initiated by Texas Parks and Wildlife in response to increasing waterfowl hunting pressure and diminishing population numbers of certain migratory game bird species on the Texas coast. Hunting pressure is widely recognized as having a substantial influence on waterfowl habitat use and distribution. Several studies have demonstrated the importance of refugia (i.e., areas free from hunting pressure) to waterfowl during hunting season and indicated their use as an efficient tool for wetland biodiversity management.

To date, the effectiveness of refugia has only been qualified visually and limited by human observer time and sphere of visual and auditory detection. Although these techniques (e.g., aerial surveys, ground counts) have been adequate to demonstrate the significant effects of hunting-free areas on relatively local waterfowl community diversity and abundance, a need exists to apply more quantitative metrics to the design and allocation of refugia across larger landscapes. This is especially true for populations that are limited by winter resources. Well-designed landscape-scale studies demand standardized equipment and protocols that generate repeatable and reliable data to draw ecologically relevant inferences and conclusions.

Audio recording units (ARUs) have been used in an ecological context since the 1970s and have specifically been employed in avian studies with increasing frequency in the last several years ARUs offer distinct advantages relative to human observers in avian surveys especially as investigative scope expands into the scale of 'landscape'

The objectives of this study are to (1) Establish high-quality, landscape-scale monitoring protocols for the coastal refugia program on the Texas coast, (2) quantify the use of sites of

refugia sites by waterfowl and wetland-reliant species, and (3) Provide practical, scientifically informed recommendations for waterfowl conservation and management on the Texas coast.

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